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(54) **DYNAMIC CANTING AND CUSHIONING
SYSTEM FOR FOOTWEAR**

(52) **U.S. Cl. 36/25 R; 36/28; 36/59 R**

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(57) **ABSTRACT**

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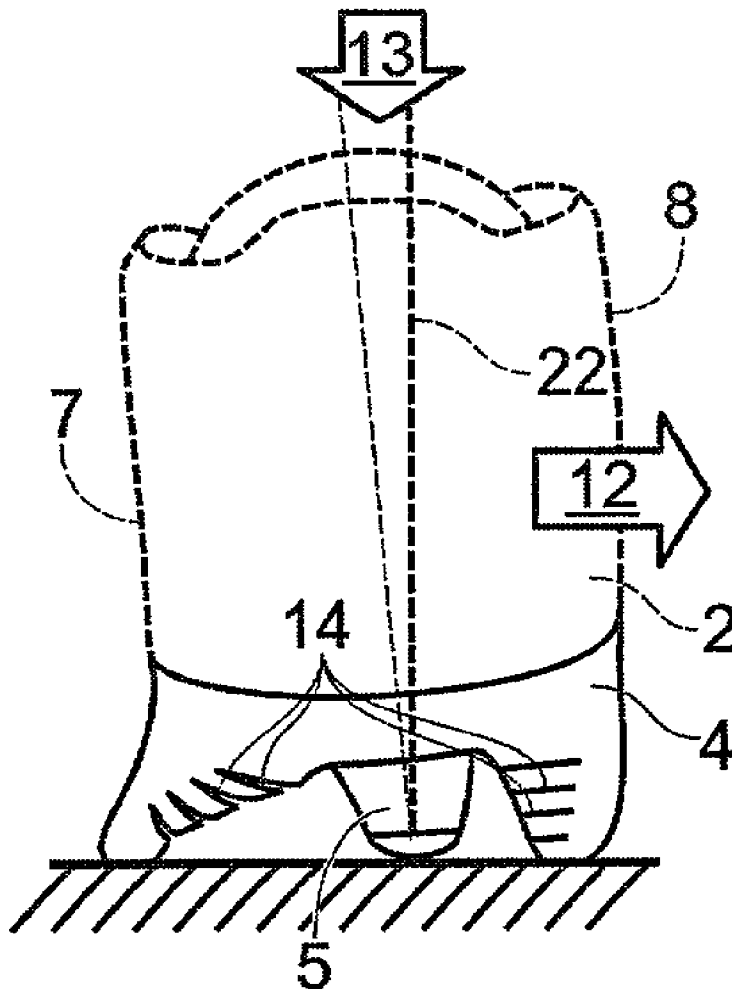
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A sole unit for footwear having, comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its bottom surface, the collapsible profile being capable of selectively, resiliently canting a side of a user's foot upwardly on the side opposite an applied lateral force during use, the collapsible profile having a canting means for facilitating the selective canting of the user's foot. The invention is also directed to methods of constructing footwear in accordance with the foregoing.



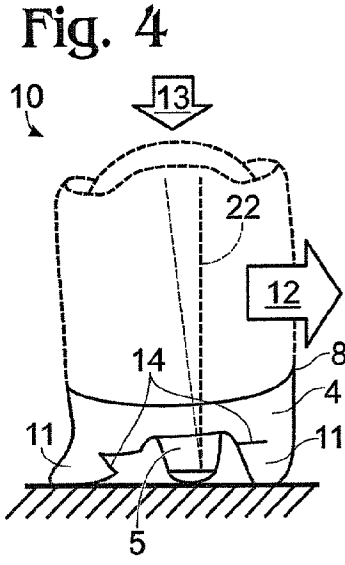
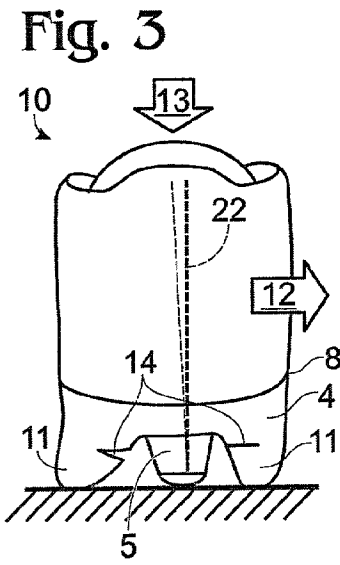
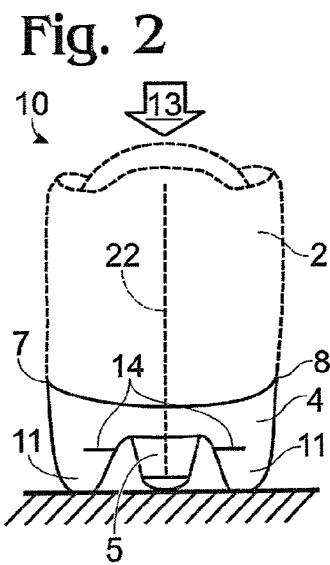
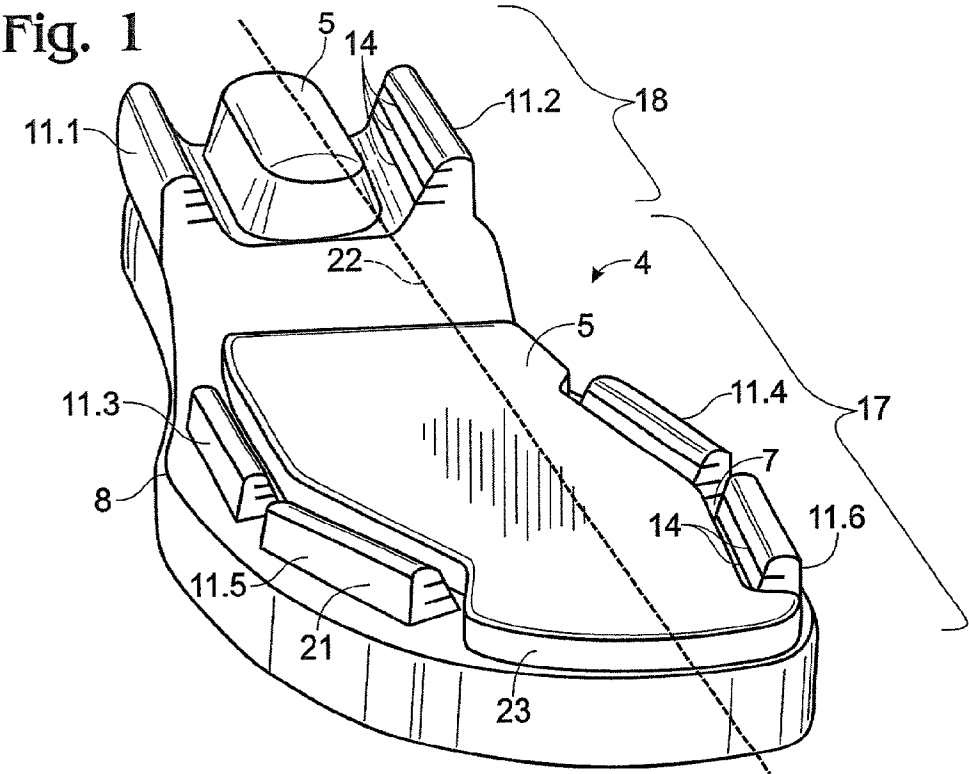


Fig. 5

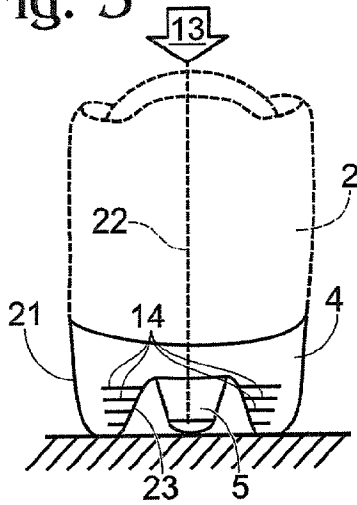


Fig. 6

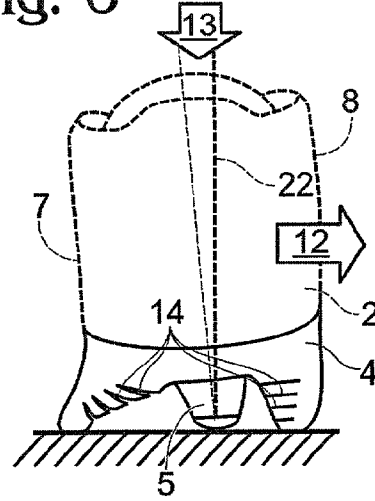


Fig. 7

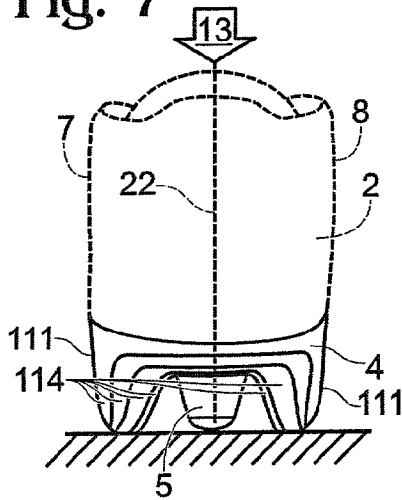


Fig. 8

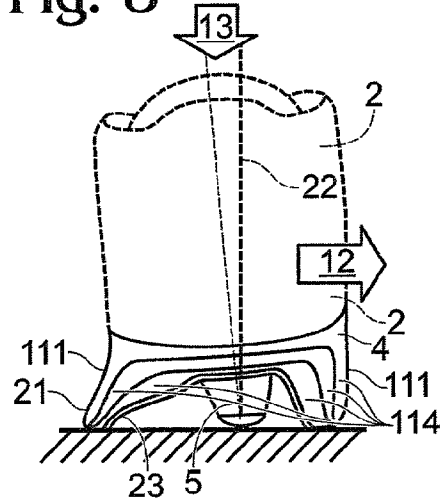


Fig. 9

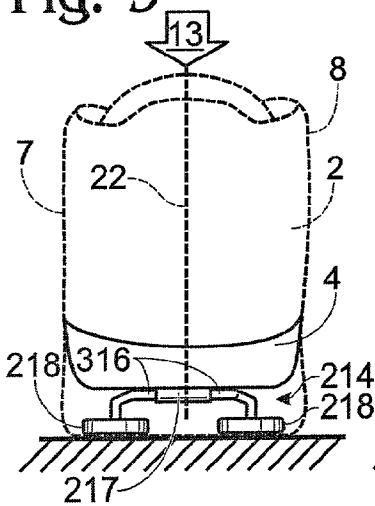


Fig. 10

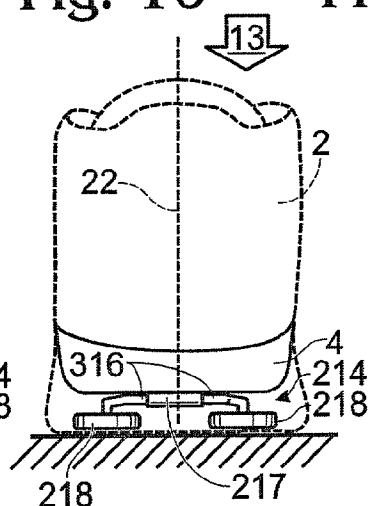


Fig. 11

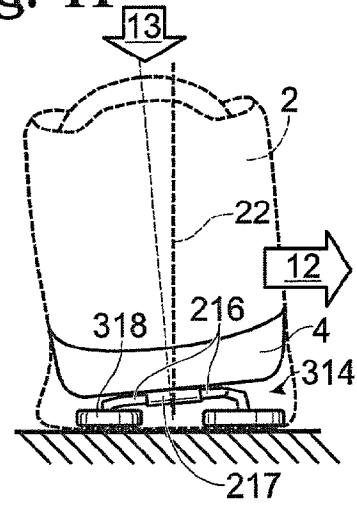


Fig. 12

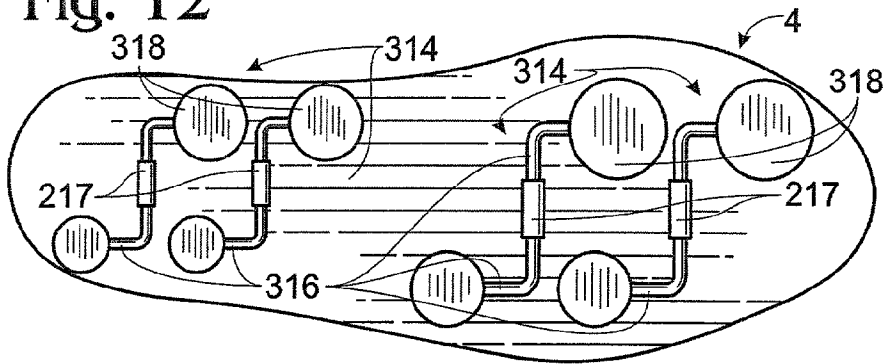


Fig. 13

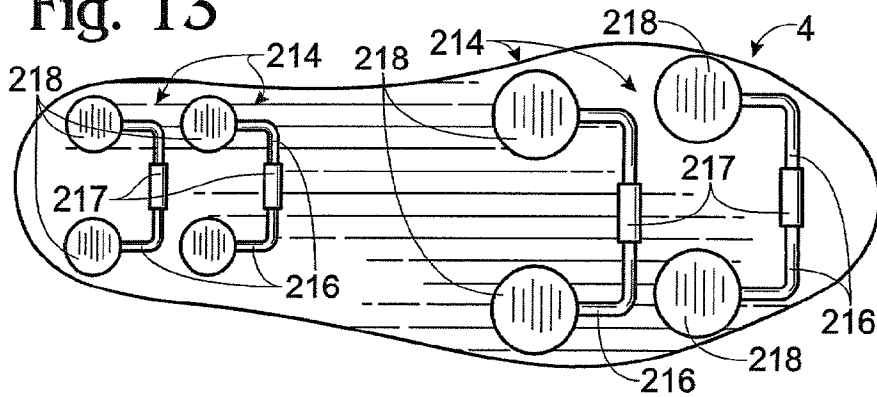


Fig. 14

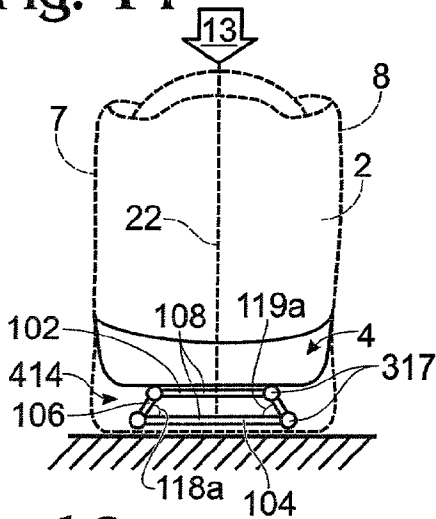


Fig. 15

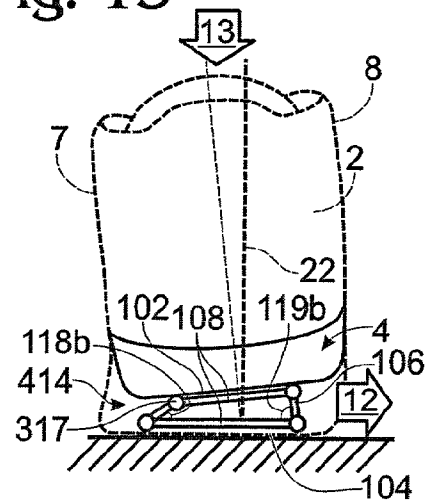
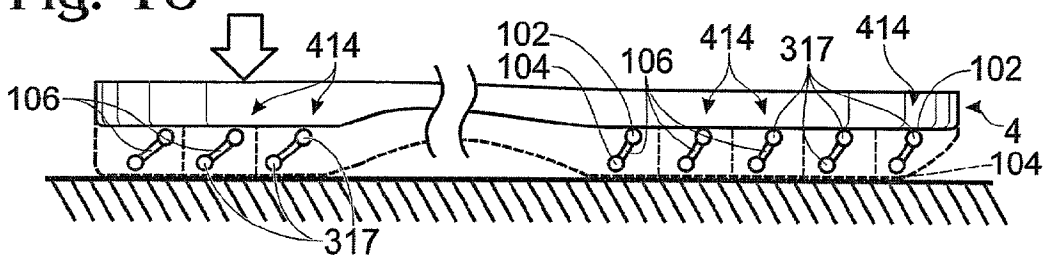


Fig. 16



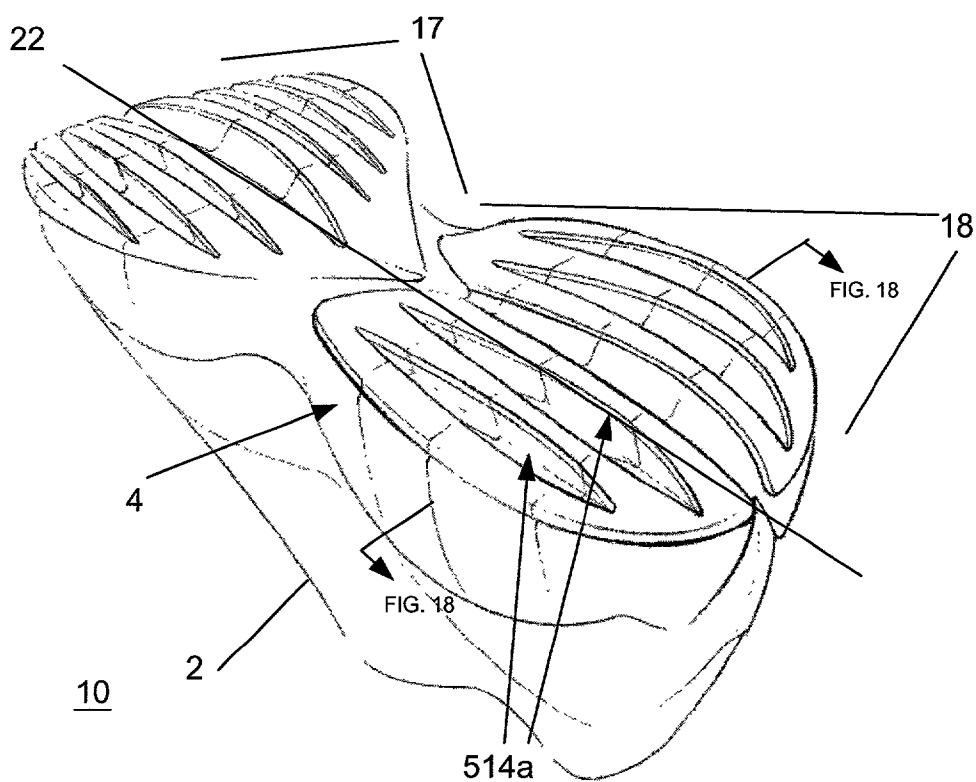


FIG. 17

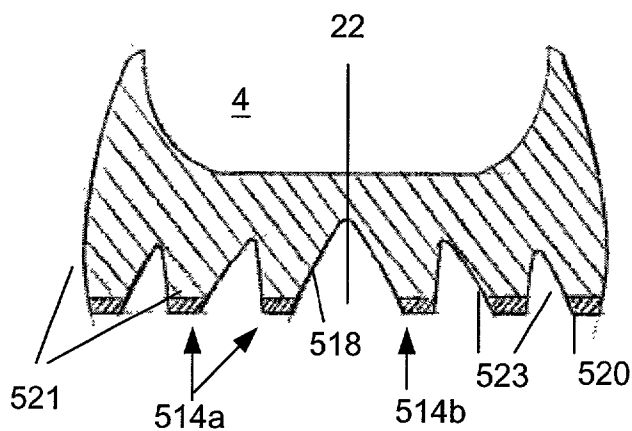


FIG. 18

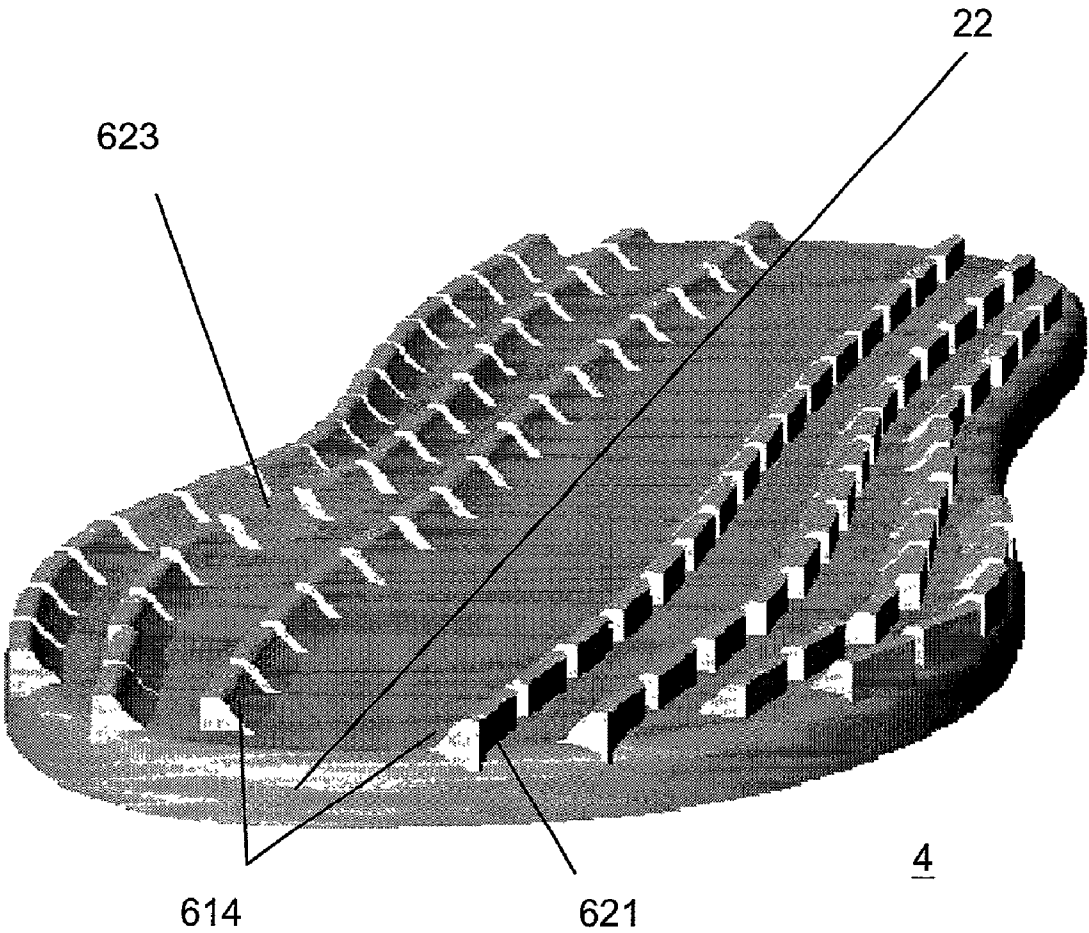


FIG. 19

DYNAMIC CANTING AND CUSHIONING SYSTEM FOR FOOTWEAR

BACKGROUND

[0001] 1. Field of the Invention

[0002] This invention pertains to a sole unit in the field of footwear and in particular it pertains to athletic footwear.

[0003] 2. Description of the Related Art

[0004] In conventional footwear, sole units (i.e. the midsole, outsole, or both) tend to maintain the bottom surface of the foot in a parallel plane to the ground during lateral cutting or stepping movements. While this effect may provide some stability against undue ankle roll, it interferes with the natural biomechanics of the foot. When a lateral movement is made by an unshod foot, the fatty tissue and musculo-skeletal structures of the foot react to the lateral force in a way that results in it deforming so as to more closely maintain the alignment of the shin and foot, in a biomechanically efficient and stable position. In conventional shoes this alignment is lost because the sole unit tends to maintain the foot in a plane parallel to the ground. As a result, conventional shoes may subject an ankle of a wearer to undue lateral rotation and consequently the potential for acute injuries. Accordingly, there is a need for a sole unit that more closely reacts to lateral force at least as well as the unshod foot. There is also a need for improved sole units that not only mimic natural biomechanics but also provide enhanced stability, performance, cushioning, and comfort under lateral and vertical forces.

SUMMARY

[0005] The present invention overcomes the disadvantages in the prior art by providing a dynamic canting system that under lateral force cants the sole unit of a shoe towards the direction of force, in effect mimicking a banked turn. This provides increased stability, performance, and comfort, while augmenting the potential for cutting sharper lateral movements or turns under greater force.

[0006] While the sole unit of the present invention is suited for use in any kind of footwear, it is especially for footwear intended for use under circumstances where there are significant lateral movements and forces during use. Athletics and sports, particularly court sports, often require such movements and generate such forces. Accordingly, the present invention is particularly suited for footwear intended for use in court sports, including basketball, tennis, soccer, volleyball, handball, racquetball, squash. Further, the present invention may be implemented in specific ways according to the demands of a particular sport. The present invention enables the construction of a lightweight, well-cushioned, low profile, adjustable shoe meant to out-perform all conventional court shoes.

[0007] In addition to improving a shoes' lateral stability and performance, embodiments of the present invention may be used to improve the shoe's response to vertical forces acting on the shoe alone or in combination with lateral forces.

[0008] In summary, this invention may offer one or more of the following advantages over conventional court-type shoes:

[0009] Prolonged lateral deceleration, which creates less stress on the lower leg and ankle, while increasing outsole grip.

[0010] Automatic inward canting of the heel, allowing for quicker and more agile lateral moves.

[0011] Increased proportional shock absorption for a given midsole thickness, since, unlike with standard technology, the heel no longer needs to provide a stable platform through the use of stiff elastomers.

[0012] Decreased weight due to use of lower-density elastomers.

[0013] Better axial alignment of the ball of the foot.

[0014] Decreased fatigue

[0015] Greater comfort/reduced risk of injuries

[0016] Better mimicking of the biomechanics of the unshod foot.

[0017] Substantial possibilities for cross-category integration and future iterations.

[0018] Substantial marketability—the dynamic is kinetic and readily apparent visually and through wear testing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 is a perspective view of the bottom side of a sole unit for a shoe according to the present invention.

[0020] FIG. 2 is a plan view of a heel side of a shoe with a sole unit according to the present invention under a relatively light vertical but not lateral force.

[0021] FIG. 3 is the shoe of FIG. 2 under a lateral force.

[0022] FIG. 4 is FIG. 2 under a greater lateral force.

[0023] FIG. 5 is a plan view of a heel side of a shoe with a sole unit according to FIG. 1 under a relatively light vertical but not lateral force.

[0024] FIG. 6 is the shoe of FIG. 5 under a lateral force.

[0025] FIG. 7 is a plan view of a heel side of a shoe with alternative embodiment of a sole unit under a relatively light vertical but not lateral force.

[0026] FIG. 8 is the shoe of FIG. 7 under a lateral force.

[0027] FIG. 9 is a schematic view of a heel portion of a shoe with a further embodiment of a sole unit according to the present invention under a vertical compressive force even with the midline of the shoe.

[0028] FIG. 10 is the shoe of FIG. 9 with the shoe under vertical compressive force that is offset from the midline of the shoe.

[0029] FIG. 11 is a shoe with another embodiment of a sole unit under a relatively light vertical and a lateral force.

[0030] FIG. 12 is a bottom plan view of the embodiment of FIG. 11.

[0031] FIG. 13 is a bottom plan view of the embodiment of FIGS. 9 and 10.

[0032] FIG. 14 is a plan view of a heel side of a shoe with another alternative embodiment of a sole unit under a vertical but not lateral force.

[0033] FIG. 15 is the shoe of FIG. 14 under a lateral force.

[0034] FIG. 16 is a side elevation view of the sole unit according to FIG. 14.

[0035] FIG. 17 is a perspective view of the bottom side of another alternative embodiment of shoe with a sole unit according to the present invention.

[0036] FIG. 18 is a sectional view of the sole unit of the shoe of FIG. 17 taken along line 18-18

[0037] FIG. 19 is a perspective view of the bottom side of another alternative embodiment of a sole unit for a shoe according to the present invention.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS OF THE PRESENT INVENTION

[0038] In the following illustrations, the features illustrated are not necessarily to scale, the illustrations intending only to be representative of the features for purpose of this discussion, it being within the skill of a person in the art to determine relative sizing and positioning of the features used in the novel combinations illustrated herein, except for the novel arrangement described herein.

[0039] When used in the context of forces, the term “lateral” means a force 12 applied substantially perpendicular to the lateral or medial side of a foot. When used in the context of the anatomy of the foot, “lateral” refers to the outside of a foot. “medial” refers to the inside of a foot that faces the opposing medial side of the opposite foot.

[0040] As used herein, the vertical compression refers to the vertical compressive force 13 that a shoe may be subject to based on the static weight of a user, as may be induced from foot strike activities such as walking, running, and jumping.

[0041] An object may react to a force isotropically or anisotropically. As used herein, isotropic means that an object deforms the same way regardless of the direction of an applied force. Anisotropic means that the object deforms differently depending on the direction of the force applied to the object.

[0042] Although this invention pertains largely to footwear it may also include designs relating to skates and selective canting of the blade or wheels in relation to the uppers.

[0043] In a basic form, the present invention includes one or more collapsing profiles which may compress in a largely vertical manner when vertical forces are applied. However, when lateral forces are applied, one side collapses resiliently more, producing a dynamic canting of the sole unit.

[0044] FIGS. 1-4 show one possible embodiment of a sole unit 4 and shoe 10 in accordance with the present invention. The shoe 10 comprises upper 2 and sole unit 4. Looking at FIG. 1, a sole unit 4 isolated from shoe upper 2 is shown.

[0045] The sole unit 4 generally may comprise (i) a midsole for energy absorption and/or return; (ii) an outsole material for surface contact and abrasion resistance and/or

traction; or (iii) a single unit providing such midsole or outsole functions. The sole unit also includes a plurality of collapsible profiles 11.1-11.6. (If a collapsible profile is being referenced in a context where the indicated positioning is not critical, the reference number “11” will be used.) The collapsible profiles 11 may individually or collectively, and in whole or in part, provide the aforementioned midsole and/or outsole for the sole unit.

[0046] The sole unit 4 may be divided generally into a forefoot portion 17 and a rearfoot or heel portion 18. In FIG. 4, sole unit 4 is shown with its bottom (ground contacting) surface up. The top surface of the sole unit may receive upper 2 or an intervening component that provides energy return or absorption. While the sole unit 4 would generally extend the length of the shoe, a sole unit could also comprise a unit that extends for a lesser area, such as just the forefoot or rearfoot portion, or some other area of lesser length or width.

[0047] The sole unit may include resilient elements that provide cushioning against shock. They may also be of a nature that provides energy return (in essence, spring) upon impact. For convenience, unless otherwise expressly or contextually indicated, “resilient element” refers to an element with either energy absorption and/or return functionality. One or more resilient elements 5 may be included in the sole unit 4 at locations where cushioning may be needed. For example, the rearfoot portion 18 of the sole unit would typically require cushioning, and resilient element 5 may be located there, as indicated in FIG. 1. Similarly, forefoot section 17 includes a resilient element 5.

[0048] Collapsible profiles 11 are disposed on the bottom surface of the sole unit 4 along opposite sides of a midline 22, generally dividing the shoe in medial and lateral halves. Preferably they are disposed adjacent the bottom side edges of the sole unit. Collapsible profiles 11.1 and 11.2 are disposed on a lateral side 7 and a medial side 8 of the rear portion 18 of the shoe. Collapsible profiles 11.3 and 11.5 are disposed along lateral edges of forefoot portion 17, and opposing them are collapsible profiles 11.4 and 11.6 disposed along the medial edges of the forefoot portion 17.

[0049] The sole unit on which the collapsible profiles 11 are disposed may comprise a standard midsole material, such as EVA or polyurethane foam and/or an abrasion resistant rubber or rubber-like material. It may also comprise a structural mid-sole component such as Hytrel or Nylon, such as disclosed in Luthi et al., U.S. Pat. No. 5,822,886, the teaching of which are hereby incorporated by reference for all purposes. The collapsible profiles may themselves be composed of such materials or structures. Referring to FIGS. 1-6, each collapsible profile contains one or more canting means 14. The canting means 14 enables a collapsible profile 11 to deform anisotropically in response in response to lateral force, allowing the sole unit to cant correspondingly. FIGS. 2-4 represent a collapsible profile with a canting means 14 comprising a flexure axis such as a slit, crease, or hinging zone, which facilitates collapsing in one direction, but not in the other.

[0050] FIGS. 2-4 show shoe 10 under different forces. In this example, shoe 10 represents a right shoe. FIG. 2 is a view of the heel portion of the shoe 10 under a vertical force 13 (force perpendicular to the bottom surface of the sole unit) here representing static weight of the wearer of the

shoe. When a moderate lateral force **12** is directed from the medial to lateral side of the shoe, as might occur during a cutting movement (e.g., during a court-sport, such as basketball or tennis), canting means **14** allows the collapsible profile **11** to collapse towards the side of the applied force **12**, as seen in **FIG. 3**. **FIG. 4** shows the further deformation of the collapsible profile under further force **12**. As seen, the collapsible profile undergoing deformation maintains substantial surface contact with the ground during deformation.

[0051] In **FIG. 3**, shoe **10** is inclined towards the direction of the applied force **12**. This demonstrates the canting action resulting from the collapse or deformation of collapsible profile **11** in response to a moderate applied force **12** (in combination with the vertical force **13**.) The lateral force **12** illustrated represents that which the wearer might subject the shoe to in a lateral cutting movement of the right foot. This force starts causing collapsible profile **11** to angle downwards away from the force vector that is the sum of vertical force **13** and lateral force vector **12**. Accordingly the orientation of a canting means **14** (discussed in greater detail below) creates an anisotropic collapse away from the force: Notice that while lateral force **12** is applied across the medial side **7** of the shoe toward the lateral side, the collapsible profile **11** on the lateral side **8** does not deform at all, or at least to a relatively lesser extent than its counterpart on the medial side. This selective or anisotropic response to the same directed force enables the shoe to cant towards the force, providing a stable platform that mimics the advantageous biomechanics of the barefoot. However, if the force is applied from the lateral to the medial side of the same shoe, the lateral collapsible profiles respond in mirrored fashion to their response to lateral force applied from the medial side.

[0052] As noted, **FIG. 4** shows that as lateral force **12** is increased, shoe **10** responds by canting increasingly more. This demonstrates that the dynamic canting effect may be proportional to the force applied. However, a limit on canting may be imposed so that there is less likelihood of a potentially injurious foot roll-over. The limit may be a rigid or relatively rigid structure on one or more sides of a collapsible profile that resists or blocks deformation. The structure may be of the same or similar material as the collapsible profiles but have different properties due to the angles or shapes. Or the structure could be of a different more rigid material that helps restrict deformation on the desired side of the collapsible profile.

[0053] In the example of **FIGS. 1-4**, the canting means **14** comprise one or more horizontal or substantially horizontal slits in the inward facing sidewall of the collapsible profile, extending partly through the collapsible profile toward the outward sidewall. The orientation of canting means **14** permits the foregoing canting effect by virtue of its hinging being dependent on the direction of the applied force. If the force is applied away from the open side of a slit, the opposing surfaces defining the slit cannot spread apart because the opposing inner surfaces block each other rather than separating.

[0054] As indicated in **FIGS. 1, 5, and 6**, a plurality of canting means may be used in any single collapsible profile. As noted, the canting means may comprise one or more slits **14**. A slit may extend from an inner wall of a collapsible profile toward the outer wall in various angles that allow the slit to open in response to a lateral force applied from the

outside wall of the slit across the inside wall, but not to open substantially in response to an opposite applied force. The slits **14** extend only partially through the downward extension of the collapsible profile. In one suitable embodiment, a slit is oriented in a line that is parallel or substantially parallel to the plane of the sole unit.

[0055] In the embodiment of **FIGS. 1, 5, and 6**, each collapsible profile has a plurality of slits **14** disposed in different vertical, substantially parallel positions in the collapsible profile. By varying the number of slits and the degree/angle to which they extend across the collapsible profile **11**, the deformation characteristics of the profile may be tuned for a particular application. For example, greater deformation might be desired for a court shoe.

[0056] By incorporating the collapsible profiles **11** in the sole unit **4**, the dynamic canting of the shoe **10** stabilizes the foot during lateral cutting movements or otherwise under lateral force. Multiple or deeper slits could be provided in the collapsible profile to promote the deformability. In a running shoe there is less need for the lateral deformability a collapsible profile can provide. Accordingly, the canting means would be less responsive to lateral force **12**. In the embodiment of **FIG. 1**, this could be achieved, for example, by fewer or less deep slits to control lateral deformability. The material properties of the collapsible profile could also factor in the deformability of the collapsible profile. For example, use of higher durometer materials would provide more resistance to deformation.

[0057] Other orientations of slits **14** or other canting means to achieve tuned deformation are, of course, possible. For instance, more vertically oriented slits could respond to vertical forces and help cushion against them. As an example, **FIGS. 17-18** show a sole unit **4** with collapsible profiles **514** extending the whole or a substantial length of the sole unit. One or more collapsible profiles **514a** are disposed on one side of midline **22** and one or more collapsible profiles **514b** are disposed on the opposite side. **FIG. 19** shows a similar sole unit with collapsible profiles **614**. Again there are opposing sets of collapsible profiles on opposite sides of a midline **22**. In this case, collapsible profiles are small projections that may vary in size. Generally the collapsible profiles of **FIGS. 17 and 19** are arranged as parallel, or substantially parallel, units or arrays running longitudinally along the sole unit. In the embodiments of **FIGS. 17 and 19**, the sole unit and collapsible profiles may be molded using conventional techniques to form a unitary sole unit structure that includes the collapsible profiles. The molding process may use conventional midsole and outsole materials. For example, looking at **FIG. 18**, the collapsible profiles **514** may be formed of standard midsole **518** and outsole **520**. In **FIGS. 17-19**, the collapsible profiles have a preferred configuration of a substantially vertical outside sidewall **521, 621** and an angled inside sidewall **523, 623**.

[0058] It is also noted that slits or other canting means need not initiate in a surface of a collapsible profile, but could be encapsulated within the profile.

[0059] Deformability in a collapsible profile **11** can also be controlled by tuning the shape of a profile. Note, for example, that the collapsible profiles **11** of **FIG. 1** have relatively vertical sidewalls **21** on the outward side of the profile, and acutely angled sidewalls **23** on the inward side.

This arrangement facilitates the collapse of the profile under vertical and/or lateral force applied from the opposite side of the collapsible profile, as shown in the figures. An opposing collapsible profile across midline 22 does not collapse at its canting means, at least in part due to the resistance of the angled sidewall. The angled sidewall is like a reinforced dike against forces from the opposite side, i.e., the angled sidewall will collapse more from a force received from the same side than from a force received from its opposite side. The sidewall arrangement of collapsible profiles therefore enhances the effect of the canting means in causing a profile to deform selectively according to the direction of the applied force. FIGS. 17 and 19 are other examples of the sidewall vertical/angled arrangement. For example, in FIG. 17, the collapsible profiles have substantially vertical outward facing sidewalls 521 and angled sidewalls 523 on the inward facing sidewalls.

[0060] In addition to slits, the canting means 14 may also comprise indentations or grooves or other means that allow the collapsible profile to splay toward the direction of the force. For example, instead of or in addition to the slits, the selective deformation administered by the canting means could be implemented, as one or more cells, such as a honeycomb or accordian-like cellular structure, that are wholly or partly collapsed under vertical load and which expand under a lateral load, much the same way as a slit 14 opens. This would approximate the dynamic illustrated in FIGS. 7-8.

[0061] The present invention contemplates other embodiments of collapsible profiles that provide the same functionality and dynamic of the embodiments of FIGS. 1-6 and 17-19. For example, FIGS. 7 and 8 show a shoe with a plurality of collapsible profiles 111 generally aligned along the lateral and medial sides of the shoe. In this embodiment the lateral profiles each comprise a unit that has zones 114 of differing elasticity or expandability. Generally, one or more stretchable zones 114 are disposed on the inward side of the collapsible profile and one or more less elastic or non-elastic zones are disposed on an outward side of a stretchable zone. The collapsible profiles may have a counterpart profile on the opposite side of a midline 22 with the same or similar construction. Under a lateral force, zones of elastic material stretch. As the collapsible profile stretches it splays in generally the same way as the collapsible profiles 11 of the embodiments of FIGS. 1-6 and 17-19. The outer zones are less resistant to stretching. A vertical/angled arrangement of sidewalls 21/23 may add to the stretching integrity and promote anisotropy deformation as earlier noted. A counterpart collapsible profile on the opposite side of the midline 22 responds generally in the same or similar way as the counterpart collapsible profiles of FIGS. 1-6, except that the collapsible profile resists deformation in the direction of the force because of the lesser elasticity of the outward zones and because inward facing elastic zones are under a compressive force rather than a separating force. Accordingly, there is selective deformation of the collapsible profile on the medial side 7 and resistance to collapse on the lateral side 8. The selective collapsibility of the profiles causes the shoe to cant downwardly toward the medial side under a force 12 applied from the medial to the lateral side.

[0062] It should be appreciated at this point that the elastic zones 114 in the collapsible profiles of FIGS. 7 and 8 act as

a canting means by allowing the collapsible profile 114 to splay outwardly in the direction of an applied lateral force 12.

[0063] In FIGS. 7 and 8 a stretchable zone 114 of a collapsible profile 111 may be made of one or more layers of elastic material. Preferably going from the outward side 21 to the inward side 23 of the collapsible profile 111 there is progressively more stretchability. In addition to using distinct layers of stretchable material for this purpose, the collapsible profile may be molded as single unit of one or more compositions providing the progressive stretchability. The stretchable zone may also be based on a cellular structure, wherein, for example, the cells are made of a stretchable material. The cells could also be designed to be resiliently compressible so that they serve as resilient element.

[0064] Example materials for the collapsible profiles of FIGS. 7 and 8 include Neoprene, Poron, rubbery EVAs, and other known materials familiar to persons skilled in the art. These may be formed in known molding processes and be of varying durometers and skin tensions. Additional permutations to embodiments of FIGS. 1-8 may include any one or more of the following:

[0065] Various combinations of elastomers/air cells or bladders forming the collapsible profiles. (In this connection, the deformation pads disclosed in U.S. Pat. No. 6,266,897 may be adapted in accordance with the present invention. The teachings of the '897 patent are hereby incorporated by reference for all purposes.)

[0066] Collapsible profiles that are removably attachable to a sole unit, by providing attachment means such as receptacles, pockets, threading, slots, zipper means or other known means to removably engage the collapsible profile to the sole unit.

[0067] Resilient elements that are removably attachable with a predetermined portion of the sole unit. For example, the removable resilient elements may be disposed on or in a central portion of a sole unit, by providing attachment means such as pockets, threading, or other known means to removably engage the collapsible profile to the sole unit. A slit or crease towards the top of the profiles which enables them to fold one way but not the other.

[0068] The inclusion of compressible pads of selected durometers and shear-ability on any side of a collapsible profile.

[0069] Variable density portions or layers of the collapsing profiles to provide tuned deformation and/or cushioning.

[0070] Various sizes, profiles, and heights of collapsible profiles arranged at various points throughout the sole unit. These may be curvilinear relative to the midline 22 of the sole unit 4. They may also range in size from a pencil-tip to profiles several inches in length.

[0071] Outsole materials co-molded or affixed to the lower portion of collapsible profiles

[0072] Variation in the angle at which a profile collapses depends on the bottom of a sole unit. For

example, the collapsible profiles instead of projecting substantially vertically from the bottom of the sole unit may be angled outwardly/inwardly or fore/aft relative to a sole unit's midline, and be non-orthogonally placed relative to the midline.

[0073] Inclusion of air bladders as cushioning means.

[0074] More rigid plastic or plastic-like profiles may be incorporated in or around a given collapsible profile.

[0075] FIGS. 9-13 show related, alternative embodiments of a sole unit having collapsible profiles 214 and 314 for enabling a cushioning and/or dynamic canting effect as described above. In the embodiments, collapsible profiles 214 and 314 comprise a torsion element, a canting means, and opposing force transfer means. The torsion element 216, 316 is coupled to a hinging 217 means disposed on the bottom surface of a sole unit. The torsion element has opposing force transfer means 218, 318 on either side of a canting means connected to the torsion element. The torsion element may rotate, at least partially within or about the canting means. Or the canting means may otherwise facilitate a rotational movement of the torsion element. Preferably, the force transfer means are disposed at each end of the torsion element.

[0076] The torsion element generally 216,316 is an elongate substantially rigid element such as a bar. Generally, the torsion element should be oriented in the direction of a lateral force applied that may act on the sole unit. In one suitable embodiment, the torsion element may be made of, for example, metals or structural polymers. The torsion element is oriented generally perpendicular to a midline section of the sole unit. But it may be oriented at other angles, depending on the direction of the forces to which it is intended to respond.

[0077] The canting means 217 provides a pivot point or bearing surface for the torsion element 216, 316, orienting the torsion element generally perpendicularly to the midline of the sole unit to which it is attached (in the example shown), and allowing rotational movement. As one example, the canting means is a sleeve, ring, ball or socket (with a complementary surface or item being disposed on the torsion element) for receiving the torsion element. It may also be a "living hinge", wherein the canting means is coupled to the torsion element, but provides rotational movement.

[0078] The force transfer 218, 318 means on opposite sides of the canting means 217 are connected to or embedded in a portion of compressibly resilient sole unit material. Preferably, the force transfer means are disposed on or towards the ends of the torsion element 216, 316. Generally, the force transfer means comprise a generally broad area of material attached to or formed on or in the torsion element. Preferably, the broad area comprises rigid or substantially rigid, generally planar pads disposed on the ends of a torsion element. The force transfer means provide an area where a force may act, with the canting means allowing rotational movement of the torsion element. In the case of the Embodiment of FIG. 12, the rotational movement translates the force on one force transfer means in an opposite direction and effect on the opposite force transfer means. For example, a generally compressive force on one side of the midline 22 (which force may have lateral and vertical components)

would tend to compress the sole unit 4, but the canting means would pull the sole unit at the point of attachment of the opposite force transfer means. Accordingly this produces a canted sole unit while the force is applied. If there is equal force on each side of the midline, there would not be canting. In addition, by providing a rigid but resilient torsion element with force transfer means in a lower plane (closer to the ground surface than the canting means) attachment to the sole unit, under a vertical force, the torsion element could flex back toward the plane of the canting means and thereby provide a cushioning effect. In contrast, to the embodiment of FIG. 12, in the embodiment of FIG. 13, a vertical force that is offset from the midline would allow equal cushioning on both sides of the midline, as indicated in FIGS. 9 and 10. This is because as one force transfer means is moved, the corresponding force transfer means on the opposite side of the midline moves the same amount in the same direction. Alternatively, the torsion elements may be of unequal lengths, thus allowing for differing amounts of movement. In order for any of these effects to take place, there must be a resilient portion of midsole material between the force transfer means and the shoe upper, preferably of a higher density material than the surrounding material. This resilient material effectively preloads the force transfer means. The force transfer means 218, 318 may be formed of the unit of material that forms the torsion element 216, 316. Or it may be a separate unit attached to the torsion element. In an alternative embodiment, the portions of the torsion elements on opposite sides of the canting means are integrated into sole unit material, the region of integration serving as the force transfer means.

[0079] As shown in FIGS. 11-12, the torsion element 316 may be non-linear and adapted to dispose one force transfer means 318 on opposite sides of the torsion element, namely one is forward of the canting means 217 and the other rearward, creating a generally s-shaped torsion element. In operation the collapsible profiles 314 of FIGS. 11-12 create a dynamic where if one force transfer means is pushed up, the force transfer means on the other side of the torsion element pushes the opposite direction (down). Thus vertical pressures on one side of the shoe are augmented by a corresponding opposite pressure on the other side of the shoe. This results in the dynamic canting effect described in relation to FIGS. 1-8. Looking at FIGS. 9-10, 13, for a given collapsible profile 214, the force transfer means 218 are located on the same side of the torsion element 216. FIG. 9 represents a shoe under the static weight of a user. In FIG. 10, an additional offset vertical force 13 pushes down the portion of the sole unit 4 where a first force transfer means 218 is disposed. As the first force transfer means is depressed, the torsion element translates the force of the opposite side of the canting means 217 to the second force transfer means 218. Because it is on the same side of the torsion element as the other force transfer means, it is also depressed into the portion of the sole unit where it is disposed. This produces the isotropically compressed sole unit of FIG. 10. Thus the embodiments of FIGS. 9-13 provide a novel cushioning system, as well as a novel canting system. In view of the foregoing, persons skilled in the art will appreciate that the embodiments of FIGS. 9-13 may be used to provide a sole unit that has tunable cushioning and/or canting properties. The torsion elements could be replaceable so that torsion element configurations and force transfer means may be swapped to provide such

tunability. Using torsion elements with different orientations of force transfer means on opposite sides of the canting means, a shoe may be tuned to suit the needs of various sports, including court, field, and running sports.

[0080] In general it will be desirable to dispose the canting means **214, 314** at about the midline **22** of the sole unit **4** and force transfer means **218, 318** for a torsion element **216, 316** are located on opposite sides of the midline, preferably toward the sides of the sole unit. This is particularly desirable where the collapsible profiles are intended to provide canting. However, individual collapsible profiles may be disposed on opposite sides of the midline, as described for the collapsible profiles of FIGS. 1-8. This may be desirable where the collapsible profiles are intended to provide cushioning.

[0081] The canting means **217** may be disposed on or within a portion of the sole unit **4**. In a possible embodiment, the canting means are disposed on or in an area of sole unit having a durometer different from that of one or both portions of the unit at which or in which a force transfer means is disposed. Preferably, the canting means is disposed on or within an area of sole unit having a higher durometer. Such an arrangement promotes the canting effect because on either side of the canting means the material is relatively more prone to collapse under force from a lateral cutting movement or vertical compressive force.

[0082] Additional permutations to embodiments of FIGS. 9-13 may include any one or more of the following:

- [0083] Differing lengths and angles of the parallels, which creates differential induction of torsion
- [0084] Inclusion of elastomers or air under or around the torsion elements which exert force upon them.
- [0085] Torsion elements may be configured to provide/optimize cushioning.
- [0086] Inclusion of a center "high spot" or "low spot" towards the longitudinal midline of shoe outsole
- [0087] A mechanism for adjusting tension and angle of torsion elements, e.g., replaceable elastomer pads or adjustable air bladders.
- [0088] Incorporation of the torsion elements into midsole material of a sole unit.
- [0089] Force transfer means comprising an abrasion resistant material or having abrasion resistant material disposed thereon.
- [0090] Various widths and lengths for the torsion element and force transfer means to control selectably the amount of force applied across the canting means and the area of the sole unit canted and or cushioned by such embodiment of a collapsing profile.
- [0091] Inclusion of various other combinations of collapsing profiles as in FIGS. 18, and 17-19.
- [0092] Inclusion of air bladders as cushioning means.

[0093] A further embodiment of collapsible profiles in accordance with the present invention is illustrated in FIGS. 14-16. In connection with these embodiments, and supplementing the disclosure hereof, U.S. Pat. No. 6,115,943, is

hereby incorporated by reference, as if set forth in its entirety, for all purposes. The '943 patent, was invented and is owned by the inventor and owner of the present patent application. Generally, the embodiments of FIGS. 14-16 are directed to a sole unit **4** with collapsing profiles **414**.

[0094] The collapsible profiles of this embodiment comprise opposing vertical displacement elements **106** preferably with horizontal displacement elements **108** disposed between the vertical elements at or near top and/or bottom positions along the opposing vertical displacement elements. At the intersection of the vertical and horizontal elements are connected canting means **317**. The canting means allow an upper sole unit portion **102** and lower sole unit portion **104** to be laterally displaceable relative to one other in response to a lateral force **12**, as shown in FIG. 15 and described in more detail below. The upper and lower horizontal displacement elements may comprise sections of midsole and/or outsole between canting means **317**. Or they may be separate elements between the canting means attached to or integrated with the midsole or outsole.

[0095] The canting means preferably define a rhomboid-like configuration for the collapsible profile that deforms into a trapezoidal-like configuration under lateral force.

[0096] The collapsible profiles may optionally include a horizontal displacement element **108** for anchoring the collapsible profile to the upper and/or lower plan as portion. Preferably the upper sole unit portions associated with a collapsible profile is also displaceable in at least a forward direction relative to the lower planar portions in response to a vertical force **13**. Canting means **317** may facilitate fore and/or aft displacement of upper portion **102** relative to lower portion **104**. In one possible embodiment, this means is a flexure axis at the intersection of the vertical and horizontal displacement elements. (A flexure axis for such displacement is taught in U.S. Pat. No. 6,115,943, which has earlier been incorporated by reference.) The axis may be oriented in one or more directions. This allows for cushioning concurrent with the lateral canting.

[0097] For a given collapsible profile **414**, a canting effect may be achieved by arranging the displacements **106** and canting means so that a pair of canting means **317** on each of the upper portion and the lower portion are on opposite sides of the midline **22** for the sole unit with the separation of the bottom pair being greater than the top pair. As noted, in a preferred embodiment, such arrangement is found in a rhomboidal to trapezoidal structure, as seen in FIGS. 14-16. Viewed from the side with no forces applied, the rhomboid may be either substantially vertical or canted forwardly or rearwardly.

[0098] Notice that the displacement elements **106** and horizontal displacement elements **104** between the lower canting means **317** form acute angles **118a** and **119** under non-lateral force, as shown in FIG. 14. Under a lateral force **12** applied from the left side of the sole unit **4** to the right, the lower acute angle **118a** on the side on which the force creates a more acute angle **118b** while the angle **119a** at the opposite side becomes a more obtuse angle **119b**, hence forming a trapezoidal-like configuration. Consequently, the upper portion **102** is not only laterally displaced but also canted towards the side of the sole unit at which the force **12** initiates.

[0099] As is the case for all other embodiments described herein, the collapsing profile structure of this embodiment is

provided with resilience (either inherent in its own structure, or from the adjoining midsole elastomers on either or both sides of the collapsible profile) so that after an acting force **12** or **13** is removed, the collapsing profile returns to its static position. The structure may also deform selectively in response to a force with a vertical component to provide both canting and cushioning. It moves appreciably fore-aft and laterally, depending on the composite or singular forces involved.

[0100] The displacement elements **106**, **108** of the present invention may have thin or wide profiles. For example, the displacement elements may be thin rod-like elements. The collapsible profiles of such an arrangement may be located at points on a sole unit where lateral displacement, canting and/or cushioning is desired. In one possible embodiment, the collapsing elements **414** comprise sole unit portions **102**, **104** and displacement elements **106** are thin or rod-like elements that are spaced along a rearfoot portion and a forefoot portion of the sole unit, as shown in **FIG. 16**. In that figure, a vertical force **13** compresses the rear portion but not the forefoot portion. Consequently, the collapsible profiles in the rear portion are shown angled forward (with a more acute angle) relative to the ones in the forward portion. Note also that there should be sufficient clearance between collapsible profiles to allow for such forward flex. The collapsible profiles may be contained in a sole unit or portion thereof as separate independent segments, as indicated by vertical dashed lines. Each segment could contain one more collapsible profiles along with midsole and/or outsole materials for the segment. As another example, multiple collapsible profiles could be contained in a portion of sole unit that extends some or all the length from rearfoot to forefoot, without segmentation.

[0101] In another possible embodiment, the displacements **106** and upper and lower sole portions **102**, **104** have wide profiles. For example, they may take the form of tubelike units having a transverse cross-section in accordance with the foregoing description of the relative arrangements of pairs of canting means in the top and bottom portions (e.g., a rhomboidal cross section). The upper and lower portions of such a tube-like collapsible profile could extend any desired length of a sole unit. One or more such units could be attached at locations where lateral displacement, canting, and/or cushioning is desired. For example, the upper portion could extend the length of a foot and serve directly or indirectly as the surface for attaching a shoe upper. The lower portion in such embodiment could also extend the length of the foot and could serve directly or indirectly as the outsole surface of the shoe, or as a direct or indirect surface for attaching outsole material. As indicated above relative to segmentation, it may be noncontiguous on its bottom surface to allow for differential flexing of the units. Note that the displacements **106**, **108** may be connected or otherwise integrated into the surface of the top or bottom portions in a variety of ways. For example the displacements could be formed into a unitary structure (e.g., incorporating a living hinge) with the upper and lower portions **102**, **104**. The upper and lower portions could comprise some or all of the sole unit **4**. In one possible embodiment the displacement elements **106**, **108** comprise rigid polymers such as Hytrel™ and PEBAX™, such as may be disclosed in U.S. Pat. No. 5,822,886, which was earlier incorporated by reference. The collapsing profile **414**, or components thereof, may be made from materials that are extruded, molded, milled, or fabri-

cated in any other manner which allows for hinging motion of the canting means between the displacements and the associated top or bottom portions of the sole units. Other suitable materials include other plastics (generally of the softer variety, such as UHMW, polypropylene, or Hytrel™ RTM™.) metals, and other materials that provide low compression set, good kinetic memory, pliability, resistance to temperature, and appropriate rigidity relative to the absorptive material.

[0102] The canting means **317** may be flexure axes at the points where the displacements integrate with the top and bottom portions, for example slits or notches where the displacements join the surface of a top or bottom surface. Hinging may also be constructed of ball and socket hinges, linear hinges, or other such known mechanical devices. Living hinges may also be employed. A damping means is preferably disposed between the outsole and the upper between top and bottom surfaces of the collapsing profile or such material may be disposed between units of collapsible profile. This damping means may be an elastomer, gas, or an gas/elastomer blend. This could be tunable, with replaceable elastomer cartridges or adjustable air bladders.

[0103] In embodiments with a canting means that affords fore and/or aft displacement, when vertical pressure is applied, the lower portion moves rearward in relation to the upper portion, providing cushioning. When lateral pressure is applied, the lateral hinges flex or shift, allowing for the novel canting dynamic of the present invention. The degree to which this happens may be modulated by the damping means incorporated in the midsole.

[0104] The embodiment of **FIG. 14** is shown under a static vertical force **13**. **FIG. 15** shows the embodiment under a lateral force applied from the medial side to lateral side of the sole unit. **FIG. 16** shows the sole unit reacting to a force with a substantial vertical component on the rear portion of the sole unit. Note the forward position of the top of the rhomboidal structures (due to compressive forces) relative to those in the forefoot portion, which are not under the vertical force.

[0105] Notably, from the foregoing it should be apparent that the present invention overcomes the disadvantages of traditional, materials and configurations for sole units. For example, such materials are often amorphous or uniform foams or rubbers that do not provide the selective deformability of the present invention. Further the prior art does not teach how to use such materials for effective selective deformability. In contrast the present invention provides the option of using such materials and others in the novel structures for the selectively deformable collapsible profiles disclosed herein.

[0106] Additional variations and permutations to embodiments of **FIGS. 14-16** may include any one or more of the following:

[0107] Adjustment means for modulating the amount of cushioning in the damping means, e.g., replaceable elastomer cartridges or adjustable air bladders.

[0108] Unitary or separate and upper and lower sole unit portions and displacement elements disposed therebetween.

[0109] Independent or separate foresole and rearsole portions that allow for differential flexing and/or orientation.

- [0110] Net movement of the shoe outsole upon vertical compression may be either fore or aft relative to the uppers.
- [0111] Inclusion of various other combinations of collapsing profiles as in FIGS. 1-13.
- [0112] The designs in FIGS. 14-16 may exclude horizontal displacement elements members on the top or bottom. Outsole may or may not bridge between the side members.
- [0113] Other variations that may be applicable to the one or more of the embodiments of FIGS. 1-19 are as follows:
- [0114] Collapsible profiles may include a combination of slits and elastomers, or the slits may be indentations and/or fold lines.
- [0115] The overall contour of the profiles (as viewed from the either end) may be slightly arcuate—domed, concave, or v-shaped.
- [0116] Variable pressure air channels may communicate between various profiles and serve as stability as well as cushioning by differentially pressurizing key areas.
- [0117] Profiles may include an outsole, or have none whatsoever. Any combination of the designs outlined in the application may be used in various combinations.
- [0118] During manufacture, the outsole may be applied in one piece, with cut-outs for the voids between profiles. The cut-out may then be popped out and recycled. This serves to stabilize the outsole and profiles during gluing.
- [0119] A variety of matrix-type materials such as honeycombs (such as Hexalite tm) and parallelogram channels can be used to differentially flex and provide the same anisotropic dynamic as the profiles and slit/variable elastomer combinations.
- [0120] Skeletal pieces of higher-durometer plastic or stiffer material (than the adjoining profile material) may reside within a plurality of profiles, effectively giving more of a framework for the profiles to flex around, thus enhancing hinging and stability by serving as defined zones of flexure and relative rigidity.
- [0121] The foregoing embodiments and features are for illustrative purposes. Persons of ordinary skill in the art will recognize the foregoing description and embodiments are not limitations, but examples. Such persons will recognize, in particular, that many modifications and variations are possible in the details, materials, and arrangements of the parts and steps which have been described and illustrated in order to explain the nature of this invention, and that such modifications and variations do not depart from the spirit and scope of the teachings and claims contained herein.

What I claim:

1. A sole unit for footwear having, comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its bottom surface, the collapsible profile being capable of selectively, resiliently canting a side of a user's foot

upwardly on the side opposite an applied lateral force during use, the collapsible profile having a canting means for facilitating the selective canting of the user's foot.

2. The sole unit of claim 1 having collapsible profiles opposing each other such that when a lateral force is applied to the sole unit, the collapsible profile at the side to which the force is applied selectively collapses at the canting means and the canting means in the opposing collapsible profile resists collapsing in the same direction.

3. The sole unit of claim 1 wherein at least one collapsible profile is disposed along at least each of a forefoot or heel portion of a medial side of the sole unit.

4. The sole unit of claim 3 wherein collapsible profiles are disposed along a forefoot or heel portion of medial and lateral sides of the sole unit.

5. The sole unit of claim 1 wherein the collapsible profile includes a canting means comprising a flexure axis oriented generally parallel to the midline of the sole unit.

6. The sole unit of claim 5 having collapsible profiles opposing each other such that when a lateral force is applied to the sole unit, the collapsible profile at the side to which the force is applied selectively collapses at the canting means and the opposing collapsible profile resists collapsing in the same direction.

7. The sole unit of claim 6 wherein the collapsible profile has an outside edge at an outside medial edge of the sole unit and a canting means that allows the collapsible profile to splay away from the outside edge under a lateral force to the medial side of the shoe.

8. The sole unit of claim 1 wherein the collapsible profile includes an outsole for ground contact.

9. The sole unit of claim 8 wherein the collapsible profile also comprises a resilient element.

10. The sole unit of claim 9 wherein the collapsible profile includes an outsole for ground contact.

11. The sole unit of claim 4 wherein midsole and/or outsole structure, not comprising a collapsible profile, is disposed closely adjacent at least about 10% the perimeter of one or more collapsible profiles.

12. The sole unit of claim 11 wherein the midsole and/or outsole is closely disposed adjacent at least about 25% of the perimeter of one or more collapsible profiles.

13. The sole unit of claim 1 wherein the collapsible profile substantially comprises a non-amorphous material.

14. The sole unit of claim 1 wherein the collapsible profile is removably disposed on the sole unit.

15. The sole unit of claim 3 wherein the collapsible profile comprises an element having a generally vertical side wall facing outwardly and an angled sidewall facing inwardly, the collapsible profile facilitating selective collapse of the collapsible profile due to the angled differences of the walls to cant the shoe.

16. The sole unit of claim 3 wherein the collapsible profile extends downwardly from the bottom surface in a direction substantially perpendicular to the plane of the bottom surface.

17. The sole unit of 1 wherein a plurality of collapsible profiles comprising a resiliently compressible material are disposed in a plurality of parallel arrays, at least two arrays on opposite sides of a midline extending at least 25% the length of the sole unit.

18. The sole unit of 1 wherein a plurality of collapsible profiles comprising a resiliently compressible material are disposed in a plurality of parallel segments, at least two

segments on opposite sides of a midline extending at least 25% the length of the sole unit.

19. The sole unit of claim 16 wherein the collapsible profile has a curvilinear shape that generally corresponds to an adjacent side contour of the sole unit.

20. The sole unit of claim 1 wherein the top surface is fore-aft translatable relative to the bottom surface under a force applied generally perpendicular to the surface of the top or bottom surface.

21. The sole unit of claim 15 wherein, under a lateral force the bottom surface of the collapsible profile at the initial side of the lateral force may maintain substantial contact with the ground, and the top surface may laterally displace in the direction of the applied force, with the side of the sole unit canting towards the side at which the force is initially applied.

22. The sole unit of claim 21 wherein the ground contacting collapsible profile is disposed on a heel portion of a sole unit and spans the heel portion from a medial side, across a midline, to the lateral side of the heel portion.

23. The sole unit of claim 21 wherein the ground contacting collapsible profile is disposed on a forefoot portion of a sole unit and spans the forefoot portion from a medial side, across a midline, to the lateral side of the forefoot portion.

24. The sole unit of claim 1 wherein there are a plurality of the canting means on the sole unit, each allowing resilient fore-aft displacement of the top surface relative to the bottom surface.

25. The sole unit of claim 1 wherein the collapsible profile comprises a torsion element coupled to a canting means disposed on the bottom surface of the sole unit, the torsion element having opposing force transfer means at each end.

26. The sole unit of claim 25 wherein the canting means comprises a sleeve for receiving the torsion element and the torsion element comprises a rigid bar that may rotationally move in the sleeve.

27. The sole unit of claim 25 wherein the force transfer means comprise substantially rigid pads.

28. The sole unit of claim 25 wherein the canting means comprises a sleeve for receiving the torsion element and the force transfer means comprise substantially rigid pads.

29. The sole unit of claim 25 wherein the canting means is disposed at about a midline of the sole unit and force transfer means for a torsion element are located on opposite sides of the midline.

30. The sole unit of claim 29 wherein the torsion element is nonlinear and adapted to dispose one force transfer means forward of the canting means and the other rearward.

31. The sole unit of claim 30 wherein there are a plurality of collapsible profiles comprising a torsion element, canting means and force transfer means on the sole unit.

32. The sole unit of claim 25 wherein the collapsible profile also comprises a resilient element.

33. A sole unit for footwear having, comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its bottom surface, the collapsible profile comprises a torsion element coupled to a canting means disposed on the bottom surface of the sole unit, the torsion element having opposing force transfer means at each end wherein the canting means is disposed at about a midline of the sole unit and force transfer means for a torsion element are located on opposite sides of the midline.

34. The sole unit of claim 33 wherein the collapsible profile comprises a resilient element.

35. The sole unit of claim 34 wherein the torsion element is nonlinear and adapted to dispose one force transfer means forward of the canting means and the other rearward.

36. A sole unit for footwear having, comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one canting means on a portion of the bottom surface for laterally displacing the top surface from the bottom surface and canting the top surface relative to the bottom surface, according to the direction of an applied lateral force, the top surface forming an acute angle on the side of the sole unit to which the lateral force is generally applied and an obtuse angle on the opposite side.

37. A sole unit, comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its bottom surface, the collapsible profile being capable of selectively, resiliently canting a side of a user's foot upwardly on the side opposite an applied lateral force during use, the collapsible profile comprising opposing vertical displacement elements with an upper or lower horizontal displacement element disposed therebetween and, the vertical elements having upward and downward ends that interface with the upper and/or lower horizontal displacement elements via canting means, the canting means facilitating the deformation of the collapsible profile to provide selective canting of the user's foot.

38. The sole unit of claim 37 wherein the vertical displacement elements form an acute angle with the lower portion under static use conditions.

39. The sole unit of claim 37 wherein the collapsible profile has one displacement element on one side of a midline of the sole unit and the other displacement element on the opposing side, the upper and lower portions and vertical displacements disposed therebetween generally having a rhomboid-like shape.

40. The sole unit of 39 wherein there are a plurality of the rhomboid-like collapsible profiles disposed along a length of the sole unit.

41. The sole unit of claim 37 wherein the upper and/or lower horizontal displacement elements comprise elements integrated or attached to the sole unit.

42. A shoe having a sole unit comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its bottom surface, the collapsible profile being capable of selectively, resiliently canting a side of a user's foot upwardly on the side opposite an applied lateral force during use, the collapsible profile having a canting means for facilitating the selective canting of the user's foot.

43. A shoe having a sole unit comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its bottom surface, the collapsible profile comprises a torsion element coupled to a canting means disposed on the bottom surface of the sole unit, the torsion element having opposing force transfer means at each end wherein the canting means is disposed at about a midline of the sole unit and force transfer means for a torsion element are located on opposite sides of the midline.

44. A shoe having a sole unit comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its

bottom surface, the collapsible profile being capable of selectively, resiliently canting a side of a user's foot upwardly on the side opposite an applied lateral force during use, the collapsible profile comprising an upper portion and a lower portion, the upper portion being connected together by vertically disposed displacement elements therebetween, the vertical elements having upward and downward ends that interface with the upper and lower portion via canting means, the canting means facilitating the deformation of the collapsible profile to provide selective canting of the user's foot.

45. A method of constructing a shoe comprising, providing a sole unit comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its bottom surface, the collapsible profile being capable of selectively, resiliently canting a side of a user's foot upwardly on the side opposite an applied lateral force during use, the collapsible profile having a canting means for facilitating the selective canting of the user's foot, and attaching the sole unit to an upper for retaining the foot of a user.

46. A method of constructing a shoe comprising, providing a sole unit comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its bottom surface, the

collapsible profile comprises a torsion element coupled to a canting means disposed on the bottom surface of the sole unit, the torsion element having opposing force transfer means at each end wherein the canting means is disposed at about a midline of the sole unit and force transfer means for a torsion element are located on opposite sides of the midline, foot, and attaching the sole unit to an upper for retaining the foot of a user.

47. A method of constructing a shoe comprising, providing a sole unit comprising: a medial side, a lateral side, a top surface, and a bottom surface; the sole unit having at least one collapsible profile on a portion of its bottom surface, the collapsible profile being capable of selectively, resiliently canting a side of a user's foot upwardly on the side opposite an applied lateral force during use, the collapsible profile comprising an upper portion and a lower portion, the upper portion being connected together by vertically disposed displacement elements therebetween, the vertical elements having upward and downward ends that interface with the upper and lower portion via canting means, the canting means facilitating the deformation of the collapsible profile to provide selective canting of the user's foot, and attaching the sole unit to an upper for retaining the foot of a user.

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