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(54) Benævnelse: **Skosål med ventilation og sko med en sådan sål**

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Field of the Invention

The invention relates to a shoe sole with a compressible chamber containing an elastically deformable material with at least one air inlet and at least one air outlet and in each case an inlet valve assigned to the air inlet and an outlet valve assigned to the air outlet, wherein the chamber is connected by the inlet valve and an air inlet space to air passages disposed on the upper face of the shoe sole and wherein the chamber is connected by the outlet valve to an opening on the shoe sole outside the upper face thereof. The invention further relates to a shoe having such a shoe sole.

Background

A shoe sole of the above-mentioned type is known from DE 199 24 256 C1. This sole should effect optimal shock absorption. Damping elements made of plastic are disposed in the heel region of this shoe sole for absorbing shocks. During the production of the shoe sole the magnitude of the damping can be adapted by the choice of the damping elements. The damping elements are disposed in a chamber. This serves additionally for ventilation of the shoe equipped with the sole, so that, during walking, air is drawn out of the interior of the shoe into the chamber and this air is subsequently expelled. A further shoe sole with damping is known from DE 196 40 655, wherein in the ball region and in the heel region deformable cavities are provided which are connected to one another and to the outer region via conduits. Furthermore, however, there is a very great need to improve the comfort when wearing and walking in shoes. WO 2008/125524 shows a shoe with shoe sole with a chamber, in which chamber air can be sucked via a centrally arranged inlet. The chamber is sealed at its upper side towards the inner sider of the shoe by a membrane, via which water vapor can enter the chamber. A material can be arranged in the chamber, which can improve the moisture absorption via the membrane.

Summary of the Invention

The object of the present invention is to improve the comfort when wearing and walking in shoes through the creation of an improved shoe sole or an improved show base. This should primarily improve the ventilation in order to achieve a good shoe climate. The shoe sole should be equally suitable for all every day, work, leisure and sports shoes and should be capable of being produced simply and cost-effectively and suitable for all designs of a shoe.

In a shoe sole as set out in the introduction, this object is achieved in that the chamber is disposed in the front region of the shoe sole and is filled almost completely with an elastically deformable material, which is such that, during its elastic expansion, it absorbs air and, during its compression, it releases air which has previously been absorbed.

It can be seen that particularly good ventilation can be achieved through the arrangement of the chamber in the front region. Furthermore good comfort when walking is obtained. The almost complete filling of the chamber with the elastically deformable material which absorbs the air and releases it again enables, through the combination of its own elasticity and through the partial compression of the air contained therein when it is released from the material, a very good air circulation cycle, which is explained in greater detail below, removing the stale or used moist air for example containing sweat particles from the interior of the shoe with every step, and drawing fresh air into the interior of the shoe when the foot is lifted. Furthermore, damping is obtained for the foot when treading, which produces a very pleasant sensation when walking. During walking the chamber is loaded on its upper face by the foot with every step when treading and is thereby compressed and expands again with the relief of load when the foot is lifted. Through the almost complete filling of the chamber with the elastic material, the part of the sole, for example the insole, which closes off the chamber at the top towards the foot and with each step is deformed, uniformly stressed or uniformly supported by the filling of the chamber with the material and thus is not subject to excessive material fatigue in the air circulation process. Thus “collapse” of the shoe sole is prevented from the interior of the shoe. This increases the comfort when walking and the durability of the insole.

The shoe base or the shoe sole according to the present invention is suitable for all designs of the shoe. It may be a directly soled design with the shoe base or sole injection molded on, in particular with an inner sole applied by a Strobel process, or it may be a stitched design. In a preferred embodiment the shoe sole or the shoe base has a design with an insole and an outsole, wherein the insole forms the outer surface of the chamber and has the passages to the air inlet space which is connected to the chamber.

Thus the embodiment of the shoe base or the sole according to the invention can be used both for a conventional sole construction for high-quality shoes and also for sneakers or other shoes. The desired ventilation function and also damping function is

always achieved, wherein owing to the claimed structure the insole can be well supported in the front region and thus does not undergo excessive loading.

It is also preferable that the air inlet space is disposed in the front region of the shoe sole, in particular before the chamber. This produces a particularly good structure of the sole and makes it possible to place an extensive ventilation region and also damping region at the location suitable therefor.

For the elastically deformable material an open-cell plastic is preferred, which is foam-like or sponge-like and during its elastic expansion absorbs air and, during compression with the walking movement, respectively during stepping and loading of the shoe sole, releases previously absorbed air again. Preferably the elastically deformable material, or in particular the open-cell plastic, itself already has a sufficient restoring force or acts as a spring means, so that this material alone effects the expansion of the chamber and thus the drawing in of air during the relief of load on the upper face of the chamber, without the need for a further means, in particular a separate spring means. However, such a separate spring means can be provided, for example in the form of at least one plastic spring or at least one metal spring, which is disposed in addition to the elastic material in the chamber and which supports the expansion of the chamber after compression thereof and subsequent relief of loading. The elastically deformable material can be disposed in an airtight sleeve which has at least one inlet connection and at least one outlet connection. This simplifies the sole construction or production, since then the chamber disposed in the sole does not need to be airtight. Any spring which may be present is then also accommodated in the sleeve. If the elastic material which absorbs air or releases air is disposed without a sleeve in the chamber, then this chamber itself must be airtight (with the exception of the air inlet and the air outlet). The sole can be implemented in this way, but necessitates a corresponding construction or corresponding production. The foam material may contain additives with known antibacterial action.

The flexibly compressible chamber can also be subdivided by partition walls or partition members into a plurality of flexibly compressible chamber regions, preferably in the longitudinal and/or transverse direction with respect to the shoe sole. Then each chamber region is almost completely filled with the material. In this case “almost completely” may be understood in all configurations of the invention to mean a filling of the chamber with the material which results in no or only very small unfilled cavities. The

chamber can in particular be filled with the material to 90% or more, in particular to 95% or more of its chamber volume in the rest position.

A throttle is preferably provided in addition to the air outlet valve in the air outlet. Thus the damping can be better controlled than with a “free” release via the outlet valve, which generally already has a certain throttle action due to its design. However, the throttling of the air can be determined or adjustable more precisely with a throttle which is explicitly provided in addition to the valve. The outlet valve can be structurally combined with the throttle or the outlet valve and the throttle can be separate components. The throttle is preferably an adjustable throttle or a throttle disposed replaceably in the shoe sole, which enables a simple adaptation of the damping. An opening for the used air to escape is advantageously disposed laterally on the sole, which is to say not on the underside thereof. In the case of an adjustable or replaceable throttle, this may then be disposed in the lateral opening of the sole, which results in good accessibility for adjustment or replacement of the throttle. However, the opening for the used air can also be disposed on the underside of the sole, if the used air is released into a shoulder of the shoe disposed below the sole. This then generally has a lateral opening for release of the air, which again can have the aforementioned throttle. Thus for the present invention the term “shoe sole” is understood to mean the entire shoe base with or without a shoulder.

In a preferred embodiment of the shoe sole a second chamber, likewise filled with elastic material of the same type, having valves (inlet valve and outlet valve), and preferably also with a throttle in the outlet, is provided in the heel region. This throttle may also be adjustable or replaceable. The second chamber is preferably likewise connected to an air inlet space. This air inlet space can, when viewed in the longitudinal direction of the sole towards the ball region, be arranged before the second chamber. Preferably the two chambers are not connected to one another.

The invention also relates to a shoe with a shoe sole according to the invention. This provides the explained advantages for the shoe. The shoe may be a man’s or woman’s shoe or a child’s shoe and may be an everyday, work, leisure or sports shoe. The shoe may be a summer, winter or all-year shoe. For the person skilled in the art it is obvious that construction of the shoe base or the shoe sole according to the invention is applicable for any design, that is to say for the directly soled design, in particular with an injection molded design and in particular with an inner sole applied by a Strobel process. This also applies to the stitched design.

Described is further a method for adjusting the ventilation and also the damping in a shoe with a shoe sole which has an adjustable or replaceable throttle for the air released through the outlet of the chamber, wherein the ventilation and the damping is adjusted by adjustment of the adjustable throttle or by replacement of the throttle with a throttle having a different passage. This enables in a simple manner the adaptation of the ventilation and also the adaptation of the damping to the body weight and the personal wishes of the wearer of the shoes in the finished shoe, for example before delivery thereof or in the shoe shop at the time of the sale and also at a later stage by the owner of the shoe.

By adaptation of the throttle cross-section the adjustable throttle enables a change to the ventilation and damping, wherein the corresponding damping characteristic is linear, progressive or degressive depending upon the embodiment. In this case it is possible to adjust the shoe sole to the corresponding body weight by hand, for example with a coin or a screwdriver. Depending upon the embodiment the adjustment takes place in individual stages or gradually. The replaceable throttle as an alternative embodiment likewise enables an adjustment of the damping values, wherein one or more throttle(s) adapted to a specific body weight are inserted into the shoe sole, for example in stages from 40-50 kg, from 50-60 kg, 60-70 kg etc.

The employed valves or throttles are in a closed state airtight and watertight. They are preferably designed to be low-noise, oil-resistant and fireproof and thus also particularly suitable for work shoes having such soles.

Brief Description of the Drawings

Further embodiments, advantages and applications of the invention are apparent from the dependent claims and from the following description with reference to the drawings. In the drawings:

Figure 1 shows a vertical section through a shoe with a shoe sole or a shoe base according to the invention in a first embodiment;

Figure 2 shows a diagrammatic view of the lower part of the shoe sole according to Figure 1;

Figure 3 shows the elastic material disposed in a sleeve;

Figure 4 shows an upper sole part or an insole with openings in the front region which form the passages to the air inlet chamber;
Figure 5 shows a vertical section through a shoe with a shoe sole or a shoe base in a second embodiment;
Figure 6 shows a diagrammatic view of the lower part of the shoe sole according to Figure 5;
Figure 7 shows the elastic material in an airtight sleeve for use in the pump chamber of the heel region; and
Figure 8 shows an upper sole part or an insole with additional passages in the heel region.

Ways of Carrying Out the Invention

Figures 1 to 5 show a first embodiment of a shoe sole or a shoe base according to the invention or a shoe equipped therewith. Figure 1 shows a vertical section through a shoe 10 having the shoe sole 1. First of all the air circulation is explained:

a) The used air A located in the shoe is drawn in via passages or openings 2 in the upper face of the shoe sole out of the interior of the shoe via an air inlet space 4 in the sole 1 and via an air inlet 5 in the chamber 6 at the moment in which the previously compressed chamber 6 expands again, i.e. when the shoe sole 1 is lifted from the floor and the sole is relieved of load thereby. In this case an air inlet valve, which for the sake of better clarity is not shown in Figure 1, is effective between the space and the chamber 6;

b) thus at the same time fresh air Fr, which replaces the used air A, is drawn in from the outside of the shoe into the inside of the shoe by an underpressure generated at this moment in the interior of the shoe. Thus the ventilation effect is achieved;

c) the used air A is first of all stored temporarily in the chamber 6 until the next time the user treads on the shoe sole 1; and

d) finally, the next time the user treads and rolls on the shoe sole 1, the used air A is released to the environment outside the shoe by the loading and thus the compression of the chamber 6 through an outlet 8 (which may be a channel or a conduit) via an outlet valve, also not shown for the sake of clarity, through an air outlet 9 in the region of the outside of the shoe. In this case the outlet valve may be disposed at any

position in the air path between the chamber 6 and the air outlet 9, but in particular in the outlet 9, where the valve can be disposed so that it is accessible from the outside.

Then with a new lifting of the foot and the relief of loading on the shoe sole 1 a new air circulation cycle begins with the step a).

Moreover, when the shoe sole 1 steps or rolls on the floor, the shoe sole 1 according to the invention enables shock absorption, represented by the arrow D in Figure 1 illustrated, as a result of the compression of the chamber 6 filled with used air A. After the relief of loading the chamber expands in direction of the arrow F.

The combination of periodic air circulation in quick succession and damping/spring action D/F results in considerably improved comfort in the shoes even over a comparatively long period of time. Moreover the described characteristics of the shoe sole 1 according to the invention also result in extraordinarily positive effects in people suffering back pain.

Figure 2 shows a schematic plan view of the lower part of the shoe sole 1. Therein, the air inlet space 4, the chamber 6 and the air inlet 5 thereof and the air outlet 9 on the outer face of the shoe sole 1 are shown. The outlet 9 could also be arranged directly in the side wall of the chamber 6, but in the illustrated example the outlet 9 is connected to the chamber 6 via a channel 8 arranged in the sole 1. The outlet can also open into a shoulder of the shoe separate from the sole, or the channel or the conduit 8 leads directly into the shoulder, and in this case the used air is discharged to the environment via an air outlet opening in the shoulder. In this case an outlet valve can be disposed in the shoulder. For the sake of better clarity the inlet valve 15 on the corresponding inlet opening 5 and the outlet valve 19, which here is employed directly in the opening of the sole or the air outlet 9 of the sole, are only indicated in Figure 2. These valves 15 and 19 may be valves of conventional construction which are known to the person skilled in the art. The function of the inlet valve 15 is to enable the passage of air from the air inlet space 4 into the chamber 6 via the air inlet 5 when an underpressure prevails in the chamber 6 by comparison with the space 4. On the other hand the valve 15 blocks the air flow from the chamber 6 back into the space 4, when the same or a higher air pressure prevails in the chamber 6 than in the space 4. The outlet valve 19 has the function of allowing the passage of air from the chamber 6 to the air outlet 9 and thus to the environment when an overpressure prevails in the chamber 6 by comparison with

the ambient pressure. On the other hand the valve 19 blocks the air path from the outlet 9 to the chamber 6 when an underpressure prevails in the chamber 6 by comparison with the ambient pressure outside the shoe. In this way the valves 15 and 19 enable the previously described air circulation and prevent another air flow. The valves are customary valves and are airtight and watertight in the closed position. They are preferably low-noise, oil-resistant and fireproof in a defined manner. The color and shape of the valves may be chosen to match the shoe. As mentioned, they can be combined with an adjustable or a non-adjustable throttle 20 for the outflow of air.

The chamber 6 is filled almost completely with an elastically deformable material 16, which is designed such that, during its elastic expansion, it absorbs air and, during its compression, it releases air which has previously been absorbed. In Figure 2 the material 16 is only partially illustrated in order to make the drawing clearer. The chamber 6 is completely filled with the material 16, wherein this means that the chamber has practically no cavities which are not filled. Naturally a filling of the chamber 6 with the material which differs slightly from 100% filling may likewise be sufficient, for example a filling to 90% or to more than 90% but below 100%. The elastically deformable material 16 may in particular be an open-cell plastic. Foams of the type V16 B21 or MR 6290 or V10 B21 from Metzeler Schaum GmbH, Memmingen, Germany, or the foam AstiTech® from Beil GmbH, Peine, Germany, as well as the foam with the product No. 110190 from Schaumstoff Härti AG, Switzerland, are particularly suitable as filling for the chamber 6.

Figure 3 shows an embodiment in which the elastic material is enclosed in an airtight sleeve 17 which can be inlaid in the chamber 6. In this example the sleeve 17 is provided with an inlet connection 11 which forms the air inlet 5. The inlet valve (not shown here) can be disposed in the connecting piece 11 or in the sleeve at the transition from the connecting piece to the sleeve 17. The sleeve 17 is connected to the outlet 9 via a conduit 8 disposed here on the sleeve 17. The conduit 8 can be inlaid in the channel of the lower part of the sole of Figure 2. The outlet valve is then for example disposed in the outlet 9 or in the sleeve 17 at the transition from the sleeve to the conduit 8 or along the conduit 8. The advantage of the embodiment according to Figure 3 is that the chamber 6 in the sole itself does not need to be airtight, since the sleeve 17 surrounds the elastic material in an airtight manner. This is particularly advantageous if the sole has a structure which is configured for the stitched design of the shoe. Figure 4 shows an insole 3 of the shoe sole with openings or with the passages 2 in the front region

which connect the inside of the shoe to the air inlet space 4. The openings 2 are formed by perforation holes, but in other variants can also be formed as slots or other shapes.

Figures 5 to 8 show in a similar representation a second embodiment of a sole or a shoe equipped therewith. The same reference numerals as before are used for elements which are identical or have the same function. The difference from the first variant according to Figures 1 to 4 is that in addition to the chamber 6 in the front region a second chamber 6' is formed in the heel region with all the necessary elements for it to function such as additional insole openings 2', a second air inlet space 4' in the heel region as well as an inlet opening 5' and outlet opening 9' or inlet and outlet conduit, if also in the heel region the elastic material is not introduced directly into the chamber 6', but has previously been enclosed in an airtight sleeve. In the variant shown the air inlet chamber 4' is positioned before the chamber 6'. In other variants, however, it could also be arranged beside or behind the chamber 6'. Both chambers 6, 6' could also be supplied via a single air chamber 4, but this is not preferable. Moreover in contrast to the first variant the outlet opening 9 is arranged laterally further forward and the second outlet opening 9' is arranged right at the rear in the heel region. In the second variant the valves are not illustrated but are likewise present, in order to determine the air circulation in the previously described manner.

Thus with the second variant a ventilation cycle is made possible in the front region and in the heel region and moreover a damping/spring action is ensured in the front region D/F and in the heel region D'/F'. By analogy with the first variant the used air A' is discharged out of the heel region, wherein the flow direction is again indicated by arrows.

Figure 7 shows, similarly to Figure 3, that the elastic material can also be disposed in an airtight sleeve 17' in the heel region. Correspondingly the elements 5', 8' and 10' (connecting pieces) have the same function as in Figure 3. It is indicated by 19' that the valve for the air outlet can be disposed at the end of the short conduit 8'. Figure 8 shows the additional apertures 2' in the upper face 13 of the sole 3 for the air inlet into the chamber 4'.

It does not show an additional throttle or additional throttle function of the particular outlet valve, which is preferably provided for all variants, and which, during the compression of the material in the chamber 6 (or optionally the chamber 6') by decreasing the flow cross-section, throttles the outflow of air from the chamber or slows it down more

strongly than the outlet valve does. This increases the damping effect due to the elastic material, which can only release the air contained in it through the throttle more slowly. Such a throttle allows, as mentioned, an individual adjustment of the damping to an individual body weight and/or individual preferences and/or to the shoe type. The throttle can be arranged at any location between the elastic material and the outlet 9. It can form a structural unit with the outlet valve. The throttle may be adjustable or replaceable. Preferably it is arranged at or in the outlet 9 (and/or optionally the outlet 9'), so that it is readily accessible for the replacement/adjustment.

PATENTKRAV

1. Skosål (1) omfattende et sammentrykkeligt kammer (6), som indeholder et elastisk deformerbart materiale, med i det mindste ét indløb (5) og i det mindste ét udløb (8), og i hvert enkelt tilfælde en indløbsventil (15) knyttet til indløbet (5) og en udløbsventil (19) knyttet til udløbet (8), hvor kammeret er forbundet, via indløbsventilen og et luftindløbskammer (4), til passager (6), som udmunder på den øvre overflade (13) af skosålen, og hvor kammeret (6) er forbundet, via udløbsventilen, med et udløb (9) på den udvendige overflade af skosålen (1), udenfor den øvre overflade (13) af denne, **kendetegnet ved, at** kammeret (6) er anbragt i forfodsområdet af skosålen (1) og er i det væsentlige fuldstændigt fyldt med det elastisk deformerbare materiale (16), som er udformet således, at under dettes elastiske ekspansion absorberer det luft og under dettes kompression frigiver det luft, som tidligere blev absorberet, og at luftindløbskammeret (4) er anbragt i forfodsområdet af skosålen (1) foran kammeret (6).

2. Skosål ifølge krav 1, **kendetegnet ved, at** skosålen omfatter en indersål (3) og en ydersål (7), hvor indersålen danner den øvre overflade af kammeret og har passager (2) til luftindløbskammeret (4).

3. Skosål ifølge krav 1 eller 2, hvor det elastisk deformerbare materiale (16) er et åbentcellet skumplastmateriale.

4. Skosål ifølge ethvert af kravene 1 til 3, **kendetegnet ved, at** det elastisk deformerbare materiale er anbragt i en lufttæt indhylning (17), som har i det mindste én indløbsforbindelse (10) og i det mindste én udløbsforbindelse (8).

5. Skosål (1) ifølge ethvert af kravene 1 til 4, **kendetegnet ved, at** den er forsynet med en drossel knyttet til udløbet (9).

6. Skosål ifølge krav 5, **kendetegnet ved, at** droslen er en justerbar drossel eller en drossel, som er udskifteligt anbragt i skosålen.

7. Skosål ifølge ethvert af kravene 1 til 6, **kendetegnet ved, at** i hælområdet er et andet kammer (6'), fyldt med elastisk materiale af samme type, konfigureret med en indløbs-

ventil og en udløbsventil, hvilket kammer er forbundet via indløbsventilen med et luft-indløbskammer (4'), som via passager er i luftforbindelse med den øvre overflade af sålen.

8. Skosål (1) ifølge krav 7, **kendetegnet ved, at** luftindløbskammeret (4') er anbragt i sålens langsgående retning foran det andet kammer (6').

9. Skosål ifølge krav 7, **kendetegnet ved, at** det første kammer (6) og det andet kammer (6') ikke er indbyrdes forbundet.

10. Sko omfattende en skosål ifølge ethvert af kravene 1 til 9.

11. Sko ifølge krav 10, **kendetegnet ved, at** skoen er konfigureret med sålen i en udformning med sålen direkte anbragt derpå, især med sålen sprøjtestøbt derpå, og især med indersålen påført ved en Strobel proces eller at skoen er udformet med sålen i en påsyet udformning.

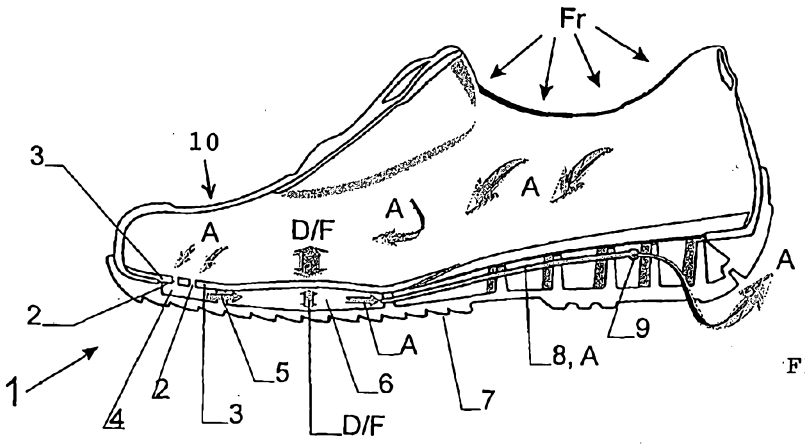

FIG. 1

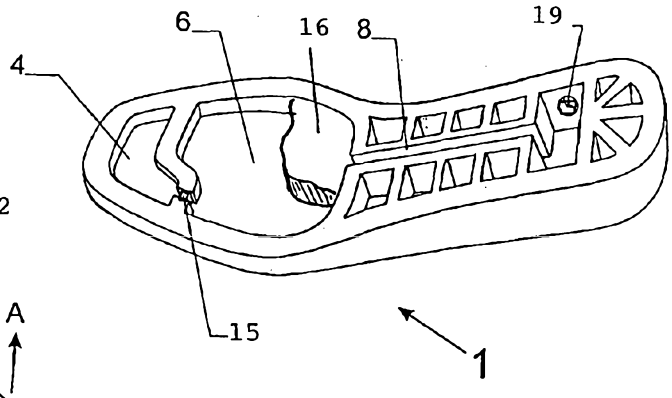

FIG. 2

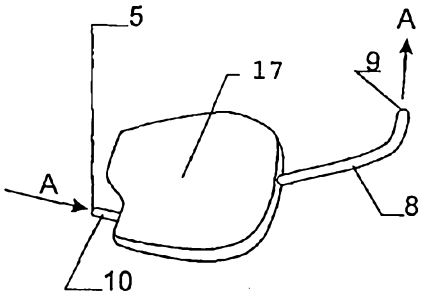

FIG. 3

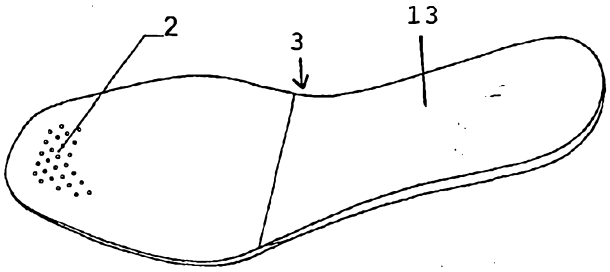

FIG. 4

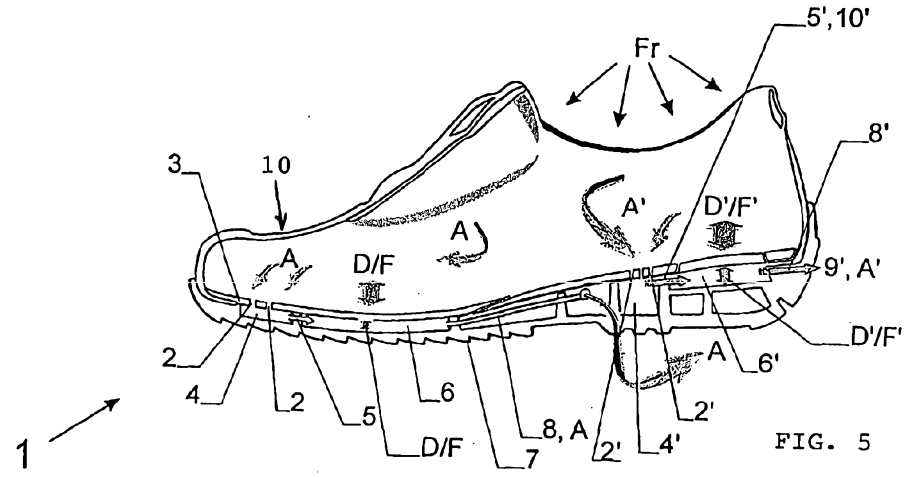

FIG. 5

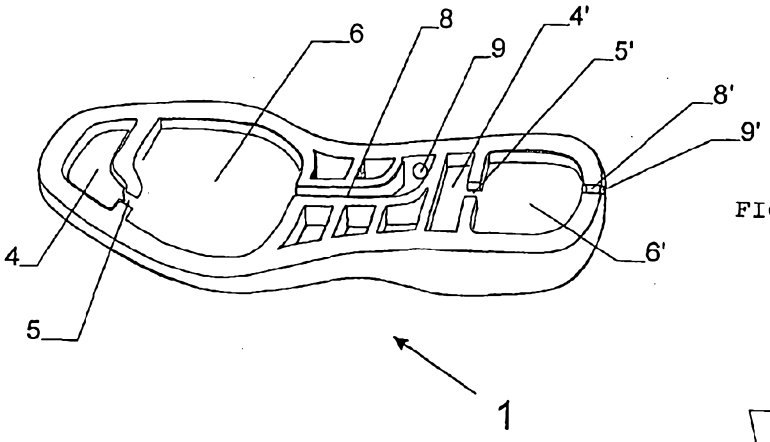

FIG. 6

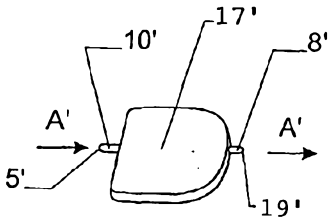

FIG. 7

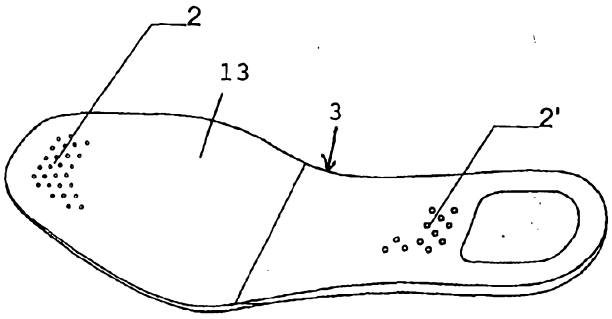

FIG. 8