June 10, 1952 L. L. GILBERT 2,600,239

PNEUMATIC INSOLE

Filed Nov. 1, 1949 2 SHEETS—SHEET 1

Fig. 1

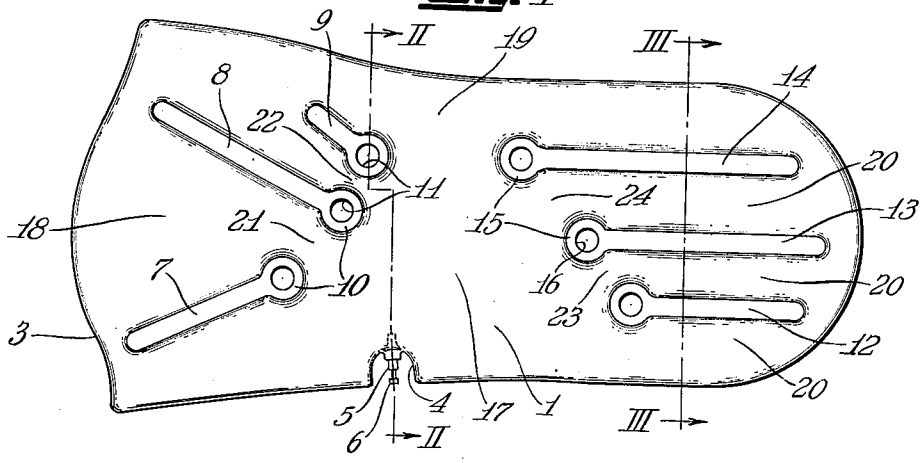



Fig. 2

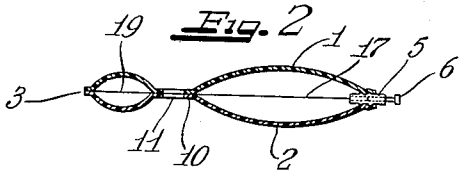



Fig. 3

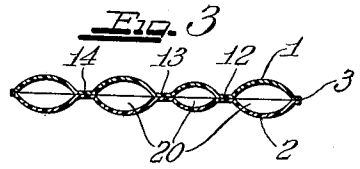



Fig. 4

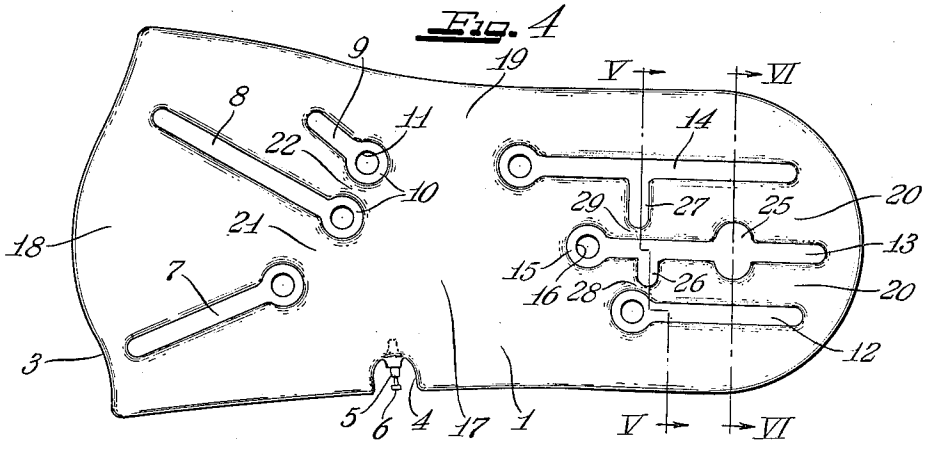



Fig. 5

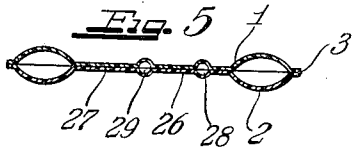
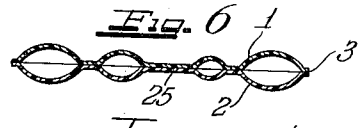



Fig. 6




Inventor

Levi L. Gilbert.

The Firm of Charles W. Hills

by Attys.

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PNEUMATIC INSOLE

Filed Nov. 1, 1949 2 SHEETS—SHEET 2

Fig. 7

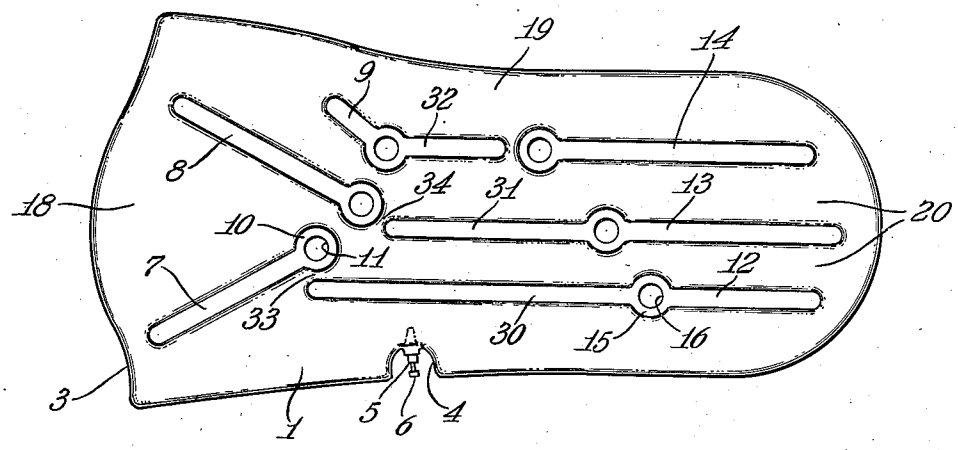
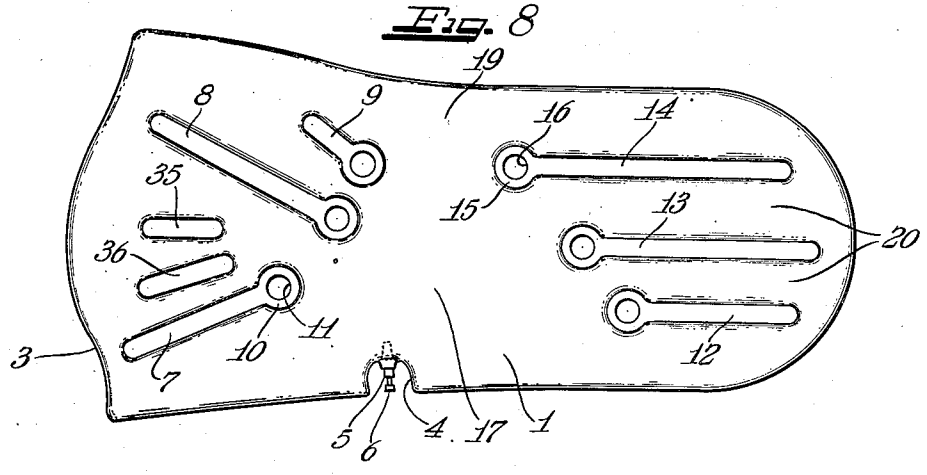



Fig. 8




Inventor
Levi L. Gilbert
The Firm of Charles W. Hills

By Attys.

Patented June 10, 1952

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# UNITED STATES PATENT OFFICE

2,600,239

## PNEUMATIC INSOLE

Levi L. Gilbert, Portland, Oreg.

Application November 1, 1949, Serial No. 124,809

6 Claims. (Cl. 36—71)

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This invention relates to improvements in a pneumatic cushioning and massaging insole, and more particularly to an inflatable device insertable in an article of footwear beneath the plantar surface of the foot to both cushion and massage the plantar surface of the foot while in use and especially during walking, although the device may have other uses and purposes as will be apparent to one skilled in the art.

The instant application is a continuation-in-part of and supersedes my copending application entitled "Pneumatic Insole," filed December 22, 1945, Serial No. 636,785, now abandoned.

It has been determined that many foot afflictions of both a mild and rather severe order can be corrected more effectively and in a shorter time provided corrective support is accompanied by a massaging action on the foot. The corrective support should preferably be of a yielding and somewhat gentle character, yet sufficiently effective to aid in rehabilitating the afflicted parts.

In the past, many and various devices have been developed for disposition beneath the plantar surface of the foot in an article of footwear, but in all cases of which I am aware these formerly known devices did not provide any effective massaging action against the foot during their use. Where such devices were pneumatic in character, that is permanently inflated or selectively inflatable to a desired extent, there was no way of controlling the time of movement of air from one location of the device to another, especially during walking, or no way of locating the pressure application areas consistent with particular and individual afflictions of the foot, and still permit mass production of the corrective appliance. In addition to such lack of economy, formerly known devices of this character were designed to fit either a right or a left foot and so two complete sets of appliances had to be manufactured simultaneously, thereby adding to the cost of production.

With the foregoing in mind, it is an important object of the instant invention to provide a pneumatic or inflatable insole of a character designed both to lend pneumatic support to the foot and massage and exercise the foot while in use.

Also an object of this invention is the provision of a pneumatic or inflatable insole which may readily be manufactured to provide corrective or supporting pressure at desired locations, and at the same time maintain the shifting of air from one location to another in the device in a forward and backward direction so as to continuously massage and exercise the plantar

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surface of the foot longitudinally thereof during use of the device, and especially when the user is walking.

Still another feature of the instant invention is the provision of a pneumatic insole provided with intermediate non-inflatable areas so designed and disposed as to valve or control the movement of air from one location to another of the device during use.

Also a feature of the invention is the provision of a pneumatic insole which may be used with either side uppermost, so that the same insole will function for either a right or a left foot.

It is also an object of this invention to provide a pneumatic insole of the character set forth herein embodying valve means to govern the amount of air in the device, the device being inflatable to any desired extent, and the valve means being so located as to be equi-distant from either side of the device, to permit either side of the device to be uppermost when in use.

A further object of this invention resides in the provision of a pneumatic or inflatable insole having intermediate spaced non-inflatable areas that may be so sized and arranged in mass production as to control the movement of air from one portion of the device to another during use, so as to prolong pneumatic support under a particular part of the foot, depending upon the particular nature of affliction the device is designed to materially aid.

Another object of the invention resides in the provision of a pneumatic insole, inflatable to a desired extent, and comprising a pair of panels marginally secured together to provide an inflatable envelope, said panels also being secured together at spaced intermediate locations to provide non-inflatable areas, such non-inflatable areas having apertures at desired locations therethrough to provide ventilation for the foot of the user during use of the device.

It is also a feature of the invention to provide a pneumatic insole in the form of an inflatable envelope with the panels of the envelope connected flatly together at intermediate locations to provide elongated non-inflatable areas, certain of which are laterally expanded to lessen the distance between adjacent areas, and thus control the movement of air from one location to another during use of the device.

It is also an object of this invention to provide a new and novel method of making a pneumatic insole of the character set forth herein.

While some of the more salient features, characteristics and advantages of the instant inven-

tion have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a plan view of a pneumatic or inflatable insole embodying principles of the instant invention;

Figure 2 is a transverse vertical sectional view through the structure of Fig. 1 taken substantially as indicated by the staggered section line II—II of Fig. 1, looking in the direction of the arrows;

Figure 3 is also a transverse vertical sectional view through the device taken substantially as indicated by the line III—III of Fig. 1;

Figure 4 is a plan view of a pneumatic insole embodying principles of the instant invention, but providing a different configuration and spacing of the non-inflatable areas, the device of this figure being designed particularly for use in connection with a spur heel or similar affliction;

Figure 5 is a transverse vertical section view of the structure of Fig. 4, taken substantially as indicated by the staggered section line V—V of Fig. 4;

Figure 6 is also a transverse vertical sectional view through the structure of Fig. 4, taken substantially as indicated by the line VI—VI of Fig. 4;

Figure 7 is a plan view of a pneumatic insole embodying principles of this invention, showing another arrangement of the non-inflatable intermediate areas; and

Figure 8 is also a plan view of a similar insole but showing a still different arrangement of the non-inflatable areas.

As shown on the drawings:

All of the forms of the invention illustrated herein are made up of a pair of flat panels of air impervious material marginally secured together to provide an inflatable envelope of the proper contour for insertion in an article of footwear beneath the plantar surface of the foot. The panels may be made of substantially any suitable material that is air impervious, such for example, rubberized or otherwise waterproofed fabric; rubber or synthetic rubber, and a highly satisfactory material is a thin flexible air-impervious plastic. Where rubber or synthetic rubber panels are utilized, the non-inflatable areas may be provided by the use of a paper pattern disposed between the panels, and provided with apertures, located, sized and shaped in accordance with the desired non-inflatable areas. Accordingly, the two sheets may be cemented or vulcanized together through the openings in the paper to provide non-inflatable areas of the desired shape, location and size. Where plastic panels are utilized, the panels may be secured together to provide the non-inflatable areas with the aid of a suitable grid or die carrying projections shaped in accordance with the desired non-inflatable areas, and this die may be subjected to high voltage high frequency electrical current to heat-seal or weld the layers flatly together in the desired location. Accordingly, it is a simple proposition to vary the size, shape and location of the non-inflatable areas by merely making a simple adjustment to the die or mold in the case of the plastic insole, or by utilizing a paper pattern with properly disposed openings therein in the case of rubber or synthetic rubber panels. In either event, a device may be changed in accordance with particular afflictions of the foot, without adding materially to the cost of production.



In that illustrated embodiment of the instant invention seen in Figs. 1 to 3 inclusive, there are a pair of panels 1 and 2 marginally secured together as at 3 to provide an inflatable envelope. The panels are shaped generally in keeping with the plantar surface of the human foot, to underlie the foot from the rear part of the heel to a point adjacent the metatarsal arch, and in the illustrated instance the first and fifth metatarsal heads will lie just off or approximately off the device itself, while support will be given beneath the second, third and fourth metatarsal heads. It is not essential that the device have the shape shown, but that is a hingly satisfactory shape for most conditions. The device illustrated in Figs. 1, 2 and 3 is the form that will most commonly be used since it will be satisfactory for most weak foot or fallen arch conditions.

At one point in the margin thereof, preferably in the region of the inner longitudinal arch of the foot, the device is provided with an arcuate marginal indentation 4 and in this region a simple air valve which may comprise a tube 5 secured between the panels, and a closure pin 6, is located, so that the valve structure is equidistant from both faces of the insole when the same is inflated. With this valve arrangement, and especially wherein the valve means are located in a thicker portion of the device when inflated, it is not necessary to manufacture devices for both left and right feet, since the same device may be utilized for both feet depending upon which panel, 1 or 2, is disposed uppermost.

The description so far given herein applies with equal fidelity to all illustrated modifications of the instant invention.

Referring again to Figs. 1 to 3 inclusive, it will be seen that the anterior portion of the device is provided with three elongated relatively narrow non-inflatable areas 7, 8 and 9 each of which is provided by securing the panels 1 and 2 flatly together in the particular area. Certain or all of these non-inflatable areas may be laterally expanded at their inner ends as indicated at 10, and certain or all of these lateral expanded areas 10 may be provided with an aperture 11 therethrough to furnish ventilation for the foot of the user. Obviously, the aperture only extends through a non-inflatable area so as to eliminate any chance of leakage at such location.

In the rear portion of the device, similar spaced non-inflatable elongated and relatively narrow areas 12, 13 and 14 are provided, the inner portions of which may be expanded as indicated at 15, and again ventilation apertures 16 may be provided. The non-inflatable areas 12, 13 and 14 preferably extend longitudinally of the device to insure movement of the air back and forth longitudinally of the device and likewise longitudinally of the plantar surface of the foot.

With the device illustrated in Figs. 1 to 3, it will be noted that the non-inflatable areas 7, 8 and 9 extend inwardly to terminate somewhat in echelon transversely of the device, and the same is true in connection with the non-inflatable areas 12, 13 and 14, which also vary in length. This arrangement provides a relatively large inflatable area 17 beneath the inner longitudinal arch of the foot to effectively support that part of the foot. The non-inflatable areas 7 and 8, and 9 if desired, preferably converge inwardly so as to provide a properly shaped and relatively large inflatable area 18 to lend support to the metatarsal arch of the foot. On the outer side of the device there is a narrower and elongated in-

flatable area 19 beneath the outer longitudinal arch of the foot which, as seen clearly in Fig. 2, will be of less depth than the aforesaid area 17 when the device is properly inflated. The fleshy part surrounding the oscalsis of the foot will be adequately supported by the inflated portion 20 around and between the non-inflatable areas 12, 13 and 14.

One of the particular features of the instant invention resides in effecting control of the movement of air from one part of the device to another, especially during walking. This not only insures an adequate support under each part of the foot at all times, but results in a definite massaging action against the plantar surface of the foot that adequately exercises the foot thereby greatly enhancing the curative powers of the device. This is accomplished by so locating and sizing adjacent portions of the non-inflatable areas to provide relative narrow passages 21 and 22 between adjacent non-inflatable areas to the rear of the metatarsal arch supporting portion 18, and likewise providing similar narrow passages 23 and 24 adjacent the inner ends of the rearward non-inflatable areas 12, 13 and 14.

During walking, for example, when the heel of the foot strikes first, air is pressed out of the rearward portion of the device and moved into the forward portion, and as the foot rolls forwardly so that pressure is ultimately on the metatarsal arch, the air is pressed out of the forward portion of the device and moved rearwardly. This effects a positive massaging action of the foot, and with the illustrated invention, that massaging action occurs longitudinally of the foot. The narrow passages 21, 22, 23 and 24 valve or control the movement of air from one part of the device to the other and prevent all of the air from immediately exiting from one portion of the device when pressure is applied on that portion. Thus, by sizing these narrow passages the escape of air from one location of the device may be prolonged to a desired extent, so that not all of the air moves from that part of the device prior to the removal of pressure and the application of pressure in a different location. In this manner, the massaging and exercising of the foot is rendered much more effective, and at the same time all parts of the foot are adequately supported.

It is a simple expedient to adapt the pneumatic insole for the treatment of a particular or individual affliction, by the sizing and location of the non-inflatable areas, in an economical manner above described. Assuming, for example, that a particular patient or user has a spur heel, but otherwise the foot is normal or weakened somewhat in either the longitudinal or metatarsal arch. For that circumstance, the device may be made in the form shown in Figs. 4, 5 and 6, wherein the entire forward portion of the device is the same as above described in connection with Figs. 1 to 3 inclusive.

However, the rearward non-inflatable areas 12, 13 and 14 may be altered to provide a lateral expansion 25 directly beneath the heel spur in the area 13, and to provide sidewise extensions 26 and 27 on the non-inflatable areas 13 and 14 which provide very narrow passageways 28 and 29 between adjacent non-inflatable areas. With this arrangement, complete longitudinal massaging of the foot along with adequate support is acquired, but in addition the spur of the heel is lodged in a recess so that no pressure comes upon it, and the fleshy parts of the heel around the spur are adequately supported by inflated areas. The inflation beneath the fleshy parts of the heel is maintained for a prolonged period of time, especially in walking, by virtue of the narrow passages 28 and 29 preventing a rapid exit of air from the heel portion of the device when weight is applied. Thus, air is maintained beneath the fleshy parts of the heel for a longer period of time than in the case of the structure seen in Fig. 1, so that this air will not be removed from beneath the fleshy parts of the heel during normal walking before pressure is applied to the forward part of the device to again tend to move the air rearwardly beneath the heel.

That embodiment of the invention illustrated in Fig. 7 is more particularly designed for a foot otherwise normal but having a weakened metatarsal arch. In this instance the non-inflatable areas 12 and 13 are provided with extensions 30 and 31, respectively, extending forwardly from the enlargement 15 which causes a considerable flattening of the above discussed inflated area 17 beneath the inner longitudinal arch. Likewise, the non-inflatable area 9 is provided with a rearward extension 32 which further flattens the junction between the parts supporting the inner and outer longitudinal arches. At the same time, the non-inflatable areas 7 and 8 converge at a sharper angle so that very narrow spaces are provided between adjacent portions of the non-inflatable areas 7, 8 and 9, and especially at 33 and 34 between the extensions 30 and the area 7 and the extensions 31 and the area 8, respectively. Thus, air is maintained for a considerable length of time beneath the metatarsal arch in the inflated region 18, and yet the longitudinal massaging action against the plantar surface of the foot is by no means sacrificed.

The showing in Fig. 8 indicates a structure highly suitable for supporting a weakened longitudinal arch in an otherwise normal foot. This structure is the same as above described in connection with Fig. 1, with the exception that additional non-inflatable areas 35 and 36 are added between the areas 7 and 8, because in this instance it is not necessary to provide support for the metatarsal arch. With such construction, an adequate amount of air is always insured beneath the inner longitudinal arch and the longitudinal massaging action is effective over the plantar surface of the foot and especially adjacent the weakened longitudinal arch.

From the foregoing, it is apparent that I have provided a simple form of pneumatic insole, usable for either foot, economically manufactured, highly durable, and which may be inflated to a desired extent. The device not only may be economically adjusted to better support a particular affliction, but under any and all circumstances adequately supports all parts of the foot, and provides a distinct massaging and exercising action longitudinally of the plantar surface of the foot. The method of making the instant invention is believed sufficiently apparent from the foregoing to warrant no further description herein.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a foot cushioning and massaging device, an air impervious inflatable envelope comprising a pair of flat panels secured together adjacent

the margins thereof, said panels being secured together at spaced intervals to provide elongated relatively narrow non-inflatable areas, certain of said areas being expanded in part to lessen the distance between adjacent areas and thus control the movement of air from and into the inflatable portion adjacent said areas during use of the device.

2. In a foot cushioning and massaging device, a pair of air impervious panels marginally secured together to form an inflatable envelope for disposition beneath the plantar surface of a foot, and said panels being secured together at spaced intervals to provide elongated flat non-inflatable areas extending generally lengthwise of the device rearwardly of the longitudinal arch of the foot, certain of said areas being laterally expanded to lessen the spacing between adjacent areas and control the movement of air to and from the rear part of the device during use.

3. In a foot cushioning and massaging device, a pair of air impervious panels marginally secured together to form an inflatable envelope for disposition beneath the plantar surface of a foot, said panels being secured together to provide flat non-inflatable areas, said areas being elongated and relatively narrow and disposed to cause a back and forth travel of air longitudinally of the device and foot thereon during use to massage the foot, certain parts of said areas being laterally expanded to lessen the space between adjacent areas to retain some of the air in one location until pressure on that location is relieved during walking.

4. In a foot cushioning and massaging device, a pair of air impervious panels marginally secured together to form an inflatable envelope for disposition beneath the plantar surface of a foot, said panels being secured flatly together at spaced intermediate locations to provide non-inflatable areas, such non-inflatable areas at the rear of the device extending longitudinally of the device, and those non-inflatable areas at the forward part of the device converging in a rearward direction to define an inflatable metatarsal lift.



5. In a foot cushioning and massaging device, a pair of air impervious panels marginally secured together to form an inflatable envelope for disposition beneath the plantar surface of a foot, said panels being secured flatly together at spaced intermediate locations to provide non-inflatable areas, such non-inflatable areas at the rear of the device extending longitudinally of the device, and those non-inflatable areas at the forward part of the device converging in a rearward direction to define an inflatable metatarsal lift, said non-inflatable areas terminating with the inner ends in echelon transversely of the device to provide an inflatable area of relatively large size beneath the longitudinal arch of the foot.

6. In a foot cushioning and massaging device, a pair of air impervious panels marginally secured together to form an inflatable envelope for disposition beneath the plantar surface of a foot, said panels being secured flatly together at spaced intermediate locations to provide non-inflatable areas, such non-inflatable areas at the rear of the device extending longitudinally of the device, and those non-inflatable areas at the forward part of the device converging in a rearward direction to define an inflatable metatarsal lift, the inner portions of said non-inflatable areas being laterally expanded to lessen the space between adjacent areas and control the movement of air from one location to another during use.

LEVI L. GILBERT.


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