Dec. 3, 1946. B. J. SILVER 2,411,901

METATARSO-PHALANGEAL BALL CUSHION

Filed Jan. 12, 1945

Fig. 1.

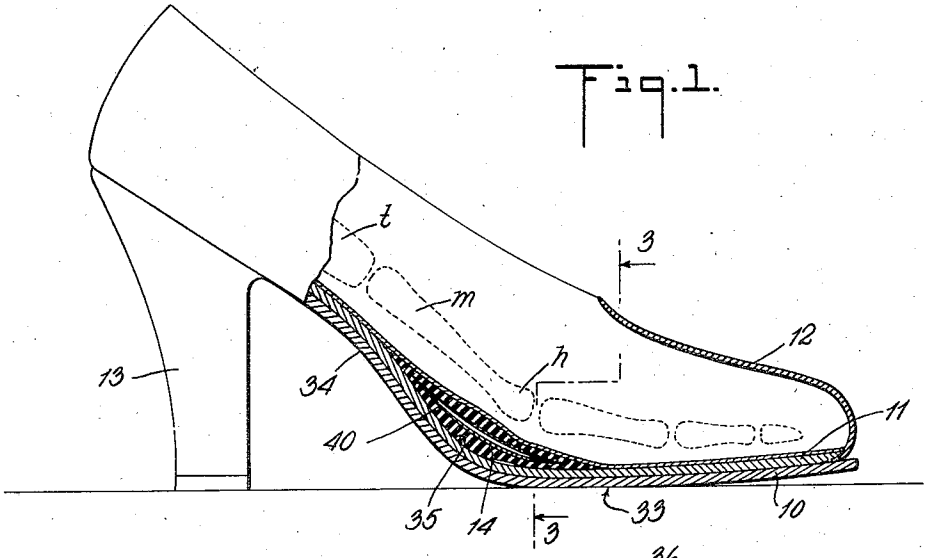
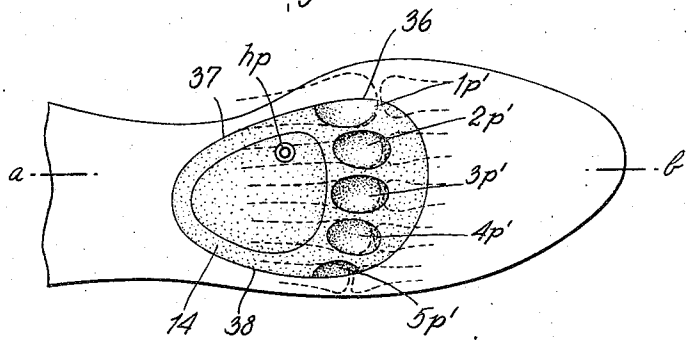


Fig. 2.



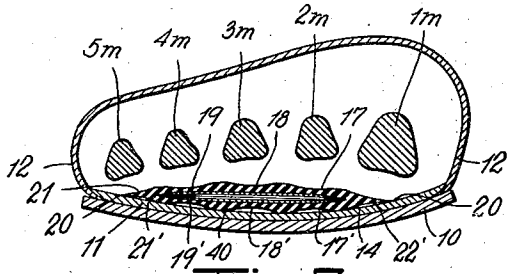


Fig. 3.

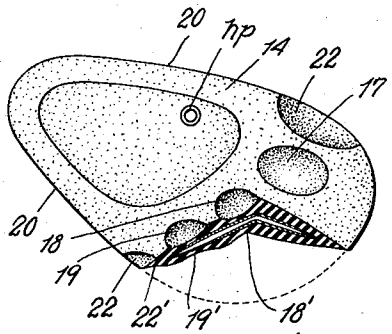


Fig. 4.

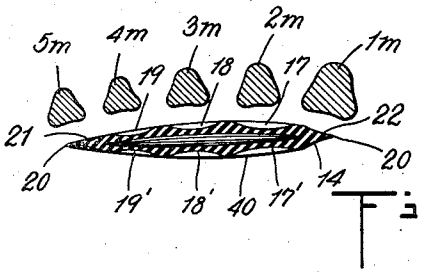


Fig. 5.

INVENTOR

BENJAMIN J. SILVER

BY

Warren S. Orton

ATTORNEY

Patented Dec. 3, 1946 2,411,901

UNITED STATES PATENT OFFICE

2,411,901

METATARSO-PHALANGEAL BALL CUSHION

Benjamin J. Silver, New York, N. Y.

Application January 12, 1945, Serial No. 572,488

9 Claims. (Cl. 36—71)

1

The invention relates in general to a shoe, particularly to a high arched woman's shoe and the invention relates specifically to a cushion forming a fabricated part of, or designed to be inserted as an attachment for such shoes, and which cushion is of the type sometimes referred to by reason of its location as a metatarso-phalangeal ball cushion.

The present disclosure constitutes a development of the metatarsal cushion disclosed in my Patent No. 2,159,054 granted May 23, 1939. In the prior patent there was disclosed a pad of approximate elliptical form and which specifically had to be made in two forms, one for the shoe of the left and the other for the shoe of the right foot. Care had to be exercised in installing these patented forms of pads in a shoe to make sure that a pad designed for a right shoe was not installed in a left shoe and the reverse. In those cases where the known form of pads were installed in shoes at the time of sale not only did care have to be exercised by the shoe salesman to be sure that he did not get a left pad in a right shoe, or the reverse, but it was not unusual for a store or shoe repair man to have a run on one kind of pad, say left pads, and he may for the time being be out of left pads while having quite a stock on hand of right shoe pads.

The present disclosure had for an object the providing of a single unitary one-piece ball cushion which can be fitted selectively into either a left or a right shoe at the ball area by the selection of that side uppermost which will fit the shoe intended, right or left.

The pad illustrated in the above patent was designed to constitute a fabricated or added element to a women's shoe of conventional heel height, and among other things to give an improved form of resiliency and increased comfort to conventional shoes while in use. However, modern styles have called for very much higher heels, and this has in turn developed a deep recess or concavity both laterally and longitudinally in these high heel shoes in the region of the metatarsal arch of the wearer. Obviously any such variation from the normal contour of the shoe produces a sharp bend in the foot encased in such shoes particularly in the region of the arch with resulting strains on the foot muscles. With the present type of high heeled shoes with their extreme and unnatural depression in the mid-portion of the sole, the foot, while in such shoes, actually becomes distorted; the arches are strained and there is a tendency for such shoes to throw the wearer off balance and in general a most uncomfortable situation results from wearing such shoes.

2

Accordingly, another and perhaps the main objective of this invention is to provide in a high heeled shoe as fabricated, or an insert for a high heeled shoe, a metatarsal cushion which will tend to avoid foot distortion; which will cause the wearer's sole while wearing such high heeled shoes to approach that form which the foot would have in walking on soft ground and thus tend to relieve foot fatigue now so prevalent with women and which has become more pronounced with increase in heel height.

Accordingly, the invention features an adaptor or compensating form of cushion which while possessing all of the advantages disclosed in the above identified patent will permit the wearing of the presently fashionable high heeled shoes and at the same time avoid the angled distortion of the foot which occurs at present when encased in shoes of the high heel type herein disclosed.

Broadly, these objectives are obtained by providing a double-faced cushion for underlapping the head ends of the metatarsals and the posterior portions of the proximal phalanges which while acting as a filler to reduce the internal angle of the inner sole and which angle would otherwise be assumed by the foot, also functions, as does the previously patented pad when a pad of the proper lateral bulge is inserted in the shoe of lesser heel height such as is disclosed in said prior patent, to give comfort to the wearer.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawing and in part will be more fully set forth in the following particular description of a form of insert for inner soles, embodying the invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawing:

Fig. 1 is a vertical sectional view taken longitudinally through the basic shoe with a sole modifying cushioning insert pad shown in position located with reference to the bone structure at the fore part of the foot shown in side elevation in dotted outline and illustrating a preferred embodiment of the invention;

Fig. 2 is a plan view looking down upon the inner sole of the basic shoe and with the pad insert as shown in Fig. 1, showing in dotted outline the bone structure particularly at the heads of the metatarsal bones;

Fig. 3 is a vertical transverse sectional view taken on the broken line 3—3 of Fig. 1;

Fig. 4 is a perspective view of the cushioning insert shown in the preceding figures and with one edge partly broken away to show the cross sectional configuration of the pad; and

Fig. 5 is a transverse cross section of the pad in its normal flat position before it has been bent into the curved form imposed thereon by the longitudinal and transverse curves of the inner face of the shoe sole.

In drawing and referring first to the basic shoe construction illustrated in Figs. 1 to 3, there is shown a conventional form of woman's deep instep shoe comprising an outer sole **10**, and inner sole **11** with the edges of the upper **12** secured at its forward portion between the soles and at its rear end secured between the upper sole and the top of the heel **13**. It is particularly noted that the shoe has a very high or French heel **13** which, of course, provides a rather high elevation to the rear ends of the soles **10** and **11**. Therefore, portion **33** of the soles as they engage the ground are flat or almost so. This means that the instep **34** quite sharply inclines downwardly and forwardly at an angle of about 45° into the flat portion **33**. This means that the inner sole forms an S-shaped curve in longitudinal section and which curve on its lower side forms a pronounced depression **35** which, as shown in Fig. 1, forms a concaved short curved arc having a relatively short radius. It is this deep depression which is having the effect of distorting the feet of women wearing shoes of this character and which the present disclosure is endeavoring to remedy. In that deep seated region **35** and which otherwise located is beneath the ball of the foot, there is fitted a ball or metatarsal area supporting pad **14**. This pad is intended among other things to restore the foot towards or at least somewhat towards its natural walking position even when encased in the foot distorting shoe herein illustrated. This pad is of a shape somewhat irregularly elliptical in plan as shown in Figs. 2 and 4 and is located in the shoe in position to receive the ball of the foot at its advanced and relatively wide end. When viewed in plan the pad is somewhat egg-shaped, or differently described, is a segment of egg form. The pad is carefully formed with relation to the bone structure of the fore part of the foot, it being noted that it entirely underlies practically the entire second, third and fourth metatarsal bones designated respectively *2m*, *3m* and *4m*, leaving the first and fifth metatarsals designated respectively *1m* and *5m*, uncushioned or substantially so particularly in the case of the first metatarsal bone *1m*.

The pad has its greatest transverse width or minor diameter in its forward portion and has its forward edge in position sufficiently advanced at least to underlap the heads of the metatarsal bones. Considered lengthwise the pad extends forwardly a distance just sufficient to underlap the first proximal phalanges, specifically designated in Fig. 2 as $2p^1$, $3p^1$ and $4p^1$, of the second, third and fourth toes, leaving all of the phalanges of the first and fifth toes as well as the second and third phalanges of the second, third and fourth toes uncushioned. Considered in its rearward dimension the pad underlaps the anterior half of each of the shanks of the second, third and fourth metatarsal and as shown in Fig. 1, extends substantially to the juncture of the tarsal and the middle metatarsal bones. Considering the pad when viewed in plan as in Fig. 2, it will be noted that it has a greater width measured along its minor axis on one side of its major axis or axis of balance indicated by the line *a*—*b* than it has on the other side, and there is thus formed a greater bulge **36** on one long side **37** than on the other long side **38**. It will thus be seen that the pad and shoe shown in Fig. 2 is for the right foot. Viewed through the drawing sheet, Fig. 2 then in reverse would show a pad and shoe for the left foot.

It is a distinctive feature of this pad, and in this it particularly distinguishes from the pad in the above identified patent, is that the combined right and left foot pad herein featured is convexo-convex, or double convex in substantially all of its cross sections and is relatively thin compared to the other dimensions. The opposite sides are so related that with one side uppermost it conforms to a right shoe and with the other side uppermost it conforms to the left shoe of a pair.

Irrespective as to which side may be facing upwardly the sole receiving surface is provided with three shallow recesses, depressions or pockets, those on one side being designated **17**, **18** and **19** and those on the opposite side being designated 17^1, 18^1, and 19^1, and whichever may be uppermost located to receive respectively the heads of the metatarsal *2m*, *3m* and *4m*. It is particularly noted that the depression on one side is opposite the corresponding depression on the other side. For instance recess **17** is opposite recess 17^1. The cushion is so formed with an outlining feathered edge **20** that the two outside half of edge recesses or pockets, **21** and **22** on the one side and 21^1 and 22^1 on the other side, are found at the extreme opposite edges to underlap respectively the inner portions of the heads of the first metatarsal *1m* and the fifth metatarsal *5m*, leaving the other edge portions of the ball portion of the foot supported directly on the uncushioned outer edge portion of the inner sole as particularly shown in Fig. 3. The centers of the three interior recesses, **17**, **18** and **19** or 17^1, 18^1 and 19^1, and the two outer half recesses **21** and **22** or 21^1 and 22^1 are disposed in a curve which when viewed in plan as in Fig. 2 is the curve defined by the centers of the heads of the five metatarsal bones and defines what has been referred to herein as the minor axis of the pair. The cushion has its maximum elevation at a point designated *hp* in Fig. 2 approximately just back of the head of the second metatarsal bone, or close thereto, irrespective as to whether the right side of the pad is uppermost in a right shoe or the opposite or left side of the pad is uppermost in a left shoe. Considered in cross section the cushion gradually decreases in thickness in all directions to the feathered edge **20** from the vertical line *c*—*d* shown by dots in Fig. 5 defining the maximum thickness connecting the points *hp* and *hp* of maximum elevation on each face.

The cushion is formed as an integral one-piece article preferably formed of a cushiony material such as a type of rubber or rubber-like material formed symmetrical with reference to a central medial plane as shown in Fig. 5, but having sufficient flexibility to be bent longitudinally as shown in Fig. 1 and transversely as shown in Fig. 3 to conform to the compound curvatures of the inner sole.

Where a high degree of flexibility is desired in the marginal portion forming the feathered edge **20** and less flexibility and thus relative ri-

gidity in the body portion, it is suggested that a thin layer **40** of leather or rubber, preferably hard rubber, be inserted within the pad to provide an internal reinforcement. As disclosed the insert is of substantially the same form as the cushion in which it is contained and the outlining edge of the insert **40** is spaced inwardly from the marginal portion of the cushion so as not to interfere with the desired flexibility in the flexible feathered edge. It is suggested that the pad be made of two halves, a right and a left, each with an upper curved face with flat undersides as shown in the above patent and the two halves connected together either with or without the relatively stiff insert **40**.

When in position in the shoe and conforming to the inner sole as shown in Fig. 3 the recesses designated when facing upward to receive the metatarsal heads also function when facing downwardly to coact with the inner sole to form air cushioning pockets.

By means of a device of this character it is possible for the repair man or shoe store to carry in stock one form of pad which can be used either in a left or right shoe simply by reversing the pad so that the bulged edge of the pad will correspond with the bulged edge of the shoe, right or left as the case may be. As it is the usual practice to provide these pads in several standard sizes the halving of the necessary supply constitutes a material saving in the number of different kinds required. It is particularly noted that the fact that the upper surface must be convex is utilized when the pad is turned upside down to accommodate itself to the deep concavity formed in these high heeled shoes and thus tends to straighten out the curve imposed on the wearer's foot without necessity of providing filling material particularly for this purpose. It is also noted that the shallow recesses which are provided on the upper surface or face to accommodate the heads of the metatarsal bones are utilized when in the upside down position as air cushioning pockets and here again providing a structural part which has two functions depending on whether the part faces upwardly or downwardly. The bulk of material which forms the support of the pad provides not only the required cushion effect but also provides a certain degree of rigidity sufficient to support the weight of the wearer without abnormal distortion of the pad and at the same time provides especially in the marginal portion that degree of flexibility which will permit the marginal distortion of the pad to conform to the minute variations in shoes, even in those shoes which are intended to be of the same size. It will be understood that the use of the leather or rubber insert is optional and is used only in those situations where the rubber or other cushioning material used to form the cushion fails to provide the requisite degree of rigidity in the weight supporting portion of the cushion.

I claim:

1. In a shoe, the combination of an outer sole, an inner sole provided in the region of the ball of the foot in its upper surface and spaced from the edges of the sole with a relatively deep depression rounding from side to side in all vertical cross sections, a semi-flexible combined metatarso-phalangeal ball cushion normally of substantially egg-shaped plan of convexo-convex form having its opposite surfaces of identical contour with its curved underside flexed under tension into a fit in said depression and secured to the inner sole, said cushion having its upper side upwardly convex in all vertical cross sections and said upper side having its point of highest elevation located under the shaft of the second metatarsal bone irrespective as to which side of the cushion may be uppermost, and reducing in elevation gradually in all radial directions from said point and forwardly to a position terminating approximately mid-length of the middle first phalanges.

2. In a shoe, the combination of an outer sole, an inner sole provided in the region of the ball of the foot in its upper surface and spaced from the edges of the sole with a relatively deep depression rounding from side to side in all vertical cross sections, a semi-flexible combined metatarso-phalangeal ball cushion of substantially egg-shaped plan, of convexo-convex form having its curved underside flexed under tension into a fit in said depression and secured to the inner sole, said cushion having its upper side upwardly convex in all vertical cross sections and said upper side having its point of highest elevation located under the shaft of the second metatarsal bone irrespective as to which side of the cushion may be uppermost, reducing in elevation gradually in all radial directions from said point and forwardly to a position terminating approximately mid-length of the middle first phalanges and in which the underside of the cushion is provided with a plurality of shallow recesses in the portion thereof beneath the ball portion of the foot coacting with the portion of the inner sole overlapped thereby to form shallow air cushioning pockets, each pocket on one face being opposite a corresponding pocket on the other face and certain of said pockets being opposite certain heads of the metatarsal bones.

3. A one-piece cushioning pad for the ball region of the foot for use in either a right or left shoe, said pad being approximately egg-shape in plan with opposing long edges rounding one into the other, having a greater width measured along its minor axis on one side of its major axis than on the other side and thus forming a more pronounced bulge in one long side than in the other long side whereby the pad may be used in a right hand shoe with that side facing upwardly which will bring the greater bulge at the right or may be used with said first named side facing downwardly in a left hand shoe with the greater bulge at the left, said pad being initially convexo-convex in substantially all cross sections and with its opposing sides each being slightly convex and having a looking glass symmetry relative to a central medial plane therebetween and relatively thin compared to its width and length dimensions and having sufficient flexibility to conform to the shoe in which it is intended to be installed.

4. A one-piece cushioning pad for the ball region of the foot for use in either a right or left shoe, said pad being approximately egg-shape in plan with opposing long edges rounding one into the other, having a greater width measured along its minor axis on one side of its major axis than on the other side and thus forming a more pronounced bulge in one long side than in the other long side whereby the pad may be used in a right hand shoe with that side facing upwardly which will bring the greater bulge at the right or may be used with said first named side facing downwardly in a left hand shoe with the greater bulge at the left, said pad being convexo-convex in substantially all cross sections and rela-

tively thin compared to its width and length dimensions, having sufficient flexibility to conform to the shoe in which it is intended to be installed and in which each side face is provided with a plurality of shallow recesses, at least three for receiving the heads of the three middle metatarsal bones, the recess for receiving the head of the second metatarsal bone when one side is uppermost in a left shoe being opposite the recess for receiving the head of the second metatarsal bone when the other side is uppermost in a right shoe.

5. A one-piece metatarsal arch pad forming a segment of an egg-shaped form and provided on one sole receiving face with three shallow depressions spaced apart transversely and along the minor axis and located to receive the portion of the sole of the wearer immediately beneath the heads of the second, third and fourth metatarsal bones of one foot when said side is facing upwardly in a left shoe and provided on its opposite surface with three shallow depressions spaced apart transversely and along the minor axis and located to receive the portion of the sole of the wearer immediately beneath the heads of the second, third and fourth metatarsal bones of the other foot when said opposite side is uppermost in a right shoe and said pad being convexo-convex in cross section along substantially all cross sections.

6. The structure defined in claim 5 in which the outlining marginal portion forms a feathered edge with the portion thereof at the minor axis fashioned to receive at least the inner portions of the heads of the first and fifth metatarsal bones irrespective as to which side is facing upward.

7. The structure defined in claim 5 and in which the pad has its point of highest elevation located under the shaft of the second metatarsal bone

irrespective as to which side of the pad may be in engagement with the sole of the wearer and thus the highest point on one side is in transverse alignment with the highest point of elevation on the other side.

8. A shoe cushion for use as a support for the metatarsal arch comprising a pad substantially elliptical in plan, wider at one end than the other and with a greater bulge on one side of said wide end than on the other side thereof, having its opposite faces slightly convex to form the pad of convexo-convex form and having a degree of flexibility to permit the underside of the same to conform to the contour of the inner sole of the shoe and said cushion exhibiting a maximum degree of flexibility in its marginal portion said opposite sides being normally convex and symmetrical with reference to a central medial plane and a thin layer of reinforcing material located in said medial plane, confined to the portion of the pad of maximum thickness and having its edges spaced inwardly from said flexible marginal portion.

9. A shoe having its sole engaging surface more nearly a straight angle in the region beneath the heads of the metatarsal bones than the outersole forms in this region, and said sole engaging surface provided with at least three shallow depressions for receiving the heads of the three middle metatarsal bones substantially elliptical in plan and having its point of highest elevation back of the head of the second metatarsal bone and reducing in elevation in all directions from said point of highest elevation and said surface in the area of said bones being more resilient and thus providing a greater cushioning effect at said area than in more remote portions of the sole engaging portions.

BENJAMIN J. SILVER.