Structure of a sole for footwear

It is disclosed the structure of a sole for footwear where the sole comprises a heel section (H) running from the rear edge of the footwear and forwards to about the middle of the sole of the footwear, and with a middle section (M) comprising a supportive and less resilient material, where internally in the heel section there is located a soft material (4), and where in a middle layer of said heel section there is located a bracer (5) beneath the soft material so that the heel section of the sole when loaded sinks down under compression of the soft material through this depression to bring the middle section of the sole relatively to become elevated for thereby providing support to the arch of the foot when stepping down on the heel section for thereby distributing the load both concerning the sole per se and with respect to the weight distribution over the foot, over a larger section than the heel section alone.
Description

[0001] The present invention concerns the structure of a sole for footwear wherein the sole is built up by a number of layers of different, equal or mainly equal or similar materials, wherein the sole comprises a heel section running from the rear end of the footwear and forwards to about the middle of the footwear sole, and a middle section comprising a supportive and less resilient material, wherein this middle section runs from about the end of the heel section and forwards along the sole to about three quarters of the length of the sole estimated from the edge of the heel, where there internally in the heel section is located a pliable material, and wherein in a middle layer of said heel section of the sole there is located a bracer under the pliable material so that the heel section is depressed when loading the pliable material for through this depression to bring the middle section of the sole to, relative to the heel section, become elevated by the load thus providing support to the metatarsal of the foot by the depression of the heel section as well as thereby distribute the load both with respect to the sole per se and with respect to the weight distribution over the foot, across a larger part than the heel section alone.

Background for the invention.

[0002] Correct and shock-absorbing footwear is essential for avoiding many and often serious problems and diseases associated with tissue, tendon and muscle wear in the feet, knees, hips and back, incorrect posture, walking and running comfort. Such diseases and injuries are e.g. sciatica, Achilles and mechanical injury or irritation, muscular tensions, chronic headaches, chronic hip and knee pains, etc.

[0003] For persons who walk, run or stand a lot both in leisure activities and in professional connection (e.g. athletic performances or hairdressers, dentists, etc.) it is important that the foot, hips and spine receives as correct posture as possible both in dynamic movement as well as in static loads.

[0004] The form of the feet is different from individual to individual. It is therefore important that footwear is adjustable to the form of the foot of each person in every detail from a normal foot curvature to persons being flat-footed. Also the external shape should be adjusted to the purpose of the footwear. Footwear being used for festivities (e.g. high-heeled shoes, plateau shoes) as well as shoes being used for work (protective shoes, rubber boots, supporting shoes (hairdressers, nurses, paramedics) etc.) and/or leisure time (leisure shoes, running shoes, jogging shoes, football shoes, etc.) should all be able to provide as good support to the foot as possible.

[0005] On this background there have previously been designed different types of soles, both of a temporal or permanent type that have to a greater or lesser degree been suited for the use of the footwear. It has e.g. been provided shock absorbers in the front section and/or heel section in running shoes and athletic shoes (football, handball, basket, etc.).

[0006] Good, correct and adequate support for the foot arch/metatarsal has previously been an area that has been given little attention concerning mass-produced footwear for sale. Problems arising subsequent to use of footwear lacking sufficient support for the foot arch/metatarsal have previously been solved by placing inlay soles in the footwear.

[0007] Normal walking and running progresses by the heel first being placed on the ground whereby the weight of the body is transferred over the middle section/foot arch of the foot and forwards to the toes that cause a pushing action by the Achilles tendon/calf muscles pulling the heel up so that he foot is rolling forwards on the toe ball. Without any support to the curvature of the foot/foot arch walking/running over longer distances (10 kilometers, half marathon, full marathon, etc.) may give load injuries in this region of the foot.

[0008] Static loads of the foot (e.g. standing work) without any support of the curvature of the foot/foot arch will in the long run wear the tendons in the metatarsal/foot arch and may without any correction/support give cramps in the foot, a depressed foot arch (flatfoot) as well as load injuries in the calf and lower spine. Such load injuries may also be distributed to the neck and may also give a headache/migraine.

[0009] To alleviate such conditions it will be of importance to provide support to the curvature of the foot/foot arch when putting a load on the heel region of the footwear. Such support may through the present invention be obtained by the heel section of the sole of the footwear being deformed and depressed for relatively to bring the section under the foot curvature/foot arch of the sole upwards for supporting the foot curvature/foot arch. The deformation will normally be achieved by a load on the sole with a weight from a normal person (25-120 kg depending on the age, build, etc.).

[0010] When walking and especially when running the heel section of a sole will be particularly subjected to strike/impact loads. Previously it has been common to provide impact dampening especially in the heel section of soles in shoes for walking or running. The provision of soft materials in the heel section in such shoes without any consideration to the location and stability of the relevant shoe will, however, create other problems than the impact dampening per se, e.g. problems with stability, torsion, etc. The present invention has provided a sole with simultaneous supportive, shock-absorbing and stabilizing properties with support to the foot arch in the down-step.

Prior art.

[0011] There are previously known shoe types with a rigid plate (bracer) molded into the shoe. Thus there is e.g. from GB patent 2156653 A known a running shoe...
with a rigid asymmetrical bracer.

Furthermore there is from US patent application US 2006/0277795 A1 and from DE patent 19608488 A1 known sole types with a stiffening bracer, but wherein the bracing action is missing in the heel section.

**General disclosure of the invention.**

The present invention concerns, as mentioned, the construction of a sole providing support for the foot arch when loading the heel section. The sole is constructed with layers, where the sole comprises a continuous material running from the outer section of the sole (the external sole/sole bottom) against the ground, and in towards the internal additional layers of the sole. Such additional layers comprise a bracer (middle layer) running from the heel edge or the heel edge area of the sole and over up to about half of the total length of the sole. The interior of the sole in the heel section has an impact cushion included facing towards the heel of the user and lying above the bracer, said impact cushion being constructed of a material being softer than the sole material. The soft and inside the sole internal material is an optionally shock-absorbing material.

In the present connection that a layer lies "mainly" within or "about" a section or overlaps "mainly" or "about" another section, means that there ma be present a deviation of up to 20% of the accurate measurements and preferably within 10% of the accurate measures. Since a sole for a footwear may normally have a length from 10 cm (baby shoes) to 35 cm or more (adult footwear of full size), the expression that the bracer runs "mainly" from the rear edge of the sole to substantially half of the length of the sole will mean that the bracer of a sole with the length of 35 cm may start from the exact rear edge of the sole and up to 7,0 cm from the rear edge of the sole and run to exactly half of the sole of the sole and up to 7,0 cm from the exact half of the length of the sole, and will preferably start at the exact read edge of the sole and up to 3,5 cm from the rear edge of the sole and run to the exact half of the length of the sole and up to 3,5 cm from the exact half of the length of the sole. Correspondingly for a shoe with a length of 10 cm the deviation may be from 0 to 2 cm, and preferably 1 cm.

In the present connection the expression "edge area" means an area running from the exact edge of the sole and inwards of the sole surface in a radius of up to 2 cm. An "edge area" ma include an area of 0.2-2.0 cm such as 0.2, 0.5, 0.7, 1.0, 1.2, 1.5, 1.7 or 2.0 cm from the edge of the sole.

In the present connection the expression "foot arch" means the area of the sole running from about one third from the rear edge of the sole of the relevant footwear to about two thirds from the rear edge of the relevant footwear.

In the present connection the expression "thread surface" of the sole means an area comprising the entire internal surface of the sole to a surface being shaped as a footprint that may run across mainly the entire length of the sole.

A sole according to the invention may e.g. be mounted on a leisure shoe such as a jogging shoe, a shoe for walking, a sandal, etc. The penetrating material 1 of the sole is preferably a support and optionally resilient material such as a polymer material, e.g. a PU material (PU = polyurethane) or TR (TR = technical rubber, synthetic rubber) or natural rubber. In this material 1 there are, numbered from the top (from the inside of the footwear), located an isolating and pressure-distributing material in the form of a stepping surface 2 that may be 1-10 mm thick, e.g. 6 mm thick and that covers mainly the entire threading surface of the foot. The material in the threading surface 2 may be PU, HGP (a polyurethane-based material) or latex or "Poron". To this threading surface there is bonded (glued/welded/cast etc.) a binding sole 3 of a conventional material e.g. "Texon" for securing surface material of the footwear (see fig. 3) to the sole.

The sole in fig. 1 is divided into three sections namely a heel section H, a middle section M and a front foot section F. The sections are shown to be equally large in the figure, but may overlap with each other as explained supra. The foot arch will normally lie in the middle section M of the sole.

Mainly in the heel section of the sole, i.e. in the section from the foot arch and backwards, there are located one or more layers of a shock-absorbing material 4 that may be compacted and springs back when walking and running. This shock-absorbing material 4 is located underneather the binding sole 3, completely adjacent or at a distance from this, e.g. at a distance of 0-25 mm, such as 1, 2, 3, 5, 7, 10, 12, 15, 17, 20, 23 or 25 mm from the binding sole and optionally in such a way that there is created a mass of sole material 1 between the shock-absorbing layer 4 and the binding sole 3. Beneath the shock-absorbing material 4 there is located a rigidity-supplying layer 5 in the form of a bracer. This rigidity-supplying layer runs mainly from the rear edge of the heel section H and forwards to substantially the center of the middle section M. In the area about the shock-absorbing material 4, and at the edges of the sole, the sole material ma in one embodiment form a "wall" assisting the side.
stability of the sole.

[0022] By placing a bracer 5 beneath the shock-absorbing material 4 and across about half the length of the sole it will be achieved that the shock-absorbing material will exert its shock-absorbing function without the shoe being considered as unstable in the heel section. The breadth of the bracer 5 in the sole according to the invention lies normally in the interval 30-60% of the breadth of the sole, even if breadths beyond this interval also may be used such as a lower breadth of 10% of the breadth of the sole and up to 100% of the breadth of the sole. In normal footwear the breadth of the bracer 5 will lie in the order of magnitude of 4-8 cm, and will normally be formed as a rectangle (although also other shapes may be possible). The material of the bracer 5 will generally be a rigid material, e.g. metal (steel) or hard plastic.

[0023] The breadth of the plant and shock-absorbing material 4 will correspond to the breadth of the bracer 5 or it may be broader than the bracer 5, such as 0-5 mm broader than the bracer 5, e.g. 0,5, 1, 1,5, 2, 2,5, 3, 3,5, 4 or 4,5 mm broader than the bracer 5, wherein this breadth reaches beyond the bracer on each side thereof in symmetrical or asymmetrical manner.

[0024] Lengthwise the soft and shock-absorbing material 4 runs mainly from the rear end of the bracer 5 and up to about two thirds of the length of the bracer. By letting the bracer 5 pass the shock-absorbing and resilient material 4, and wherein the front part of the bracer 5 is cast into the sole material 1, when stepping down on the heel section H the heel will sink down by compacting the resilient material 4 while simultaneously maintaining the middle section M rigid on account of the location of the bracer 5 in this section. The net effect of this movement will be that when stepping down it will be obtained a shock-absorption in the heel section H of the sole while simultaneously supporting the foot arch by a relative "elevation" of the middle section M relative to the heel section H.

[0025] For adding further shock-absorption to the heel section without compromising the stability of the sole, there may in an alternate embodiment of the invention additionally be possible to include an extra layer of a shock-absorbing material also beneath the bracer 5 in an immediate proximity thereto, but not so close to the underside of the sole that the bracing effect of the bracer 5 or the side stability being removed.

[0026] In a further alternative embodiment of the invention it will be possible to equip the sole with an extra layer of shock-absorbing material in the metatarsal area of the sole (not shown). Also here it is important, if such a shock-absorbing layer in the toe section of the sole is present, that there exists sufficient material underneath the shock-absorbing material for the sole not to be experienced as unstable. A thickness of the sole material beneath the shock-absorbing material in the toe area may lie within the interval 0,5 cm and up to the entire thickness of the sole, e.g. in the area 0,5-2,5 cm if the thickness of the sole is 2,5 cm.

[0027] For further conveying side stability to the sole, it may also be relevant optionally to equip the sole with an external layer of a more rigid material of rubber or plastic (see Fig. 2). By placing the sole inside such a material there will be formed bracing and vertical edges to support the sole in the side direction. It may also be possible to make the bottom of the sole somewhat broader than its inner threading surface (see Fig. 2) for providing further side stability to the sole. The sole may thus be 0,5-10 mm broader in its lower surface (towards the ground) than in its threading surface (towards the foot).

[0028] The upper side (cover surface) of footwear with a sole according to the present invention may be selected from conventional materials and designs. Normally there will be used an upper side of leather or a synthetic material.

Examples.

Example 1:

[0029] This example concerns a sandal with a sole with a maximum thickness of 50 mm beneath the heel-middle foot section and with a sole constructed in accordance with the invention. The sole material 1 of this sole is made of a polyurethane (PU) material wherein a binding sole 3 of "Texon" and with a thickness of 2 mm is glued to the PU sole material 1, and wherein an inner sole 2 being made of "Poron" and with a thickness of 5 mm being fastened to the upper surface of the binding sole 3. In the heel section running from manly the rear heel edge and to about the center of the middle foot section (M) and beneath the binding sole 3 there is located, at a distance of 2 cm from the rear edge of the sole, a layer of a shock-absorbing material 4 (HGP material) with a thickness of 5 mm. Beneath he layer of shock-absorbing material 4 there is located a bracer 5 of a rigid material (steel) with a thickness of 0,3 mm running from about 2 cm from the rear heel edge of the sole and forwards to about the center of the middle foot section (M) of the sole and at a distance of about 4 cm past the resilient and shock-absorbing material 4. The breadth of the shock-absorbing and resilient material 4 equals the breadth of the bracer 5 and is about 50% of the breadth of the sole.

[0030] To he binding sole there is secured (glued/stitched) a shoe cover of leather in the form of a conventional sandal with straps for heel and metatarsal in the form of strips of Velcro.

Example 2:

[0031] This example concerns a sole for a running shoe where the sole is constructed correspondingly to the sole in example 1, however with the addition that the sole in its edge area from the rear heel section and forwards to the middle section of the foot (about half of the length of the shoe) is equipped with vertically descending edges of a firmer latex material than the sole material
(PU material) for providing additional side stability to the sole. The upper side of the shoe is here made of a synthetic water-repellent material with airing holes covering the entire foot.

Example 3:

[0032] This example concerns a sole for a leisure/walking shoe that also may be used as a running shoe, where the sole is constructed as in example 2, but with the additional feature that the underside of the sole is 5 mm broader than the breadth of the rest of the sole.

Example 4:

[0033] This example concerns a sole for a leisure/walking shoe that also may be used as a running shoe, where the sole is constructed as in example 1, but with the additional feature that the underside of the sole is 5 mm broader than the rest of the breadth of the sole, and that the breadth of the shock-absorbing material is 3 mm broader than the bracer on each side of the bracer.

Claims

1. Sole for footwear constructed with layers, wherein the sole comprises a penetrating material (1) running from the external part of the sole (external sole, sole bottom) against the ground and inwards towards the additional internal layers of the sole, wherein such additional layers may comprise a binding sole (3) and a shock-absorbing material (2), characterized in that in the heel section (H) of the sole there is located a bracer (5) with a resilient and shock-absorbing material (4) being located above the bracer (5) and wherein the resilient and shock-absorbing material (4) lengthwise runs from mainly the rear edge of the bracer (5) and to about two thirds of the length of the bracer.

2. Sole according to claim 1, characterized in that in the heel section of the sole and in immediate adjacency to and beneath the bracer (5) is comprised an additional layer of a shock-absorbing material.

3. Sole according to claim 1 or 2, characterized in that in the toe section of the sole there is located a shock-absorbing material.

4. Sole according to any of the preceding claims, characterized in that the underside of the sole is broader than the upper side of the sole.

5. Sole according to any of the preceding claims, characterized in that the sole material is of a PU material.

6. Sole according to any of the preceding claims, characterized in that the shock-absorbing material comprises a HGP material.

7. Sole according to any of the preceding claims, characterized in that the bottom surface of the sole is broader than the upper stepping surface of the sole.

8. Sole according to any of the preceding claims, characterized in that the shock-absorbing material (4) of the sole has a breadth lying within the interval 0-5 mm broader than the breadth of the bracer (5).

9. Use of the sole according to any of the claims 1 - 8 in footwear selected among sandals, leisure shoes and running shoes.
## DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document with indication, where appropriate, of relevant passages</th>
<th>Relevant to claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>EP 1 354 526 A1 (ASTRA S R L [IT]) 22 October 2003 (2003-10-22) * figures 5-7 *</td>
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### TECHNICAL FIELDS

- A43B

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The present search report has been drawn up for all claims

**Place of search**: Munich  
**Date of completion of the search**: 1 March 2010  
**Examiner**: Vesin, Stéphane

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