March 28, 1939. M. ŠARČEVIĆ 2,151,720

ORTHOPEDIC FOOTWEAR WITH FOOT-SUPPORTING PLATE

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Fig. 1.

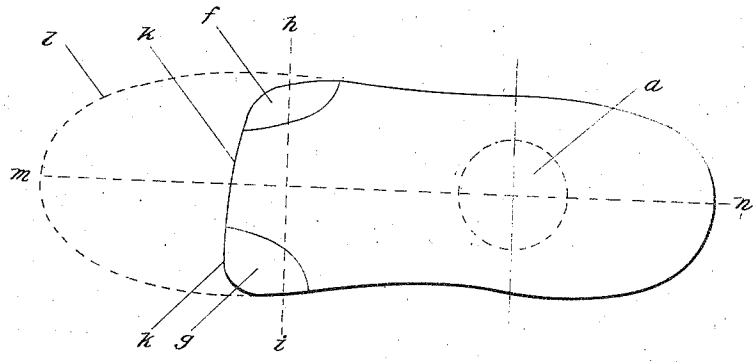


Fig. 2.

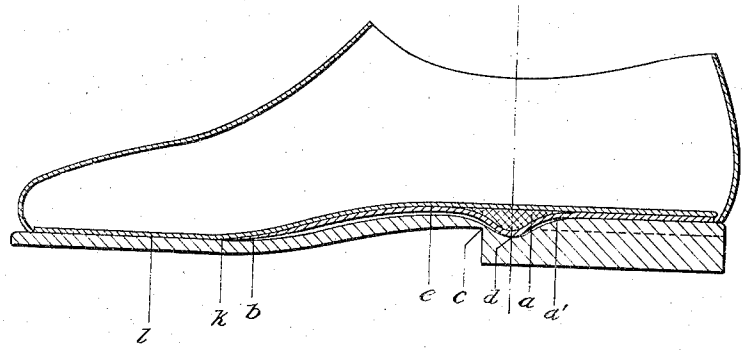
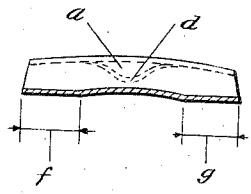


Fig. 3.



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ORTHOPEDIC FOOTWEAR WITH FOOT-SUPPORTING PLATE

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9 Claims. (Cl. 36—71)

The present invention relates to an orthopedic foot supporting plate for shoes. The fundamental idea for the construction of an orthopedic articulated foot-support and socket-joint, into which is fitted the joint-head of the foot-support, is founded on scientific knowledge of the construction and action of the foot as the supporting and locomotive organ of the body. The principal organ of the foot is the longitudinal arch of the foot, which is formed of the heel-bone, the front portion of which is raised, the adjacent tarsal and metatarsal bones, in co-operation with the respective joints, ligaments and muscles. The stability of the foot-arch and with it of the whole foot is determined by the tripod of the foot formed of three points of support, the after one consisting of the posterior lower corner of the heel-bone and the two frontal points by the heads of the first and fifth metatarsal bones.

When standing or walking, the weight of the body is sustained through the talus, below which is the so-called sustentaculum tali, whence it is distributed to the foot tripod and to the foot-arch respectively, so that the weight finally rests on one side upon the heel-bone and on the other on the heads of the first and fifth metatarsal bones. Therefore, in order that the foot may suitably carry out its duties of standing and walking, there is an absolutely necessary condition of a continual and painless formation and maintenance of a foot-arch capable of maintaining that load and of muscular and articulated action. This condition has been taken into account empirically in the traditional and customary boot and shoe construction already, inasmuch as the heel of the boot or shoe is so connected to the sole as to form the so-called elastic spring of the boot or shoe which supports the foot-arch.

Now it is a well-known fact that the arch of a foot continually booted or shoed tends to become weakened, in such a way that the respective joints, muscles and ligaments become incapable of sustaining it firmly and painlessly when standing or walking. This leads to a pathological change in the position of the heel-bone and various evil effects resultant therefrom, whence arise foot defects and especially weak feet and flat feet, which are characterized by painful disturbances of the stability of the foot tripod and of the instep-arch, by which is diminished or destroyed the stability of the foot and its capacity for supporting the weight and assuring the balance of the body and for correctly carrying out their work of standing and walking.

The elimination of the above-mentioned foot defects has been attempted up to the present by the use of various orthopedic boot or shoe arch-supports which are constructed on the principle of direct support and elevation of the foot, thus artificially creating and/or supporting the instep-arch. Such direct support has for the most part been applied directly under the vertex of the instep-arch and at the same time beneath the anterior section of the heel-bone. For that purpose all such boot or shoe foot-supports hitherto known have a convex elevation or arch according with the shape of the instep-arch, called the arch of the foot-support, which from below directly supports the instep longitudinally while at the same time elevating the anterior section of the heel-bone.

However such direct and inflexible support and elevation has not proved successful in fully preventing the loss or diminution of the capacity to form and maintain the instep-arch or of maintaining the stability of the foot. It has one outstanding disadvantage, which is that the muscles of the foot which normally help to form and to maintain the instep-arch are excluded from so doing and as a result of this passive inactivity are still further weakened, so that effective correction or cure of these foot weaknesses becomes out of the question with this type of foot-support.

For this reason this simple direct and inflexible support of the foot is abandoned in this invention and is replaced by a new method of support based on a scientific orthopedic conception, which combines a two-fold leverage and an articulated method of supporting the arch of the foot and which is largely indirect. In this way the invention strengthens the natural capacities of the muscles in question and therefore assures the restoration and maintenance of the instep-arch when standing or walking and thereby removes already existent, or threatened, instability or diminution of stability of the tripod of the foot, as well as removing or avoiding the various foot defects mentioned above.

For this reason the foot-support according to this invention has on the under side a new firm support, the socket joint of the foot-support, in the form of a downward convexity which projects on the under side of the foot support and is usually rounded and which, while the foot-support is in use, acts as an assisting supporting and transmission point between the three points of the natural foot-tripod described above. In boots or shoes intended for use with this articulated foot-support, there is constructed for the

reception of this convexity a corresponding concavity which serves as a socket in which the articulated convexity of the foot-support is fitted to act as a joint, i. e., to permit of articulated movement.

The attached drawing gives a general idea of the construction, showing: (1) a view of the orthopedic plate seen from above, (2) a longitudinal cross-section of a shoe fitted with the orthopedic plate, along the line *m—n* of Fig. 1, and (3) a cross-section along the line *h—i* of Fig. 1.

The orthopedic plate as represented in these designs fits in the usual horizontal position between the heel of the foot and that of the shoe, but possesses a support *a*—Figs. 1, 2 and 3—in the form of a downward protuberance, generally rounded. No other orthopedic plate hitherto known possesses this constructive property. Its characteristic consists in the fact that, instead of the idea of supporting the arch of the foot directly in or about the vertex, which is here abandoned, a new point of support *d* is created below the horizontal level of the plate, and that under the sustentaculum tali of the foot located substantially in rear of the breast line of the shoe heel, whence the upward forces resultant on the reaction of the pressure of the weight of the body are distributed over all parts of the orthopedic plate and thereby to the whole periphery of the arch of the foot, so that the lines of pressure thus obtained influence indirectly all the articulations of the foot and of the leg which take part in the maintenance of the arch of the foot and the maintenance of the body in an upright position.

The advantage of this new construction of orthopedic plates consists in the fact that the new point of support *d* is placed conveniently in the right position between the three above mentioned points of support of the foot tripod, so that it makes, in fact, a fourth central point of support of the tripod which increases the capacity of the foot in general, and especially makes it possible really to obtain a correction of foot weaknesses and of flat feet.

The other parts of the orthopedic plate provided with this support *a* are correspondingly designed in order to complete and strengthen the effect of this support so that the after portion of the heel of the support and the whole section in front of the support *a* are, by their shape, in effective contact with the arch of the foot in the normal manner. In order to assure the most perfect contact, that section of the orthopedic plate in front of the support *a* is curved downwards so that the front edge *k* of the plate touches the ball of the sole while the medial (inner) and lateral (outer) angles of this edge *k*, which are in contact with the first metatarsal at *g* and the fifth metatarsal at *f* are flattened out to fit the heads of the metatarsal bones. The whole middle section of the plate between these flattened angles and the support *a* under the sustentaculum tali of the foot forms a slight convexity, whose vertex is at *e* and which slopes gently from the inner (medial) to the outer (lateral) edge and also forwards.

As a further advantage of this new orthopedic plate, one can state that it is not necessary to take a plaster cast of the foot to be fitted, as the form of the plate does not conform exactly to that of the arch of the foot. It is sufficient, for its construction, to draw the outline of the foot on paper, indicating the position of the support *a*, the highest point *e* of the metatarsal elevation and the position of the two flattened sockets at *f* and *g*, after diascopical X-ray examination or photographs. In practice it will even be very convenient to construct these plates in serial production in several types and sizes, which can easily be planned so that one of these will usually be found suitable to fit individual needs.

The relation between the foot and the orthopedic plate has to be such that the foot continually feels the pressure and influence of the orthopedic plate, whether standing or walking, at all points of the sole of the foot. To attain this end it is necessary to construct the shoe to be fitted with the orthopedic plate as described, according to Fig. 2, so that it has under the support *a* in the frontal portion of the heel of the shoe and the adjacent portion of the sole connected to it at *c*, a concave depression *a'* to fit the support *a* of the othopedic plate. This cavity may also be in the heel of the shoe only, which is suitably prolonged forwards. This cavity *a'* has to be made in order that the support *a* at its lowest point *d* is suitably embedded and fitted therein.

When in use, while treading on the front part of the foot, pressure is applied to the front portion of the plate, thereby rocking the same forwardly within certain limits so that the heel portion of the plate separates slightly from the shoe heel. When pressure of the foot is applied to the rear heel supporting portion of the plate, the plate is rocked in the reverse direction so that the front portion is slightly separated from the sole of the shoe. In this manner the natural capacities of the muscles of the foot are strengthened and restoration and maintenance of the instep arch is assured when standing or walking.

The orthopedic plate may be constructed in any suitable material, such as metal, wood, Celluloid, artificial resin etc. The support *a* has to fit individually, in shape and form, which however can generally be attained also by serial production in several types and sizes. According to the nature of the material employed or the method of construction, the support *a* may be hollowed or stamped out in such a way that, seen from above, it has the form of a cavity, the disadvantageous effect of which is prevented by the usual covering *l* of an orthopedic plate or also by being filled with some appropriate material.

It is to be understood that the form of the invention shown and described is merely illustrative of a preferred embodiment and that such changes may be made as fall within the purview of one skilled in the art without departing from the spirit of the invention and the scope of the appended claims.

I claim:

1. An orthopedic foot support comprising a plate adapted to be positioned in a shoe and having a heel supporting rear portion and a front portion extending forwardly sufficient to support the metatarsal area, said plate having an intermediate depending portion adapted to project downwardly in a depression located substantially in rear of the breast line of the shoe and constitute therewith a single plate supporting universal joint upon which the plate is adapted to rock within certain limits when foot pressure is applied to the front or rear portions of the plate.

2. An orthopedic foot support comprising a plate adapted to be positioned in a shoe and having a heel supporting rear portion and a front portion extending forwardly sufficient to support the metatarsal area, said plate having an intermediate depending substantially semi-spherical portion adapted to project downwardly into a

substantially semi-spherical depression located substantially in rear of the breast line of the shoe and constitute therewith a single plate supporting universal joint upon which the plate is adapted to rock within certain limits when foot pressure is applied to the front or rear portions of the plate.

3. An orthopedic foot support comprising a plate adapted to be positioned in a shoe and having a heel supporting rear portion and a front portion extending forwardly sufficient to support the metatarsal area, said plate having an intermediate substantially semi-spherical portion adapted to cooperate with a substantially semi-spherical portion located substantially in rear of the breast line of the shoe to form a plate supporting universal joint upon which the plate is adapted to rock within certain limits when foot pressure is applied to the front or rear portions of the plate.

4. In combination, a shoe having a depressed portion forming a socket substantially in rear of the breast line of the heel within the shoe, and an orthopedic foot support comprising a plate positioned within the shoe and having a heel supporting rear portion and a front portion extending forwardly sufficient to support the metatarsal area, said plate having a depending portion projecting into the shoe socket and forming therewith a plate supporting pivot upon which the plate is adapted to rock within certain limits when foot pressure is applied to the front or rear portions of the plate.

5. In combination, a shoe having a depressed substantially semi-spherical portion forming a socket substantially in rear of the breast line of the heel within the shoe, and an orthopedic foot support comprising a plate positioned within the shoe and having a heel supporting rear portion and a front portion extending forwardly sufficient to support the metatarsal area, said plate having a depending substantially semi-spherical portion projecting into the shoe socket and forming therewith a plate supporting pivot upon which the plate is adapted to rock within certain limits when foot pressure is applied to the front or rear portions of the plate.

6. In combination, a shoe having a heel and sole portion, and an orthopedic foot support comprising a plate positioned within the shoe and having a heel supporting rear portion and a front portion extending forwardly sufficient to support the metatarsal area, said shoe having a rounded portion located substantially in rear of the breast line of the heel, and said plate having a depending rounded portion engageable with the rounded portion of the shoe and forming therewith a plate supporting pivot upon which the plate is adapted to rock within certain limits when foot pressure is applied to the front or rear portions of the plate.

7. An orthopedic foot support comprising a non-flexible plate adapted to be positioned in a shoe and having a heel supporting rear portion and a front portion extending forwardly sufficient to support the metatarsal area, said plate being substantially flat in transverse cross-section throughout its length and having an intermediate substantially semi-spherical portion adapetd to cooperate with a substantially semi-spherical portion located substantially in rear of the breast line of the shoe to form a plate supporting universal joint upon which the plate is adapted to rock within certain limits when foot pressure is applied to the front or rear portions of the plate.

8. An orthopedic foot support comprising a substantially rigid plate adapted to be positioned in a shoe and having a heel supporting rear portion and a front portion extending forward sufficiently to support the metatarsal area, said plate having an intermediate portion to cooperate with a complemental portion of the shoe to form a single plate supporting universal joint upon which the plate is adapted to rock within certain limits, said intermediate portion when in operative position in the shoe being located substantially under the sustentaculum tali of the foot.

9. In combination, a shoe having a heel and sole portion, and an orthopedic foot support comprising a substantially rigid plate positioned within the shoe and having a heel supporting rear portion and a front portion extending forward sufficiently to support the metatarsal area, said plate having an intermediate portion, and said shoe having a complemental portion cooperating with the said portion of the plate to form a single plate supporting universal joint upon which the plate is adapted to rock within certain limits, said intermediate portions of the plate and shoe, when in operative position, being located substantially under the sustentaculum tali of the foot.

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