Aug. 1, 1939. H. SELIGMANN 2,167,933

ORTHOPEDIC FOOT ARCH SUPPORT

Filed Nov. 10, 1937

Fig. 1.

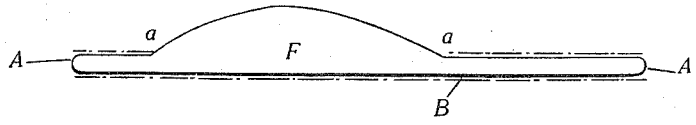


Fig. 2.

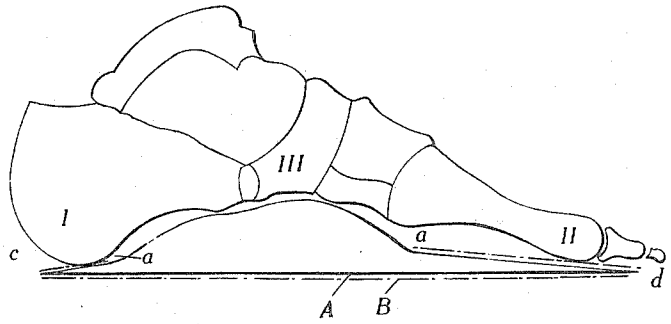


Fig. 3.

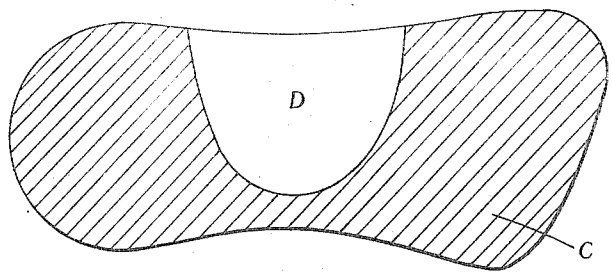
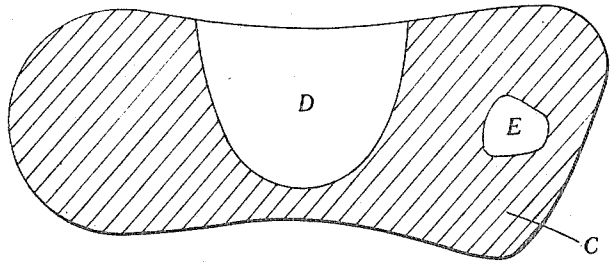


Fig. 4.



INVENTOR
Hans Seligmann
BY
L. Sokal.
ATTORNEY

Patented Aug. 1, 1939 2,167,933

UNITED STATES PATENT OFFICE

2,167,933

ORTHOPEDIC FOOT ARCH SUPPORT

Hans Seligmann, Munich, Germany, assignor to Heinz Reichmann, Chicago, Ill.

Application November 10, 1937, Serial No. 173,765
In Germany November 21, 1936

5 Claims. (Cl. 36—71)

This invention relates to an orthopedic boot and shoe insole or foot arch support.

It is an object of this invention to provide a foot arch support which provides a good balancing of the arch and also a support in which the supporting pressure conforms dynamically to the varying load.

It is a further object of the invention to provide a foot arch support which, in use, forms a continuous healing means and not one which merely gives symptomatic easing or assistance to the foot.

It is a still further object of the invention to provide a foot arch support in which the balancing of the arch is effected hydraulically.

It is yet another object of the invention to provide a boot and shoe insole or foot arch support which consists of a hollow rubber body which is filled with liquid and comprises parts shaped to conform to the under surface of the heel, ball and side portions of the human foot, which parts are made inexpansible by covering with solid leather, and an arched portion which is shaped roughly to the foot arch, which preformed arched portion is not covered by the solid leather and is consequently expansible. By this means, on pressure being applied to the insole, liquid is forced from the inexpansible portions to the expansible arched portion to cause the outer contour thereof to correspond to the contour of the wearer's foot arch, with the result that a supporting effect corresponding to the load moment at the time and the balancing of the foot arch is attained together with simultaneous correct adjustment of the foot, i. e. supination and the exertion of the muscles which serve to produce this position, that is to say this particular lifting of the middle edge of the foot.

The invention is illustrated by way of example in the accompanying drawing, in which:

Fig. 1 is a longitudinal section of an unloaded insole or foot arch support embodying the invention.

Fig. 2 is a similar view of the support shown under load, a skeleton of a foot being placed in position thereover so as more clearly to illustrate the improved effect.

Fig. 3 is a top plan view of the support, and

Fig. 4 is a similar view of a modification.

Referring to Figs. 1 and 2, the foot arch support comprises the hollow rubber body A which surrounds the space F, which is filled with liquid. B indicates the leather covering which renders the heel, ball and side portions of the support inexpansible. Only the rubber face *a*—*a*, which is preformed to a certain extent in the unloaded state, is not provided with any leather covering, and this portion is consequently expansible.

The heel I and the balls II of the foot are arranged on the inexpansible leather covered surfaces at *c* and *d* respectively. The foot arch III lies on the expansible rubber part *a*—*a*.

Referring now to Figs. 3 and 4, C indicates the inexpansible rubber face covered with leather, whilst D indicates the expansible rubber portion. The portions indicated by C, that is to say the pressure loaded parts of the foot arch support, correspond to the heel, ball and side edges of the foot, whilst the foot arch rests on the surface indicated by D.

In Fig. 4 the foot arch support is provided with a further expansible portion which corresponds to the transverse arch. This expansible portion is indicated by E.

It will be seen that the foot presses with its main supporting points, namely the heel, ball and lateral edges of the foot, on the support and thus displaces liquid which can only escape under the arch. The latter is thus supported according to the load; indeed the supporting pressure always corresponds to the load, that is to say with small load the supporting pressure will also be small owing to the slight displacement of liquid and vice versa.

The supporting pressure is always such that in any case a good balancing of the arch is obtained. For this purpose the arch is not merely statically balanced but the supporting pressure is made to conform dynamically to the load.

The new insole, in contradistinction to all prior insoles, does not form merely a symptomatic easing of the foot arch, but actually acts in an effective healing capacity.

The central point of thought which has led to this invention is the fact that all the prior practical orthopedic insoles have the basic fault that they aggravate the misery or suffering of a fallen or weak-jointed foot as has been especially emphasised by Privy-Councillor Prof. Dr. Erich Lexer, so that any person who, on account of a disposition to fallen or weak feet, has used an insole of any kind is never able to leave it off again. This circumstance is traceable to the fact that all the prior insoles or foot arch supports merely have the purpose of filling out the foot arch (longitudinal and transverse arches) with any material such as metal, wood, cork, rubber, Celluloid, air cushions or liquid cushions, etc. All these prior constructions are the same in principle. They all act in a harmful manner.

By simply filling the foot arch with any material it is true that the arch is supported and cannot drop any further. Any inconvenience is removed for a time but at the same time the germ for the growth of the complaint is laid. For by simply filling out and balancing the arch the muscles and ligaments which hold the foot arch are likewise balanced and kept inactive.

It is a known physiological fact that muscles and ligaments, if they are put out of operation, in a short time, even in a few weeks, are diminished as regards their vital function and weaken or soften and thus become atrophied, similarly to the extensive determinable muscle atrophy which takes place even after fourteen days within the area of the splint bandage after bone fractures.

The purpose of this invention consists in producing a foot arch support or insole, which, on the one hand supports the foot arch sufficiently corresponding to the load and thus removes the aforesaid inconveniences, and on the other hand at the same time trains or breaks in the muscles or ligaments which hold the arch automatically in the manner required by the particular circumstances. By means of the invention there is provided an improved support for the arch, which is sufficiently strong and withal supple, and at the same time conforms to any particular load moment. In contradistinction to the former insoles, the invention offers a novel insole which, by its particular method of supporting, produces no injury but, on the contrary, produces a constant improvement and healing of the basic complaint. This novel insole necessitates a constant exertion on the part of the wearer positive, automatic and reflex-like. Only by the construction and the arrangement of the novel insole are the above described effects made possible. A quite definite supporting pressure corresponding accurately to the particular load moment at the time and directed against the weakest parts of the longitudinal arch and also in the case of spreading feet the transverse arch is produced.

This extensive supporting effect only sets in, however, when the foot treads or acts in the physiologically correct position. This assurance is obtained in the construction of the insole according to the invention. The foot is thus placed, so as to be well balanced, automatically, reflex-like always in the correct position (supination) and thereby exercises entirely as required the muscles and ligaments which are necessary for attaining this position, that is to say the muscles which raise the middle foot edge and hold the arch.

A further exertion factor in connection with the muscles and ligaments is obtained in that the arch is not statically rigidly maintained inactive, but the supporting pressure conditions varying at any load moment demand and obtain complementary conforming of the muscles and ligaments.

The former rigid insoles thus act injuriously because they force the foot into a definite single prescribed position and prevent the free play of the muscles, sinews and ligaments. Thus any possibility of exercising the latter is excluded. This disadvantage is removed in the case of the insoles according to the invention as they can take up the form corresponding to the particular movement moment.

Furthermore the rigid insoles for the most part exert an injurious pressure on any part of the under surface of the arch, which leads at this particular position to breakdowns or to interruptions in the circulation of the blood with interruptions in the nutrition. The direct result is a weakening of the tissue at these parts, which normally represent the transverse tensioning holding the arch. With the novel insole, however, the supporting pressure produced is distributed uniformly over the whole under face of the arch in accordance with the basic principle of hydraulics, namely that the pressure exerted on a liquid is transmitted uniformly in all directions.

It is not possible to fill the whole body with air instead of liquid as if this were done the above described effect would not take place as air is compressible. Moreover, it is not possible to hold air for any length of time under pressure in a hollow rubber body.

Apart from the flexible or expansible face under the main foot arch a further expansible surface can also be formed under the so-called transverse arch, whereby the same balancing effect is also produced in the case of spreading feet.

The essence of the present invention is the central flexible and preformed part of the upper wall. By means of the preformed arching effect in the unloaded state even the smallest displacement of liquid from the hollow spaces disposed under the heel, ball and lateral edge of the foot must produce a supporting effect, and it is not necessary to displace a larger quantity of liquid from the said hollow spaces in order first to fill out the arch.

In accordance with the invention, by means of the central flexible arching (in the case of spreading feet also by the transverse flexible arching), it is attained that the insole is applied in the unloaded condition to the whole under surface of the foot and therefore any displacement of liquid can be converted into supporting pressure. The result is that quite a small quantity of liquid is necessary for producing the supporting pressure, and the inner width of the spaces present under the heel, ball and lateral edge of the foot can be maintained quite narrow and the whole insole can be made very thin and so as to fit in any shoe.

The hollow wall body is made inexpansible by covering with solid leather. Only at a place corresponding to the weakest parts of the longitudinal arch (and also the transverse arch in the case of spreading feet) is the preformed expansible rubber wall left uncovered. In this way a supporting effect on the weakest parts of the arch, which acts entirely automatically, according to the circumstances, is obtained, the supporting pressure corresponding accurately to the load by suitable adjustment of the dimensions of the expansible and inexpansible outer surface. The leather covering ensures that the whole pressure produced by displacement of the liquid is concentrated on the arch or arches, so that no loss of pressure can take place in that the hollow body is expanded at an inappropriate part.

The result of this is that the whole displaced liquid is used only to produce the supporting pressure and thus cannot be pressed at an inappropriate part. The smallest possible quantities of liquid thus come into question and the inner width of the hollow spaces lying under the heel, ball and lateral edge of the face can be small. The leather covering enables the rubber wall itself to be made thin because danger of breakage is prevented by the covering. Furthermore the direct contact of the foot with the

rubber is prevented. In this way the damming of the heat flow produced by the rubber with its attendant phenomena is avoided.

The improved foot arch support or insole must fit any foot and consequently must be made of different sizes corresponding to the shoe sizes. Any fitting operations are superfluous. The manufacture is cheap and simple in that a rubber hollow body which is closed at all sides is produced, which body is partly covered with leather, and the body can be filled with liquid in any suitable manner. Valves are not necessary.

The novel invention thus consists in that in the carrying out of a basic idea, by the co-operation of the parts, a unitary whole has been produced, which not only eases and corrects by a mechanical static filling out of the foot arch, but besides this ample support also heals, in consequence of the possibility provided of perfecting and strengthening the deformed and weak-jointed foot, by the constant exertion resulting without any special voluntary impulse, which is automatically the result of the co-operation of the principles brought out by the invention.

I claim:

1. An orthopedic foot arch support comprising a hollow liquid-filled expansible rubber body consisting of parts shaped to conform to the under surface of the heel, ball and side portions of the foot, and a central preformed arched portion on the upper side thereof corresponding to the foot arch, and a solid leather covering surrounding said heel, ball and side portions only whereby said heel, ball and side portions are rendered substantially inexpansible and said preformed portion remains unaffected such that on pressure being applied to said inexpansible portions, liquid will be displaced from said inexpansible portions into said preformed expansible portion, a supporting effect corresponding to the load moment at the time and a balancing of the foot arch being thereby attained.

2. An orthopedic boot and shoe insole comprising a hollow liquid-filled expansible rubber body having portions corresponding to the heel, ball and sides of the foot, and a pair of pre-arched portions corresponding respectively to the central and transverse arch of the foot, and a solid leather covering surrounding said heel, ball and side portions only, whereby said heel, ball and side portions are rendered substantially inexpansible and said pre-arched portions remain unaffected, such that, on pressure being applied to said inexpansible portions, liquid will be displaced from said inexpansible portions into said pre-arched expansible portions, a supporting effect corresponding to the load moment at the time and a balancing of the foot arches being thereby attained.

3. An orthopedic boot and shoe insole comprising a hollow incompressible-fluid-filled expansible rubber body, having portions corresponding to the heel, ball and sides of the foot and a portion corresponding to the foot arch; and means for rendering said heel, ball and side portions substantially inexpansible, the expansibility of the arch portion remaining unaffected.

4. An orthopedic boot and shoe insole comprising a hollow liquid-filled expansible rubber body having portions corresponding to the heel, ball and sides of the foot and a portion corresponding to the foot arch; and a layer of inexpansible material covering said heel, ball and side portions only, whereby said heel, ball and side portions are rendered substantially inexpansible and said arch portion remains expansible.

5. An orthopedic boot and shoe insole comprising a hollow expansible rubber body filled with an incompressible fluid, said body having portions corresponding to the heel, ball and sides of the foot and a portion corresponding to the foot arch; and a leather-cloth covering surrounding said heel, ball and side portions only, whereby said heel, ball and side portions are rendered substantially inexpansible and said arch portion remains unaffected.

HANS SELIGMANN.