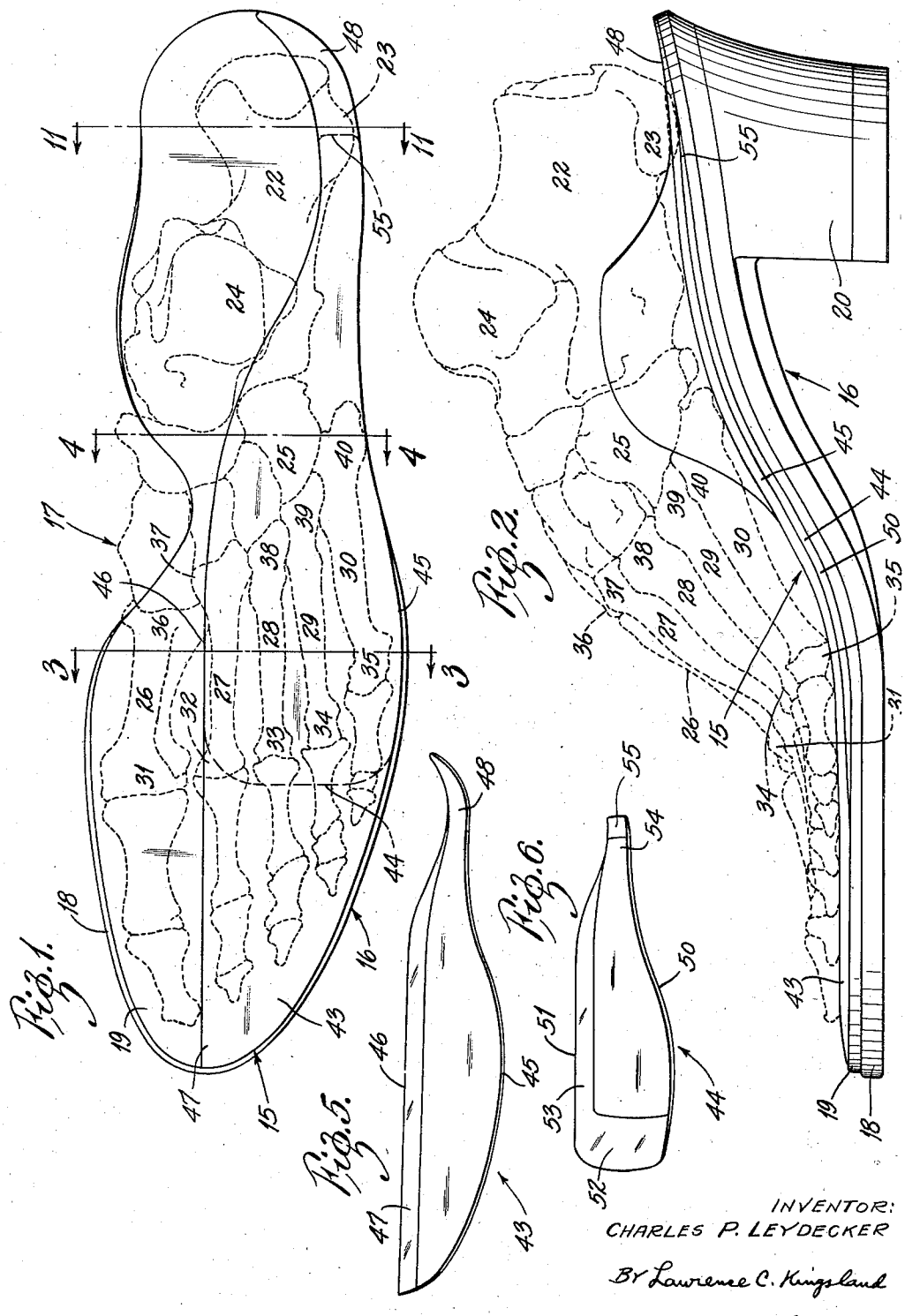
Aug. 19, 1941. C. P. LEYDECKER 2,252,936

METHOD OF BALANCING A FOOT WITHIN A SHOE

Filed March 5, 1938 2 Sheets-Sheet 1



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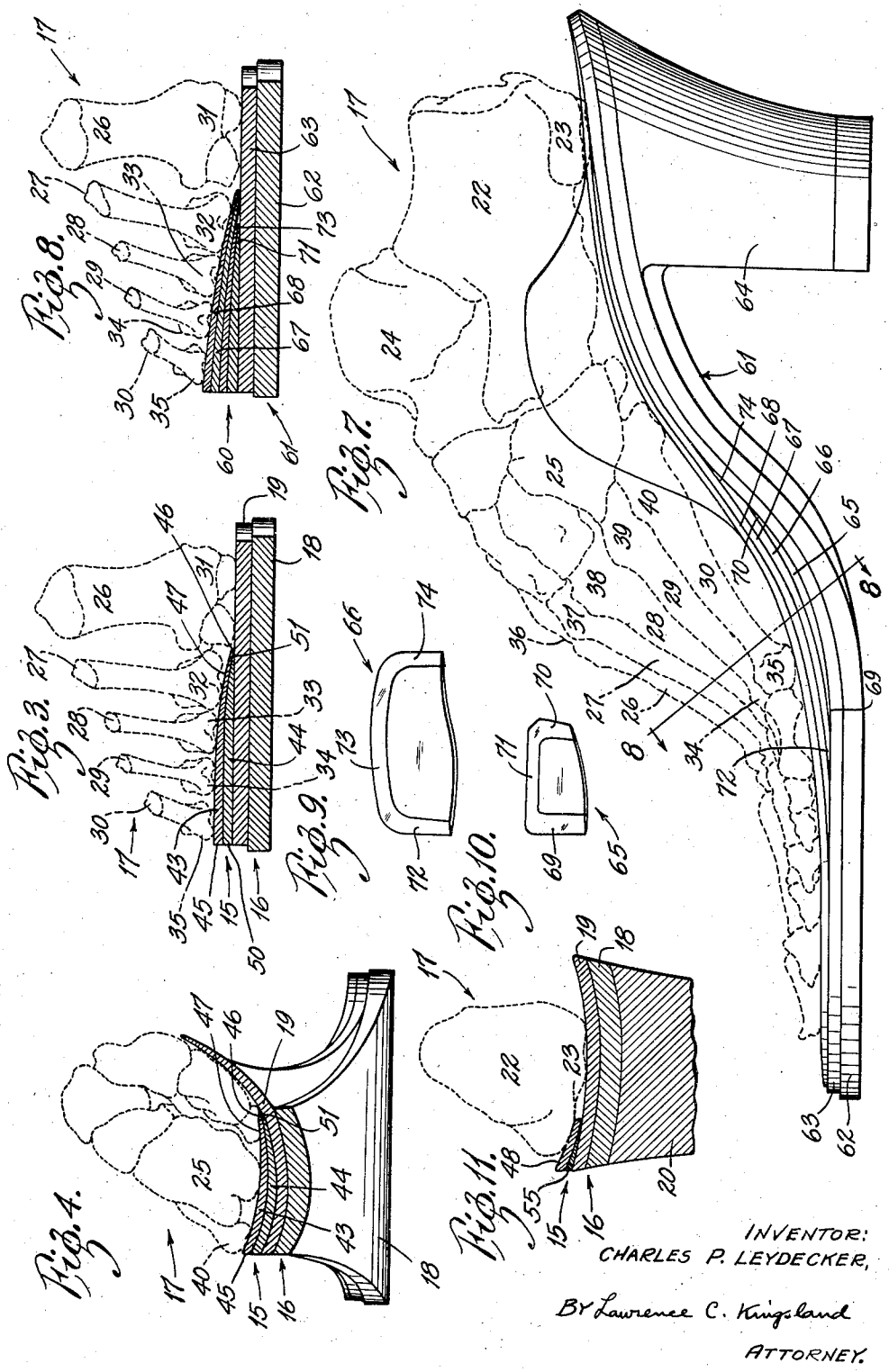


Fig. 8.

Fig. 7.

Fig. 3.

Fig. 9.

Fig. 10.

Fig. 4.

Fig. 11.

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METHOD OF BALANCING A FOOT WITHIN A SHOE

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5 Claims. (Cl. 12—142)

The present invention relates generally to shoes, and more particularly to a method for effecting foot balance within a shoe, and means for achieving such balance.

The present invention is predicated upon the theory that there is only one longitudinal bone arch in the foot construction when the heel bone or os calcis is raised above the plane of the forepart of the foot, the main columns or supports of which comprise the os calcis and the forward portion of the first metatarsal. Many authorities aver that there are three or four arches in the longitudinal dimention of the foot; but a study of the bones in the feet shows that the many bones which comprise a foot when in the just stated relationship make up one complete arch, some parts of which are concave and some parts of which are convex, but all of which contribute to the one single arch.

Modern shoe construction has resulted in the dropping of certain bones of the foot, notably the cuboid and the fifth metatarsal, so that the rear portion of the fifth metatarsal contacts the shoe in walking at a point below a plane through the bottom of the os calcis and the forward portion of the first metatarsal. This, however, is not a natural position. This lowering of the enumerated bones of the feet has been caused by constructing shoes with heels, which, of course, raises the position of the os calcis relative to the forward portion of the first metatarsal. In ladies' shoes the base of the fifth metatarsal actually slides downwardly along the steep shank thereof at each step.

Many devices have been devised in an effort to compensate for the position of the bones in the foot in this man-made position relative to the ground; and none of them has been singularly successful. Many have concentrated on supporting the inner side of the foot at the center of the arch by means which are generally designated arch supports.

However, few have seriously considered the outer side of the longitudinal arch which, in the final analysis, is the primary weight carrier of the foot. Experiment has shown that the weight of the body in walking is carried from the os calcis, or heel bone, as one main support along a substantially curved line through the cuboid and the fifth metatarsal to the forward portion of the first metatarsal as the second main support. In other words, in walking, the weight of the body is distributed along the outer edge of the foot in an arc of a circle from the heel bone to the forward portion of the first metatarsal. The forward portions of the fifth, fourth, third and second metatarsals assist to only a minor degree this weight transfer from the base of the fifth metatarsal to the forward portion of the first metatarsal when the os calcis and the forward portion of the first metatarsal are on the same plane, but when the former is raised relative to the latter by high heels their weight shifting function increases greatly. The foot has a tendency to roll, which is a balanced movement when the heel is not maintained raised relative to the metatarsals.

Before proceeding, it should be observed here that the lower portion or supporting surface of the os calcis is not flat, but is rounded and has a tuberosity on the outer side. To prevent all wobbling of the foot in walking, a support is necessary beneath the tuberosity where high heel shoes are worn, which changes the general relationship of the bones of the foot.

As the weight is shifted forwardly in walking, the base of the fifth metatarsal, which is, in effect, a marked protuberance, assists in the forward shifting thereof by contact with the walking surface. However, when the heel bone is elevated, the base of the fifth metatarsal is likewise relatively elevated and, to contact the walking surface, must drop a greater degree, which results in straining the main longitudinal arch, inasmuch as the bone structure must give to allow this unnatural ultimate position of the base of the fifth metatarsal. This dropping downwardly of the rear portion of the fifth metatarsal accentuates the rolling weight distribution throughout the foot and results in the outward turning over of the shoe which is one of the greatest wear points in modern shoe construction. The majority of shoes, after being worn a short while, show this overturning outwardly of the upper over the edge of the sole. The present invention contemplates correcting this distorted action of the bone structure by providing a natural support for the front and rear portions of the fifth metatarsal and the front portions of the fourth, third, and second metatarsals which will alleviate strain in the foot and save this undue overturning of the shoes outwardly.

The above noted undue lowering of the outside bone structure of the foot, resultant of raising the heel relative to the forward portion of the first metatarsal, strains the whole foot structure and causes tiring of an individual prematurely. Only when the foot is properly balanced is the circulation of the blood normal and can the blood enter and leave the pedal extremity without

straining the heart. There are nerves passing through the feet which transmit the proper amount of nerve impulses when the circulation is normal, and quite obviously impoverished circulation will lead to subnormal nerve impulses and resultant impaired activity of the feet. Lengthy experiments have proved that a foot housed in a shoe constructed in line with the present invention has normal blood circulation. Wearers of such shoes have been able to withstand very substantially greater strains in usage of the feet than when wearing shoes of conventional design and construction.

Therefore, an object of the present invention is to provide a method of balancing a foot within a shoe to reduce bone and muscle strain and to prevent the outward overturning of the shoe upper over the edge of the sole.

Other objects and advantages will be apparent from the following description, taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a plan view of the sole assembly of a shoe showing one exemplification of the present invention in position on the inner sole, the bones of a foot being shown in dotted lines;

Fig. 2 is a side elevation of the shoe sole assemblage, exemplification of the present invention, and foot bones shown in Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a section on the line 4—4 of Fig.1;

Fig. 5 is a perspective view of one of the elements of the device comprising the subject matter of the present invention;

Fig. 6 is a perspective view of a second element of the device comprising the present invention;

Fig. 7 is a side elevation similar to Fig. 2 showing another exemplification of the present invention, the heel of the sole assembly being of a greater height than the heel shown in Fig. 2;

Fig. 8 is a section on the line 8—8 of Fig. 7;

Fig. 9 is a perspective view of a third element of a device comprising the subject matter of the present invention;

Fig. 10 is a perspective view of a fourth element of a device comprising the subject matter of the present invention; and,

Fig. 11 is a section on the line 11—11 of Fig. 1.

Referring to the drawings more particularly by reference numerals, there is shown in Figs. 1–4 one exemplification of the present invention in the form of the insert 15 disposed in operative relation to a sole assemblage 16 of a shoe, bones 17 being shown by dotted lines in a normal relation thereto.

The sole assemblage 16 is part of a woman's shoe and includes an outer sole 18, an inner sole 19, and a relatively low heel 20.

Before passing to a more detailed consideration of the insert 15 forming the subject matter of the present invention, it is well to point out the several more important of the foot bones 17 shown in dotted lines. The foot bones 17 include an os calcis 22 having a tuberosity 23, an astragalus 24, a cuboid 25, and the first, second, third, fourth, and fifth metatarsals 26, 27, 28, 29, and 30, respectively, which include front portions 31, 32, 33, 34, and 35, respectively, and rear portions or bases 36, 37, 38, 39, and 40, respectively (Figs. 1 and 2).

The insert 15 includes an upper element 43 and a lower element 44 (Figs. 5 and 6, respectively). The element 43 is of a general configuration shown in Fig. 5, and is of substantially the length of the inner sole 19, as can be appreciated from an inspection of Fig. 1. It has an outer edge 45, which follows the contour of the outer edge of the inner sole 19, and an inner edge 46. The element 43 is beveled at 47 adjacent the edge 46 and includes a reduced hooked portion 48 which is adapted to extend around the base of the os calcis 22 and to receive thereon or wedged thereagainst the tuberosity 23 thereof. The element 43 is of substantially uniform thickness, being biplanar when in flat form.

The element 44 is of the general configuration shown in Fig. 6 and includes an outer edge 50, which follows the contour of the inner sole 19, and an inner edge 51. The element 44 is beveled forwardly at 52 and at 53 adjacent the edge 51. As can be appreciated from Figs. 3 and 4, the element 44 slopes slightly from the outer edge 50 towards the bevel 53 for a purpose to be described. A reduced rear extremity 54 is beveled at 55. In Fig. 1, the element 44 is shown in dotted lines beneath the element 43.

Referring to Figs. 7 and 8, there is shown a modified insert or device 60 which is adapted to be used with a sole assemblage 61 having a higher heel than the sole assemblage 16. The sole assemblage 61 includes an outer sole 62, an inner sole 63, and a heel 64. The foot bones 17 are shown in the same relation as they are shown in Figs. 1–4, with the exception that the os calcis is on a higher level relative to the forward portion of the first metatarsal in Figs. 7 and 8 than in Figs. 1–4.

The insert 60 differs from the insert 15 by the inclusion of additional elements 65 and 66, elements 67 and 68 being identical with the elements 44 and 43, respectively.

The element 65 is of the configuration shown in Fig. 10 and is of biplanar construction. It is beveled forwardly at 69, rearwardly at 70, and along the inner side at 71.

The element 66 is of the configuration shown in Fig. 9 and is beveled along the front, the inner side, and the rear at 72, 73, and 74, respectively. The relationship of the elements 65, 66, 67, and 68 in their formation of the insert 60 is clearly shown in Fig. 7.

In use, the device forming the subject matter of the present invention, be it the insert 15 or 60, is placed in a shoe on the inner sole and below the sock lining along the outer side thereof. This can be readily seen by an inspection of Fig. 1. When the shoe has a relatively low heel, as the heel 20, the insert 15 is employed.

When in the shoe, the hooked portion 48 extends partially around the os calcis 22 and receives either in wedging relation thereagainst or directly thereupon the tuberosity 23 of the os calcis 22. The fifth metatarsal 30 is raised both at the base 40 and at the forward portion 35 (Fig. 2). Further, the forward portions 34, 33, and 32 of the fourth, third, and second metatarsals are raised to the degree shown in Fig. 3. The metatarsals are thus elevated relative to the inner sole 19 so that, in walking, the weight is easily and evenly shifted from the os calcis through the base 40 of the fifth metatarsal 30 to the forward portion 31 of the first metatarsal 26, the forward portions 35, 34, 33, and 32 of the fifth, fourth, third, and second metatarsals assisting in the transfer of the weight from the base 40 of the fifth metatarsal 30 to the forward portion 31 of the first metatarsal 26.

Referring to Figs. 7 and 8, the insert 60 is disposed on the inner sole 63 in the same relative position as the insert 15 is on the inner sole 19. The insert 60, however, includes the additional

elements **65** and **66** in order to build up the shoe to raise the forward portions **35**, **34**, **33**, and **32** of the fifth, fourth, third, and second metatarsals a proportionate amount in order to compensate for the additional height of the heel **64**. This must be done because the base of the os calcis is on a higher level relative to the forward portion **31** of the first metatarsal **26** when it rests on the heel **64** than when it rests on the heel **20**.

It is thus apparent that there has been worked out a device for securing proper foot balance which is of a greater thickness in that area around the forward portions of the fifth, fourth, third, and second metatarsals when applied to a shoe having a relatively high heel than when applied to a shoe having a relatively low heel. In other words, a ratio of thickness has been established for what may be termed the critical area. The invention, therefore, contemplates the varying of the thickness of the device in this critical area so that the forward portions of the fifth, fourth, third, and second metatarsals properly assist in easing the weight forwardly from the base of the fifth metatarsal to the forward portion of the first metatarsal when walking.

It is to be understood that the present foot balancing device can be constructed of one piece cut to a proper configuration. It has been found, however, that the use of several elements facilitates the securing of the proper relative thickness for the critical area. The invention contemplates the use of any suitable material, such as leather, and the like.

It is to be understood that the foregoing description and accompanying drawings have been given by way of illustration and example and not for purposes of limitation, the invention being limited only by the claims which follow.

What is claimed is:

1. A method of properly locating a foot within a conventional shoe comprising wedging the tuberosity of the os calcis to prevent wobbling at the heel, elevating the base of the fifth metatarsal relative to the surface of the inner sole of the shoe, and elevating the forward portions of the fifth, fourth, third, and second metatarsals predetermined amounts relative to the surface of the inner sole of the shoe.

2. A method of properly locating a foot within a conventional shoe comprising elevating the base of the fifth metatarsal relative to the surface of the inner sole, and elevating the forward portion of the fifth metatarsal a greater distance above the surface of the inner sole than the base thereof is elevated.

3. A method of properly locating a foot within a conventional shoe comprising elevating the base of the fifth metatarsal relative to the surface of the inner sole, elevating the forward portion of the fifth metatarsal a greater distance above the surface of the inner sole than the base thereof is elevated, and elevating the forward portions of the fourth, third and second metatarsals in proportionate degree to the elevation of the fifth metatarsal to ease the weight shifting from the base of the fifth metatarsal to the forward portion of the first metatarsal.

4. A method of properly locating a foot within a conventional shoe comprising elevating the base of the fifth metatarsal relative to the surface of the inner sole, elevating the forward portion of the fifth metatarsal a greater distance above the surface of the inner sole than the base thereof is elevated, elevating the forward portions of the fourth, third and second metatarsals in proportionate degree to the elevation of the fifth metatarsal to ease the weight shifting from the base of the fifth metatarsal to the forward portion of the first metatarsal, and wedging the tuberosity of the os calcis to prevent wobbling and to assist forward transfer of weight.

5. A method of properly locating a foot within a conventional shoe comprising elevating the base of the fifth metatarsal relative to the surface of the inner sole, elevating the forward portion of the fifth metatarsal relative to the surface of the inner sole, and elevating the forward portions of the fourth, third and second metatarsals in proportionate degree to the elevation of the fifth metatarsal to ease the weight shifting from the base of the fifth metatarsal to the forward portion of the first metatarsal.

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