Jan. 28, 1958 A. J. HELFET 2,821,032

ORTHOPEDIC APPLIANCE FOR FLAT-FOOTEDNESS

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Fig. 1.

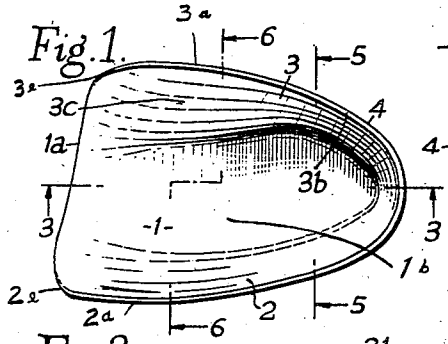


Fig. 2.

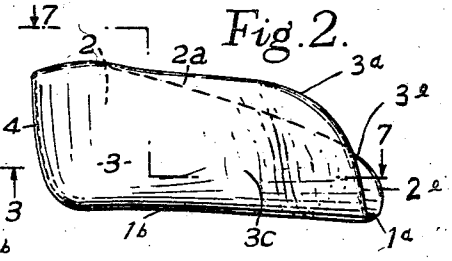


Fig. 3.

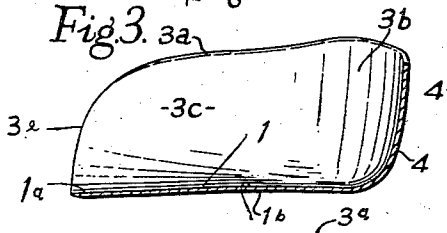


Fig. 4.

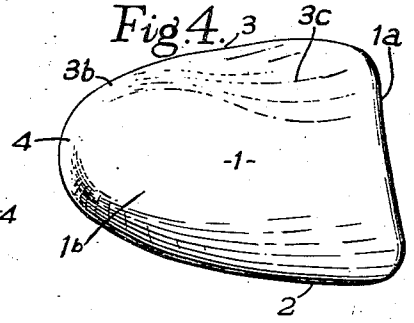


Fig. 5.

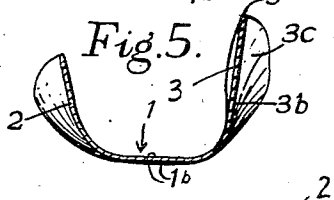


Fig. 6.

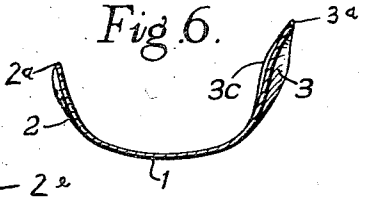
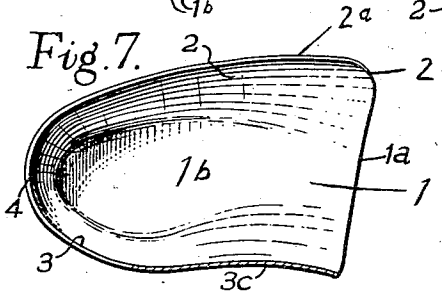


Fig. 7.



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ORTHOPEDIC APPLIANCE FOR FLAT-FOOTEDNESS

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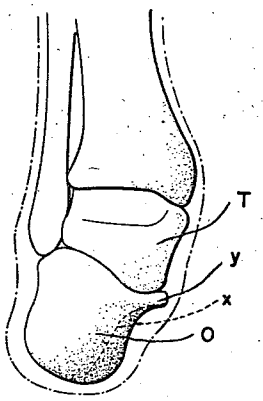


Fig. 8.

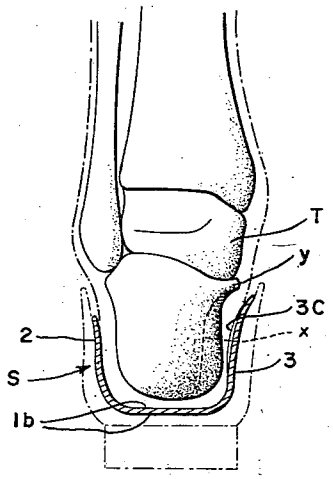


Fig. 9.

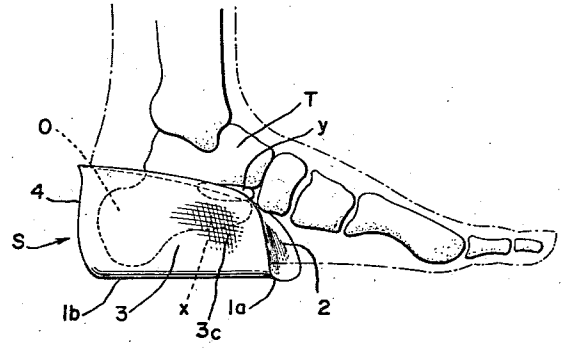


Fig. 10.

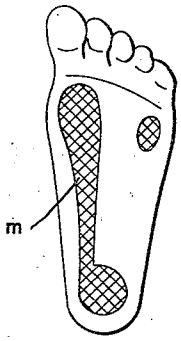


Fig. 11.

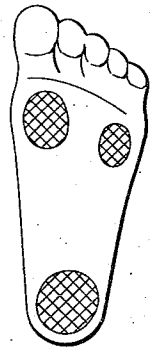


Fig. 12.

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ORTHOPEDIC APPLIANCE FOR FLAT-FOOTEDNESS

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Application November 29, 1955, Serial No. 549,778

Claims priority, application Great Britain December 24, 1954

5 Claims. (Cl. 36—71)

This invention relates to an orthopedic appliance for the correction of flat-footedness or other deformities of the human foot caused by an everted heel and is a continuation-in-part of my invention disclosed in my copending application, Serial No. 307,245, filed August 30, 1952, now abandoned.

Flat-footedness in humans is of two kinds—i. e., congenital or acquired—and commences in childhood in an otherwise normal mobile foot. Flat-footedness is caused by the weakness of the tibial group of tendons and muscles on the inner side of the foot and the consequent stronger pull of the peroneal tendons and muscles of the outside, resulting in the everted tilting of the os calcis transversely of the foot in an oblique direction with its lower portion directed outwardly and its upper portion directed inwardly of the foot. Since the normal human foot bears a person's weight chiefly in tripod fashion at three points—that is, at the heel (os calcis) and at the heads of the first and fifth metatarsals—such everted tilting of the os calcis causes the talus and the adjacent bones of the foot arch to lower, thus breaking down the arch of the foot so as to place the weight of the person along the inner or medial border of the foot, which is not suitable for weight-bearing and thus produces discomfort and awkward gaits—i. e., "pigeon-toed" walking or an outwardly splayed gait. This eversion of the heel, and consequent lowering of the arch, causes the stiffening material of the counter of the shoe worn on such foot to break down after little use and spread laterally outward of the shoe, as is well known.

It was first sought to remedy this condition by the use of arch support (which are still used to some extent), but such arch supports only raise the arch of the foot and do not develop strength in the muscles thereof to sustain the arch in its normal raised position. Thus, when the arch support is removed, the arch of the foot collapses.

Lately, and now quite prevalently, the, so-called, "Thomas" heel has been employed to correct eversion—i. e., by elongating the heel on the bottom of the shoe for about one inch along the inner or medial edge of the shoe to extend under the arch of the foot and by thickening (by about ⅛-inch) the heel on its medial or inner side to tilt the ankle of the foot outwardly within the shoe upper. With this construction, and if the stiffened heel counter of the shoe fits snugly around the heel of the foot, this tilting of the ankle does temporarily tend to correct the eversion of the os calcis; but, since the forwardly extending elongated portion of the shoe heel inverts the forefoot slightly, no matter how long the child wears these altered shoes, his foot and heel relapse in some degree after the treatment is discontinued.

Among the other disadvantages of the Thomas heel, the main one is that it is difficult to preserve the snug fit of the counter of the shoe around the child's heel as the foot tends to slip down the sloping inner sole to the outer side of the shoe, deforming the outer wall of the stiffened counter and wearing the shoe heel down along its outer border. Once the grip on the heel of the foot is lost, the

shoe must be repaired or renewed, or otherwise it is ineffective. Another disadvantage is that the Thomas heel is not wholly effective for forming or re-forming the arch of the foot, as continuity of wear must be maintained and the child cannot wear other types of shoes such as slippers, sandals, boots, tennis shoes, or football shoes, without breaking the continuity of treatment.

The object of the present invention is to effectively correct the everted heel with an appliance which is fitted to the heel of the foot in the area only of the os calcis and which is so formed and shaped that, when the foot supports the weight of the wearer in the normal way—that is, with the heel of the foot and the fore part of the foot resting upon a supporting surface—the os calcis is shifted by the appliance from its everted position to its normal vertical position and lifts the bones in the arch of the foot to their normal relationship, thus restoring the three-point weight bearing position of the foot, whether or not the foot is enclosed by a shoe or boot or other foot covering, and without the aid of arch supporting means or other devices, whereby, in the case of growing children, permanent correction is eventually attained due to the surrounding muscles and tendons developing and strenghtening in their normal way to hold the os calcis and the other bones of the foot in corrected position, thus permitting the discontinuance of the use of the device or any other further aid.

Another object of the invention is the provision of such an appliance, as just mentioned, that may be inserted into and removed at will from any shoe or foot covering its user may desire to wear, whereby the user needs only one such appliance (for each foot that may require correction) during the period that such appliance proper fits his foot; or, in other words, until he has outgrown it and needs a larger size. While the appliance is equally effective if no foot covering is employed (should it be laced onto the foot) and since most people wear shoes of some type, it is practical to use the appliance in connection with a boot, shoe, tennis shoe or the like.

The objects of the present invention are attained by providing a relatively thin rigid heel-seat having a generally scoop-shaped formation with its inner surfaces shaped to conform snugly to the contour of the foot of an individual by whom it will be worn, embracing only the os calcis portion of the foot and extending no farther forward of the foot than to underlie approximately the navicular or scaphoid bones of the foot, the upper and under faces of the bottom wall of the scoop-like device or heel-seat being flat under the os calcis bearing portion thereof to provide a non-rolling or non-rocking anchor for the appliance under the weight of the wearer and having its side walls generally vertical; but, since the sustentaculum tali broadens transversely of the foot as it approaches the under surface of the head of the talus, substantially the forward and upper horizontal half of the side walls follow this broadening and diverge slightly upwardly and outwardly; and the inner or medial side wall has a slight inwardly projecting bulge which corresponds to and complements an opposing depression in the os calcis underlying the sustentaculum tali. Thus, the inner surface of the generally vertical side walls of the rigid scoop-like heel-seat follows and fits the configuration of the flesh or tissue enveloping the os calcis and boxes the os calcis firmly between its bottom, side and rear walls. The outer surface of the heel-seat generally conforms with the configuration of the inner surface. It should be noted that the heel-seat of this invention gives no direct support whatever to the arch of the foot.

The invention will be understood more readily from the following detailed description of one embodiment thereof when read in conjunction with the accompanying

drawings illustrating the appliance as at present devised and used.

In the drawings:

Figure 1 is a top plan view of the heel-seat in accordance with the present invention and designed for the left foot;

Figure 2 is a side elevation of the heel-seat shown in Figure 1, as viewed from its medial side or inside when applied to the foot;

Figure 3 is a longitudinal sectional view taken on line 3—3 of Figure 1;

Figure 4 is a bottom plan view of the heel-seat shown in Figure 1;

Figure 5 is a transverse sectional view taken on line 5—5 of Figure 1;

Figure 6 is a transverse sectional view taken on line 6—6 of Figure 1;

Figure 7 is a plan view of the heel-seat with the front portion of its medial or inside side wall in section and taken on line 7—7 of Figure 2, to illustrate the inwardly extending bulge thereof in a horizontal plane;

Figure 8 is a back or rear view of an everted heel of a left foot illustrating the position of the os calcis and talus relative to the tibia leg bone and its associated fibula, the flesh layer being shown in phantom lines;

Figure 9 is a back or rear view of an everted heel, similar to Figure 8, but with the heel-seat appliance of this invention applied to said heel and the foot bearing the weight of the wearer which has caused the os calcis and talus to shift to proper normal position, the flesh layer and a shoe being shown in phantom lines;

Figure 10 is an elevational view, similar to Figure 2, showing the medial or inner side of the heel-seat and its relationship with the bones of the foot when applied to the foot;

Figure 11 is a bottom plan of the left foot shown in Figure 8 and illustrating the weight-bearing characteristics of a flat foot having an everted heel and fallen arch; and

Figure 12 is a view similar to Figure 11 and illustrating the normal three-point weight-bearing areas of a normal foot.

The heel-seat S shown in the drawings, Figs. 1 to 7, inclusive (which is intended for use on the left heel of the wearer) is in the general shape of a scoop, comprising a bottom wall or platform portion 1 from which upwardly extend an outer side wall 2, an inner side wall 3 and a curved rear wall 4, all of said walls connecting and merging and being of a one-piece rigid construction of relatively thin material, substantially uniform in thickness, that may be molded from suitable plastic materials or fashioned from metal. This scoop-shaped rigid one-piece heel-seat S is made to snugly conform with the contour of the heel of the foot of the individual by whom it will be worn, embracing the os calcis O only. Since the os calcis of the human foot is substantially the same relative shape in all persons, it has been found that it is only necessary in most cases to provide the heel-seat of this invention in different sizes according to the development of the child or adult.

The bottom wall or platform 1 has flat opposite parallel bottom and top surfaces for its major area 1*b* that underlies and affords the main bearing support for the os calcis O. The forward or front marginal portion 1*a* of the platform may be declined very slightly on a gentle curve, as shown in Figures 2 and 10, and does not extend beyond the forward part of the wearer's heel area—that is, no farther than the proximal edge of the navicular or the scaphoid bone; and, further, the major portions of the side walls 2 and 3 are substantially vertical and diverge forwardly with their forward upper marginal portions sloping gradually upwardly and outwardly, thereby conforming to the shape of the os calcis as shown in Figures 1, 5 and 7, allowing of course, for the intervening flesh tissues surrounding the os calcis.

To effect the corrective inverted tilting of the os calcis with this heel-seat, the forward portion of the inner or medial wall 3 is formed with an inwardly extending convexed bulge 3*c* positioned to be opposite and conform with the contour of the depression *x* in the os calcis lying under its portion *y*, known as the sustentaculum tali, the function for which will presently appear.

A heel-seat S of proper size, such as has just been described, when applied to the heel of the foot in the manner shown in Figures 9 and 10 (whether within a shoe or without a shoe or other foot covering), has no effect in correcting the mal-condition of the foot; however, as soon as the weight of the body of the wearer is placed upon the foot resting upon a supporting surface, said weight anchors the flat bottom face 1*b* of the heel-seat to said supporting surface, with the forward portion of the foot bearing its share of the weight on the supporting surface. Under the action of such weight, the bulge 3*c* on the inner wall 3 then presses against the face of the depression *x* of the os calcis, under the sustentaculum tali *y*, and shifts the os calcis at the subastragaloid joint from its everted position to a vertical position and presses it against the outer wall 2 of the heel-seat, which results in the forward end of the os calcis O causing the talus T and its associated bones—and hence the arch of the foot—to rise, relieving the weight from the inner or medial border *m* of the forefoot (Fig. 11) and establishing the normal three-point weight-bearing for the foot as shown in Figure 12.

By holding the os calcis O vertical with the heel-seat of this invention, as above described, the wearer walks normally and, in the case of growing children, if the os calcis is held vertical long enough during the weight-bearing activities of the foot, the surrounding muscles and tendons strengthen and the foot sets with a proper normal arch.

It will be noted that the top edge 2*a* of the outer side wall 2 (Figs. 2 and 10) slopes downwardly from a point forward of the rear wall 4 at a greater degree of declination to the front edge 1*a* of the platform than does the top edge 3*a* of the inner side wall 3, the front portions 2*e* and 3*e* of these top edges being rounded as indicated. Thus, the forward portion of the top edge 3*a* of the inner or medial wall 3 may be generally slightly higher than that of the outer or lateral wall 2, so that the top portion of the inner wall 3 will extend substantially to a point opposite the sustentaculum tali *y* (see Fig. 9) to afford an abutment surface for the top medial side of the os calcis, which abutment coacts with the outer wall 2 to shift the os calcis when the device is applied to the heel of the wearer's foot and the foot is supporting his weight.

It will also be observed that, due to the curved formations of the heel-seat, the convex-concavo bulge 3*c* may not appear too pronounced. Nevertheless, this bulge 3*c* occupies an area extending from just below the top edge 3*a* of the wall 3 to the platform 1 and is curved slightly in the horizontal plane, as can be seen from Figures 5, 6 and 7. The crest of this bulge 3*c* is positioned to lie opposite and follow the contour of the depression *x* in the os calcis on its medial side to exert pressure thereon at this point, as above mentioned.

The most convenient manner in which to wear the heel-seat of this invention is in connection with a pair of boots, shoes or soft shoes (such as tennis shoes, bowling shoes and the like), as such foot coverings hold the heel-seat in place during the locomotion of the wearer. When boots or shoes are employed having stiff heel counters, such counters give added support to hold the heel-seat in position in the shoe, but the wearing of the present invention with shoes having stiff heel counters is not essential, as has been above pointed out.

It will be apparent that a heel seat for use with a right heel must be formed as a mirror image of the one described and illustrated which, as mentioned above, is intended to be worn on a left heel.

The heel seats according to this invention can most conveniently be manufactured from plastic material or light metal alloys, and they may readily be moulded in known manner which would enable large numbers to be produced very cheaply. Only one pair of heel-seats is required at a time for any one person because they may be transferred as the shoes are changed, it taking from six to nine months before the average child outgrows any one size. The plastic material referred to may be a phenol formaldehyde resin, a vinyl resin, polystyrene, acrilic resin, cellulose acetate, cellulose nitrate or hard rubber. However, at the present time I prefer to construct the heel-seats of a so-called fiber glass with a binder such as a polyester resin.

While the heel-seat appliance of this invention may be used for adults with flat feet, it is intended that the heel seats should be utilized mainly for the strengthening of the feet of growing children which need correction for slight deformity, in order to prevent flat-footedness or knock-knees, and it has been found that with continuous wear the foot is forced into its natural position, and since the weight of the wearer is distributed and borne by the proper supporting surfaces, in time the muscles of the foot are strengthened, and the heel seat may be discarded when the deformity has been overcome. Any support under the arch of the foot in connection with the heel-seat device of this invention would be detrimental to the treatment. I find that the average time a child must wear constantly the heel-seat appliances of this invention, before the arch is "set," is from two to two and a half years, by which time the muscular structure is sufficiently strong to maintain the arch permanently in its corrected position and no further treatment is required.

It will be apparent that the present invention provides a heel seat which is cheap to manufacture in large quantities from plastic material or metal and which may be worn with the minimum of discomfort in normal foot-wear. The heel seat ensures that the correct weight bearing surfaces of the foot are employed and since no weight is borne unnaturally by the arch of the foot, the wearing of the heel seat gradually strengthens the foot and eventually enables the heel seat to be discarded having reformed the foot into its correct shape.

For ordinary flat feet these heel-seats could be prescribed by family and school doctors and dispensed by appliance makers, or by trained employees in any good shoe store. If the heel-seat fits the child's heel it is the right heel-seat. So prescribed, it would relieve some of the congestion in hospital orthopedic departments. It may also be used prophylactically in convalescence if the child's feet are weakened by illness or recumbency.

I claim:

1. An orthopedic appliance for correcting everted heels comprising a one-piece rigid scoop-shaped member of relatively thin material adapted to fit upon and receive only that area of the heel of the wearer occupied by the os calcis; said scoop-shaped member having a flat bottom wall the surfaces of which are substantially horizontal and parallel and having the opposing side walls and the rear wall joined with the bottom wall on a rounded curve and shaped internally to conform to the outline of a normal heel to encase and firmly grip said everted heel medially, laterally and rearwardly; the front portion of the medial side wall being formed on its inner surface with a curvilinear convexed bulge portion extending horizontally of said wall to conform with the depression in the os calcis underlying the sustentaculum tali thereof, whereby, under the weight of the wearer standing on his heel and forefoot, the bottom wall of said scoop-shaped member is held flat on a supporting surface and the convexed portion acts to exert a pressure against the front portion of the medial side of the everted os calcis to invert it to normal vertical position and hold it against the lateral wall and force the talus and its associated bones of the arch of the foot upwardly to restore the foot to normal arched position.

2. The orthopedic appliance as set forth in claim 1, wherein the outer surfaces of said scoop-shaped member conform to the configuration of the inner surfaces thereof, and the rear portions of said side walls are substantially vertical above their curving juncture with the bottom wall and diverge outwardly and forwardly of the scoop-shaped member.

3. An orthopedic device as set forth in claim 2, wherein the upper edges of said side walls gradually decline toward the forward end of the scoop-shaped member and merge with the front end of the bottom wall in a rounded curve, the upper edge of the lateral side wall being declined at a greater degree than the upper edge of the medial side wall.

4. The subject-matter of claim 3, wherein said side walls lie below the medial and lateral malleoli and, together with the bottom wall, extend no farther forward than the proximal edge portion of the navicular bone, when the heel-seat is worn.

5. The subject-matter of claim 1, wherein the forward edge portion of the bottom wall declines slightly from its flat surface toward the forward edge thereof.

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