US 20050086838A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2005/0086838 A1

Khantzis (43) Pub. Date: Apr. 28, 2005

(54) SHOE SOLE TO IMPROVE WALKING, SENSORY RESPONSE OF THE TOES, AND HELP DEVELOP LEG MUSCLES

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(21) Appl. No.: **10/800,233**

(22) Filed: **Mar. 11, 2004**

Related U.S. Application Data

(60) Provisional application No. 60/514,139, filed on Oct. 24, 2003.

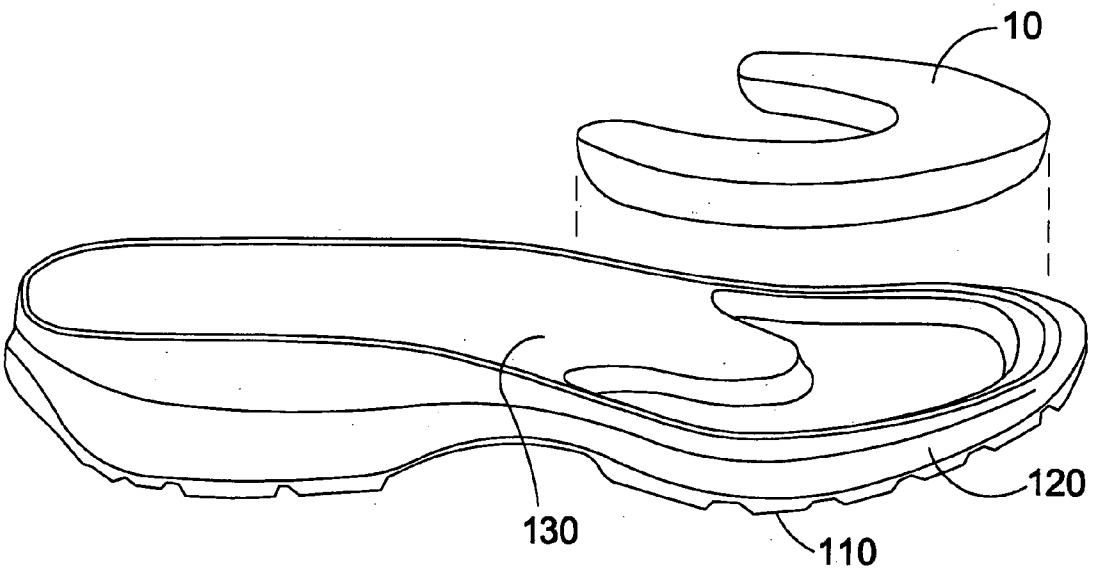
Publication Classification

(51) **Int. Cl.**[7] **A43B 13/18**

(52) **U.S. Cl.** ..... **36/30 R**; 36/25 R

(57) **ABSTRACT**

An improvement in the design of a shoe wherein a flexible material is placed inside the shoe sole at the level over the insole and below the toes of the foot and either above or also in line with the midsole, so that the wearer's toes rest along the flexible material when the wearer's foot is inserted into the shoe. The flexible material also extends to the area at the base of the big toe and behind the ball of the foot behind the big toe under the 1st metatarso-phalange joint base of the big toe. In a variation of the present invention, the flexible material only extends under the toes and does not extend behind the big toe. Therefore, in addition to all five toes resting on the flexible material, the ball of the foot area at the base of the big toe also rests on the flexible material. By filling the frontal section of the shoe sole with the flexible material, the flexible material permits the toes to curl downward when walking. The flexible material can be any type of-gel, deformable liquid or gel containing pack, polyurethane gel, silicone, soft rubber, foam, memory soft material, neoprene, polyvinyl, polyethylene, polyurethane and any type of natural or synthetic soft flexible material to simulate walking on sand.



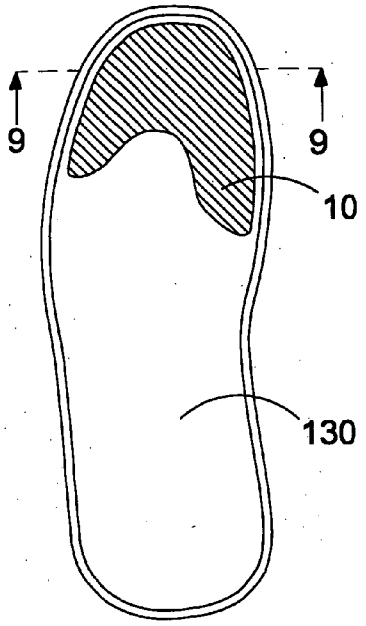


FIG.1

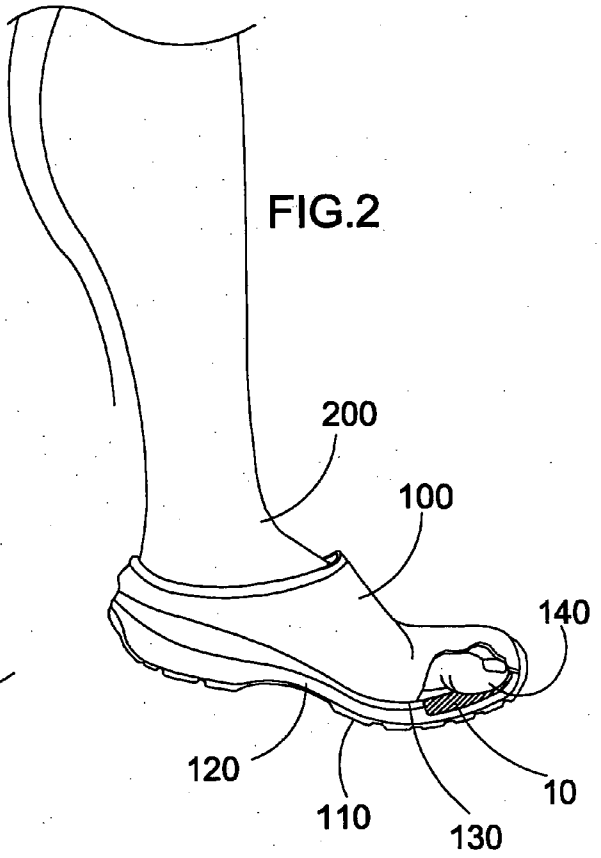


FIG.2

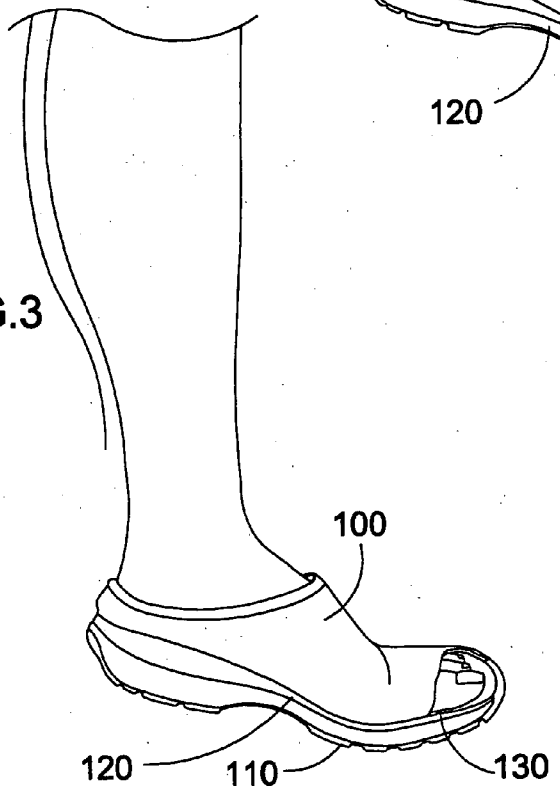


FIG.3

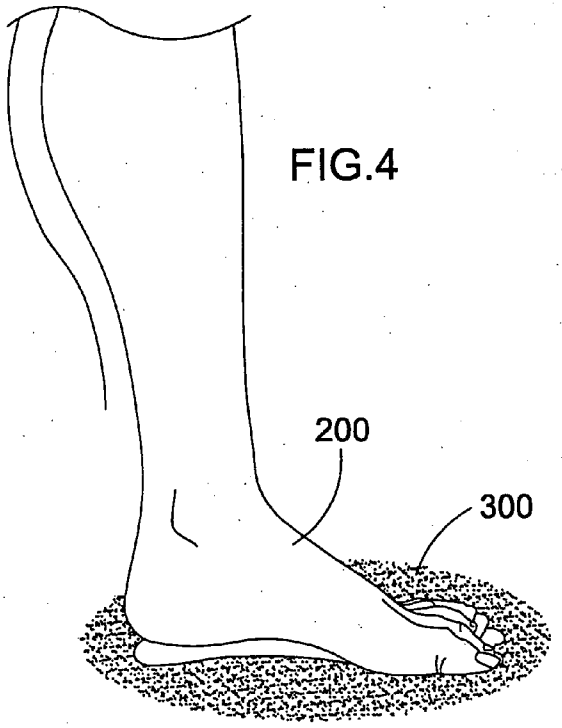


FIG.4

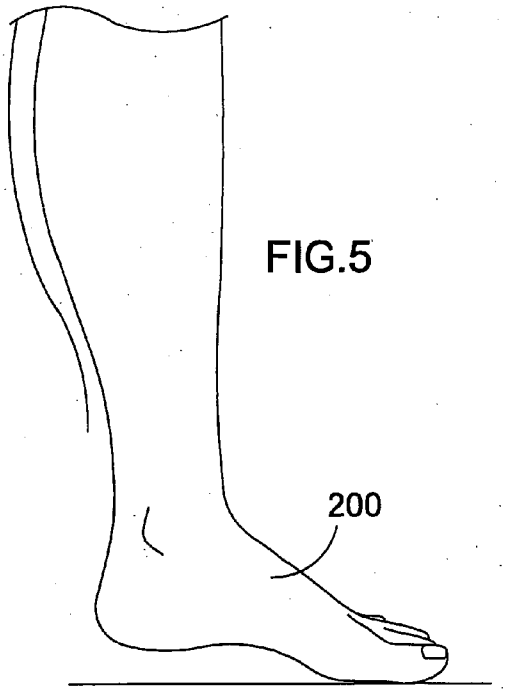


FIG.5

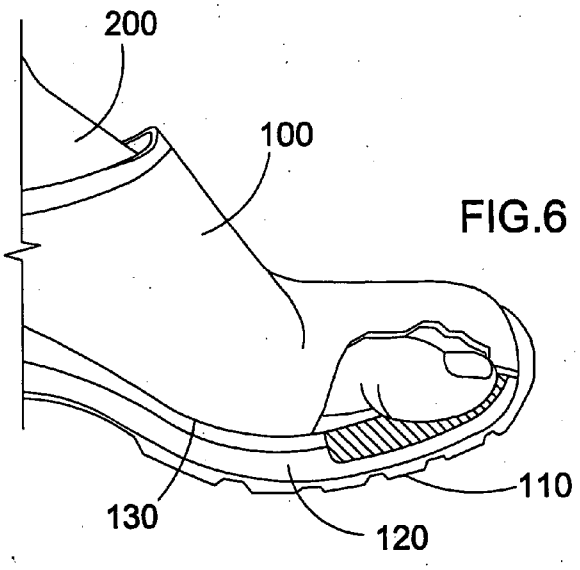
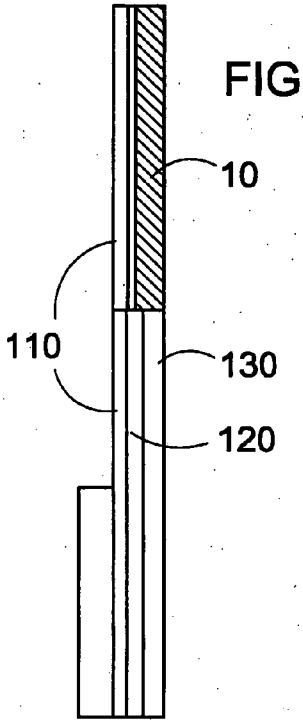


FIG.6

FIG.7



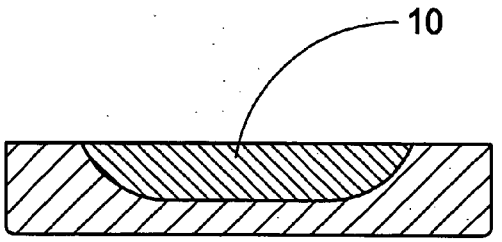
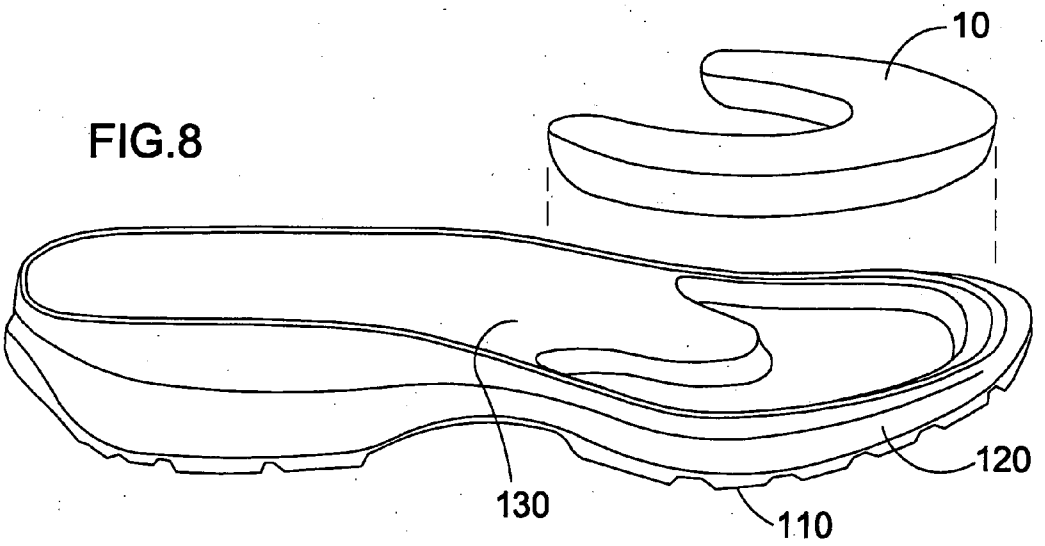


FIG.9

FIG.8



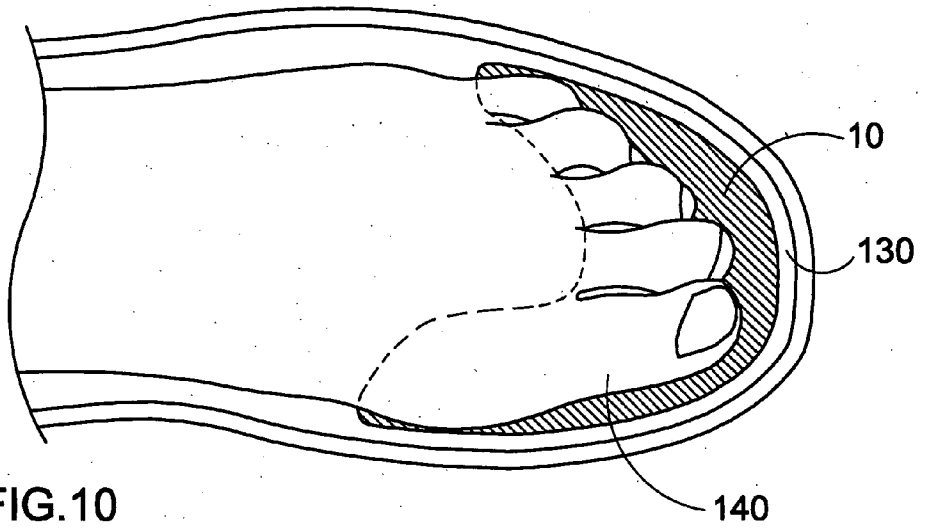


FIG.10

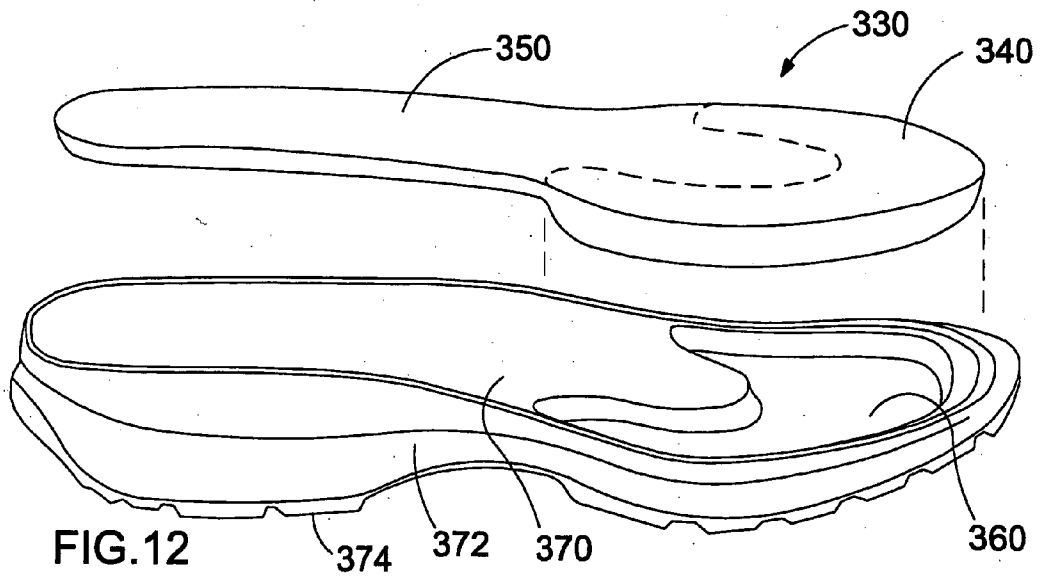


FIG.12

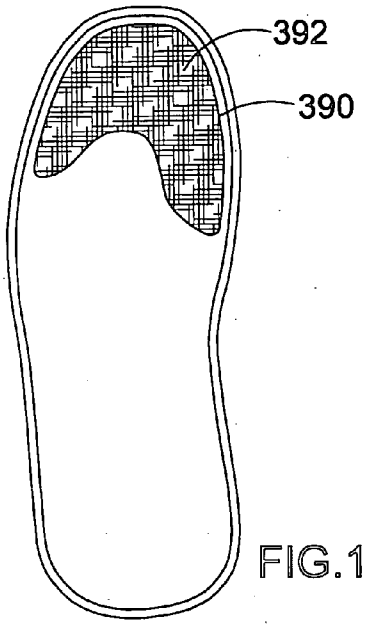


FIG.11

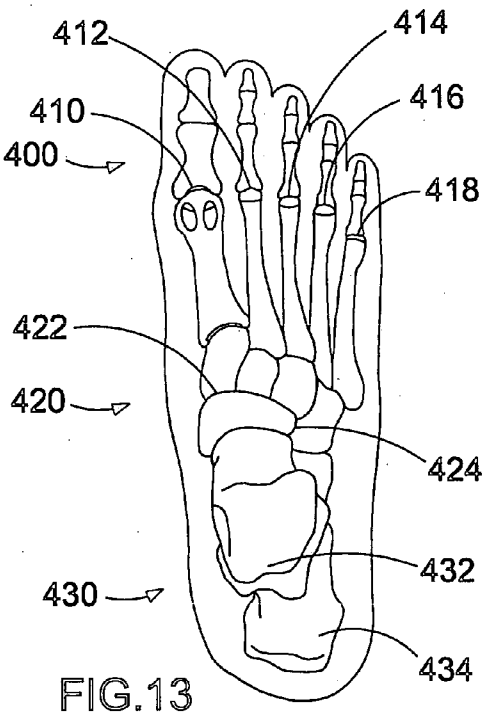


FIG.13

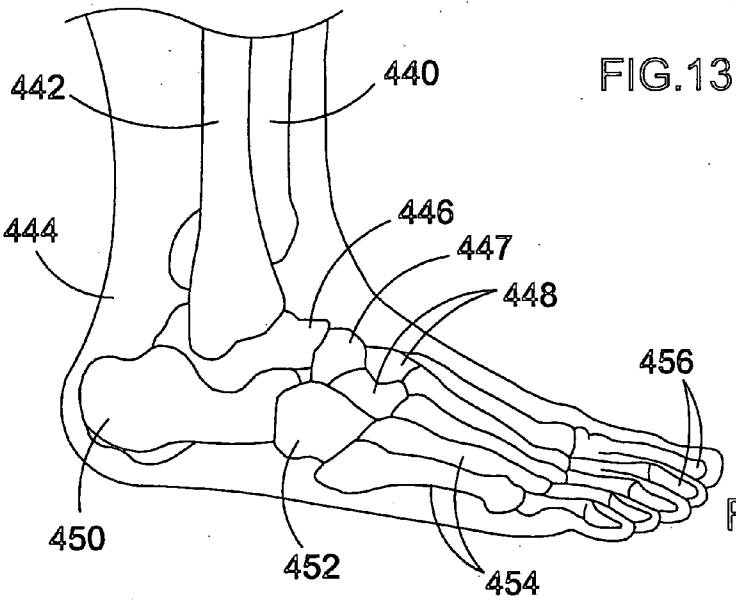


FIG.14

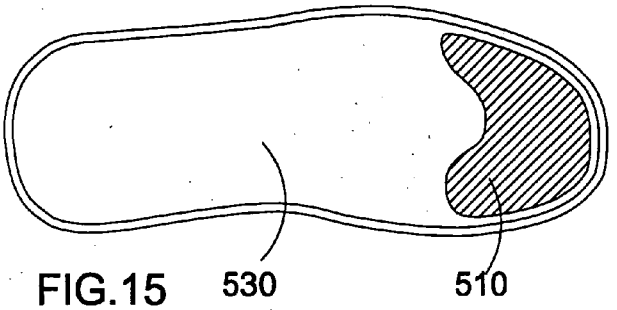


FIG.15

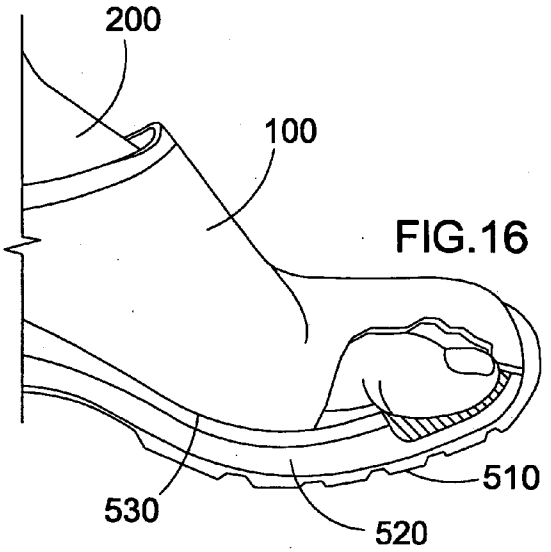


FIG.16

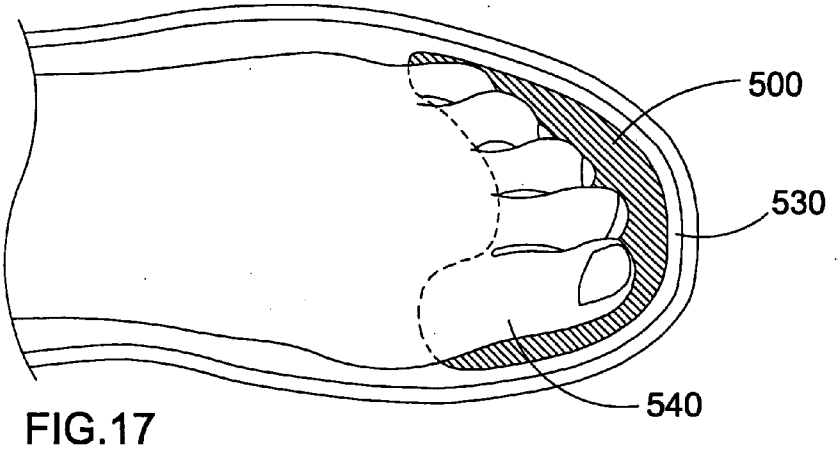


FIG.17

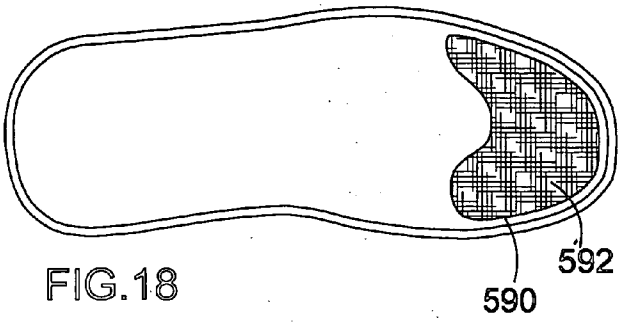


FIG.18

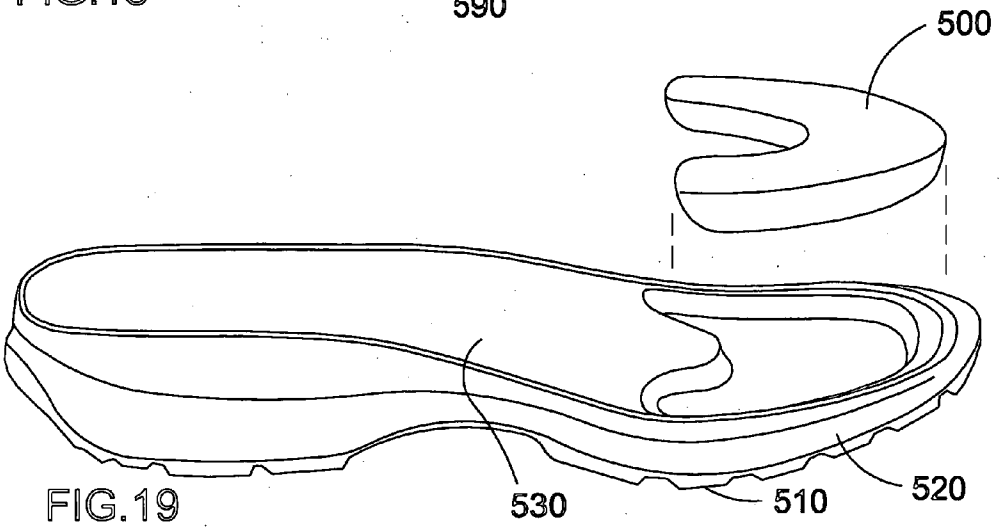


FIG.19

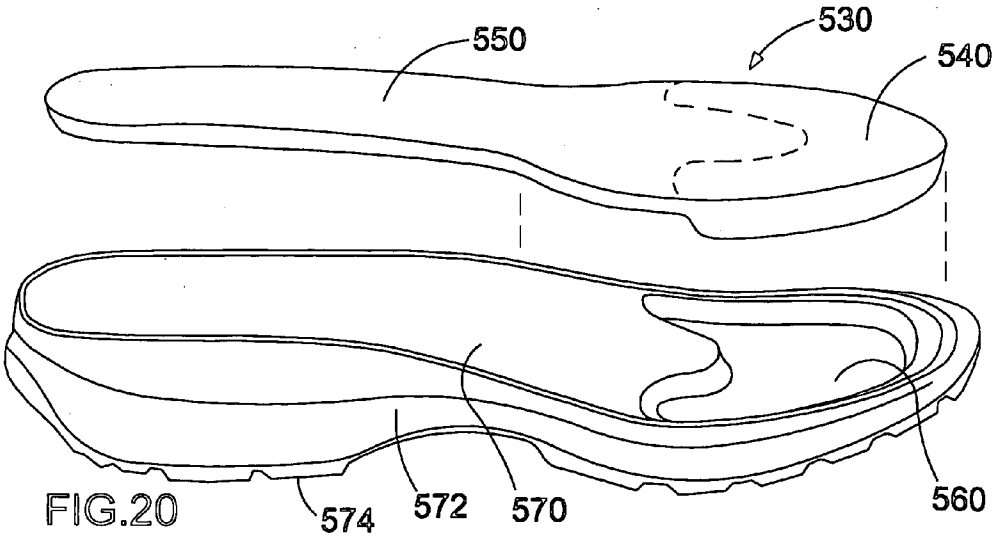


FIG.20

SHOE SOLE TO IMPROVE WALKING, SENSORY RESPONSE OF THE TOES, AND HELP DEVELOP LEG MUSCLES

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to the field of shoes and in particular, to a significant structural change in the construction of the sole of a shoe to provide greater mobility to the toes, which are partly immobilized today with other shoe sole designs.

[0003] 2. Description of the Prior Art

[0004] Each year, consumers spend hundreds of millions of dollars for "walking shoes" promising to help the wearer walk "right" or more comfortably. Each year, additional hundreds of millions of dollars are spent for orthotics designed to "normalize" foot balance, stability, and gait. Podiatrists and other medical practitioners are constantly applying therapies and ancillary products to correct gait faults and re-establish "normal" gait which contributes to the muscle development and enhancement of the calf area. While such therapies provide some relief from gait-induced distress symptoms, they are largely ineffectual in re-establishing natural gait. Why? Because natural gait is biomechanically impossible for any shoe-wearing person. Natural gait and shoes are biomechanically incompatible because all shoes automatically convert the normal to the abnormal, the natural to the unnatural. And no therapy or mechanical device, no matter how precisely designed or expertly applied, can fully reverse the gait from wrong to right. Gait is the single most complex motor function of the human body. So complex, in fact, that it is the only motor function for which a definition or standard or "normal" does not exist. It involves half of the body's 650 muscles and 200 bones, along with a large share of the joints and ligaments.

[0005] First, it is important to distinguish between "normal" and "natural." Normal is defined as an accepted standard, a mean or average. For example, everyone occasionally catches a cold; hence the common cold is "normal," though it is neither healthy nor natural. Conversely, natural means the pristine, ideal state, the ideal of form and function stemming from nature itself. Hence the difference between normal and natural is essentially the difference between what is and what can or ought to be.

[0006] Applying this to human gait, we can say that in shoe-wearing societies many people have what appears to be "normal" gait, while in shoeless societies they have "natural" gait. And there are pronounced differences between the two both in form and function.

[0007] In shoe-wearing societies a visibly faulty gait can often be corrected and made normal, but it can never be made natural as long as conventional shoes are worn. It is biomechanically impossible because of the forced alterations from the natural in foot stance, postural alignment, body balance, equilibrium, body mechanics and weight distribution caused by shoes.

[0008] The Role of Heels

[0009] The role of heels or heel heights has been given much attention in the literature because their influence is so obvious, especially on heels two or more inches in height. Barefoot, the perpendicular line of the straight body column creates a ninety-degree angle with the floor. On a two-inch heel, were the body a rigid column and forced to tilt forward, the angle would be reduced to seventy degrees, and to fifty-five degrees on a three-inch heel. Thus, for the body to maintain an erect position, a whole series of joint adjustments (ankle, knee, hip, spine, head) are required to regain and retain the erect stance.

[0010] In this reflex adjustment scores of body parts—bones, ligaments and joints, muscles and tendons—head to foot must instantly change position. If these adjustments are sustained over prolonged periods, or by habitual use of higher heels, as is not uncommon, the strains and stresses become chronic, causing or contributing to aches of legs, back and shoulders, fatigue, etc.

[0011] But the alterations are internal and organic, as well. For example, when standing barefoot, the anterior angle of the female pelvis is twenty-five degrees; on low, one-inch heels it increases to thirty degrees; on two-inch heels to forty-five degrees; on three-inch heels to sixty degrees. Under these conditions, what happens to the pelvic and abdominal organs? Inevitably, these must shift position to adapt.

[0012] Does the wearing of low, one-inch "sensible" heels prevent these problems of postural adaptation? No. All the low heel does is lessen the intensity of the negative postural effects. Hence, the wearing of heels of any height automatically alters the natural erect state of the body column. (Note: millions of men habitually wear boots or shoes with heels one and a half to three inches in height, such as on western boots or elevator shoes.)

[0013] But shoe heels have other, lesser-known influences on gait. For example, any heel, low to high, requires a compensatory alteration or forward slant on the last, which is translated to the shoe. This slant is known as the "heel wedge angle." This is the slope or slant of the heel seat, rear to front, to compensate for the shoe heel height. The higher the heel, the greater the angle.

[0014] On the bare foot there is no wedge angle. The bottom of the heel is on a level one hundred and eighty degrees, with body weight shared equally between heel and ball. Inside the heeled shoe the wedge angle shifts body weight forward so that on a low heel body weight is shared forty percent heel, sixty percent ball; and on a high heel ninety percent ball and ten percent heel.

[0015] Under these conditions the step sequence is no longer heel-to-ball-to toes and push-off, as with the bare foot. On heels two or more inches in height little weight is borne by the heel of the foot, an step push-off is almost wholly from the ball, and the toes, restricted by the hard sole surface are unable to "claw" in and push-off.

[0016] In medium to higher heels, due to the reduced base of the heel top-lift, the line of falling weight shifts, causing a wobbling of the less-secure ankle, which tilts medially. The shift in the body's center of gravity alters the equilibrium of the body column and prevents a natural step sequence,

[0017] One consequence is that heel strike moves to the lateral-rear corner of the heel top-lift. This is not natural. The heel of the shoeless foot receives its initial heel strike not at

the lateral-rear corner but in the center at the site of the plantar calcaneal tuberosity. The natural plantar path of the step sequence—heel to lateral border to ball to big toe (hallux) and push-off—is forced to shift, further affecting natural gait because the toes are restricted and unable to dig-in or claw-in.

[0018] Let's add one further influence of shoe heels, low to high. The shoe's elevated heel shortens the Achilles tendon and accompanying shortening of the calf muscles. Both the tendon and the muscles are, of course, vital to step propulsion and gait stamina—which may help to explain the performance dominance of marathon runners from nations where the barefoot state is common from infancy to adulthood.

[0019] The heeled shoe "steals" much of this propulsive power from the tendon and leg muscles. This not only places more stress on them to achieve needed propulsion, but power must be borrowed from elsewhere—knees, thigh muscles, hips, and trunk. A small army of anatomical reinforcements must come to the rescue of the handicapped tendon and calf muscles.

[0020] Thus a shoe heel of any height sets in motion a series of gait-negative consequences, making natural gait—meaning the barefoot form—impossible. While the invention does not fully correct the problem of high heels it will help mitigate the effect by making the foot return to the heel-to-ball-to toes and push-off walk as with the bare feet.

[0021] Toe Spring

[0022] If you rest a shoe, new or old, on a table and view it in profile from the side, it reveals an up-tilt of the toe tip varying from five-eighths to one inch or more. More on worn shoes. This is known as "toe spring" and is built into the last.

[0023] On the bare, natural foot the digits rest flat, their tips grasping the ground as an assist in step propulsion, which constrict the calf muscles contributing to their enhancement. Inside the shoe, the digits are lifted slantwise off the ground, unable to fulfill their natural ground-grasping function.

[0024] A toe spring is built into the last to compensate for lack or absence of shoe flexibility at the ball. The toe spring creates a rocker effect on the shoe sole so that the shoe, instead of full flexing as it should, forces the foot to "roll" forward like the curved bottom of a rocking chair. The thicker the sole, such as on sneakers or work boots, or the stiffer the sole, the greater the toe spring needed because of lack of shoe flexibility.

[0025] With toe spring, the toes of the foot are constantly angled upward five to twenty degrees, depending upon the amount of shoe toe spring. Functionally, they are "forced out of business," denied much or all of their natural ground-grasping action and exercise so essential to exercising of the entire foot and calf muscles because 18 of the foot's 19 tendons are attached to the toes.

[0026] The combination of the up-tilted toes caused by the toe spring, and the down-slanted heel and foot caused by the heel wedge angle, create an angle apex at the ball where the two angles converge. The angle apex has a dagger-point effect on the ball. This is certainly an important contributing cause of metatarsal stress symptoms and lesions.

[0027] Equally important, the natural gait mechanics are affected. Because the big toe (hallux) and other digits are largely immobilized by their up tilted position, the step propulsion must come almost wholly from the metatarsal heads in the ball of the foot. This not only imposes undue stress on the heads, but also forces an unnatural alteration of the gait pattern itself.

[0028] The shoe's last, the form of mold over which the shoe is made, is not visible to the consumer. but it bears much influence on the shoe and gait. There are several built-in design faults with most commercial lasts, but two in particular have relevant influence on gait and calf muscle development.

[0029] First, almost all shoe lasts are designed with inflare, whereas almost all feet are designed on a straight axis. This automatically creates a biomechanical conflict between foot and last (or shoe). This is the prime reason why virtually all shoes go out of shape with wear—because foot and shoe are mismated. If, because of this conflict, the foot cannot function naturally inside the shoe, it cannot take a normal or natural step.

[0030] A second common fault of the last is the concavity at most lasts under and across the ball, which is automatically "inherited" by the shoe at the same site.

[0031] The reason conventional lasts are made with a concavity under the ball. About 80 years ago a shoe manufacturer discovered that the foot could be made to look smaller and trimmer by allowing it to "sink" into a cavity in the shoe that no one would see—thus reducing the amount of foot volume visible above. It was so successful in its mission of smaller-looking feet that it was quickly adopted by other manufacturers. It has long since become a standard part of last design.

[0032] This cavity is further accentuated by the construction of the shoe itself, wherein the space between outsole and insole must be filled with a special filler material (ground cork, foam rubber, fiberglass, etc.). However, the combination of the foot's heat, moisture, and pressure forces the filler material to compress and "creep," deforming its original flat surface.

[0033] The combination of the concave-bottom last at the ball an the compression and creep of the filler material sinking into the cavity, creates a sinkhole into which the three middle metatarsal heads at the ball of the foot fall as the first and fifth heads rise on the rim. We thus have the classic "fallen" metatarsal arch. The application of a metatarsal pad, whether in the shoe or via an orthotic or strapping, provides relief—not because it "raises" the arch but simply by filling in the cavity and returning the heads to their natural level plane.

[0034] Therefore, the important role of the metatarsal heads as a fulcrum (pivot) and the toes as grasping-gripping mechanisms for step propulsion is seriously diminished. The step push-off is now almost entirely from the ball, and weakly so because the metatarsal heads are pushing from a cavity rather than from a flat surface. A propulsive energy must now be drawn from other sources—Legs, thighs, hips, the forward tilt of the trunk and shoulders—with undue strain on all those body sectors. The gait loses natural form and function and the calf muscles are not developed.

[0035] Ironically, the closest we have ever come to an "ideal" shoe was the original lightweight, soft-sole, heel-less, simple moccasin, which dates back more than 14,000 years. It consisted of a piece of crudely tanned but soft leather wrapped around the foot and held on with rawhide thongs. Presto! custom fit, perfect in biomechanical function, and no encumbrances to the foot or gait.

[0036] It took four million years to develop our unique human foot and our consequent distinctive form of gait, a remarkable feat of bioengineering. Yet, in only a few thousand years, and with one carelessly designed instrument, our shoes, we have warped the pure anatomical form of human gait, obstructing its engineering efficiency, afflicting it with strains and stresses and denying it its natural grace of form and ease of movement head to foot. The invention hopes to correct this problem.

[0037] Sensory Response

[0038] The soles and tips of the toes contain over 200,000 nerve endings, perhaps the densest concentration to be found anywhere of comparable size on the body. In this respect, little attention has been given to the sensory response of the foot and its enormous influence on gait. Our nerve-dense soles are our only tactile contact with the physical world around us. Without them we would lose equilibrium and become disoriented.

[0039] Says orthopedist Philip Lewin, "The foot is the vital link between the person and the earth, the vital reality of his day-to-day existence." City College of New York anatomists Todd R. Olson and Michael E. Seidel write, "Because the sole is so abundantly supplied with tactile sensory nerve endings, we use our feet to furnish the brain with considerable information about our immediate environment."

[0040] Thus there is a sensory foot/body, foot/brain connection vital to body stability, equilibrium, and gait.

[0041] Yet, much of it is denied us because of our thick-layered, inflexible shoes that shut off a considerable amount of this electromagnetic inflow and our sensory response to it. B. T. Renbourne, M.D., of England's Brookside Hospital, has done considerable research in this field. He writes, "Modern shoes give good wear, but they also impair the foot's sensory response to the ground and earth, affecting the reflex action of the foot and leg muscles in gait. This sensory foot contact is essential for stable, sure-footed walking."

[0042] It is well known by both common experience and clinical testing that infants are able to walk with much more confidence and stability barefoot than with shoes on. In fact, the same can be said of adults. This is not only because of the foot's biomechanics (flexing, toe grasping, heel-to-toe step sequence, etc.), but also because of the neural energy assist from the sensory response.

[0043] However, when several layers of shoe bottom materials are packed between foot and ground, a certain amount of sensory blockage is inevitable, and the gait loses some of its natural energies and functional efficiency. (Why Shoes Make "Normal" Gait Impossible, How flaws in footwear affect this complex human function. By William A. Rossi, D.P.M.)

[0044] Shoe soles constructed of flexible materials or deformable liquid or gel containing packs, or gel filled padding made out of a gel pack encased in a stretch Lycra® fabric or gel filled plastic container, non-leaking semi-solid gel filled padding, silicone, foam, memory foam or any memory type material, or any soft material, rubber or synthetic plastic material, are known in the art. However, such prior shoe sole support systems primary objective and function is to provide cushioning for comfort and shock absorption and do not provide the toes the ability to flex down ward or provide grasping-gripping motion or improve or induce calf muscle tone development in a manner similar to walking on sand barefooted.

[0045] Other prior systems provide support for the heel or hind foot and at the arches or mid foot or at the ball of foot with deformable flexible materials for cushioning and shock absorption by creating a dense area of material for padding sometimes as thick as 20 mm at those points and some have cushioning materials through the entire foot, but none permit the toes to bend downward in a grasping gripping motion and none have a thick layer of deformable material only below the area where the toes will rest. Further, none provide for a deformable flexible material or deformable liquid or gel built inside a chamber or cavity engineered into the shoe sole and deep into the mid-sole with a deepness of at least 6 mm in a contoured area underneath the toes shaped around the upper border of the ball of the foot and/or starting right below and including the ball of the big toe (1^{st} metatarso-phalangeal joint) and the other digits (lesser metatarso-phalangeal joints), that will permit the toes to flex and bend downward in a grasping motion in a fashion similar to the effect of walking on sand giving mobility and grasping action to the toes nor will they permit the toes to bend downward to a degree enough to induce contractions to stimulate calf muscle development and growth.

[0046] Further, other systems have cavities or chambers engineered into the mid-sole for the insertion of deformable materials or gels, but only underneath the heel, the arches or the ball of the foot and none have cavities or chambers engineered only into the section of the toe tip underneath the toes in shape contoured underneath the toes shaped around the upper border of the ball of the foot and/or starting right below and including the ball of the big toe (1^{st} metatarso-phalangeal joint) and the other digits (lesser metatarso-phalangeal joints), that will permit the toes to flex and bend downward in a grasping motion in a fashion similar to the effect of walking on sand giving mobility and grasping action to the toes.

[0047] The relevant bones of the foot are illustrated in **FIG. 11**. The forefoot **440** includes the first metatarso-phalangeal joint **410** and lesser metatarso-phalangeal joints **412**, **414**, **416** and **418**. The mid foot **420** includes the talo navicular joint **422** and the calcaneo cuboid joint **424**. The rear foot **430** includes the approximate position of the subtalar joint **432** and the calcaneous (heel) bone **434**. The relevant bones of the leg are also illustrated in **FIG. 12** and these include the tibia **440**, the fibula **442**, the Achilles tendon **444**, the astragalus **446**, the scaphoid **447**, the cuneforms **448**, the heels **450**, the cuboid **452**, the metatarsals **454** and the phalanges **456**.

[0048] The following fifteen patents or patent applications are found to be relevant to the present invention.

[0049] 1. U.S. Pat. No. 2,760,281 issued to Cosin on Aug. 28, 1956 for "Moldable Foot Support" (hereafter the "Cosin Patent");

[0050] 2. U.S. Pat. No. 2,863,231 issued to Jones on Dec. 9, 1958 for "Fabrication of Footwear Having Differentially Deformable Insoles" (hereafter the "Jones Patent");

[0051] 3. U.S. Pat. No. 3,103,931 issued to Knellwolf on Sep. 17, 1963 for "Shoe Sole" (hereafter the "Knellwolf Patent");

[0052] 4. U.S. Pat. No. 3,257,742 issued to Feinberg on Jun. 28, 1966 for "Foot Support For Shoes" (hereafter the "Feinberg Patent");

[0053] 5. U.S. Pat. No. 4,934,073 issued to Robinson on Jun. 19, 1990 for "Exercise-Enhancing Walking Shoe" (hereafter the "Robinson Patent");

[0054] 6. U.S. Pat. No. 4,955,147 issued to Bos on Sep. 11, 1990 for "Shoe, Sandal Or Similar Footwear" (hereafter the "Bos Patent");

[0055] 7. U.S. Pat. No. 5,692,318 issued to Aliano on Dec. 2, 1997 for "Golf Shoe Sole" (hereafter the "Aliano Patent");

[0056] 8. U.S. Pat. No. 5,752,330 issued to Snabb on May 19, 1998 for "Athletic Shoes With Reverse Slope Sole Construction" (hereafter the "Snabb Patent");

[0057] 9. U.S. Pat. No. 6,312,361 B1 issued to Hayes on Nov. 6, 2001 for "Synthetic Sand Frontal Training Shoe" (hereafter the "Hayes Patent");

[0058] 10. U.S. Pat. No. 6,516,540 B2 issued to Seydel et al. on Feb. 11, 2003 for "Ground Contacting Systems Having 3D Deformation Elements For Use In Footwear" (hereafter the "Seydel Patent");

[0059] 11. PCT Application No. PCT/HU89/00032 filed on Jun. 28, 1989 for "Footwear" (hereafter the "'00032 PCT Application").

[0060] 12. U.S. patent Publication US 2003/0208930 A1 published on Nov. 13, 2003 filed by inventor Swigart for "FOOTWEAR SOLE COMPONENT WITH A SINGLE SEALED CHAMBER" (hereafter "Swigart Application").

[0061] 13. U.S. patent Publication US 2001/0045028 A1 published on Nov. 29, 2001 filed by inventors Crane et al. for "GEL INSOLES WITH LOWER HEEL AND TOE RECESSES HAVING THIN SPRING WALLS" (hereafter "Crane Application").

[0062] 14. U.S. patent Publication US 2003/0024134 A1 published on Feb. 6, 2003 filed by inventors Howlett et al. for "INSOLE FOR FITNESS AND RECREATIONAL WALKING"(hereafter "Howlett Application").

[0063] 15. U.S. patent Publication US 2003/0121180 A1 published on Jul. 3, 2003 filed by inventor Poe for "ELASTOMERIC, ENERGY MANAGEMENT CUSHION" (hereafter "Poe Application").

[0064] The Cosin Patent discloses a moldable foot support in the front area of the shoe, primarily behind the base of the big toe and that portion of the foot behind the toes, not at the location of the toes.

[0065] The Jones Patent is a fabrication of footwear having differentially deformable insoles which are located at the heel of the foot and also right in front of the front arch of the foot, behind the fifth metatarsal support area.

[0066] The Knellwolf Patent emphasizes the benefits of walking barefoot on a beach upon wet sand. This patent discloses the concept of placing soft material within the shoe although it is in a whole area of the front and the back heel portion of the shoe as shown in **FIGS. 2, 3** and **4**.

[0067] The Feinberg Patent is a foot support for shoes wherein it appears to be placed in the entire location of the shoe. As set forth in Column 7, Line 11, "When the foot support is placed in the shoe, the foot will sink into the soft pad providing a type of support found in nature when walking on soft sod or sand." In this case it is an entire soft pad in the shoe.

[0068] The Robinson Patent discloses a walking shoe which includes a reverse wedge which increases in thickness in the forward section. The reverse wedge terminates forward of the shoe heel. The design is to enhance the amount of the exercise of the walker while walking.

[0069] The Bos Patent discloses a shoe (1) having a flat inner surface (5) and between said flat inner surface (5) and the instep a flat layer (6, 12) of constant thickness for support of the foot, which flat layer (6,12) is of a highly springy elastic material with a high elastic recovery capacity. It is an entire layer in the entire surface of the inner shoe.

[0070] The Aliano Patent discloses a golf shoe sole. A portion of the shoe disposed between the ball of the foot of the user is thicker than the region disposed below the heel of the user in order to balance the user. The toes of the user may be braced forward to shift the weight of the user back to better balance the user. This is shown in particular in item no. 28 of **FIG. 10** to which I direct your attention. The purpose of this is to provide better balancing.

[0071] The Snabb Patent is an athletic shoe with reverse slope sole construction. The concept is to place the heel of the shoe inner sole significantly lower than the ball of the foot and toes.

[0072] The Hayes Patent discloses an athletic training shoe that is designed to simulate beach training so as provide the user with all of the positive effects of beach training. The athletic training shoe is comprised of a highly pliable foot receiving member which places the user's foot in an ample depth of sand simulating material contained by a material holding element, positioned specifically under the front portion of the user's foot.

[0073] The Seydel Patent is a very long and extensive patent on a ground contacting system having 3D deformation elements for use in footwear. Referring to Column 52, the patent states "The inventors have found that a new ground contacting system can be designed to provide adequately damping action and to mimic the light sliding action a shoe experiences when a user walks or runs on dirt, sand or gravel."

[0074] Going to Column 53, the patent states "The present invention seeks to advance the state of the art of athletic footwear by providing anisotropic deformation pads that can be applied to the shoe soles to simulate the sliding that occurs when running on a dirt road." The pads are placed at various locations in the shoe.

[0075] The PCT Application discloses footwear having a sole part (1) made of some flexible material and formed with a double layer, with an upper layer (2) and a lower layer (3). Between the two layers there is a space forming a closed cavity which is filled with a material of liquid state.

[0076] The Swigart Application, shows a sole component for footwear combining the desirable response characteristics of a fluid filled chamber and an elastomeric material. The chamber can be formed as a single bladder chamber in contact with an elastomeric midsole, or a single chamber formed by a sealing a void in elastomeric material.

[0077] The Crane Application discloses a removable insole for insertion into footwear, which includes a lower layer made of a viscoelastic gel and including a lower surface, an upper surface, a toe portion, a heel portion, and a medial arch portion interconnecting the toe portion and the heel portion, a first recess formed in the lower surface of the toe portion and the a second recess formed in the lower surface of the heel portion, each recess having a peripheral side wall and a top wall, a plurality of thin, parallel, spaced apart sinusoidal wave shaped spring walls formed from the viscoelastic gel and connected to the top wall and the peripheral side wall in each recess.

[0078] The Howlett Application discloses an insole for fitness and recreational walking and includes a plurality of spaced apart spring walls formed with a viscoelastic gel in a first recess, the spring walls having lower edges generally coplanar with the lower surface of the forefoot portion which is in surrounding relation to a first recess; and a shell extending under the mid foot portion and made of resilient material that is stiffer than the unitary resilient material. The gel material is in the general forefoot area but is not under the toes as in the present invention.

[0079] The Poe Application is an elastomeric, energy management cushion. The invention is elastomeric, energy-management cushion formed of at least one or more spaced, expandable, geometrically shaped cushioning elements disposed in a pattern on the supporting base of the shoe.

SUMMARY OF THE INVENTION

[0080] The present invention pertains to a flexible support system for the toes of the foot built inside a chamber or cavity engineered into the shoe sole and deep into the mid-sole in a contoured area shaped around the upper border of the ball of the foot at the base of the toes starting right below and including the ball of the big toe (1st metatarsophalangeal joint) and the other digits (lesser metatarsophalangeal joints), that will permit the toes to flex and bend downward in a grasping motion in a fashion similar to the effect of walking on wet sand giving mobility and grasping action to the toes (hallux and other digits) shifting the step propulsion from the ball of the foot (metatarsal heads) back to the toes improving gait and resulting in a more natural walk by returning the step sequence to heel-to-ball-to-toes and push-off as with bare feet. In a variation of the present invention, the flexible system described above only extends beneath the toes and does not extend to the ball of the big toe.

[0081] In particular, this invention pertains to a toe support system, which will allow the user to rest his or her toes on a deformable and flexible surface or liquid container or gel pack or other soft flexible materials. Further, in particular, this invention pertains to a support system for the toes, which includes flexible and deformable members, which deform to the contour of a particular user's toes and further disperses the load applied over a wider area to give the toes flexibility, mobility, deep cushioning support and grasping-gripping motion.

[0082] Further, this invention pertains to a toes support system that will return to the toes their natural ground-grasping action inducing a more natural gait and a walking pattern of heel-to-ball-to-toes and push-off as with bare feet, shifting the body's center of gravity and altering the equilibrium of the body column resulting in a natural step sequence similar to walking barefooted.

[0083] More in particular this invention will result in an enhancement or build-up of the calf-muscles by recreating the beneficial effect that walking barefooted on sand or other soft surfaces have on the calf muscles by permitting the toes, which are now partly immobilized with other shoe sole designs, to flex and bend downward deep into the cavity or chamber of the shoe sole filled with the deformable system in a grasping-gripping motion for step propulsion, which results in contractions of the calf muscles improving muscle tone and calf muscle development.

[0084] Still further, this invention directs itself to a support system for the toes where the deformable portion of the system is imbedded in a cavity or chamber inside the shoe sole and by permitting the toes to flex deep into the deformable portion of the cavity or chamber it will provide the tips of the toes with a sensory stimulation improving the body's response to the ground and earth affecting the reflex action of the foot and leg muscles in gait restoring the foot's biomechanics of flexing, toe grasping and heel-to-toe step sequence. The invention will add greater comfort and sensory response to the toes improving stability and equilibrium as well as completely new sensory experience as the tips of the toes are stimulated by the deformable base.

[0085] The present invention is an improvement in the design of a shoe sole wherein a flexible support system for the toes is provided to give the toes mobility and gripping-grasping motion. The toe support system includes a deformable liquid or gel containing packs or gel filled padding made out of a gel pack encased in a stretch Lycra® fabric or gel filled plastic container, or an insole with a deformable material built-in and engineered to fit inside a cavity in the midsole, non-leaking semi-solid Gel filled padding, silicone, foam, memory foam or any memory type flexible material, or any soft material, soft rubber or soft synthetic plastic material in varying thickness depending on the thickness of the sole but no less than 6 mm in depth, which will permit the toes to flex, curl, bend or grasp downward.

[0086] The toes support system is built inside or inserted inside a chamber or cavity or engineered inside the shoe sole area below the toes at the level of the insole and either below or also in line with the midsole reaching the level of the insole, so that the wearer's toes rest along the flexible material when the wearer's foot is inserted into the shoe. The toes support system extends in a contoured area shaped around the upper border of the ball of the foot starting right below and including the ball of the big toe (1st metatarsophalangeal joint) and the other digits (lesser metatarsophalangeal joints), that will permit the toes to flex and bend

downward in a grasping motion in a fashion similar to the effect of walking on sand giving mobility and grasping action to the toes (hallux and other digits). In a variation of the present invention, the flexible system described above only extends beneath the toes and does not extend to the ball of the big toe.

[0087] The forefoot is composed of the five toes (called phalanges) and their connecting long bones (metatarsals). Each toe (phalanx) is made up of several small bones. The big toe (hallux) has two phalanges, two joints (interphalangeal joints), and two tiny, round sesamoid bones that enable it to move up and down. The other four toes each have three bones and two joints. The phalanges are connected to the metatarsals by five metatarsal phalangeal joints at the ball of the foot. The forefoot bears half the body's weight and balances pressure on the ball of the foot. The flexible material will be inserted below the toes area.

[0088] Therefore, in addition to all five toes resting on the flexible material, the base of the big toe right below the 1st. metatarso-phalangeal joint may also rest on the flexible material. By filling the frontal section of the shoe sole with the flexible material, the flexible material permits the toe to curl downward when walking. The flexible material can be any type of deformable liquid or gel containing packs, or gel filled padding made out of a gel pack encased in a stretch Lycra® fabric or gel filled plastic container, non-leaking semi-solid gel filled padding, silicone, foam, memory foam or any memory type material, or any soft material, rubber or synthetic plastic material, all which may be treated with fungicides, which will permit the toes to flex, curl, bend or grasp downward for step propulsion.

[0089] It has been discovered, according to the present invention, that if the frontal area of the shoe sole is filled with a flexible material such as a flexible gel, deformable liquid or gel containing pack and covered with a material that will stretch, the toes and base of the big toe which rest on the flexible material can curl downward, so that the invention enables the wearer to simulate the effect of walking on sand.

[0090] It is therefore an object of the present invention to redesign the front of a shoe sole so that it simulates walking on sand so that the shoe will permit the toes to curl downward and complete the natural motion of the foot and complete a natural gait.

[0091] It is also an object of the subject invention to improve calf muscle tone, development and enhancement by recreating the beneficial effect that walking on sand has on the development of the calf muscles. Through the effect of causing the toes to flex and curl down-ward in a grasping-gripping mechanism for step propulsion this will also result in a contraction of the gastrocnemius (double headed muscle that forms the back of the calf), the soleus and the peroneus muscles thereby contributing to their enhancement and development.

[0092] A further object of the present invention is to induce a walking pattern of heel-to-ball-to-toes and push-off as with the bare foot, shifting the body's center of gravity and altering the equilibrium of the body column resulting in a natural step sequence similar to walking barefooted.

[0093] Still further, an object of the subject invention will give mobility to the big toe (hallux) and other digits, which are partly immobilized today with other shoe sold designs, shifting step propulsion from the ball of the foot (metatarsal heads) back to the toes.

[0094] A still further object of the subject invention is to provide the tips of the toes with a sensory stimulation improving the body's response to the ground and earth affecting the reflex action of the foot and leg muscles in gait. The sensory foot/body, foot/brain connection vital to body stability, equilibrium and gait is now "turned-on" and functioning. The foot's biomechanics (flexing, toe grasping, heel-to-toe step sequence is also restored.

[0095] Still further, an object of the subject invention system is to provide a toe support system wherein a liquid containing pack is inserted inside a chamber or cavity on the sole of the shoe underneath the toes.

[0096] A still further object of the subject toe support system is to provide a releasably secured liquid containing pack or gel pack which deforms and is flexible responsive to interface with the user's toes when the users his or her toes thereon.

[0097] Another object of the toe support system is to disperse the load forces applied by the toes during the grasping-gripping motion during walking.

[0098] A further object of the toe support system is to a provide a releasably secured liquid containing or gel pack captured within a pocket formed to correspond to a particular shape which permits the ball of the big toe and other digits to rest on and bordering the ball of the foot.

[0099] Another embodiment of the invention of the toe support system is to provide for an insole that has a deformable material or bladder elements which are encapsulated in place during the midsole formation and dropped into shallow straight cavity inside the midsole and cemented in place. The top layer of can be made from any suitable stretch material that will permit the toes to bend and curl downward.

[0100] Although the present invention has been disclosed relative to a specific cavity depth inside the midsole, it will be appreciated that an mid-sole according to the present invention can be made to various shapes, depth and thickness.

[0101] Further, although the front section of the shoe sole has been shown to have a uniform height along the entire width thereof, other variations may provide for various shapes.

[0102] Although the present invention uses the term midsole, it will be appreciated that the use of other equivalent or similar terms such shoe sole or innersole are considered to be synonymous and interchangeable, and thereby covered by the present invention.

[0103] Further novel features and other objects of the present invention will become apparent from the following detailed description, discussion and the appended claims, taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0104] Referring particularly to the drawings for the purpose of illustration only and not limitation, there is illustrated:

[0105] Referring particularly to the drawings for the purpose of illustration only and not limitation, there is illustrated:

[0106] **FIG. 1** is a top plan view of a shoe with the section cut away to illustrate the present invention in the toe area at the location of the insole;

[0107] **FIG. 2** is a side elevational view of a shoe which is a left shoe with the toe section cut away to illustrate the present invention, with a left foot placed inside the shoe to illustrate the toe down with the shoe flat;

[0108] **FIG. 3** is a side elevational view of a shoe which is a left shoe with the toe section cut away to illustrate the present invention, with the left foot inserted in the shoe and demonstrating the present invention in the ordinary walking position;

[0109] **FIG. 4** is an illustrative view of a left foot walking on sand with the left toe down pressing against the sand;

[0110] **FIG. 5** is an illustrative view of a left foot walking on a flat surface with the left foot flat;

[0111] **FIG. 6** is a close-up view of a shoe which is a left shoe with the toe section cut away to illustrate the present invention, with a left foot placed inside the shoe to illustrate the toe down with the shoe flat;

[0112] **FIG. 7** is a cross-sectional view of a shoe illustrating the embodiment where the gel is aligned with the insole and the midsole;

[0113] **FIG. 8** is an exploded view illustrating the present invention removed from its cavity within the shoe;

[0114] **FIG. 9** is a cross-sectional view taken along line **9-9** of **FIG. 1**;

[0115] **FIG. 10** is a top plan view of a shoe with the top section cut away to illustrate the five toes resting over the present invention area;

[0116] **FIG. 11** is a top plan view of a shoe with the top section cut away to illustrate the base of the shoe incorporating another embodiment of the present invention with the gel area covered by a covering layer;

[0117] **FIG. 12** is an exploded view illustrating an alternative embodiment of the present invention;

[0118] **FIG. 13** is a top view of a skeletal drawing of bones of a foot;

[0119] **FIG. 14** is a side view of the skeletal drawing of the bones of a foot and ankle area;

[0120] **FIG. 15** is a top plan view of a shoe with the section cut away to illustrate a variation of the present invention in the toe area at the location of the insole where the gel only extends beneath the toes and does not extend beyond the 1st metatarso-phalangeal joint of the ball of the big toe;

[0121] **FIG. 16** is a close-up view of a shoe which is a left shoe with the toe section cut away to illustrate the variation of the present invention wherein the gel only extends beneath the toes, with the left foot placed inside the shoe to illustrate the toe down with the shoe flat;

[0122] **FIG. 17** is a top plan view of a shoe with the top section cut away to illustrate the variation of the present invention where the five toes rest over the present invention gel but the gel does not extend beyond the 1st metatarso-phalangeal joint of the ball of the big toe;

[0123] **FIG. 18** is a top plan view of a shoe with the top section cut away to illustrate the base of the shoe incorporating the variation of the present invention gel assembly extending only underneath the toes of the foot, with the gel covered by a covering layer;

[0124] **FIG. 19** is an exploded view illustrating the present invention removed from its cavity within the shoe illustrating the variation where the gel only covers the areas underneath the toes and does not extend beyond the 1st metatarso-phalangeal joint of the base of the big toe; and

[0125] **FIG. 20** is an exploded view illustrating an alternative embodiment of the variation of the present invention where the gel only extends underneath the toes and does not extend under the 1st metatarso-phalangeal joint of the base of the big toe.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0126] Although specific embodiments of the present invention will now be described with reference to the drawings, it should be understood that such embodiments are by way of example only and merely illustrative of but a small number of the many possible specific embodiments which can represent applications of the principles of the present invention. Various changes and modifications obvious to one skilled in the art to which the present invention pertains are deemed to be within the spirit, scope and contemplation of the present invention as further defined in the appended claims.

[0127] The present invention is an improved shoe sole that will contribute to a more natural gait and greatly enhance the pleasure of walking by permitting the toes to grasp and returning tactile function to the toes. It will also have a beneficial effect on a specific set of leg muscles, which are the soleus, the gastrocnemius and peroneus, contributing to their development and muscle growth.

[0128] The invention incorporates the principle that walking on sand will induce the growth of calf muscles. The present invention consists of a change in the structure of the shoe sole that helps a user replicate the effect of walking on sand. The present invention incorporates the principle that walking barefoot on loose sand is an especially good conditioning exercise and helps to build calf muscles. The extra effort needed to position and roll the foot in sand can greatly help build coordination and muscle mass.

[0129] When walking barefoot, the digits of the foot rest flat, their tips grasping the ground as an assist in step propulsion. Inside a shoe, these digits of the foot are lifted slantwise off the ground, unable to fulfill their natural ground-grasping functions.

[0130] When walking on sand, the toes will bend and curl downward as the foot digs into the sand creating a muscle contraction that pushes the weight of the body upward and raises the heels ready for the next step. The typical and common shoe sole surface is a hard leather or rubber that keeps the toes straight when walking. Although the toes have very little to do when the wearer is standing, when the

wearer is walking, they provide stability by maintaining ground contact until the final phase of push-off. The invention is a change in the surface hardness in the area below the toes that permits the toes to bend and curl downward replicating the effect of walking on sand.

[0131] This is accomplished by filling the frontal section of the shoe sole with a deformable liquid or gel containing pack or a gel type material, polyurethane gel, gel filled padding made out of a gel pack encased in a stretch Lycra® fabric, non-leaking semi-solid gel filled padding, silicone, foam, memory foam or any memory type material, or any soft material, rubber soft synthetic plastic material, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane that will permit the toes to curl downward when walking.

[0132] The flexible and deformable area which deforms to the contour of the toes will border the 1st metatarso-phalangeal joint and lesser metatarso-phalangeal of the toes (ball of foot area) and may extend downward to fill underneath the base area of the big toe right below the 1st. metatarso-phalangeal joint. Walking on this new type of sole will permit the toes to curl or flex downward and complete the natural motion of the foot causing a contraction of the gastrocnemius (double headed muscle that forms the back of the calf), soleus and peroneus muscles.

[0133] Referring to **FIGS. 1 through 3** and **6, 7, 9** and **10**, there is illustrated one preferred embodiment of the present invention. The drawings are illustrated with the front of the shoe cut away so that the present invention can be readily seen. It will be appreciated that the present invention can be incorporated into any type of men, boy's, women's and girl's shoes including open-toed shoes and closed toe shoes. In addition to walking shoes, the present invention can be incorporated into any other type of shoes such as athletic shoes, sneakers, tennis shoes, deck shoes, floppies, etc.

[0134] The shoe **100** conventionally comprises an outsole **110**, a midsole **120** and an insole **130** against which the flat of the foot **200** rests. The present invention **10** is a gel type material, deformable liquid or gel containing pack, which is placed in the front area of the shoe preferably in line with the insole **130** and above the midsole **120** (although it can also be in line with a portion of the midsole as illustrated in **FIGS. 2 and 7**). The gel **10** covers the entire interior front of the shoe so that all five toes rest on top of the gel **10** as best illustrated in **FIG. 10**.

[0135] As illustrated in **FIGS. 1, 2, 6, 8, 9** and **10**, the gel **10** also extends into the shoe so that it is under the 1st metatarso-phalangeal joint base of the big toe. In this way, the gel **10** is positioned under all five toes and also under the ball of the foot immediately behind the big toe **140**. While only the left shoe is illustrated, it will be appreciated that the right shoe is also designed with the gel **10** under all five toes of the right foot and extends behind the ball of the right foot behind the right toe under the 1st metatarso-phalange joint base of the big toe.

[0136] The gel **10** causes the toes to simulate walking on sand **300** as illustrated in **FIG. 4**. The gel **10** thereby enables the toes to bend and curl downward as the foot digs into the sand, thereby creating a muscle contraction that pushes the weight of the body upward and raises the heels ready for the next step. Walking on the shoe which incorporates the present invention gel **10** will permit the toes to curl downward and complete the natural motion of the foot, resulting in a more pleasant walking experience and causing a contraction of the gastrocnemius (double headed muscle that forms the back of the calf), soleus and peroneus muscles.

[0137] The present invention gel **10** can include any type of material, which has the above-described flexibility. This includes but is not limited to gel, polyurethane gel, silicone, soft rubber, foam, memory soft material, neoprene, polyvinyl, polyethylene, polyurethane, a gel pack encased in a stretch Lycra® fabric and any type of natural or synthetic soft flexible material.

[0138] An alternative embodiment of the present invention gel assembly **330** is illustrated in the exploded view of **FIG. 12**. In this alternative embodiment, instead of being a separate section formed into the front area of the shoe as previously discussed, the gel **340** is formed into an upper strip **350** with the gel **340** fitting into a cavity **360** aligned with the insole **370**. The midsole **372** and the outsole **374** are in their conventional locations.

[0139] The gel **390** can also be covered with a covering layer **392** as illustrated in **FIG. 10**.

[0140] While the figures have been illustrated with a bare foot to show the toes against the present invention, it will be appreciated that the wearer typically will wear socks, nylons, or any other conventional foot covering. The present invention works equally well with any type of foot covering worn over the foot when placed in the shoe.

[0141] One variation of the present invention is to have the gel in both embodiments only extend around the toes and not extend under the first metatarso-phalangeal joint base of the big toe. The first embodiment of this variation is illustrated in **FIGS. 15, 16, 17, 18** and **19**. The drawings are illustrated with the front of the shoe cut away so that this variation of the present invention can be readily seen. It will be appreciated that this variation of the present invention can also be incorporated into any type of men's, boy's, women's or girl's shoes including open toed shoes and closed toe shoes. In addition to walking shoes, this variation of the present invention can also be incorporated into any other type of shoes such as athletic shoes, sneakers, tennis shoes, deck shoes, floppies, etc.

[0142] Because the parts are numbered identically to the preceding embodiment with the only difference being that the gel does not extend to beyond the first metatarso-phalangeal joint beyond the ball of the big toe, the numbers are similar but with the series being in the 500 series. Once again, the shoe **100** conventionally comprises an outsole **110**, midsole **120** and an insole **130** against which the flat of the foot **200** rests. The present invention **500** is a gel type material, deformable liquid or gel containing pack, which is placed in the front area of the shoe, preferably in line with the insole **130** and above the midsole **120** (although it can also be in line with a portion of the midsole as illustrated in **FIGS. 1 and 7**). The gel **500** covers the entire front of the shoe so that all five toes rest on the gel **10** as best illustrated in **FIG. 17**.

[0143] As illustrated in **FIGS. 15, 16, 17, 18** and **19**, in this variation of the present invention, the gel only extends to being under the toes and does not extend to under the 1st metatarso-phalangeal joint base of the big toe as with the

first variation discussed above. In this variation, the gel **500** is positioned under all five toes.

[**0144**] The gel **500** causes the toes to simulate walking on sand **300** as illustrated in **FIG. 4**. The gel **500** thereby enables the toes to bend and curl downward as the foot digs into the sand, thereby creating a muscle contraction that pushes the weight of the body upward and raises the heels ready for the next step. Walking on the shoe which incorporates the present invention gel **500** will permit the toes to curl downward and complete the natural motion of the foot, resulting in a more pleasant walking experience and causing a concentration of the gastrocnemius (double headed muscle that forms the back of the calf), soleus and peroneus muscles.

[**0145**] The present invention gel **500** can include any type of material, which has the above described flexibility. This is selected from a group consisting of a deformable liquid gel pack, deformable liquid gel, a gel pack encased in a stretch Lycra® fabric, silicone, foam, memory foam, soft memory type flexible material, soft rubber, soft synthetic plastic, polyurethane gel, neoprene, polyvinyl, polyethylene, or polyurethane. The gel **590** can also be covered with a covering layer **592** as illustrated in **FIG. 18**.

[**0146**] A variation of the alternative embodiment of the present invention is illustrated in **FIG. 20**. In this alternative embodiment, instead of being a separate section formed into the front edge of the shoe as previously discussed, the gel **540** is formed into an upper strip **550** with the gel **540** fitting into a cavity **560** aligned with insole **570**. The midsole **572** and outsole **574** are in their conventional locations. Once again, the gel in this variation only extends above the toes and does not extend beyond the 1st metatarso-phalangeal joint base of the big toe.

[**0147**] Defined in detail, the present invention is a shoe having a shoe sole including an outsole, a midsole, an insole and having a front area over which the toes of a foot rest when the shoe is worn, the improvement comprising: a non-leaking deformable gel formed within the front area of the sole and aligned with the insole so that the gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the gel; whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[**0148**] Defined alternatively, the present invention is a shoe having a shoe sole including an outsole, a midsole, an insole and having a front area over which the toes of a foot rest when the shoe is worn, the improvement comprising: (a) a deformable padding formed within the front area of the sole and aligned with the insole so that the deformable padding is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the deformable padding and the base of the big toe rests right below the 1st metatarso-phalangeal joint and also rests on the deformable padding; and (b) the deformable padding is selected from the group consisting of a deformable liquid gel pack, a deformable liquid, a gel pack encased in a stretch Lycra® fabric, silicone, foam, memory foam, soft memory type flexible material, soft rubber, soft synthetic plastic, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane; (c) whereby, the deformable padding permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[**0149**] Defined more broadly, the present invention is a foot wearing item to be worn on a foot, the foot wearing item including an insole against which the foot rests and having a front area over which the toes of the foot rest when the foot wearing item is worn, the improvement comprising: (a) a flexible and deformable material formed within the front area of the foot wearing item and aligned with the insole so that the flexible material is located beneath the toes of the foot when the foot wearing item is worn so that all five toes rest on the flexible material and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the flexible material; (b) whereby the flexible material permits the toes to curl downward when a wearer of the wearing apparel is walking.

[**0150**] Defined even more broadly, the present invention is a shoe having a shoe sole including an outsole, a midsole, an insole having a cavity in the front area of the shoe sole, the cavity aligned with the outsole and located in the area over which the toes of a foot rest when the shoe is worn, the improvement comprising: (a) a non-leaking deformable gel connected to an elongated strip so that the non-leaking deformable gel fits into the cavity and the strip rests on the insole so that the non-leaking deformable gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the non-leaking deformable gel; (b) whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[**0151**] Defined even more broadly, the present invention is a shoe having a shoe sole including an outsole, a midsole having a cavity in the front area of the shoe sole, an insole having a cavity in the front area of the shoe sole, the cavities aligned with the outsole and located in the area over which the toes of a foot rest when the shoe is worn, the improvement comprising: (a) a non-leaking deformable gel connected to an elongated strip so that the non-leaking deformable gel fits into the cavities aligned with the insole and the midsole and the strip rests on the insole so that the gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the non-leaking deformable gel; (b) whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[**0152**] Defined even more broadly, the present invention is a shoe having a shoe sole including an outsole, a midsole, an insole, a cavity in the front area of the shoe over which the toes of the foot rest when the shoe is worn, the improvement comprising: (a) a deformable padding connected to an elongated strip so that the deformable padding fits into the cavity and the strip rests on the insole so the deformable padding is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the deformable padding and the base of the big toe below the 1st metatarso-phalangeal joint also rests on the deformable padding; (b) the deformable padding is selected from the group consisting of a deformable liquid gel pack, a deformable liquid, a gel pack encased in a stretch Lycra® fabric, silicone, foam, memory

foam, soft memory type flexible material, soft rubber, soft synthetic plastic, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane; (c) whereby, the deformable padding permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[0153] Defined even more broadly, the present invention is a foot wearing item to be worn on a foot, the foot wearing item including an insole, and having a cavity in the front area of the insole over which the toes of the foot rest when the foot wearing item is worn, the improvement comprising: (a) a flexible and deformable material connected to an elongated strip so that the flexible and deformable material fits into the cavity and the strip rests on the insole so that the flexible and deformable material is located beneath the toes of the foot when the foot wearing item is worn, so that all five toes rest on the flexible and deformable material and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the flexible and deformable material; (b) whereby the flexible material permits the toes to curl, flex, bend or grasp downward when a wearer of the wearing apparel is walking.

[0154] Defined even more broadly, the present invention is a shoe having a shoe sole including an outsole, a midsole, an insole and having a front area over which the toes of a foot rest when the shoe is worn, the improvement comprising: (a) a non-leaking deformable gel formed within the front area of the sole and aligned with the insole so that the gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel; (b) whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[0155] Defined even more broadly, the present invention is a shoe having a shoe sole including an outsole, a midsole, an insole and having a front area over which the toes of a foot rest when the shoe is worn, the improvement comprising: (a) a deformable padding formed within the front area of the sole and aligned with the insole so that the deformable padding is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the deformable padding; and (b) the deformable padding is selected from the group consisting of a deformable liquid gel pack, a deformable liquid, a gel pack encased in a stretch Lycra® fabric, silicone, foam, memory foam, soft memory type flexible material, soft rubber, soft synthetic plastic, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane; (c) whereby, the deformable padding permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[0156] Defined even more broadly, the present invention is a foot wearing item to be worn on a foot, the foot wearing item including an insole against which the foot rests and having a front area over which the toes of the foot rest when the foot wearing item is worn, the improvement comprising: (a) a flexible and deformable material formed within the front area of the foot wearing item and aligned with the insole so that the flexible material is located beneath the toes of the foot when the foot wearing item is worn so that all five toes rest on the flexible material; (b) whereby the flexible material permits the toes to curl downward when a wearer of the wearing apparel is walking.

[0157] Defined even more broadly, the present invention is a shoe having a shoe sole including an outsole, a midsole, an insole having a cavity in the front area of the shoe sole, the cavity aligned with the outsole and located in the area over which the toes of a foot rest when the shoe is worn, the improvement comprising: (a) a non-leaking deformable gel connected to an elongated strip so that the non-leaking deformable gel fits into the cavity and the strip rests on the insole so that the non-leaking deformable gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel; (b) whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[0158] Defined even more broadly, the present invention is a shoe having a shoe sole including an outsole, a midsole having a cavity in the front area of the shoe sole, an insole having a cavity in the front area of the shoe sole, the cavities aligned with the outsole and located in the area over which the toes of a foot rest when the shoe is worn, the improvement comprising: (a) a non-leaking deformable gel connected to an elongated strip so that the non-leaking deformable gel fits into the cavities aligned with the insole and the midsole and the strip rests on the insole so that the gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel; (b) whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[0159] Defined even more broadly, the present invention is a shoe having a shoe sole including an outsole, a midsole, an insole, a cavity in the front area of the shoe over which the toes of the foot rest when the shoe is worn, the improvement comprising: (a) a deformable padding connected to an elongated strip so that the deformable padding fits into the cavity and the strip rests on the insole so the deformable padding is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the deformable padding; (b) the deformable padding is selected from the group consisting of a deformable liquid gel pack, a deformable liquid, a gel pack encased in a stretch Lycra® fabric, silicone, foam, memory foam, soft memory type flexible material, soft rubber, soft synthetic plastic, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane; (c) whereby, the deformable padding permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

[0160] Defined even more broadly, the present invention is a foot wearing item to be worn on a foot, the foot wearing item including an insole, and having a cavity in the front area of the insole over which the toes of the foot rest when the foot wearing item is worn, the improvement comprising: (a) a flexible and deformable material connected to an elongated strip so that the flexible and deformable material fits into the cavity and the strip rests on the insole so that the flexible and deformable material is located beneath the toes of the foot when the foot wearing item is worn, so that all five toes rest on the flexible and deformable material; (b) whereby the flexible material permits the toes to curl, flex, bend or grasp downward when a wearer of the wearing apparel is walking.

[0161] Of course the present invention is not intended to be restricted to any particular form or arrangement, or any specific embodiment, or any specific use, disclosed herein, since the same may be modified in various particulars or relations without departing from the spirit or scope of the

claimed invention hereinabove shown and described of which the apparatus or method shown is intended only for illustration and disclosure of an operative embodiment and not to show all of the various forms or modifications in which this invention might be embodied or operated.

What is claims is:

1. A shoe having a shoe sole including an outsole, a midsole, an insole and having a front area over which the toes of a foot rest when the shoe is worn, the improvement comprising:

a. a non-leaking deformable gel formed within the front area of the sole and aligned with the insole so that the gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the gel;

b. whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

2. The invention in accordance with claim 1, wherein said gel is covered with a stretch material.

3. The invention in accordance with claim 1, wherein said gel is treated with a fungicide.

4. A shoe having a shoe sole including an outsole, a midsole, an insole and having a front area over which the toes of a foot rest when the shoe is worn, the improvement comprising:

a. a deformable padding formed within the front area of the sole and aligned with the insole so that the deformable padding is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the deformable padding and the base of the big toe rests right below the 1st metatarso-phalangeal joint and also rests on the deformable padding; and

b. the deformable padding is selected from the group consisting of a deformable liquid gel pack, a deformable liquid, a gel pack encased in a stretch Lycra® fabric, silicone, foam, memory foam, soft memory type flexible material, soft rubber, soft synthetic plastic, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane;

c. whereby, the deformable padding permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

5. The invention in accordance with claim 4, wherein said deformable padding is at least 6 mm in depth.

6. The invention in accordance with claim 4, wherein said deformable padding is also aligned with a portion of the midsole in addition to being aligned with the insole.

7. The invention in accordance with claim 4, further comprising a cavity formed into the front portion of the shoe to receive the deformable padding.

8. The invention in accordance with claim 4, wherein said deformable padding is covered with a stretch material.

9. The invention in accordance with claim 4, wherein said deformable padding is treated with a fungicide.

10. A foot wearing item to be worn on a foot, the foot wearing item including an insole against which the foot rests and having a front area over which the toes of the foot rest when the foot wearing item is worn, the improvement comprising:

a. a flexible and deformable material formed within the front area of the foot wearing item and aligned with the insole so that the flexible material is located beneath the toes of the foot when the foot wearing item is worn so that all five toes rest on the flexible material and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the flexible material;

b. whereby the flexible material permits the toes to curl downward when a wearer of the wearing apparel is walking.

11. The invention in accordance with claim 10, wherein the flexible material is selected from the group comprising non-leaking semi-solid gel filled padding, silicone, foam, memory foam, soft rubber, soft synthetic plastic, a gel pack encased in a stretch Lycra® fabric, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane.

12. The invention in accordance with claim 10, wherein the foot wearing item is selected from the group comprising shoes, sandals, flip-flops or athletic shoes.

13. The invention in accordance with claim 10, wherein said flexible and deformable material is covered with a covering material.

14. The invention in accordance with claim 10, wherein said flexible and deformable material is treated with a fungicide.

15. A shoe having a shoe sole including an outsole, a midsole, an insole having a cavity in the front area of the shoe sole, the cavity aligned with the outsole and located in the area over which the toes of a foot rest when the shoe is worn, the improvement comprising:

a. a non-leaking deformable gel connected to an elongated strip so that the non-leaking deformable gel fits into said cavity and the strip rests on the insole so that the non-leaking deformable gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the non-leaking deformable gel;

b. whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

16. The invention in accordance with claim 15, wherein said gel is covered with a stretch material.

17. The invention in accordance with claim 15, wherein said gel is treated with a fungicide.

18. A shoe having a shoe sole including an outsole, a midsole having a cavity in the front area of the shoe sole, an insole having a cavity in the front area of the shoe sole, the cavities aligned with the outsole and located in the area over which the toes of a foot rest when the shoe is worn, the improvement comprising:

a. a non-leaking deformable gel connected to an elongated strip so that the non-leaking deformable gel fits into said cavities aligned with the insole and the midsole and the strip rests on the insole so that the gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the non-leaking deformable gel;

b. whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

19. The invention in accordance with claim 18, wherein said non-leaking deformable gel is covered with a stretch material.

20. The invention in accordance with claim 18, wherein said non-leaking deformable gel is treated with a fungicide.

21. A shoe having a shoe sole including an outsole, a midsole, an insole, a cavity in the front area of the shoe over which the toes of the foot rest when the shoe is worn, the improvement comprising:

a. a deformable padding connected to an elongated strip so that the deformable padding fits into said cavity and the strip rests on the insole so the deformable padding is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the deformable padding and the base of the big toe below the 1st metatarso-phalangeal joint also rests on the deformable padding;

b. the deformable padding is selected from the group consisting of a deformable liquid gel pack, a deformable liquid, a gel pack encased in a stretch Lycra® fabric, silicone, foam, memory foam, soft memory type flexible material, soft rubber, soft synthetic plastic, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane;

c. whereby, the deformable padding permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

22. The invention in accordance with claim 21, wherein said cavity is aligned with the insole and the deformable padding is aligned with the insole.

23. The invention in accordance with claim 21, wherein said cavity is aligned with the insole and the midsole and the deformable padding is aligned with the insole and the midsole.

24. The invention in accordance with claim 21, wherein said cavity is at least 6 mm and said deformable padding is at least 6 mm.

25. The invention in accordance with claim 21, wherein said deformable padding is covered with a stretch material.

26. The invention in accordance with claim 21, wherein said deformable padding is treated with a fungicide.

27. A foot wearing item to be worn on a foot, the foot wearing item including an insole, and having a cavity in the front area of the insole over which the toes of the foot rest when the foot wearing item is worn, the improvement comprising:

a. a flexible and deformable material connected to an elongated strip so that the flexible and deformable material fits into said cavity and the strip rests on the insole so that the flexible and deformable material is located beneath the toes of the foot when the foot wearing item is worn, so that all five toes rest on the flexible and deformable material and the base of the big toe right below the 1st metatarso-phalangeal joint also rests on the flexible and deformable material;

b. whereby the flexible material permits the toes to curl, flex, bend or grasp downward when a wearer of the wearing apparel is walking.

28. The invention in accordance with claim 27, wherein the flexible and deformable material is selected from the group comprising non-leaking semi-solid gel filled padding, silicone, foam, memory foam, soft rubber, soft synthetic plastic, a gel pack encased in a stretch Lycra® fabric, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane.

29. The invention in accordance with claim 27, wherein the foot wearing item is selected from the group comprising shoes, sandals, flip-flops or athletic shoes.

30. The invention in accordance with claim 27, wherein said flexible and deformable material is covered with a covering material.

31. The invention in accordance with claim 27, wherein said flexible and deformable material is treated with a fungicide.

32. A shoe having a shoe sole including an outsole, a midsole, an insole and having a front area over which the toes of a foot rest when the shoe is worn, the improvement comprising:

c. a non-leaking deformable gel formed within the front area of the sole and aligned with the insole so that the gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel;

d. whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

33. The invention in accordance with claim 32, wherein said gel is covered with a stretch material.

34. The invention in accordance with claim 32, wherein said gel is treated with a fungicide.

35. A shoe having a shoe sole including an outsole, a midsole, an insole and having a front area over which the toes of a foot rest when the shoe is worn, the improvement comprising:

a. a deformable padding formed within the front area of the sole and aligned with the insole so that the deformable padding is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the deformable padding; and

b. the deformable padding is selected from the group consisting of a deformable liquid gel pack, a deformable liquid, a gel pack encased in a stretch Lycra® fabric, silicone, foam, memory foam, soft memory type flexible material, soft rubber, soft synthetic plastic, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane;

c. whereby, the deformable padding permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

36. The invention in accordance with claim 35, wherein said deformable padding is at least 6 mm in depth.

37. The invention in accordance with claim 35, wherein said deformable padding is also aligned with a portion of the midsole in addition to being aligned with the insole.

38. The invention in accordance with claim 35, further comprising a cavity formed into the front portion of the shoe to receive the deformable padding.

39. The invention in accordance with claim 35, wherein said deformable padding is covered with a stretch material.

40. The invention in accordance with claim 35, wherein said deformable padding is treated with a fungicide.

41. A foot wearing item to be worn on a foot, the foot wearing item including an insole against which the foot rests

and having a front area over which the toes of the foot rest when the foot wearing item is worn, the improvement comprising:

a. a flexible and deformable material formed within the front area of the foot wearing item and aligned with the insole so that the flexible material is located beneath the toes of the foot when the foot wearing item is worn so that all five toes rest on the flexible material;

b. whereby the flexible material permits the toes to curl downward when a wearer of the wearing apparel is walking.

42. The invention in accordance with claim 41, wherein the flexible material is selected from the group comprising non-leaking semi-solid gel filled padding, silicone, foam, memory foam, soft rubber, soft synthetic plastic, a gel pack encased in a stretch Lycra® fabric, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane.

43. The invention in accordance with claim 41, wherein the foot wearing item is selected from the group comprising shoes, sandals, flip-flops or athletic shoes.

44. The invention in accordance with claim 41, wherein said flexible and deformable material is covered with a covering material.

45. The invention in accordance with claim 41, wherein said flexible and deformable material is treated with a fungicide.

46. A shoe having a shoe sole including an outsole, a midsole, an insole having a cavity in the front area of the shoe sole, the cavity aligned with the outsole and located in the area over which the toes of a foot rest when the shoe is worn, the improvement comprising:

a. a non-leaking deformable gel connected to an elongated strip so that the non-leaking deformable gel fits into said cavity and the strip rests on the insole so that the non-leaking deformable gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel;

b. whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

47. The invention in accordance with claim 46, wherein said gel is covered with a stretch material.

48. The invention in accordance with claim 46, wherein said gel is treated with a fungicide.

49. A shoe having a shoe sole including an outsole, a midsole having a cavity in the front area of the shoe sole, an insole having a cavity in the front area of the shoe sole, the cavities aligned with the outsole and located in the area over which the toes of a foot rest when the shoe is worn, the improvement comprising:

a. a non-leaking deformable gel connected to an elongated strip so that the non-leaking deformable gel fits into said cavities aligned with the insole and the midsole and the strip rests on the insole so that the gel is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the gel;

b. whereby the non-leaking deformable gel permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

50. The invention in accordance with claim 49, wherein said non-leaking deformable gel is covered with a stretch material.

51. The invention in accordance with claim 49, wherein said non-leaking deformable gel is treated with a fungicide.

52. A shoe having a shoe sole including an outsole, a midsole, an insole, a cavity in the front area of the shoe over which the toes of the foot rest when the shoe is worn, the improvement comprising:

a. a deformable padding connected to an elongated strip so that the deformable padding fits into said cavity and the strip rests on the insole so the deformable padding is located beneath the toes of the foot when the shoe is worn, so that all five toes rest on the deformable padding;

b. the deformable padding is selected from the group consisting of a deformable liquid gel pack, a deformable liquid, a gel pack encased in a stretch Lycra® fabric, silicone, foam, memory foam, soft memory type flexible material, soft rubber, soft synthetic plastic, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane;

c. whereby, the deformable padding permits the toes to curl, flex, bend or grasp downward when a wearer of the shoe is walking.

53. The invention in accordance with claim 52, wherein said cavity is aligned with the insole and the deformable padding is aligned with the insole.

54. The invention in accordance with claim 52, wherein said cavity is aligned with the insole and the midsole and the deformable padding is aligned with the insole and the midsole.

55. The invention in accordance with claim 52, wherein said cavity is at least 6 mm and said deformable padding is at least 6 mm.

56. The invention in accordance with claim 52, wherein said deformable padding is covered with a stretch material.

57. The invention in accordance with claim 52, wherein said deformable padding is treated with a fungicide.

58. A foot wearing item to be worn on a foot, the foot wearing item including an insole, and having a cavity in the front area of the insole over which the toes of the foot rest when the foot wearing item is worn, the improvement comprising:

a. a flexible and deformable material connected to an elongated strip so that the flexible and deformable material fits into said cavity and the strip rests on the insole so that the flexible and deformable material is located beneath the toes of the foot when the foot wearing item is worn, so that all five toes rest on the flexible and deformable material;

b. whereby the flexible material permits the toes to curl, flex, bend or grasp downward when a wearer of the wearing apparel is walking.

59. The invention in accordance with claim 58, wherein the flexible and deformable material is selected from the group comprising non-leaking semi-solid gel filled padding, silicone, foam, memory foam, soft rubber, soft synthetic plastic, a gel pack encased in a stretch Lycra® fabric, polyurethane gel, neoprene, polyvinyl, polyethylene or polyurethane.

60. The invention in accordance with claim 58, wherein the foot wearing item is selected from the group comprising shoes, sandals, flip-flops or athletic shoes.

61. The invention in accordance with claim 58, wherein said flexible and deformable material is covered with a covering material.

62. The invention in accordance with claim 58, wherein said flexible and deformable material is treated with a fungicide.

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