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DEVICES FOR CIRCULATING AIR IN FOOTWEAR

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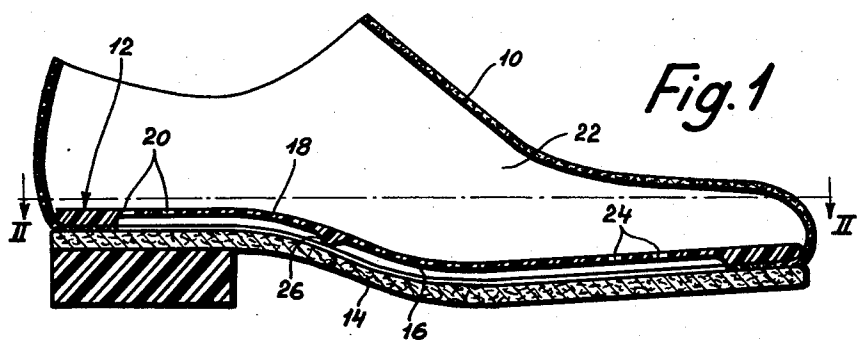


Fig. 1

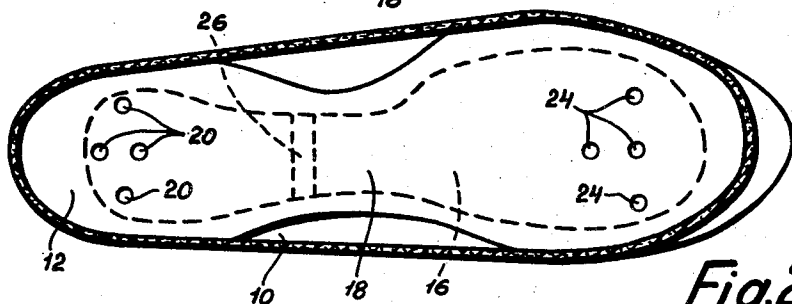


Fig. 2

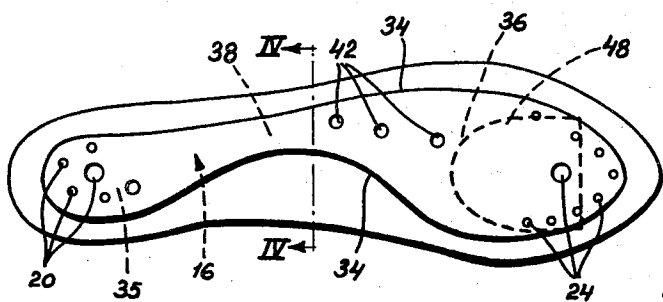


Fig. 3

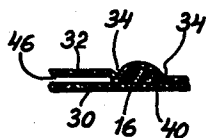


Fig. 4

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DEVICES FOR CIRCULATING AIR IN FOOTWEAR

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This invention relates to devices for circulating air internally in footwear and of the kind comprising a cavity member arranged in or adapted to be inserted into the bottom part of a footwear, which cavity member acts as a pump connected through openings or apertures to the inside of the footwear.

Many devices have been suggested for providing air circulation, particularly in rubber or heavy footwear, in such a manner that damp air may be removed from the lower portion thereof. In such devices a cavity acting as a pump has been formed in the bottom part of the footwear and so arranged that the foot will provide alternating pressures against this part and thus cause a pumping effect. However, in every known device of this kind the cavity has been arranged as a bellows pump having at least an exhaust valve and usually both an intake valve and an exhaust valve and generally the cavity has been so positioned and shaped that the pump was operated only by the heel although some bellows pumps have been known to be operated by the sole of the foot or to extend the full length of the bottom of the footwear.

In the known devices of the kind referred to a considerable disadvantage has been, however, the necessity of using valves. Valves do not only add to the cost of manufacture, but are easily damaged and thus render the pump inefficient as it continuously sucks in and pumps out the same air without providing the required circulation. Despite the many advantages obtained by providing air circulation in footwear such devices have gained very little popularity as they have proved, after a time, to be too inefficient.

It is an object of the invention to provide a device of the kind referred to which is extremely simple and accordingly inexpensive to manufacture, and which has no valves and is accordingly not liable to become ineffective in time.

Another object of the invention is to provide a device of the kind referred to, by which the fact is utilized that, during the process of working the foot does not exert a pressure on different portions of the bottom of the footwear at the same time but rather effects a rolling movement causing first a pressure on the heel portion after which the pressure is progressively shifted forward to the toe portion; and vice versa during backwards walk.

A further object of the invention is to provide a device of the kind referred to, which device comprises a cavity member defining a compressible and self-expandable longitudinal channel, and which cavity member is provided at the heel portion thereof with at least one opening connecting the rear end of said channel to an internal portion of the footwear under or immediately behind the wearer's heel, and at the foremost part thereof with at least one opening connecting the foremost part of said channel to an internal portion of the footwear close to the wearer's toes, whereas said channel is adapted to be compressed by the wearer's foot over a portion extending from a point below the wearer's heel to a point under his sole.

During the wearer's forward walk and while his foot is lifted off the ground such a channel will be filled with air. When the foot is subsequently put to the ground the channel portions near the heel will first be subjected to a comparatively high pressure and thus be compressed

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whereupon the pressure will shift progressively forward and the air contained in the channel will correspondingly be pressed forward in the channel and leave this through the aperture near the toe. By then the pressure at the heel will have been substantially reduced and consequently air will be sucked in through the aperture near the heel partly at the same time as air leaves at the toe.

When the foot is again lifted from the ground the channel will be filled with air derived from the rear aperture and at the next step it will be this fresh intake of air which will be pressed out through the front end of the channel.

The channel will also provide air circulation under different circumstances for example during backwards walk in which case the operation just described is reversed. When the wearer is at rest, for example sitting with his foot resting on the ground air circulation will also be produced as it has been found that a person at rest moving his foot will do so in a manner corresponding to the rolling movement of a normal walk.

While a person's heel and sole is in contact with a comparably wide area of the bottom of his footwear and exerts a comparably high pressure thereon, his longitudinal arch presses only slightly and only along a very narrow portion near the outer side of the foot. It is possible, therefore, that in the portion of the above said channel immediately below the longitudinal arch, a cavity remains wherein part of the air which has been advanced by the pressure of the heel may accumulate and then return rearwards by the subsequent sole pressure and which thus renders a large part of the channel ineffective as a pump.

It is also an object of the invention to prevent such reversing of the air.

Still another object of the invention is to provide a device of the kind referred to and provided with a channel as aforesaid, which channel has comparatively wide heel and sole portions connected by a narrow shank portion which is arranged to be aligned with the outside part of the wearer's longitudinal arch, the very part of the wearer's longitudinal arch which is capable of exerting at least some pressure on the device and thereby to compress the channel.

A still further object of the invention is to provide a device of the kind referred to and provided with a channel as aforesaid, which channel is filled with a sponge material such as sponge rubber or yieldable foam plastic, so that a pleasant support of the wearer's foot is obtained without the discomforts experienced with the previously used, known, cavity members which were made from comparatively hard rubber.

Another object of the invention is to make it possible in a device of the kind referred to to utilize the property of such sponge material consisting therein that air is readily pressed through the material and at the same time a comparatively high resistance to the passage of air arises when the sponge material is partly compressed.

Still another object of the invention is to provide an insole or sock lining adapted for insertion into footwear and consisting of or provided with a cavity member as aforesaid for circulating air internally in the footwear.

It is also an object of the invention to provide such an insole or sock lining which simultaneously may be used as an orthopedic insole or sock lining.

These and other objects of the invention will appear from the following description in which by way of examples two different embodiments of the invention will be described with reference to the accompanying drawing in which

FIG. 1 shows a vertical longitudinal section of a shoe provided with an embodiment of the invention;

FIG. 2 shows a sectional view along the line II—II in FIG. 1;

FIG. 3 shows a plan view of a sock lining constituting another embodiment of the invention, and

FIG. 4 shows a sectional view along the line IV—IV of FIG. 3.

The shoe shown in FIG. 1 has an upper part 10 fastened along its edge between an insole 12 and an outsole 14. The insole 12, made of a flexible resilient material, such as rubber, is provided with a cavity 16 which opens onto its underside and extends along the major part of its length and forms a channel between the upper part 18 of the insole 12 which upper part 18 constitutes a cover for the channel, and the outsole 14. The cover 18 is provided with apertures 20 arranged at the heel end of the shoe and connecting the interior 22 of the shoe with the channel 16. Similar apertures 24 are provided near the front end of the cover 18 but at such distance from the front end thereof that the apertures 24 are disposed immediately behind the toes of the wearer.

On the underside of the cover 18 and near its shank where it contacts the longitudinal arch of the wearer's foot, the cover 18 is provided with a transverse ridge 26 which ensures that even the low pressure exerted by the wearer's longitudinal arch is sufficient to close the channel and prevent the air from being pressed in the opposite direction to that in which the foot during walking progressively shifts the pressure.

When a wearer of the shoe described walks forwardly the channel 16 will when the wearer lifts his foot off the ground be filled with air. When the foot is subsequently put to the ground, the portion of the channel 16 near the heel of the wearer will first be subjected to a comparatively high pressure and thus be compressed whereupon the pressure will shift progressively forwards and the air contained in the channel 16 will correspondingly be pressed forward in the channel 16 and leave this through the aperture 24 near the wearer's toe. By then the pressure of the heel will have substantially reduced and consequently air will be sucked into the channel 16 through the apertures 20 near the heel partly at the same time as air leaves at the toe.

Normally the longitudinal arch of a wearer's foot will only exert a comparatively slight pressure on the part of the cover 18 below said longitudinal arch and only at the part thereof nearest the outside of the wearer's foot. However, owing to the ridge 26 even this slight pressure will be sufficient for closing the channel below the wearer's longitudinal arch, so that air cannot escape backwards from the front part of the channel 16.

FIGS. 3 and 4 show a sock lining made from two layers, an upper layer 30, and a lower layer 32 of soft leather or similar suitable material assembled by a stitching 34 in such a manner that a channel is formed inside the sock lining along the whole or the major part of its length and so shaped that it has a comparably wide heel portion 35 and a comparably wide sole portion 36 the two portions 35 and 36 being mutually connected by a comparably narrow shank portion 38 displaced towards the side of the sock lining nearest the outside of the foot and thus positioned under the part of the longitudinal arch which at least exerts a significant pressure against the sock lining during walk.

The channel 16 as shown in FIG. 4 is filled with sponge rubber or foam plastic 40 which is compressible, but after compression, self expandable.

Near the rear end of the heel portion 35 are apertures 20 leading from the outside into the heel portion 35 of the channel and similar apertures 24 are disposed near a part of the front end of the channel which lies immediately under or behind the wearer's toes. Additional apertures 42 are shown intermediately distributed between the apertures 20 and 24 along the length of the channel, these apertures 42 enabling an even distribution of air

from the heel portion of the channel into the front part of the shoe. It has to be noted that in most cases the apertures 42 will be left out.

The apertures 20, 24 and 42 may be formed in the upper layer 30 prior to assembly of the two layers 30 and 32 by the stitching 34. It is preferable, however, to cut the apertures after assembly when the sponge material 40 is in position, thus ensuring that the apertures extend through all three layers 30, 32 and 40. The apertures in the under side of the sock lining will have practically no effect while the apertures through the sponge material will add to the air circulation since a larger sponge material surface area will be exposed to admit the passage of air, through the apertures.

As seen in FIG. 4 a pocket 46 is formed alongside the shank portion of the channel 16. This may serve to receive an orthopedic longitudinal arch support member. A similar pocket 48 is formed under the front end of the insole to receive a support member for the front part of the foot.

The invention is not restricted to the embodiments shown and described as these may be varied in many ways within the scope of the invention. For example the channel shown in FIGS. 1 and 2 may also be filled with a sponge material in which case the ridge 26 may be wholly of partly left out. The ridge 26 may be left out in any case if the channel 16 is made sufficiently narrow at the shank of the shoe. It should be noted also that the apertures 24 and 20 may be formed as slots, and if the channel 16 or the channel forming cavity member is arranged at a higher level than the remaining top surface of the shoe bottom, these slots may be so arranged, for example at the front and rear end of the channel that they are not covered up by the foot.

The channel may also be given a depth which varies along its length with the maximum depth arranged where the highest pressure is exerted during walk, that is, preferably at the heel, but also immediately in front of the shank.

Further it has to be noted that in the embodiments shown the channel 16 is formed either in a built in insole or on a loose insole or sock-lining, and the arrangement of the channel 16 in such a cavity member will generally be most convenient. It is, however, possible, to arrange the channel 16 in the slip sole of a shoe bottom, or even in the outsole itself so that the slip sole or the outsole serves as cavity member. The use of the out sole as cavity member may be convenient where rubber soled footwear is concerned.

I claim:

1. A device for circulating air in footwear, comprising a sole member adapted to be arranged in footwear, said member having a heel portion, a shank portion and a toe portion, corresponding to the heel, longitudinal arch, and forefoot, respectively, of a wearer's foot, said sole member including an upper layer and a lower layer spaced therefrom, said layers being connected together at least along a line which defines a closed geometrical figure which in size is equal to substantially the major portion of the area of the upper layer, thereby to define a single cavity extending from said heel portion through said shank portion and into said toe portion, the cavity thereby defined including a heel cavity portion within said heel portion, a shank cavity portion within said shank portion, and a toe cavity portion within said toe portion, said upper layer being provided with at least one opening disposed in the heel portion only near the rearward end thereof and for providing free communication between said heel cavity portion and the atmosphere, said upper layer being provided with at least one opening in the toe portion and only near the forward end thereof for providing free communication between said toe cavity portion and the atmosphere, the portions of the upper and lower layers which define said shank cavity portion being imperforate and free of structure which will normally

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impede free air passage in both directions between said heel cavity portion and said toe cavity portion, said sole member being compressible for pumping air from the heel cavity portion into the shank cavity portion and then into the toe cavity portion due to the compression between said layers caused by the walking of a wearer, and means disposed within said shank cavity portion for interrupting free communication between said heel cavity portion and said toe cavity portion when the foot of the wearer compresses said shank portion, thereby to prevent air within said cavity from being returned to said heel cavity portion.

2. A device for circulating air in footwear, comprising, a sole member adapted to be arranged in footwear, said member having a heel portion, a shank portion, and a toe portion, corresponding to the heel, longitudinal arch, and forefoot, respectively, of a wearer's foot, said sole member including an upper layer and a lower layer spaced therefrom, said layers being connected together at least along a line which defines a closed geometrical figure, thereby to define a single cavity extending from said heel portion through said shank portion and into said toe portion, the cavity thereby defined including a heel cavity portion within said heel portion, a shank cavity portion within said shank portion, and a toe cavity portion within said toe portion, said upper layer being provided with at least one opening disposed in the heel portion for providing free communication between said heel cavity portion and the atmosphere, said upper layer being provided with at least one opening in the toe portion for providing free communication between said toe cavity portion and the atmosphere, the portions of the upper and lower layers which define said shank cavity portion being

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imperforate and free of structure which will normally impede free air passage in both directions between said heel cavity portion and said toe cavity portion, said sole member being compressible for pumping air from the heel cavity portion into the shank cavity portion and then into the toe cavity portion due to the compression between said layers caused by the walking of a wearer, and means disposed within said shank cavity portion for interrupting free communication between said heel cavity portion and said toe cavity portion when the foot of the wearer compresses said shank portion, thereby to prevent air within said cavity from being returned to said heel cavity portion.

3. A device as defined in claim 2 wherein said means includes a transverse ridge arranged within said shank cavity portion and limiting the height thereof.

4. A device as defined in claim 2 wherein at least said shank cavity portion is filled with a sponge material constituting said means.

5. A device as defined in claim 2 wherein said cavity is filled with a sponge material.

6. A device as defined in claim 5 wherein said openings constitute parts of holes cut through at least said upper layer and said sponge material.

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