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D. J. MORTON

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MEANS FOR COMPENSATING FOR FOOT ABNORMALITIES

Filed June 20, 1927

Fig. 1.

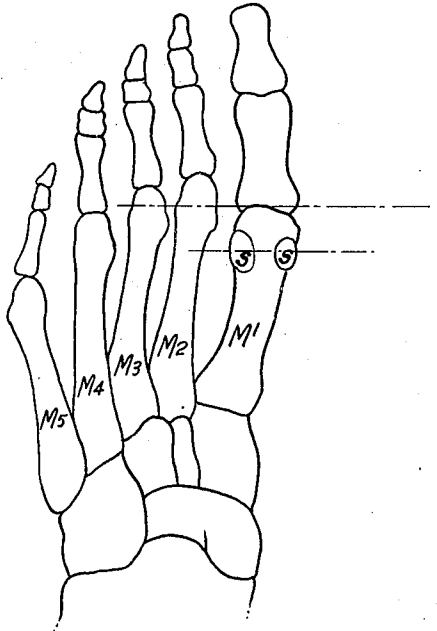


Fig. 4.

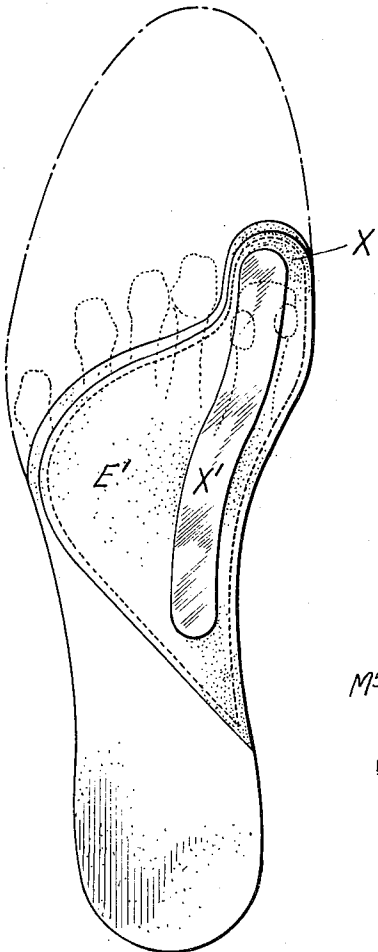


Fig. 3.

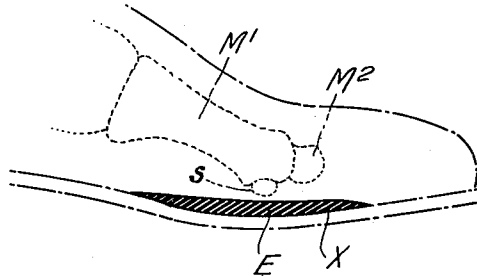
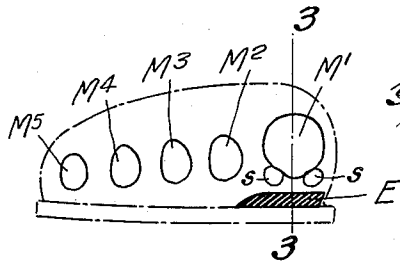


Fig. 2.



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MEANS FOR COMPENSATING FOR FOOT ABNORMALITIES

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In the course of my investigations concerning the human foot, I have discovered that in some individuals there is an undue shortness of the first metatarsal bone, so that it does not extend as far forward as the second, or in some cases even the third. As a result, the longer metatarsal bones receive the concentrated stresses of body weight in walking and in other locomotor activities, while the first metatarsal bone fails to perform its proper share of function. Such unequal distribution of functional stresses is a frequent cause of severe pain and discomfort in the forepart of the foot, and of painful callosities.

In some other feet, I have found that the anterior ends (heads) of the first and second metatarsal bones are on a line with each other, being equi-distant from the heel, but the sesamoid bones which represent the point of ground contact of the first metatarsal bone, are located rearwardly relative to the head of the second metatarsal bone. The effect upon the foot's function is similar to that produced by a short first metatarsal bone.

The present invention aims to provide a method of and means for compensating for such morphologic variations and avoiding or removing the pain and discomfort not infrequently attendant therewith, and the invention includes the novel method and means hereinafter described and defined in the appended claims.

In order that the invention may be more readily understood reference is made to the accompanying drawings, in which:—

Figure 1 is a plan view of the bones of the forward portion of a human foot having such comparatively short first metatarsal bone.

Fig. 2 is a cross section through a shoe (shown conventionally) to illustrate my method and means for correcting the effects of the abnormal condition, the bones being shown in their relative positions, but all else omitted.

Fig. 3 is a section on line 3—3 of Fig. 2, with the relative position of the head of the second metatarsal bone indicated, and

Fig. 4 is a diagrammatic plan view illustrating a modification.

In Figure 1 which is a reproduction from an X-ray photograph of such a type of foot, the metatarsal bones are designated respectively M1, M2, M3, M4 and M5 and it will be observed that the first bone M1 is considerably shorter than the second M2 or even the third M3, and such a condition produces under locomotor activities the pain and other troubles hereinbefore referred to.

I have discovered that by placing beneath that portion of the foot which underlies the front end of the first metatarsal bone M1 a thickness of supporting material, such as indicated at E, this will compensate for its relative shortness in stance and make the foot function in locomotor activities, like an ordinary foot, thereby avoiding the distressing results which usually follow such a structural variation.

The same thing is true in cases where the ends of the first and second metatarsal bones are in line, but the sesamoid bones (indicated at s s in the same figures for convenience) are located rearwardly relative to the head of the second metatarsal bone.

The essential features of the present invention are; (1) providing a sufficient difference in thickness of material (E) interposed between the foot and the supporting surface or ground, beneath the head of the first metatarsal bone on the one hand, and the adjacent metatarsal bones on the other, the greater thickness underlying the first metatarsal in order to compensate for its relative shortness in stance; and (2) a forward extension of the material E (as X in Fig. 3) beyond the line of the basal joint of the great toe in order to make it effective as an artificial extension of the first metatarsal bone in the leverage action of the foot. Although distinctly different in their fundamental action, these two features or elements are intimately related because they apply to the two phases of foot function; either of them may be employed separately, but they are preferably and more properly used in combination.

The increased thickness of material (E) underlying the ball of the great toe may be

designated a "metatarsal lift". If carried beyond the forward end of the first metatarsal bone as X, it is ordinarily effectual as an artificial extension of that bone, because the greater depth of material furnishes some degree of increased rigidity in that area. A more rigid extension X 1 (Fig. 4) however, may comprise a strip or plate of metal or other suitable material, which extends from some rearward position to beyond the head of the first metatarsal bone and under the base of the great toe. Also, such an extension may be incorporated in the design of an arch support or other device, as a supplementary feature; the present models of arch support extending practically to, but not beyond, the head of the first metatarsal bone.

It is not an uncommon procedure in the treatment of pronation (commonly termed "weak ankles", "fallen arches") to supplement a wedge on the inner side of the heel of a shoe, with another wedge along the inner border of the sole. In pronation the inward roll of the ankle causes a concentration of body weight upon the inner arched border of the foot; consequently these combined wedges are used in order to more effectively tilt the foot outwardly and thereby transpose the concentration of body weight toward the outer border of the foot. Such a combination of wedges produces an absolutely different effect than is indicated or desired in the present case. In a foot with a short first metatarsal bone, the object to be accomplished is to elevate the supporting surface beneath the head of the first metatarsal, and to extend its effective leverage action so that this bone will be caused to assume a greater share of functional stresses, and in doing so, to relieve the second metatarsal from an undue concentration of such stresses, without the mechanism of the entire foot being disturbed or altered.

These features may be applied directly in the making of a shoe, or by subsequent alterations, in two ways: (1) by reducing the material of the sole which lies under the second and third metatarsals, or (2) by the insertion of extra material to underlie the first metatarsal bone. As another mode of application, the features may be incorporated in an insole or some other foot device, to be worn within the shoe. (Fig. 4.)

When using the device in the form of a removable insole, the added thickness of material (E') may be extended backwardly to stiffen the middle section of the insole against wrinkling, and laterally so that padding of some sort can be held in the area behind the heads of the second and third metatarsals, to further reduce the pressure exerted at the points of their ground contact where painful callosities have been formed in a large per cent of such cases.

It will be understood that when I use the

term "article of footwear" herein it is intended in the broad sense and to be inclusive of not only shoes of all kinds, but insoles, devices, or attachments to be used with shoes.

What is claimed is:

1. A device adapted to be worn under the foot in a shoe, comprising a flat piece of leather or other suitable material, which extends from beneath the heel, forwardly to a transverse line immediately behind the heads of the four outer metatarsal bones, and with an extension which continues forward beneath the head of the first metatarsal bone.

2. A device of the nature of an insole, extending from under the heel, forwardly to a line immediately behind the heads of the four outer metatarsal bones, and having an extension which continues forwardly beneath the head of the first metatarsal bone, this extension being of greater thickness than the main portion of the insole.

3. A device of the nature of an insole extending from a rearward position, from under the heel, forwardly to a transverse line close behind the heads of the four outer metatarsal bones, and continuing forwardly beneath the head of the first metatarsal bone, the said device being two-layered or split, and suitably joined so as to allow for adjustment of thickness in the extended area and in the central portion behind the metatarsal heads by means of various thicknesses of inserts.

4. An insole extending from under the heel forwardly to a line closely behind the heads of the four outer metatarsal bones, and continuing forwardly beneath and beyond the head of the first metatarsal bone, and having a relatively rigid strip or plate positioned along and under the inner border of said insole and continuing forwardly beneath its extended portion underlying the base of the great toe.

5. The combination with a shoe sole of an inner member carried thereby and lying beneath and corresponding substantially in width to the head of the first metatarsal bone of the wearer and supporting said first metatarsal bone upon a relatively horizontal plane abruptly raised above the surface which supports the heads of the four outer metatarsal bones.

6. The combination with a shoe sole of an inner member overlying the shank thereof having the major portion of its forward edge located on a line immediately behind the location of the heads of the four outer metatarsal bones and with the remaining portion provided with an extension continuing forward beneath the location of the head of the first metatarsal bone.

7. A shoe having a sole provided on its upper face with a raised portion positioned to underlie the head of the first metatarsal bone and being of substantially the same width as said bone, said raised portion being

of uniform thickness in transverse section and tapering towards the front and back of the shoe.

8. A shoe having a sole provided on its
5 upper face with a raised portion positioned to underlie the head of the first metatarsal bone and being of substantially the same width as said bone, said raised portion being of uniform thickness in transverse section
10 and tapering towards the front and back of the shoe and having its longitudinal edge adjacent the outer side of the shoe inclined.

In testimony whereof, I affix my signature.
DUDLEY J. MORTON.

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