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METHOD OF FORMING PEDAL APPLIANCES

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This invention relates to a method of forming pedal appliances, and more particularly to an improved method of forming corrective plantar foot appliances.

The use of pedal appliances for correcting malalignments, deformities and other abnormalities of the foot is well known. Various types of appliances have been proposed heretofore. Among such devices are stock appliances which may be either built into the shoe or which may be removably carried therein (such as the well known steel shank or counter secured to a leather or other similar base, or plastic type appliance), appliances made to a plaster of Paris cast of the foot, and appliances made to imprints, charts, pencil outlines, and radiographic or X-ray prints. In the case of stock appliances, it is apparent that they cannot be suitable for all kinds and degrees of abnormalities. Hence, in many cases, they provide only approximate corrections at best. Where stock appliances are removable from the shoe, they have been found, in many instances, to fit neither the foot nor the shoe. Appliances made to plaster models of the foot, while fitting the foot generally, are not specific enough in detail and are also subject to the disadvantage that they seldom properly fit the shoe in which they are to be worn. Many pedal appliances have done harm or had to be discarded because they did not harmonize with the shoe as well as the foot.

Appliances constructed by means of pencil outlines, chemical charts, radiographic or X-ray prints, and similar methods prove their shortcomings and inadequacies in that accurately fitting appliances suitable to the requirements of a particular condition of the foot can seldom be produced. For example, in the use of chemically treated charts on which an impression of the foot is made, it has been found that the impressions are frequently blurred and inaccurate and cannot be held to suitable dimensions. Radiographic prints, while showing the metatarsal pattern, cannot guarantee proper fit since the forms, molds, and materials used in making the appliances are entirely independent of the prints.

In order for a plantar foot appliance to be suitable for use in a shoe, it is apparent that the appliance must not only fit the foot, but that it must fit the shoe as well. In this respect, appliances of the prior art have failed grossly, since little or no cognizance has been taken of the requirements of the shoe. Hence, more often than not, such appliances have frequently failed to provide the necessary correction because they were not specific and detailed sufficiently to the foot problems and because they did not harmonize accurately with the shoe, thus failing to produce a completely compatible correction.

The primary object of my invention is to provide an improved method of forming corrective pedal appliances, which method will be entirely free from the above mentioned and other similar defects, characteristic of prior art methods.

More particularly, it is an object of my present invention to provide an improved method of forming corrective plantar and other foot appliances which will accurately fit both the foot and the shoe, thereby insuring compatibility with both.

Another object of my present invention is to provide an improved method of forming a corrective foot appliance whereby the appliance may be made directly on the foot and to which the shoe may be directly applied during the formative stages thereof.

Still another object of my present invention is to provide an improved method of forming corrective pedal appliances which will insure accurate fitting of the appliances to the feet.

A further object of my present invention is to provide an improved method as aforesaid which permits seeking out and protecting unusual abnormalities with great detail.

Still a further object of my present invention is to provide an improved method of forming corrective pedal appliances wherein adjustments are seldom necessary.

Another object of my present invention is to provide an improved method of producing corrective pedal appliance which may be made as flexible or as rigid as may be required and which may be made partly rigid (for example, under the longitudinal arch) and partly flexible (as at the metatarsal region).

A further object of my present invention is to provide an improved method of forming corrective appliance which can be made as thick or as thin, as light or as heavy as may be found desirable.

Still a further object of my present invention is to provide an improved method of molding or casting corrective pedal appliances wherein the mold or the cast material itself becomes the actual appliance which can be worn in a shoe.

Still another object of my present invention is to provide an improved method of forming corrective pedal appliances whereby the requisite corrective members may be placed on the foot.
in the exact position or positions where they are needed.

Another object of my present invention is to provide an improved method of forming corrective pedal appliances which readily lends itself to easy and accurate adjustment.

Yet another object of my present invention is to provide a novel method as above set forth which can be practiced at relatively low cost, and which is highly efficient for the intended purpose.

In accordance with one form of my present invention, I utilize a pair of sheet-like layers formed of a material which is either initially supple or which may be rendered supple by the use of suitable activating materials so that they can be easily shaped or molded to the foot. The material of which these sheets are made should also be one which will become set in the course of time after treatment by a suitable activator. Where a planar appliance is to be made, the first one of these two sheets is removably secured to the sole or planar region of the foot over the area where the corrections are required, as by means of rubber cement or other suitable adhesive. The required corrective elements are then secured to this first sheet in position over the point or points where correction is required. Thereafter, the exposed parts of the sheet secured to the sole as well as the second of the two sheets are treated with a suitable activator to render the material plant and supple and to cause the material to become set in the course of time.

The second sheet is then placed over the first sheet and over the corrective members, thereby enclosing or "sandwiching" the corrective members in between the two sheets.

The assembly is then molded and contoured to the foot so that it will accurately fit the foot. Preferably, the aforementioned sheets should extend somewhat beyond the heel and are provided with a lateral extension which may be pressed against the inner aspect of the foot, following the general contour of the areas involved. A socket or the like is then placed over the appliance, thus molded, after which the proper shoe is placed on the foot while the appliance is still adhered thereto, and the shoe is tightly laced. The patient is then permitted to stand for a period of ten or fifteen minutes to apply pressure which causes the appliance to become contoured to the shoe in which it is to be worn, as well as to the foot to which it has been applied. After a suitable period of time during which the pressure is applied, the appliance becomes set in the required contours. The shoe is then removed, the corrective appliance is carefully removed from the sole of the foot and, subsequently, the appliance may be finished in appropriate manner to provide a light, sturdy appliance of appropriate and highly pleasing finish.

In some cases, it may be desirable to use only one of the aforementioned base sheets to which the corrective members are applied, instead of two. For example, where the appliance is to be corrected by more or less entirely changing the form of the foot, all corrections may be made in the base sheet thereto. A single sheet is then applied over the corrective members, and the above described procedure followed from there on to cause the assembly to conform to the contours of the foot and the shoe, after which the appliance may be suitably finished.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description of one embodiment thereof, when read in connection with the accompanying drawing, in which

Figure 1 is a bottom plan view of the planar region of a foot with part of an appliance formed in accordance with my present invention applied thereto.

Figure 2 is a side elevation showing the foot with appliance attached thereto inside of a shoe in which the appliance is to be worn.

Figure 3 is a perspective view of the finished appliance, and

Figure 4 is a sectional view taken along the line IV—IV of Fig. 3.

Before proceeding with a more detailed description of the drawing, it may be pointed out that my present invention is also concerned with a diagnosis of the condition of the foot to be corrected, but rather with the method to be followed in producing a pedal appliance in conformity with the requirements of the foot after the diagnosis has been made. Let it be assumed, therefore, that a diagnosis has previously been made by any suitable method and that, by way of illustration, it has been found that the condition of the foot requires balancing of the heel from the medial-plantar aspect, lifting the entire inner and mid-tarsal portion of the sole, and raising or holding some of the metatarsal bones in a more normal position. The appliance, then, is to fulfill these requirements.

Referring, now, more particularly to the drawing, wherein similar reference characters indicate corresponding parts throughout, there is shown a foot 1 to the sole or planar region of which is applied a first sheet 3 of suitable base material. The sheet 3 is preferably of a material which is either inherently supple and therefore can be shaped or molded to the contours of the foot, or one which is rendered supple and moldable by suitable chemical treatment. The material of the sheet 3 should also be one which can be made to become set after having been suitably shaped or contoured. Among the materials which I have found suitable and which I prefer at the present time is one known in the trade as "Celastic" material. This is a cellulose impregnated, porous, cotton material which is available in sheets of various thicknesses and may be obtained through the United Shoe Machinery Corporation of Boston, Massachusetts. This particular material may be activated by acetone, certain lacquers, and various other activators which render it soft and supple so that it can be molded readily into any desired shape. At the same time, it has the property of hardening and setting in a short time after having been treated by the activator.

The sheet 3 is provided with a lateral extension 3a which may be folded upwardly and fitted snugly to the inner aspect of the foot, as best shown in Fig. 2. The sheet 3 is so placed on the foot that it preferably extends from a point about ½ inch behind the heel forwardly past the metatarsal heads at the junction with the toes, laterally overriding the outer border of the foot slightly, particularly in the region of the heel, and medially extends on
the inner side of the heel, scaphoid, cuneiform and first metatarsal. Before applying the sheet 3, it is preferably skived along the edges and it is placed against the foot with the skived edges outwardly, being cemented to the sole of the foot by a good rubber or other suitable cement previously applied to the sole. This cement should be of a type which will hold the sheet 3 firmly in place, but which will permit ready removal of the appliance from the foot after it has become set.

For best results, it is preferable to have the foot extended so that it is substantially perpendicular to the leg. This permits stretching of the skin and other flexible tissues as in standing and thus simulates the condition which exists when the patient stands or walks. In this way, an accurate fit of the appliance is assured.

The outer, skived face of the sheet 3 may now be coated with a suitable cement and a plurality of corrective members 5, 7 and 9 applied thereto over the areas where corrections are required. The members 5, 7 and 9 may be made of wool felt, solid rubber, sponge rubber, leather, cork, plastics, or of any other material found suitable for the particular case at hand.

The member 5 is first applied to the sheet 3 in the particular case illustrated, and may be about \( \frac{1}{3} \) inch thick at the center with a gradual taper toward the longitudinal edges. The member 5 is of properly calculated length and width and is so cut, designed and skived as to permit raising of the inner border and balancing of the heel. For this purpose, the member may commence at the medial posterior aspect of the heel and extends forwardly a distance sufficient to include the navicular and first cuneiform, and extends laterally to include the mids-tarsal area. Its highest point of elevation is at the anterior junction of the calcaneus with the talus.

The corrective member 7 is also about \( \frac{1}{3} \) inch in maximum thickness and of properly calculated length and width, and partially overlaps the member 5. The member 7 is so cut, designed and skived as to raise or support the entire mid-tarsal area of the arch structure, the first, second and third metatarsals, the inner, medial and external cuneiforms, the navicular, the astragalus, and the anterior-medial portion of the calcaneus. The member 7 commences directly behind the heads of the first, second and third metatarsals and terminates about \( \frac{1}{3} \) inch distal to the anterior portion of the calcaneus. It is designed to maintain the bones mentioned in a more normal position laterally and medially and helps to relieve the strain on the ligamentous and muscle structure. The greatest elevation of the corrective member 7 is between the medial cuneiform-navicular articulation, and the greatest elevation of the combined corrections 5 and 7 in their superimposed regions is at the astragaloidal navicular and mid-tarsal area.

Following application of the member 1, a third corrective member 9, also of felt or the like, and about \( \frac{1}{3} \) inch thick is applied to the sheet 3 in partly overlapped relation to the member 7. The correction 9 is also of properly calculated length and width, the member 9, designed and skived as to elevate the head of the second metatarsal. The member 9 is applied directly behind the head and tapers off posteriorly, extending backward about 1 inch on the site of the metatarsal shaft. With the members 5, 7 and 9 applied as above described, all the corrections are properly located in the exact positions needed to be most beneficial.

With the foot still extended as above described, the entire unexposed area of the base sheet 3 (and the corrective members 5, 7, 9, as well, if desired) should be coated with a suitable activator. I have found that a lacquer manufactured by Castex Laboratories, Inc., of Watertown, Massachusetts, and sold under the name "Castex" lacquer is admirably suited for the purpose. Two or three coats of this lacquer may be applied to the sheet 3. Thereafter, a second sheet 4 shaped and skived similarly to the sheet 3 and made of the same material as the sheet 3 is also coated with one or two layers of the lacquer or other activator on the skived surface which, in this case, is the inner surface, or the one facing the sheet 3 and the members 5, 7 and 9. While the two opposing surfaces of the sheets 3 and 4 are still slightly moist, the sheet 4 is applied over the sheet 3 and the corrective members 5, 7 and 9, thus sandwiching the corrective members in between the sheets 3 and 4. The operator now molds the entire assembly with his hands, making sure that there is no slipping or sliding, and that all ends, edges and sides are properly adhered. As pointed out above, the activator temporarily softens the material, permitting it to assume any desired shape or form. Thus, the assembly may be readily caused to conform to the contour of the foot, the extension 3a and the corresponding extension 4a of the sheet 4 being brought up into engagement with the inner aspect of the foot, and the extension or flange 3b of the sheet 3 and the corresponding extension 4b of the sheet 4 being brought up snugly around the heel, as best seen in Fig. 2.

At this point, a sock or socket is placed over the foot and the partly set form. The shoe 11 in which the appliance 13 is constituted by the assembly of the sheets 3 and 4 and the corrections 5, 7 and 9 is to be worn is now carefully put on the foot while the appliance 13 remains adhered to the foot, and the shoe is tightly laced. The patient is then required to stand or walk so as to apply pressure to the appliance 13 and thereby cause it to conform to the contour of the shoe as well as to that of the foot, the foot now being held in the corrected and more normal position. After about 10 or 15 minutes, which is usually sufficient time to permit the appliance to become set in shape, the shoe is removed and the corrective form or appliance 13 is carefully removed from the foot. It will be found that the appliance 13 has set into a fairly hard, but rather flexible mold, perfectly fitted to the exact contour of the foot and entirely compatible with the shoe. Obviously, the appliance 13 is suitable to hold the foot in the new and more normal position which it requires. After the appliance has become entirely dry, all the edges are ground, skived or smoothed and the entire appliance is finished off in any suitable manner. This may be done, for example, by applying thereover a covering 15 of leather, suede, or the like. In place of the leather coating, the appliance may be coated with or dipped in suitable dyes, or in liquid rubber, latex, collodion, flexible, non-activating shellacs, etc. In cases where it is found desirable to make the appliance completely rigid, the appliance may be dipped, sprayed, painted or otherwise suitably covered with "Castex" lacquer or other suitable material which hardens on drying. Several successive coatings may be thus applied in place of the leather, suede, or other similar covering 15, provided each preceding layer has become entirely dry.

When the several coatings have become hard and set, the appliance remains permanently in the
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molded shape and the coating material may be polished to provide a highly pleasing finish. This form of covering has the advantage of being water-proof and oil-proof and will have an exceptionally long life by reason of its great strength and durability.

From the foregoing description, it will undoubtedly be apparent to those skilled in the art that I have provided a novel method of molding corrective appliances directly on the foot in a manner which will permit placing the corrections precisely where required. The method constituting my present invention has the great advantage that it enables the operator to determine, either by palpating or in any other appropriate manner, exactly where the corrections are needed and of permitting placing the corrections directly over these areas. Where, as in some cases, further corrections are to be made, the sheet 3 may be omitted and the corrections 5, 7 and 9, or such other corrections as may be required, can be placed directly on the sole of the foot, and the sheet 4 applied thereover. Subsequently, as the condition of the foot necessitates, one or more of the corrections may be removed, or additional corrections may be applied. The last described form of my invention therefore has the advantage of permitting alterations as and when necessary.

Although I have described one form of my invention in great detail, it will undoubtedly be obvious to those skilled in the art that many variations thereof are possible. For example, in some cases, it may be found desirable to employ more than two of the sheets 3 and 4 with suitably interposed corrective members between adjacent sheets. Other similar changes or variations are also possible. Hence, I do not wish to be limited to the precise materials or steps mentioned in the foregoing description, but rather wish it to be understood that my invention is not to be limited except insofar as is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. The method of forming a corrective foot appliance suitable for use in a shoe and made in part from a supple sheet material capable of being shaped and of becoming relatively permanently set in shape in the course of time when treated with an activator, said method comprising adhering to the plantar region of a foot requiring correction one or more corrective members at points where correction is needed and at least one sheet of said material, causing said members and said sheet to adhere to each other as a unit to ultimately constitute the appliance, treating the exposed parts of said sheet with said activator, shaping said sheet while still supple to the contour of said region, placing said shoe on said foot while said unit remains adhered to said foot and while said sheet is still supple, and effecting pressure between said foot and said shoe whereby to cause said appliance to conform to the contours of both said foot and said shoe, said pressure being maintained for a period of time sufficient for said sheet to become substantially set in said contours under the influence of said activator.

2. The method of forming a corrective plantar foot appliance suitable for use in a shoe and made in part from a supple sheet material capable of being shaped and of becoming relatively permanently set in shape in the course of time when treated with an activator, said method comprising adhering to the plantar region of a foot requiring correction the first of two substantially similarly shaped sheets of said material, adhering to said first sheet one or more corrective members at points where correction is needed, treating the exposed parts of said first sheet with said activator, treating the second one of said two sheets with said activator, applying said second sheet over said corrective members and said first sheet and causing said two sheets and said members to adhere to each other as a unit to ultimately constitute the appliance, shaping said sheets while still supple to the contour of said region, placing said shoe on said foot while said unit remains adhered to said foot and while said sheets are still supple, thereafter effecting pressure between said foot and said shoe whereby to cause said appliance to conform to the contours of both said foot and said shoe, said pressure being maintained for a period of time sufficient for said shoe to become substantially set in said contours under the influence of said activator, thereafter removing said shoe from said foot, subsequently removing said appliance from said foot, and finally applying to said appliance a covering which is contoured to and snugly fits said appliance.

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