July 18, 1944. J. J. JAKOSKY 2,353,829

FOOTWEAR

Filed July 9, 1941

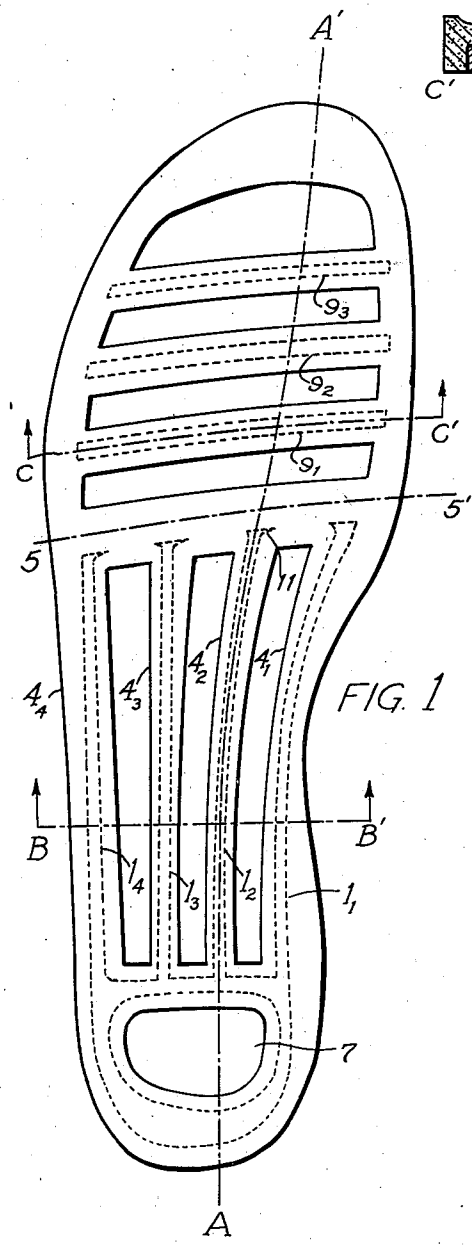


FIG. 1

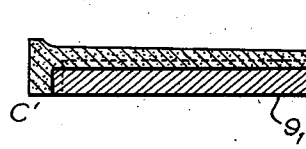


FIG. 4

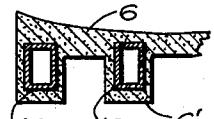


FIG. 5

FIG. 2

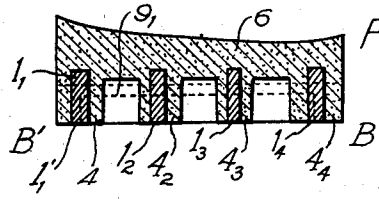


FIG. 3

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FOOTWEAR

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11 Claims. (Cl. 36—59)

This invention relates to an improvement in footwear, and is of special value for military and athletic purposes since it provides the proper arch support necessary for long marches and other activities with continual foot strain.

Various types of flexible soles have been designed, usually of monolithic construction, that are contoured to give comfortable support to the foot when standing upon a flat surface, but obviously can give no support when stepping, due to the flexible nature of the sole which yields when any pressure is applied at the arch. Such devices cannot offer the much needed support when marching, running, or stepping.

In action, the foot comes almost into straight line with the leg, but when settling upon the ground it bends to keep flat with the ground. A series of arches form the symmetry of the foot, the function of these arches being that of weight bearing. The five arches of the foot converge on the heel, the toes being flying buttresses to them. The balls of the foot form a transverse arch. The inner arches of the foot are successively higher, forming half of a transverse arch whose completion is in the opposite foot.

One purpose of this invention is to provide a foot support that will maintain a substantially uniform support for the arch of the foot in both the standing and stepping positions.

Another purpose of this invention is to provide a foot support or shoe sole that is substantially unyielding in a longitudinal direction between the ball and heel, and flexible between the ball and forward end of the foot.

Another purpose of the invention is to provide a foot support that is substantially unyielding in a longitudinal direction and flexible in a transverse direction between the heel and ball of the foot, and flexible between the ball and the forward end of the foot.

Another purpose of the invention is to provide a foot support that is substantially unyielding in a longitudinal direction and flexible in a longitudinal direction but substantially unyielding in a transverse direction between the ball and the forward end of the foot.

Another object is to provide a support type of sole that will allow an easing of pressure underneath the astragalus bone of the heel.

Another object of the invention is to provide a support for weak or fallen arches, thereby minimizing the distressful condition common to those who must be on their feet.

Another object is to provide a sole that will have the comfort of a flexible sole, but the support and protection of the rigid type of sole.

Another object is to provide a uniform, low-cost sole by means of molded or monolithic construction, into which is incorporated rigid members for supporting the foot.

Referring to the sheet of drawings:

Figure 1 is a bottom view of a preferred design of a sole.

Figure 2 is a longitudinal cross-section along the line A—A' of Figure 1.

Figure 3 is a transverse cross-section along the line B—B' of Figure 1.

Figure 4 is a transverse cross-section along the line C—C' of Figure 1.

Figure 5 illustrates one type of construction.

The general nature of my invention may be understood by the following description and drawing:

Referring to Figure 1: A substantially rigid portion or supporting member of the sole extends from the heel to a transverse line 5—5' near the ball of the foot, and a flexible portion extends forward of this line to the toes. In the preferred construction, the supporting portion of the sole comprises a series of longitudinal ridges or structural members 4_1, 4_2, 4_3, etc., terminating substantially on the line 5—5'. The position of this line is best determined by experimentation in order to obtain the desired arch supporting action as will be described later. For proper traction and safety, and to increase flexibility, the sole portion forward of line 5—5' is comprised of a series of transverse ridges.

Figure 2 shows a longitudinal section along the line A—A' of Figure 1. The substantially rigid support comprises a structural member l_2, extending from the heel substantially to the line 5—5'. The lower side l'_2 of this support member may be exposed, as shown in the drawing or it may be wholly imbedded with the rubber ridge 4_2.

A good bond must be obtained between the support member and the rubber. If the support members are made of hollow formed aluminum, or molded hollow plastic sections, I have found that suitable bonding may be obtained by first treating the material by rubber plating, using well known processes. If the support members are of fabric or other porous material, they may be subjected to impregnation with rubber or wetting solutions prior to vulcanization of the sole.

The supporting member may comprise a single piece of rigid or substantially rigid material ex-

tending from the heel to a position slightly to the rear of the forward end of the metatarsus bones of the normal foot. In a preferred construction shown, the supporting member comprises a multiplicity of longitudinal members which allow some transverse flexing, but are substantially rigid in their longitudinal direction.

The support member may be of different designs and materials. In the construction illustrated, this member is made of rubber impregnated cotton. At the forward end it preferably terminates into an enlarged or spread end **11** to allow better end support.

By proper proportioning of the relative lengths of the support members 4_1, 4_2, 4_3, etc., as shown, together with the proper positioning of the line of flexure **5—5'**, the major lifting action can be made to take place on the inside portion of the arch, where it is most needed. In a normal foot, substantially no lifting should take place along the outside members as 4_4.

The support member may be made of a hollow section, to conserve rubber and to decrease weight. A satisfactory design uses a hollow plastic rectangular shaped section, with 3/64 inch wall and of such size in relation to slot and rubber section as to provide a $\frac{1}{16}$'' wall of rubber on the sides and ⅛'' or more, wall on the bottom of the section. This construction is illustrated in Figure 5, wherein the molded sole **6** encompasses the hollow sections 10_1, 10_2, etc.

Supplementing the lifting action of the support member is a differential movement of the soft rubber sole, as shown by the arrow **8** in Figure 2, which further increases the height of the arch when stepping. This feature is governed by the thickness of soft rubber above the fulcrum or hinge 2_2, etc.

The support members may be made integral with, or terminate at a support member positioned underneath the heel. This member is so shaped as to allow a resilient portion (preferably air space) to be located at the point where the astragalus bears on the sole, as indicated at **7**. Thus, I have shown the intermediate support members 1_2 and 1_3 as located wholly forward of the position at which the astragalus bears, while the support members 1_1 and 1_4 adjacent the respective sides of the sole extend rearward beyond such position.

Figure 3 is a simplified cross-section taken along the line B—B' of Figure 1. The longitudinal support members are shown at 1_1, 1_2, etc., and the transverse support members by the dotted lines at 9_1. The upper portion of the sole **6** is contoured to fit the underside of the foot.

Forward of the line **5—5'**, the sole may be flexible in all directions, as would normally be the case for molded or vulcanized soles. I have found however, that such flexible construction is a strain and subjects the foot to bruises when marching over small rocks and similar irregular terrain. This condition may be remedied, however, by so designing the forward portion of the sole that it may be flexed in a longitudinal direction, but not in a transverse direction. A preferred means of construction is shown in Figures 1 and 4. Figure 4 is a cross-section along the line C—C' of Figure 1. Imbedded within the molded sole **6** are a series of transverse supporting members 9_1, 9_2, 9_3, etc., with decreasing width from the ball of the foot toward the toe. These transverse supporting members are shown as embedded within the transverse ridges of the forward portion of the sole. In the construction shown in Figs. 2, 3 and 4, the vertical dimension of each of the longitudinal support members 1_1, 1_2, etc., and of each of the transverse support members 9_1, 9_2, etc., is materially greater than the horizontal dimension thereof in a direction transverse to its length.

When stepping, the forward portion of the sole will flex and allow full comfort in walking, while transverse bending of the sole is prevented by the transverse support members, with resultant protection to the foot in irregular terrain.

The construction of the upper portion **12**, of a shoe utilizing this improved sole is substantially similar to that of practically all shoes. It is most desirable that the upper and the instep portion or band around the ankle are adjustable and capable of being made a snug or firm fit over the instep in order to lift the support member upward with each step. This lifting action, combined with the pivoting and differential action on, and at **6'**, as previously described, allows the necessary increase in arch height when stepping.

Stepping may be defined as any bending of the foot at the ball joint or forward end of the metatarsus bones as when walking, maching, standing on tiptoe, or otherwise supporting the whole or partial weight of the body on the ball or forward end of the foot. Standing may be defined as the normal position of the foot when resting upon a floor or other flat surface and with the body in a normal upright position with the weight on both feet. The ball of the foot refers to the transverse line of flexure along the joints on the forward end of the metatarsal bones.

I have described the preferred forms of my invention, but I do not wish to be limited to the specific disclosures herein made, but claim as my invention, all modifications of construction, design and method as fall within the scope and spirit of the invention disclosed herein.

I claim:

1. A sole for footwear of proper contour to support the arch directly from the floor when standing, incorporating a support member positioned underneath the heel and arch of the foot and extending in a substantially longitudinal direction, and a series of support members positioned forward of the ball of the foot and extending in a substantially transverse direction.

2. A molded sole for footwear, of proper contour to support the arch directly from the floor when standing, incorporating a series of support members positioned underneath the heel and arch of the foot and extending in a substantially longitudinal direction, and another series of support members positioned forward of the ball of the foot and extending in a substantially transverse direction.

3. A sole for footwear, including in combination a support member positioned underneath the heel and arch, said support member comprising a plurality of longitudinally extending hollow members imbedded in said sole.

4. A sole as in claim 3 in which said longitudinally extending members are formed with different lengths, the member of greatest length being positioned adjacent the inside edge of said sole.

5. A sole for footwear, including in combination means underneath the heel and arch portion of said sole rendering the after portion of said sole rigid in a longitudinal direction, and means rendering the forward portion of said sole rigid in a transverse direction, there being a flexible portion joining said after and forward portions.

6. A sole for footwear, including in combina-

tion a support member positioned underneath the heel and arch, said support member comprising a plurality of longitudinally extending members embedded in said sole, each of said members having a vertical dimension materially greater than its transverse dimension.

7. A sole for footwear, including in combination a support member positioned underneath the heel and arch, said support member comprising a plurality of longitudinally extending members embedded in said sole, said members being made of material substantially rigid in their longitudinal direction and being formed with different lengths, the member of greatest length being positioned adjacent the inside edge of said sole.

8. A sole for footwear of proper contour to support the arch directly from the floor when standing, incorporating a support member positioned underneath the heel and arch of the foot and extending in a substantially longitudinal direction, and a support member positioned forward of the ball of the foot and extending in a substantially transverse direction.

9. In footwear of the character described, a sole of flexible material, and a plurality of longitudinally extending support members embedded in said sole and positioned beneath the heel and arch of the wearer, said support members including a member adjacent each side of the sole extending rearward beyond the position where the astragalus bone of the wearer bears thereon and also including intermediate members located wholly forwardly of said position.

10. A sole for footwear formed to provide a plurality of spaced longitudinally extending ridges positioned underneath the heel and arch of the foot and a plurality of spaced transversely extending ridges positioned forward of the ball of the foot.

11. A sole for footwear formed to provide a plurality of spaced longitudinally extending ridges positioned underneath the heel and arch of the foot and a plurality of spaced transversely extending ridges positioned forward of the ball of the foot, said sole incorporating a plurality of longitudinally extending support members embedded within the respective longitudinally extending ridges and a plurality of transversely extending support members embedded within the respective transversely extending ridges.

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