(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 315 340 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **15.02.95** (51) Int. Cl.[6]: **A43B 13/18**, A43B 5/00

(21) Application number: **88309833.7**

(22) Date of filing: **20.10.88**

(54) **Athletic shoe with pronation control device.**

(30) Priority: **06.11.87 US 115661**

(43) Date of publication of application:
10.05.89 Bulletin 89/19

(45) Publication of the grant of the patent:
15.02.95 Bulletin 95/07

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(56) References cited:
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GB-A- 2 114 869
US-A- 4 490 928
US-A- 4 561 195
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Description

The invention relates to footwear, more particularly to athletic shoes, wherein a cushioning sole is provided with a pronation control device to control the pronation motion of a wearer's foot. The sole includes a sole member which is compressible and resilient to thereby cushion foot impact, and the control device increases the resistance to compression of the sole member in the area adjacent the medial side of the sole.

BACKGROUND OF THE INVENTION

The modern shoe, particularly an athletic shoe, is a combination of many elements which have specific functions, all of which must work together for the support and protection of the foot. Athletic shoes today are as varied in design and purpose as are the rules for the sports in which the shoes are worn. Tennis shoes, racquetball shoes, basketball shoes, running shoes, baseball shoes, football shoes, weightlifting shoes, walking shoes, etc. are all designed to be used in very specific, and very different, ways. They are also designed to provide a unique and specific combination of traction, support and protection to enhance performance. Not only are shoes designed for specific sports, they are also designed to meet the specific characteristics of the user. For example, shoes are designed differently for heavier persons than for lighter persons; differently for wide feet than for narrow feet; differently for high arches than for low arches, etc. Some shoes are designed to correct physical problems, such as over-pronation, while other include devices, such as ankle supports, to prevent physical problems from developing.

A shoe is divided into two general parts, an upper and a sole. The upper is designed to snuggly and comfortably enclose the foot, while the sole must provide traction, protection, and a durable wear surface. The considerable forces generated by running require that the sole of a running shoe provide enhanced protection and shock absorption for the foot and leg. It is also desirable to have enhanced protection and shock absorption for the foot and leg in all types of footwear. Accordingly, the sole of a running shoe typically includes several layers, including a resilient, shock absorbing or cushioning layer as a midsole and a ground contacting outer sole or outsole which provides both durability and traction. This is particularly true for training or jogging shoes designed to be used over long distances and over a long period of time. The sole also provides a broad, stable base to support the foot during ground contact.

The typical motion of the foot during running proceeds as follows. First, the heel strikes the ground, followed by the ball of the foot. As the heel leaves the ground, the foot rolls forward so that the toes make contact, and finally the entire foot leaves the ground to begin another cycle. During the time, that the foot is in contact with the ground, it typically is rolling from the outside or lateral side to the inside or medial side, a process called pronation. That is, normally, the outside of the heel strikes first and the toes on the inside of the foot leave the ground last. While the foot is air borne and preparing for another cycle the opposite process, called supination, occurs. Pronation, the inward roll of the foot in contact with the ground, although normal, can be a potential source of foot and leg injury, particularly if it is excessive. The use of soft cushioning materials in the midsole of running shoes, while providing protection against impact forces, can encourage instability of the sub-talar joint of the ankle, thereby contributing to the tendency for over-pronation. This instability has been cited as a contributor to "runners knee" and other athletic injuries.

Various methods for resisting excessive pronation or instability of the sub-talar joint have been proposed and incorporated into prior art athletic shoes as "stability" devices. In general, these devices have been fashioned by modifying conventional shoe components, such as the heel counter, and by modifying the midsole cushioning materials. For example, one technique incorporates a relatively stiff heel counter support over the heel counter, as shown in U.S. Patent No. 4,288,929. A similar technique, wherein support is provided to a heel counter by a bead of material, is shown in U.S. Patent No. 4,354,318. Another prior art technique to enhance motion control during foot impact is by building up the heel counter itself, such as shown in U.S. Patent Nos. 4,255,877 and 4,287,675.

Both U.S. Pat. Nos.4,364,188 and 4,364,189 propose solutions to the problem of over pronation which rely on the use of materials with different compressibilities, the material having the lowest compressibility being arranged on the medial side of the shoe. US 4,364,188 also discloses the use of a plurality of hard cylindrical rubber plugs having a high resistance to compression. These plugs can be inserted by the wearer into vertical bores formed parallel to the peripheral edge of the medial side of the head portion of the midsole in an attempt to reduce over pronation. By increasing the number of plugs inserted, or by using plugs of different resistances to compressibility it is claimed that the wearer can select the degree of resistance to over pronation provided by the shoe.

The use of a less compressible or firmer fluid tight chamber in the medial heel area of a sole is disclosed in U.S. Patent Nos. 4,297,797 and

4,445,283. Although these prior art techniques have exhibited a degree of success in controlling sub-talar joint motion and, hence, over-pronation, they have certain disadvantages. Generally, these techniques add to the weight and manufacturing expense of the shoes. Furthermore, the firmer, higher density foam midsole materials are subject to compression set and reduce the efficacy of the cushioning system.

The present invention was designed to take advantage of the lightweight cushioning capability of the materials used in current athletic shoes, while enhancing the stability of the shoes without incurring the above disadvantages of prior art "stability" devices.

SUMMARY OF THE INVENTION

The invention relates to a cushioning sole for use in footwear which includes a pronation control device to control the pronation motion of a wearer's foot. The sole comprises a sole member which extends along at least the heel and arch areas of the sole. The sole member is compressible and resilient to thereby cushion foot impact, and includes a mechanism incorporated into it for increasing the resistance to compression of the sole member in an area adjacent its medial side to thereby control pronation motion. The compression resistance increasing mechanism includes at least one substantially rigid member formed of a substantially non-compressible material and extending vertically through at least a portion of the vertical extent of the sole member.

The sole member preferably extends along substantially the entire foot bed and is formed at least partially of a foam material. The compression resistance increasing mechanism preferably includes at least one generally horizontally extending plate which gradually increases the resistance to compression of the sole member from the lateral side to a maximum adjacent the medial side of the sole member. The rigid member is preferably formed as at least two hollow columns spaced longitudinally from one another, and the plate extends between and laterally from adjacent the tops of the columns in a cantilever manner. The plate is preferably formed as a plurality of separate plate members which extend laterally from the medial side to an area past the centerline of the heel area.

When the foot of a typical runner initially contacts the ground along the lateral heel area, the material of the sole member compresses to cushion the foot. As the runner's foot begins to roll inward (pronate), the distal ends of the plate members add a degree of resistance to compression of the sole member. As the runner's foot further rolls inwards, portions of the plate members which extend in a cantilever fashion from the medial side of the sole resist compression of the sole member to a greater degree, thereby further stabilizing the foot. Maximum resistance to compression of the sole member and, hence, maximum stabilization of the foot occurs along the medial side of the sole where the vertically extending, non-compressible rigid members are disposed.

The use of the pronation control device of the present invention enables soft cushioning materials to be used in footwear soles while retaining sub-talar joint stability. The device functions by increasing the compaction resistance of the medial side of the midsole, thereby resisting pronation, while the more compliant lateral side allows deflection of the lateral portion of the midsole during impact. This controlled deflection reduces the lever arm for the force acting around the sub-talar joint. The device thus effectively reduces calcaneal eversion at foot strike, resulting in increased resistance to pronation of the sub-talar joint and lower velocities of pronation.

The biomechanical characteristics of the pronation control device and, hence, the degree of resistance to pronation and high rates of pronation of the sub-talar joint may be varied by changing the number and height of the rigid members of columns, by changing the number, size and spacing of the separate horizontal plate members, and by changing the physical properties of the material forming the rigid member and plate members.

The use of a separate device, according to the present invention, for the control of pronation has several advantages over the prior art techniques of adjusting the densities of the cushioning materials. The stability characteristics of the shoe can be varied independently of the materials used for cushioning and is thus not dependent on the characteristics of these materials. Also, since the pronation control device is made of relatively high modulus and high hardness material, the device is not subject to compaction like foam cushioning materials, weighs less, is easier to manufacture, and may be combined with a variety of cushioning materials.

Various advantages and features of novelty which characterize the invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However, for a better understanding of the invention, its advantages, and objects obtained by its use, reference should be had to the drawings which form a further part hereof, and to the accompanying descriptive matter, in which there is illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side view of an athletic shoe embodying the invention;

Figure 2 is a top plan view of the sole of the athletic shoe illustrated in Figure 1, with the pronation control device illustrated in phantom line;

Figure 3 is a perspective view of the pronation control device;

Figure 4 is a sectional view taken generally along the lines 4-4 of Figure 3; and

Figure 5 is a sectional view similar to Figure 4, illustrating an alternate embodiment of a pronation control device in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings, wherein like numerals indicate like elements, an article of footwear in accordance with the present invention, such as a running shoe, is generally shown as 10. Shoe 10 includes a sole structure 12 and an upper 14 attached to it. Upper 14 can be of any conventional design, while sole structure 12 incorporates novel features of the present invention. Sole structure 12 includes a cushioning or force absorbing midsole 16 and a flexible, wear resistant outsole 18. Of course, where appropriate, the midsole and outsole portions can be formed as a single integral unit.

Shoe 10 and, hence, sole 12 can be generally divided into a heel section 20 rearward of line L1, an arch section 22 between lines L1 and L2, and a forepart section (24) forward of line L2. Lines L1 and L2 are not precise lines of demarkation but rather divide sole 12 into relative sections related generally to portions of the human foot. Line L3 is a centerline of heel section 20, which divides heel section 20 and arch section 22 into a medial half 26 and a lateral half 28. The medial side wall of sole 12 is indicated as 27, while the lateral side wall is indicated as 29.

Midsole 16 is formed of a cushioning, resilient foam material, such as a polyurethane foam into which a sealed resilient insert 30 is encapsulated. The perimeter of insert 30 is shown diagrammatically in dashed line in Figure 2. Insert 30 is preferably a gas-filled bladder formed according to the teachings of U.S. Patent Nos. 4,183,156 and 4,219,945 of Marion F. Rudy. Such a gas filled bladder is formed from a flexible material which is sealed along its perimeter and at preselected locations within its perimeter which, after being filled to a relatively high pressure by a gas having a low diffusion rate through the flexible material, takes on a generally flat bladder configuration. The bladder is thereafter encapsulated in the foam material comprising the remainder of the midsole, as disclosed in the '945 patent. Alternatively, insert 30 can be omitted and the entire midsole 16 can be formed of a cushioning foam material. In either case midsole 16 functions as a compressible and resilient unit which cushions foot impact.

A pronation control device 40 is incorporated into midsole 16 in heel section 20 and arch section 22. Device 40 is preferably formed of a single integral piece of plastic material, such as a thermoplastic polyester elastomer. The plastic material is relatively hard and substantially non-compressible. The plastic material preferably has a relatively high flex modulus, e.g. preferably 75,000 to 125,000 psi as determined by a standard ASTM test, and a hardness preferably in the range of 65 to 72 Shore D. This is in sharp contrast to the much softer foam material used in a typical midsole, such as midsole 16, which generally has a hardness in the range of 40 to 70 on the Asker C scale. Device 40 functions to gradually increase the resistance to compression of midsole 16 proceeding from a minimum resistance at the lateral side to a maximum resistance at the medial side. Device 40 includes a pair of longitudinally spaced rigid members 42a and 42b and a plurality of separate horizontal plates 44a, 44b, 44c, 44d and 44e. Device 40 is incorporated into midsole 16 with rigid members 42a and 42b disposed adjacent the medial edge of midsole 16 in heel section 20 and arch section 22, and extending generally vertically. In the illustrated embodiment, rigid members 42a and 42b extend vertically substantially from the bottom of midsole 16, to the top of midsole 16, which is illustrated by dashed line 46. If less compaction or compression resistance is desired, the vertical extent of rigid members 42a and 42b can be decreased. Alternatively, if additional resistance to compact ion is desired, an additional number of rigid members can be added along the medial side of sole 12. In order to keep the weight of device 42 to a minimum, rigid members 42a and 42b are preferably formed in the shape of hollow columns having a generally rectangular cross-sectional configuration. Typically the walls of the columns have a thin cross-section or thickness, such as 0.03" to 0.04".

As best seen in Figure 2, plate members 44 extend horizontally from the medial side of sole member 12 toward the lateral side of sole member 12 and past the centerline L3 of heel section 20. As best seen in Figures 3 and 4, plate members 44a and 44e extend from rigid members 42a and 42b respectively and are connected to the rigid members through downwardly extending curved sections 46a and 46e. While plate members 44b, 44c and 44d are separate or independent plate members, they are interconnected along a common base 48. To further reduce the weight and material

costs of device 40, each plate member 44 has a centrally disposed gap 50.

Plate members 44a through 44e thus extend horizontally in a cantilever manner from the medial side of sole 12. That is, plate members 44a and 44e extend laterally from the top of rigid members 42a and 42b, respectively, and plate members 44b, 44c and 44d extend laterally from base 48. All plate members 44 extend along an area adjacent the top of midsole 16. Plate members 44 have a perimeter which tapers from a broadest area adjacent the medial side of sole 12 to a rounded point at their distal ends on the lateral side. Plate members 44 thus take on a finger or comb-like configuration. The tapering shape and cantilever extension of plate members 44 function to provide gradually increasing resistance to compression of sole member 12 disposed below the plate members. That is, along the distal ends of plate members 44, the plate members bend more easily and, hence, provide less resistance to compression. However, the portions of plate members 44 which are closer to their cantilever connection along the medial edge are more difficult to bend and provide increased resistance to compression. Maximum resistance to compression is reached along the medial edge of sole 12 where the rigid members 42a and 42b are located.

Figure 5 illustrates an alternate embodiment of a device 40' wherein rigid members 42 are again formed as hollow columns. However, the hollow columns include a spring or flex section 54 which allows the columns to compress vertically a limited degree. Spring section 54 is formed as a bent out section of the column which extends horizontally around the perimeter of the hollow column, thereby forming a bendable flex line. Device 40' is used when it is desirable to vary the compliance of the columns without relying on the use of foams or adjusting the modulus of the columns.

Numerous characteristics, advantages, and embodiments of the invention have been described in detail in the foregoing description with reference to the accompanying drawings. However, the disclosure is illustrative only and the invention is not limited to the precise illustrated embodiments. Various changes and modifications may be effected therein by one skilled in the art without departing from the scope and spirit of the invention. For example, while the plate members are illustrated as a plurality of separate figure like elements, the plate members can be formed as a single integral plate. Similarly, while two rigid members are illustrated, where appropriate a single rigid member, or more than two rigid members can be used.

Claims

1. A cushioning sole for use in footwear with a pronation control device to control the pronation motion of a wearer's foot comprising:

a sole member (12) extending along at least the medial heel (20) and medial arch (22) areas of the cushioning sole, said sole member being compressible and resilient for cushioning foot impact; and

means (40), incorporated into said sole member, for gradually increasing the resistance to compression of said sole from its lateral side to a maximum adjacent its medial side to control pronation motion, said gradual compression resistance increasing means including:

a substantially rigid member (42) formed of substantially non-compressible material, disposed substantially within said sole member and extending vertically through at least a portion of a vertical extent of said sole; and

a plate (44) extending in a cantilever manner from said substantially rigid member toward the lateral side of said sole, wherein said plate includes a plurality of separate plate members (44a-44e).

2. A cushioning sole in accordance with claim 1, wherein a gap (50) is formed in said plate members.

3. A cushioning sole in accordance with claim 1, wherein some of said plate members have medial ends connected to one another and have perimeters gradually tapering from the respective medial ends.

4. A cushioning sole in accordance with claim 1, wherein said rigid member is formed in the shape of a column.

5. A cushioning sole as claimed in claim 1

with at least one substantially rigid member formed of substantially non-compressible material and extending vertically through at least a portion of a vertical extent of said sole member, and

at least one plate extending in a cantilever manner from said at least one rigid member toward the lateral side of said sole member, wherein at least one of said plate members (44a, 44e) extends toward the lateral side of said sole member past a centre line of a heel section.

6. A cushioning sole as claimed in claim 1 comprising:

at least one substantially rigid member formed of substantially non-compressible material and extending vertically through at least a portion of a vertical extent of said sole member, and

at least one plate extending in a cantilever manner from said at least one rigid member toward the lateral side of said sole member, wherein at least one of said plate members is connected to said at least one rigid member through a downwardly extending substantially curved section(46a, 46e).

7. A cushioning sole as claimed in any one of claims 1 to 6, wherein said vertically extending substantially rigid member (42) extends substantially from a bottom of said sole member (12) to a top of said sole member.

8. A cushioning sole as claimed in any one of claims 1 to 6, wherein said sole member (12) is formed at least partially of a foam material.

9. A cushioning sole as claimed in any one of claims 1 to 6 wherein said sole member (12) is formed substantially completely of said foam material.

10. A cushioning sole as claimed in any one of claims 1 to 6 wherein said sole member (12) includes an insert (30) formed of a gas filled flexible bladder.

11. A cushioning sole as claimed in claim 1 to 6 wherein said rigid member (42) is formed in the shape of a column.

12. A cushioning sole as claimed in claim 11, wherein said column (42) is hollow.

13. A cushioning sole as claimed in claim 12, wherein said hollow column (42) includes a spring section (54) for allowing a limited degree of vertical deflection of said hollow column.

14. A cushioning sole as claimed in any one of claims 11 to 13, wherein said column (42) is formed of a relatively hard plastic.

15. A cushioning sole as claimed in claim 14, wherein said plastic has a Shore D hardness of at least 65.

16. A cushioning sole as claimed in any one of claims 1 to 15, wherein said at least one plate (44) extends from adjacent the top of said at least one rigid member (42) and along an area adjacent the top of said sole member (12).

17. A cushioning sole as claimed in claim 1 or 6, wherein said at least one plate (44) extends past the centreline of the heel area (20) of said sole member (12).

18. A cushioning sole as claimed in any one of claims 1 to 6, wherein said at least one plate (44) extends to an area adjacent the lateral side of said sole member (12).

19. A cushioning sole as claimed in claim 5 or 6, wherein said at least one plate (44) is formed as a plurality of separate plate members (44a-44e).

20. A cushioning sole as claimed in claim 5 or 6, wherein at least some of said plate members (44a-44e) have medial ends connected to one another and have perimeters gradually tapering from the respective medial ends.

21. A cushioning sole as claimed in claim 5 or 6, wherein a gap (50) is formed in the or each plate member (44a-44e).

22. A cushioning sole as claimed in any one of claims 1 to 6, wherein said gradual compression resistance increasing means (40) includes at least two of said rigid members (42a, 42b) spaced longitudinally from one another and said at least one plate (44) extends in a cantilever manner between and from said at least two rigid members toward the lateral side of said sole member (12).

23. A cushioning sole as claimed in any of claims 1 to 6, wherein said members (42a, 42b) and said plate (44) are formed of a single integral piece of plastic.

24. A cushioning sole as claimed in any of claims 1 to 6, wherein said plate (44) extending in a cantilever manner has a proximate end portion which is close to said substantially rigid members and a distal end portion, and said proximate end portion of said plate is more difficult to bend and provides increased resistance to compression relative to the distal end portion of said plate.

25. A cushioning sole as claimed in claim 1 or 5, wherein at least some of said plate members (44a, 44e) are connected to said rigid members (42a, 42b) by downwardly curved sections (46a, 46e) of the respective plate members.

26. A cushioning sole as claimed in claim 5 or 6, wherein footwear having an upper (14) and a cushioning sole in accordance with any preceding claim, attached to said upper.

27. Footwear having an upper and a cushioning sole in accordance with any one of claims 1 to 26 attached to said upper.

Patentansprüche

1. Dämpfungssohle zum Einsatz in Schuhwerk mit einer Pronationsbegrenzungseinrichtung, um die Pronationsbewegung eines Fußes eines Trägers zu beeinflussen, welche folgendes aufweist:

ein Sohlenteil (12), welches sich wenigstens entlang der Medialfersenteil- (20) und Medialwölbungs-(22) -Bereiche der Dämpfungssohle erstreckt, wobei das Sohlenteil kompressibel und federnd nachgiebig zur Dämpfung der Fußstoßbelastung ist; und

eine Einrichtung (40), welche in das Sohlenteil eingebaut ist, um allmählich den Kompressionswiderstand der Sohle ausgehend von der Querseite zu einem maximalei Wert der Nähe der Medialseite größer zu machen und die Pronationsbewegung zu begrenzen, wobei diese Einrichtung zur allmählichen Vergrößerung des Kompressionswiderstandes folgendes umfaßt:

ein im wesentlichen starres Teil (12), welches aus einem im wesentlichen nicht kompressiblen Material hergestellt ist, welches im wesentlichen in dem Sohlenteil angeordnet ist, und das sich vertikal durch wenigstens einen Teil einer Vertikalerstreckung der Sohle erstreckt; und eine Platte (44), welche freitragend sich ausgehend von dem im wesentlichen starren Teil in Richtung zu der Querseite der Sohle erstreckt, wobei die Platte eine Mehrzahl von gesonderten Plattenteilen (44a - 44e) umfaßt.

2. Dämpfungssohle nach Anspruch 1, bei der ein Zwischenraum (50) in den Plattenteilen vorgesehen ist.

3. Dämpfungssohle nach Anspruch 1, bei der einige der Plattenteile mediale Enden haben, welche miteinander verbunden sind, und die Umfangsteile haben, welche allmählich sich ausgehend von den zugeordneten medialen Enden verjüngen.

4. Dämpfungssohle nach Anspruch 1, bei der das starre Teil in Form einer Säule ausgebildet ist.

5. Dämpfungssohle nach Anspruch 1 mit wenigstens einem im wesentlichen starren Teil, welches aus einem im wesentlichen nicht kompressiblen Material ausgebildet ist und sich vertikal durch wenigstens einen Teil einer vertikalen Erstreckung des Sohlenteils erstreckt, und mit wenigstens einer Platte, welche sich auf eine freitragende Weise ausgehend von wenigstens einem starren Teil in Richtung zu der Querseite des Sohlenteils erstreckt, bei der wenigstens einer der Plattenteile (44a, 44e) sich in Richtung zu der Querseite des Sohlenteils an einer Mittellinie eines Fersenteils vorbei erstreckt.

6. Dämpfungssohle nach Anspruch 1, welche folgendes aufweist:

wenigstens ein im wesentlichen starres Teil, welches aus einem im wesentlichen nicht kompressiblen Material hergestellt ist, und sich vertikal durch wenigstens einen Teil einer vertikalen Erstreckung des Sohlenteils erstreckt, und

wenigstens eine Platte, welche auf freitragende Weise sich ausgehend von wenigstens einem starren Teil in Richtung zu der Querseite des Sohlenteils erstreckt, wobei wenigstens eines der Plattenteile mit wenigstens einem starren Teil über einen nach unten verlaufenden, im wesentlichen gekrümmten Teil (46a, 46e) verbunden ist.

7. Dämpfungssohle nach einem der Ansprüche 1 bis 6, bei der das vertikal verlaufende, im wesentlichen starre Teil (42) im wesentlichen ausgehend von einem Boden des Sohlenteils (12) zu einer Oberseite des Sohlenteils erstreckt.

8. Dämpfungssohle nach einem der Ansprüche 1 bis 6, bei der das Sohlenteil (12) wenigstens teilweise aus einem Schaumstoffmaterial ausgebildet ist.

9. Dämpfungssohle nach einem der Ansprüche 1 bis 6, bei der das Sohlenteil (12) im wesentlichen vollständig aus dem Schaumstoffmaterial herausgeformt ist.

10. Dämpfungssohle nach einem der Ansprüche 1 bis 6, bei der das Sohlenteil (12) einen Einsatz (30) umfaßt, welcher von einer mittels Gas gefüllten, flexiblen Blase gebildet wird.

11. Dämpfungssohle nach einem der Ansprüche 1 bis 6, bei der das starre Teil (12) in Form einer Säule ausgebildet ist.

12. Dämpfungssohle nach Anspruch 11, bei der die Säule (42) hohl ist.

13. Dämpfungssohle nach Anspruch 12, bei der die hohle Säule (42) ein Federteil (54) umfaßt, welches in einem begrenzten Ausmaß eine vertikale Auslegung der hohlen Säule gestattet.

14. Dämpfungssohle nach einem der Ansprüche 11 bis 13, bei der die Säule (12) aus einem relativ harten Kunststoffmaterial ausgebildet ist.

15. Dämpfungssohle nach Anspruch 14, bei der der Kunststoff eine Härte nach Shore D von wenigstens 65 hat.

16. Dämpfungssohle nach einem der Ansprüche 1 bis 15, bei der wenigstens eine Platte (44) sich ausgehend von der Nähe des Oberteils des wenigstens einen starren Teils (42) und entlang eines Bereichs erstreckt, welcher an das Oberteil des Sohlenteils (12) angrenzt.

17. Dämpfungssohle nach Anspruch 1 oder 6, bei der wenigstens eine Platte (44) sich an der Mittellinie des Fersenbereichs (20) des Sohlenteils (12) vorbei erstreckt.

18. Dämpfungssohle nach einem der Ansprüche 1 bis 6, bei der wenigstens eine Platte (44) sich zu einem Bereich in der Nähe der Querseite des Sohlenteils (12) erstreckt.

19. Dämpfungssohle nach Anspruch 5 oder 6, bei der wenigstens eine Platte (44) als eine Mehrzahl von gesonderten Plattenteilen (44a - 44e) ausgebildet ist.

20. Dämpfungssohle nach Anspruch 5 oder 6, bei der wenigstens einige der Plattenteile (44a - 44e) mediale Enden haben, welche miteinander verbunden sind, und die Umfangsteile haben, welche ausgehend von den zugeordneten medialen Enden allmählich sich verjüngen.

21. Dämpfungssohle nach Anspruch 5 oder 6, bei der ein Zwischenraum (50) in dem oder jedem Plattenteil (44a - 44e) ausgebildet ist.

22. Dämpfungssohle nach einem der Ansprüche 1 bis 6, bei der die Einrichtung (40) zum allmählichen Größermachen des Kompressionswiderstandes wenigstens zwei der starren Teile (42a, 42b) umfaßt, welche in Längsrichtung voneinander im Abstand angeordnet sind, und bei der wenigstens eine Platte (44) auf eine freitragende Weise zwischen und ausgehend von wenigstens zwei starren Teilen angeordnet ist und in Richtung der Querseite des Sohlenteils (12) weist.

23. Dämpfungssohle nach einem der Ansprüche 1 bis 6, bei der die Teile (42a, 42b) und die Platte (44) aus einem einzigen, einteiligen Stück aus Kunststoff ausgebildet sind.

24. Dämpfungssohle nach einem der Ansprüche 1 bis 6, bei der die Platte (44), welche sich auf freitragende Weise erstreckt, ein proximales Endteil hat, welches nahe zu den wesentlichen starren Teilen angeordnet ist, und ein distales Endteil hat, wobei das proximale Endteil der Platte sich schwieriger biegen läßt und einen vergrößerten Kompressionswiderstand relativ zu dem distalen Endteil der Platte bereitstellt.

25. Dämpfungssohle nach Anspruch 1 oder 5, bei der wenigstens einige der Plattenteile (44a, 44e) mit den starren Teilen (42a, 42b) durch nach unten gebogene Abschnitte (46a, 46e) der zugeordneten Plattenteile verbunden sind.

26. Dämpfungssohle nach Anspruch 5 oder 6, bei der das Schuhwerk eine obere Sohle (14) und eine Dämpfungssohle nach einem der vorangehenden Ansprüche hat, welche an der oberen Sohle (14) angebracht ist.

27. Schuhwerk, welches eine obere Sohle und eine Dämpfungssohle nach einem der vorangehenden Ansprüche 1 bis 26 hat, die an der oberen Sohle angebracht ist.

Revendications

1. Semelle à amortissement destinée à être utilisée dans une chaussure avec un dispositif de réglage de la pronation pour contrôler le mouvement de pronation du pied de l'utilisateur, caractérisée en ce qu'elle comprend :

un élément de semelle (12) s'étendant le long d'au moins les zones de talon médian (20) et de cambrure médiane (22) de la semelle à amortissement, cet élément de semelle étant compressible et élastique pour amortir le choc du pied ; et

des moyens (40) incorporés dans l'élément de semelle pour augmenter progressivement la résistance à la compression de la semelle à partir de son côté latéral, pour atteindre un maximum au voisinage de son côté médian, de manière à contrôler le mouvement de pronation, ces moyens d'augmentation progressive de la résistance à la compression comprenant :

un élément essentiellement rigide (42) for-

mé d'un matériau essentiellement non compressible disposé essentiellement à l'intérieur de l'élément de semelle et s'étendant verticalement à travers une partie au moins de la dimension verticale de la semelle ; et

une plaque (44) partant en porte-à-faux de l'élément essentiellement rigide, vers le côté latéral de la semelle, cette plaque comprenant une pluralité d'éléments de plaque séparés (44a-44e).

2. Semelle à amortissement selon la revendication 1, caractérisée en ce qu'un évidement (50) est formé dans les éléments de plaque.

3. Semelle à amortissement selon la revendication 1, caractérisée en ce que certains des éléments de plaque ont des extrémités médianes reliées les unes aux autres, et présentent des périmètres allant en s'amincissant progressivement à partir des extrémités médianes respectives.

4. Semelle à amortissement selon la revendication 1, caractérisée en ce que l'élément rigide est réalisé sous la forme d'une colonne.

5. Semelle à amortissement selon la revendication 1, avec au moins un élément essentiellement rigide formé d'un matériau essentiellement non compressible et s'étendant verticalement à travers une partie au moins de la dimension verticale de l'élément de semelle, et

au moins une plaque partant en porte-à-faux de l'élément rigide au moins unique, vers le côté latéral de l'élément de semelle, caractérisée en ce que l'un au moins des éléments de plaque (44a, 44e) s'étend vers le côté latéral de l'élément de semelle, au-delà de l'axe central de la partie de talon.

6. Semelle à amortissement selon la revendication 1, comprenant :

au moins un élément essentiellement rigide fermé d'un matériau essentiellement non compressible et s'étendant verticalement à travers une partie au moins de la dimension verticale de l'élément de semelle, et

au moins une plaque partant en porte-à-faux de l'élément rigide au moins unique, vers le côté latéral de l'élément de semelle, caractérisée en ce que l'un au moins des éléments de plaque est relié à l'élément rigide au moins unique, par l'intermédiaire d'une partie essentiellement courbe dirigée vers le bas (46a, 46e).

7. Semelle à amortissement selon l'une quelconque des revendications 1 à 6, caractérisée en ce que l'élément essentiellement rigide disposé verticalement (42) s'étend essentiellement du bas de l'élément de semelle (12) jusqu'au sommet de cet élément de semelle.

8. Semelle à amortissement selon l'une quelconque des revendications 1 à 6, caractérisée en ce que l'élément de semelle (12) est formé au moins partiellement d'un matériau de mousse.

9. Semelle à amortissement selon l'une quelconque des revendications 1 à 6, caractérisée en ce que l'élément de semelle (12) est formé essentiellement complètement du matériau de mousse.

10. Semelle à amortissement selon l'une quelconque des revendications 1 à 6, caractérisée en ce que l'élément de semelle (12) comprend un élément d'insertion (30) constitué par une vessie souple remplie de gaz.

11. Semelle à amortissement selon l'une des revendications 1 à 6, caractérisée en ce que l'élément rigide (42) est réalisé sous la forme d'une colonne.

12. Semelle à amortissement selon la revendication 11, caractérisée en ce que la colonne (42) est creuse.

13. Semelle à amortissement selon la revendication 12, caractérisée en ce que la colonne creuse (42) comprend une partie de ressort (64) pour permettre un degré limité de déviation verticale à cette colonne creuse.

14. Semelle à amortissement selon l'une quelconque des revendications 11 à 13, caractérisée en ce que la colonne (42) est formée d'une matière plastique relativement dure.

15. Semelle à amortissement selon la revendication 14, caractérisée en ce que la matière plastique présente une dureté Shore B d'au moins 65.

16. Semelle à amortissement selon l'une quelconque des revendications 1 à 15, caractérisée en ce que la plaque au moins unique (44) part du voisinage du sommet de l'élément rigide au moins unique (42) et s'étend le long d'une zone adjacente au sommet de l'élément de semelle (12).

17. Semelle à amortissement selon la revendication 1 ou 6, caractérisée en ce que la plaque au moins unique (44) s'étend au-delà de l'axe central de la zone de talon (20) de l'élément de semelle (12).

18. Semelle à amortissement selon l'une quelconque des revendications 1 à 6, caractérisée en ce que la plaque au moins unique (44) s'étend jusqu'à une zone au moins adjacente au côté latéral de l'élément de semelle (12).

19. Semelle à amortissement selon la revendication 5 ou 6, caractérisée en ce que la plaque au moins unique (44) est formée d'une pluralité d'éléments de plaque séparés (44a-44e).

20. Semelle à amortissement selon la revendication 5 ou 6, caractérisée en ce que certains au moins des éléments de plaque (44a-44e) ont des extrémités médianes reliées les unes aux autres, et présentent des périmètres allant en s'amincissant progressivement à partir des extrémités médianes respectives.

21. Semelle à amortissement selon la revendication 5 ou 6, caractérisée en ce qu'un évidement (50) est formé dans l'élément ou dans chacun des éléments de plaque (44a-44e).

22. Semelle à amortissement selon l'une quelconque des revendications 1 à 6, caractérisée en ce que les moyens d'augmentation progressive de la résistance à la compression (40) comprennent au moins deux des éléments rigides (42a, 42b) espacés longitudinalement l'un de l'autre, et en ce que la plaque au moins unique (44) s'étend en porte-à-faux entre et à partir des éléments rigides au moins au nombre de deux, vers le côté latéral de l'élément de semelle (12).

23. Semelle à amortissement selon l'une quelconque des revendications 1 à 6, caractérisée en ce que les éléments (42a, 42b) et la plaque (44) sont constitués d'une pièce en matière plastique unique d'un seul tenant.

24. Semelle à amortissement selon l'une quelconque des revendications 1 à 6, caractérisée en ce que la plaque (44) s'étendant en porte-à-faux comporte une partie d'extrémité proximale voisine des éléments essentiellement rigides, et une partie d'extrémité distale, la partie d'extrémité proximale de la plaque étant plus difficile à courber et fournissant une plus grande résistance à la compression, par rapport à la partie d'extrémité distale de la plaque.

25. Semelle à amortissement selon la revendication 1 ou 5, caractérisée en ce que certains au moins des éléments de plaque (44a, 44e) sont reliés aux éléments rigides (42a, 42b) par des sections courbées vers le bas (46a, 46e) des éléments de plaque respectifs.

26. Semelle à amortissement selon la revendication 5 ou 6, caractérisée en ce que la chaussure comporte une empeigne (14) et une semelle à amortissement selon l'une quelconque des revendications précédentes, cette semelle à amortissement étant fixée à l'empeigne.

27. Chaussure comportant une empeigne et une semelle à amortissement selon l'une quelconque des revendications 1 à 26, cette semelle étant fixée à l'empeigne.

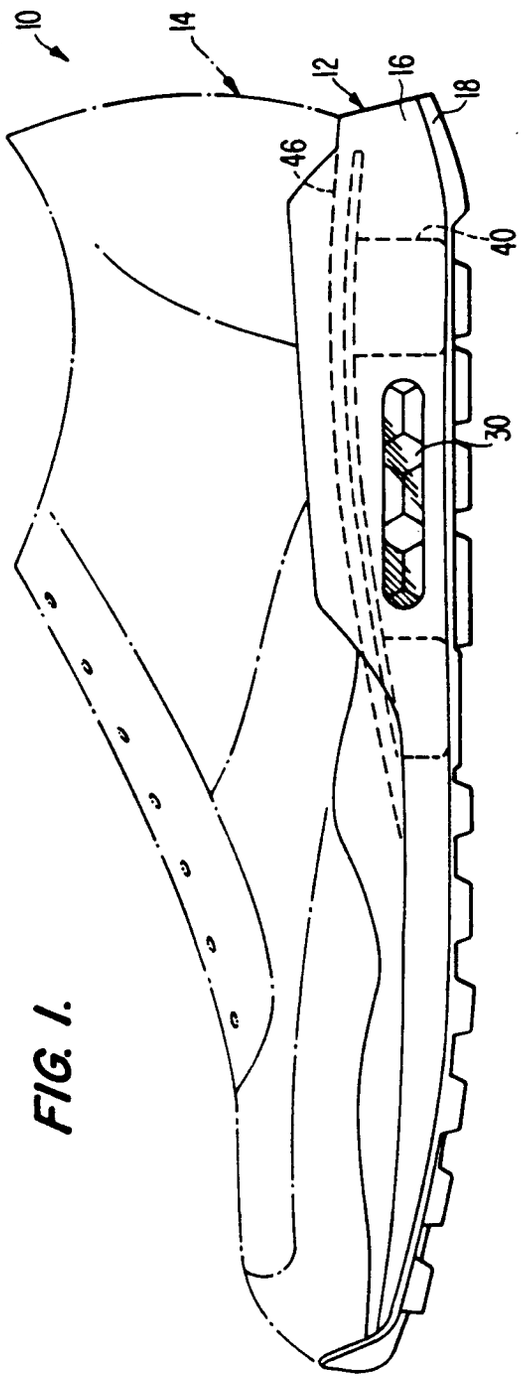
10
14
12
16
18
46
40
30

FIG. 1.

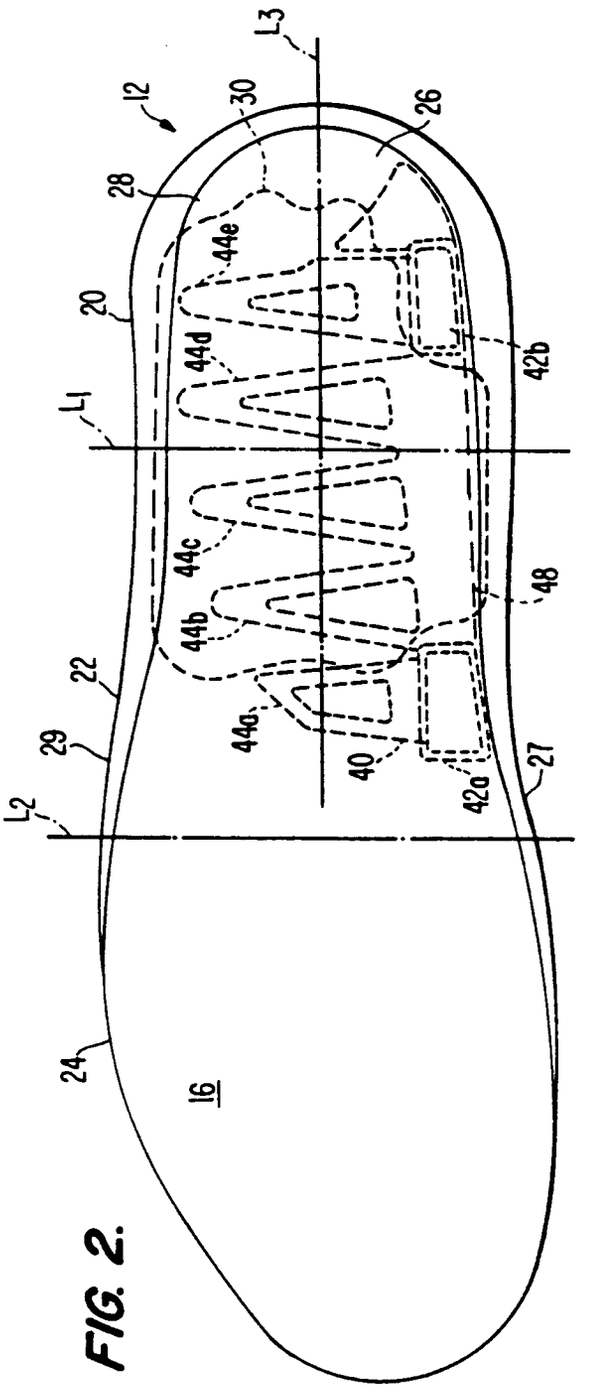
L3
12
30
26
28
44e
20
44d
42b
L1
44c
48
44b
22
29
44a
40
42a
27
L2
24
16

FIG. 2.

FIG. 3.

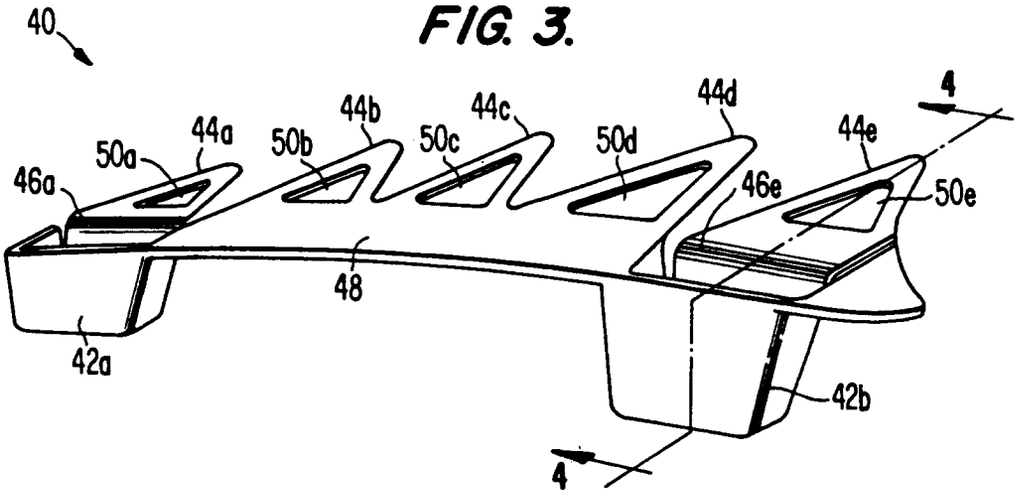

FIG. 4.

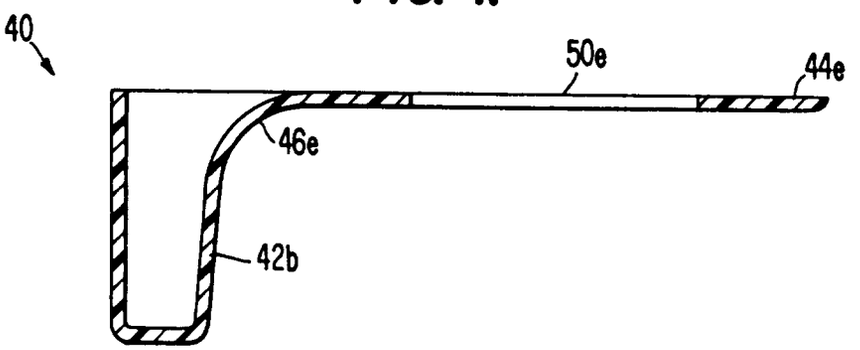

FIG. 5.