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(54) **SHOE DYNAMIC FITTING AND SHOCK ABSORBTION SYSTEM.**

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Description

Sport shoes such as running shoes must fit tightly on the user's foot. During certain maneuvers, with the running shoe during heel strike and toe off, for example the tightness of the fit needs to be greater than during other times such as midstance when the forces transmitted between the foot and the ground via the shoe are not as severe. In court and contact running shoes the tightness of the fit needs to be greatest when the largest forces are being applied between the shoe and the playing surface. In the past, it was typical to tighten the shoe as much as possible, and physically bearable, to prevent or at least minimize relative movement of the foot in the shoe at times when maximum forces were transmitted between the floor and the shoe. As a practical matter, such a fit is excessively tight during most other times and quite frequently is uncomfortable, can lead to numbness and, in extreme cases, can even result in injuries. Thus a compromise is frequently reached by tightening the shoe on the foot more than is necessary for the small forces that are applied and less than is desired to prevent relative movement of the foot in the shoe when large forces are applied. Consequently, the fit of such shoes is almost always other than what it should be.

This problem has been recognized in the past in connection with ski boots where the exerted forces are especially large and the required tightness of the fit for extreme maneuvers is typically unbearable for any length of time. Thus, this inventor has developed dynamic fitting systems which temporarily increase the tightness of the fit of the boot on the foot in response to certain skiing maneuvers, for example, by constructing the ski boot so that the tightness of the fit of the boot, or of at least a portion of the boot increases in response to a forward lean of the skier. U.S. Patent No. 4,360,979, entitled A SPORT SHOE WITH A DYNAMIC ADJUSTABLE CUFF ASSEMBLY, and U.S. Patent No. 4,382,342, entitled DYNAMIC FITTING SYSTEM FOR A SPORT SHOE, describe such dynamic fitting systems.

In many respects, ski boots present a particular problem because it is one of their objectives to significantly limit the mobility of the user's ankle joint. For practical purposes, the skier's leg is movable in only a forward direction and even this movement is greatly limited when compared with the anatomical freedom of movement provided by the ankle joint. Further, ski boots are large, relatively bulky and have thick walls to provide the desired strength, rigidity and heat insulation. Consequently, there is ample space within which to build a system to tighten the boot in response to a particular movement, e.g. flex of the leg relative to the foot.

FR—A—2 407 681 refers to a ski boot with a tightening means being connected with a sensing means which is activated upon insertion of the ski boot into the binding of a ski, such that the tightening means is tightened at the time of locking of the binding. According to one embodiment the sensing means is elevating a sole within the ski boot during the insertion of the ski boot into the binding. The tightening means is provided outside of the inner boot of the ski boot.

Up to now, little or no consideration has been given to the relative tightness of running shoes, particularly lightweight highly mobile sports shoes such as running shoes. The lightness of such running shoes and the lack of an adequate analysis of the interaction between the running shoe and the user's foot led to the practice of simply tightening the shoe to suit the user's taste, feel or preference. In some instances, the shoe might be too loose and not infrequently, slipped significantly relative to the foot in a particularly strenuous maneuver such as a sudden change in direction when turning. This was considered an inevitable adjunct to participating in sports.

Upon closer analysis, however, it becomes apparent that there are distinct phases in the use of a running shoe when forces applied by the foot to the shoe momentarily greatly exceed the normally encountered forces. In running, for example, when the runner places his weight on the forefoot just prior to lifting the foot off the ground, there are significant forces which tend to push the foot in a rearward direction relative to the shoe. Conversely, during heel strike, that is when the foot contacts the ground at the end of a stride, there are forces generated by both the runner's weight and the deceleration of the foot which tend to move the foot in a forward direction relative to the shoe. Such movements may be relatively small, say the order of no more than a few millimeters but they are present and, typically, they are repeated thousands of times during a single run. This can lead to discomfort, skin irritation from rubbing between the floor and the shoe and energy losses which though small are highly undesirable, particularly in competitive sports. The problem is magnified in contact type team sports where the forces can be significantly greater than those encountered during running, for example. Up to now, no solution to this problem has been available.

The present invention greatly reduces or eliminates relative movement between the foot and the shoe while improving shock absorption characteristics by increasing the tightness of the fit of the shoe on the foot as a function of weighting the shoe during foot strike and throughout shoe-playing surface contact. At the same time, the tightness of the fit can be reduced when the foot is in its unweighted condition when minimum forces are exerted to prevent discomfort or possible injury from an overtightening of the shoe for excessive lengths of time. In particular, the present invention increases the tightness of the fit when the foot weights the sole or a dynamically movable footbed when foot strike resulting in a tightening of the shoe in the hindfoot, midfoot and forefoot. The invention also provides means for dispersing the energy of foot

strike impact by the movement of the sole or the footbed distributing the shock load impulse to the midfoot and forefoot.

Broadly speaking, therefore, the present invention provides a shoe forming a comfortable close fit on the foot of the lower extremity when the foot is in a generally unweighted condition. The tightness of the fit is increased when the foot is placed in a weighted condition. This is accomplished with means for sensing a relative weighting of the sole or a dynamically movable footbed and means operatively coupled with the sensing means and the shoe for increasing the tightness of the fit of the shoe on the foot in response to a relative weighting of the lower extremity when the foot moves downwardly toward the sole of the shoe. This system can be directly incorporated in a shoe and in such an instance forms an integral part thereof. Alternatively, the system can be provided in the form of a kit that is adapted to be placed into a conventional shoe to convert such a shoe into one having the above discussed characteristics.

One embodiment of the invention provides that the sensing means be defined by a bar which straddles a movable footbed and which has an upper end attached to one end of a strap or apron extending over the instep and forefoot. The opposite end of the strap is then attached to the footbed. The bar is pivotally attached to the lateral sides of the footbed. The lower end of the bar rests on the upper surface of the sole so that movement of the foot in a downward direction pivots the bar with respect to the shoe. The strap or apron is attached to the upper end of the bar so that pivotal movement of the bar in a direction to move the bar towards a position parallel to the footbed increases the tightness of the strap or apron on the foot as a function of the extent to which the foot has moved toward the sole of the shoe. A separate forefoot strap that tightens over the forefoot upon toe off can be connected to the pivoting bar.

In another embodiment of the invention, a strap is secured to the inside of the shoe medial heel counter wall and then passes through a slot on the medial side of a dynamically movable footbed. The strap is flared over the instep and forefoot and then passes through a slot on the lateral side of the footbed and is secured to the inside of the lateral heel counter wall. Weighting of the dynamically movable footbed moves the footbed downwardly tightening the strap over the instep and the heel counter against the heel.

In a running shoe, therefore, the tightness of the fit is increased during foot strike when the foot is weighted and the dynamically movable footbed moves toward the ground. Depending on the individual's running style, plantarflexion and dorsiflexion of the foot may take place during different phases of heel strike, midstance and toe off. Consequently, during those moments when large forces are transmitted from the foot to the ground via the shoe, the shoe fits the tightest, thereby reducing or eliminating movements of the foot in the shoe.

Preferably, the shoe instep strap is attached to an insert within the shoe which is defined by a footbed that extends forwardly from the heel to about the metatarsal-phalangeal area or the ball or the user's foot. The footbed helps to anchor the insert in the shoe and for this purpose can either be semirigid or rigid. By constructing it of semirigid or rigid materials, it further acts as a movable footbed to press the instep strap against the foot to increase the tightness of the fit. For purposes of this application the term "rigid footbed", which forms part of the insert, means and is intended to mean, a footbed which has a rigidity that is about equal to or slightly greater than the rigidity of the shoe sole. This should be contrasted with the term "flexible footbed" which can also be attached to the insert but which is substantially more flexible than the shoe sole.

Other aspects of the present invention permit the adjustment of the instep strap relative to the shoe, the bar and the insert so as to adapt it for use with feet of differing sizes.

To summarize, therefore, the present invention provides a dynamic fitting system for shoes which allows a reduced tightness unweighted condition for the foot when the tightness of the fit is at a minimum and which increases the tightness in response to movement of the foot toward the sole. This greatly enhances the utility of a sport shoe in that it is tightest on the foot when the foot is moved downwardly which typically is the condition in which maximum forces are transmitted between the foot and the shoe. Due to the tightness of the fit, relative movements between the foot and the shoe are minimized or eliminated. Yet, the discomfort and possibility of injury which would accompany the use of a shoe tightened to take into account maximum forces, which are encountered for only fractions of a second, are eliminated, because when the foot is in its relative unweighted position, or in a position which deviates therefrom by only a minor amount, the fit of the shoe can be such as to cause no discomfort whatsoever.

Aside from momentarily increasing the tightness with which the shoe fits on the wearer's foot, the fitting system of the present invention also absorbs shock and helps reduce the maximum forces to which the foot is subjected. This aspect of the present invention renders it particularly suitable for running shoes when during a single run the foot strikes the ground thousand of times, each time subjecting it to forces of a magnitude that may exceed the user's weight several times. This shock absorbing characteristic results from the relative lowering of the foot when the shoe touches the ground during heel strike and as the foot moves towards its midstance position. Thus, when the shoe sole first strikes the ground, the runner's heel is still spaced from the sole and it is permitted to decelerate over a significant distance as compared to the distance over which the foot can decelerate when in direct contact with the shoe sole. Also, the impact shock is dispersed to the midfoot and forefoot. This greatly reduces the maximum impulse force to which the foot, and indeed the entire leg of the user, including his

knee, which is particularly susceptible to injury from excessive impact forces, is subjected. In the past, impact forces during heel strike could only be lowered by making the shoe sole of a resiliently compressible material, such as closed cell foam. The extent to which the forces can be reduced in this manner, is severely limited because an undue resiliency in the shoe sole renders it uncomfortable and unstable. Moreover, the resiliency of the material is quickly lost due to permanent set in the material.

Brief Description of the Drawings

Fig. 1 is a side elevational view of a shoe provided with a dynamic fitting and shock absorption system in an unweighted position constructed in accordance with the present invention.

Fig. 2 is a vertical section through the shoe of Fig. 1.

Fig. 3 is a side elevational view of the shoe of Fig. 1 with the dynamic fitting and shock absorption system in a weighted position.

Fig. 4 is a side elevational view of a shoe including a dynamic fitting and shock absorption system constructed in accordance with another embodiment of the present invention.

Fig. 5 is a vertical section through the shoe of Fig. 4.

Fig. 6 is a partial top view of the shoe of Fig. 4.

Fig. 7 is a side elevational view of a shoe including a dynamic fitting and shock absorption system constructed in accordance with another embodiment of the present invention.

Fig. 8 is a vertical section through the shoe of Fig. 7.

Fig. 9 is a side elevational view of a shoe including a dynamic fitting and shock absorption system constructed in accordance with another embodiment of the present invention.

Fig. 10 is a vertical section through the shoe of Fig. 9.

Fig. 11 is a side elevational view of a shoe including a dynamic fitting and shock absorption system constructed in accordance with another embodiment of the present invention.

Fig. 12 is a vertical section through the shoe of Fig. 11.

Fig. 13 is a partial top view of the shoe of Fig. 11.

Fig. 14 is a side elevational view of a shoe including a dynamic fitting and shock absorption system constructed in accordance with another embodiment of the present invention.

Fig. 15 is a vertical section through the shoe of Fig. 14.

Fig. 16 is a partial top view of the shoe of Fig. 15.

Fig. 17 is a side elevational view of a shoe including a dynamic fitting and shock absorption system constructed in accordance with another embodiment of the present invention.

Fig. 18 is a partial horizontal section through the shoe taken along line A—A.

Fig. 19 is a partial view of the shoe of Fig. 17.

Fig. 20 is a vertical section through the shoe taken along line B—B of Fig. 18.

Description of the Preferred Embodiments

Referring to Figs. 1—3, a shoe 1 such as a running shoe has lower sole 2 constructed of a resilient material such as an elastomer and an upper shell 3 constructed of a flexible material such as leather or nylon secured to the lower sole and defining the inside of the shoe within which the user places his foot. The upper shell of the shoe includes a conventional, typically v-shaped cut out 4 above the forefoot 5 and extending generally from about the instep 6 towards a front or toe end 7 of the shoe. A tongue 8 underlies the cut out and is secured to the upper in the vicinity of the toe end. The v-shaped cut out may be closed by laces 9 passing through eyelets 10 arranged in the conventional manner. The upper is further defined by a cuff 11 which is usually located below the user's ankle joint. The upper terminates in a heel end 12 which surrounds and engages the user's heel and which includes a heel counter 13.

Disposed within the shoe is an insert 14 which forms part of the shoe dynamic fitting and shock absorption system 15 of the present invention. The insert is defined by a footbed 17 which extends forwardly from the heel end, rests on the shoe sole and terminates in the area of the ball 18 of the user's foot. Thus, in use, the insert engages the underside of the foot from the heel to about the ball of the foot.

A sensor in the form of a U-shaped pivot bar 19 straddles the footbed. The pivot bar pivots about pivot pins 20 which are secured to the sides of the footbed. The pivot bar has lower segments 21 connected by a cross member 22 and an upper segment 23. Load distributing bars 24 are pivoted by pivot pins 25 from the base of the lower segments 21 and rest on the upper surface of the sole.

The upper end of the upper segment has an outwardly extending strap hook 26. One end of an instep strap 27 is connected by the strap hook to the pivot bar. The strap then extends over the instep and forefoot of the user and is attached on the opposite end to the side 28 of the footbed. Instep strap adjustment holes 29 engage the strap hook so as to adapt the instep strap for use with feet of differing sizes. A spring (not shown) may be interposed between the instep strap and the pivot bar strap hook to absorb a portion of the shock load of foot strike.

In use, a foot is initially placed inside the shoe in an unweighted condition and the instep strap 27 is adjusted to provide a close fit on the foot with the footbed resting a distance above the sole. When the user places weight on his foot as during foot strike the footbed 17 is lowered toward the sole 2 causing clockwise rotation of the pivot bar 19 toward a position parallel to the footbed. Thus, the instep strap is pulled downwardly, inwardly and rearwardly against the upper surface of the foot. As a result, the tightness with which the shoe fits on the foot is increased and relative movements of the foot in the shoe are reduced even though the forces that are exerted between them might be momentarily very high. In addition, the tightening

of the instep strap on the upper surface of the foot distributes a portion of the shock load of foot strike to the midfoot and forefoot. When the downward force is removed from the footbed such as during the latter phase of toe off and swing through, the pivot bar rotates counterclockwise loosening the instep strap on the foot. A forefoot strap 29 may be attached by one end to the side of the footbed and the opposite end connected by a cable 30 to the upper segment 23 of the pivot bar 19. The cable passes around a pulley 31 attached to the footbed so that counterclockwise rotation of the pivot bar in unweighting of the foot tightens the forefoot strap.

Referring to Figs. 4—6 in another embodiment of the present invention, a shoe 32 has a lower sole 33 and an upper shell 34 secured to the sole. The upper shell includes a v-shaped cut out 38 above the midfoot and forefoot. A tongue 39 underlies the cut out and is secured in the vicinity of the toe end of the shoe. Instep straps 35 include finger like projections 36 which are secured by rivets 37 or the like to the shell adjacent to the cut out. The straps extend over the cut out and downwardly and rearwardly in an inclined direction and are attached on the opposite ends to the upper segments 40 of elongated pivot bar members which are fixed to a rod 42 which rotatably extends through a bore in the sole of the shoe to the comparable pivot bar on the opposite side on the sole. Lower segments 43 of the pivot bars are shaped to engage the contact surface during heel strike. The instep straps include adjustment holes 46. Stops 47 attached to the sole prevent excessive counterclockwise rotation of the pivot bars and straps.

In use, and after instep straps 35 have been adjusted there is a close comfortable fit in an unweighted condition with the lower segments of the pivot bars projecting below the bottom of the sole. During heel strike, the pivot bars rotate in a clockwise direction pulling the instep straps downwardly and rearwardly closing the v-shaped cut out and tightening the upper on the foot. Upon unweighting during toe off, the pivot bars are rotated in a counterclockwise direction loosening the instep straps and the shoe upper to the close comfortable fit.

Referring now to Figs. 7 and 8 in another embodiment of the present invention, a shoe 48 has a lower sole 49 and an upper shell 50 secured to the sole. A footbed 51 extends from the heel to the ball of the foot. One end of an instep strap 52 is connected to the inside of the medial heel counter 53 wall and then passes upwardly through a slot 54 in the medial side of the footbed, is directedly forwardly and upwardly in an inclined direction and is flared over the instep. The instep strap then passes rearwardly and downwardly through a slot 54 in the lateral side of the footbed and is connected to the inside of a lateral heel counter 53 wall. The instep strap 52 may be fitted with an adjustable fastener such as snaps or a Velcro® fastener 55 so that it can be adjusted for feet of differing sizes.

In use, and after the instep strap has been tightened there is a close comfortable fit in an unweighted condition with the footbed resting a distance above the sole. When the user's weight is placed on the footbed, the footbed moves downwardly toward the sole. The instep strap is tightened over the instep and forefoot. This is due to relative shortening of the instep strap over the foot as the distance is increased from the instep strap attachment on the heel counter to the footbed. As a result of the increased force applied to the instep strap, relative movement between the shoe and the foot including excessive pronation and supination is prevented. Upon unweighting of the footbed the force on the instep strap is reduced loosening the shoe on the foot to the close comfortable fit.

Referring to Figs. 9 and 10 in another embodiment, a shoe 56 has a lower sole 57 and an upper shell 58. The upper of the shoe includes a conventional, typically v-shaped cut out 59 generally above the forefoot 60 and extending generally from about the instep 61 towards the front or toe end 62 of the shoe. A tongue 63 underlies the cut out in a conventional manner and normally is secured to the upper in the vicinity of the toe end. Disposed within the shoe is a footbed 64, extending from the heel end 65 to the area of the ball 66 of the foot. The footbed includes a semirigid heel cup 67 which is shaped to fit over the heel of the user's foot. A lace or cable 68 is secured to the heel cup, passes around a guide 71 on the inside wall of a heel counter 69 through an islet 70 in the heel cup and then extends outwardly through an opening 72 in the shoe upper wall. The lace extends there from on each side of the outside of the shoe in a generally forward and upwardly inclined direction to a series of closure guides or pulleys 73 arranged on each side and spaced over the length of the v-shaped cut out in the upper of the shoe to about the end of the cut out. An overcenter clamp 74 is secured to the upper in the vicinity of the toe end, which, when closed, pulls on the lace and thereby closes the v-shaped cut out and generally tightens the laces. Load distributing compressible material 75 may be located between the footbed and lower sole.

In use, the foot is placed inside the shoe and the over center clamp is adjusted and closed to establish an initial close fit of the shoe on the foot in the unweighted condition. The shoe is now ready for use. Downward force of the footbed such as would occur when the foot pushes the shoe against the ground in court sports, closes the v-shaped cut out and tightens the upper and the heel cup on the foot. This is due to relative shortening of the lace between the overcenter clamp and the heel cup as the relative length of the lace increases between the heel cup and the heel counter attachment.

Referring to Figs. 11—13 in still another embodiment, a shoe 76 has lower sole 77 and upper shell 78. The upper shell of the shoe includes a conventional typically v-shaped cut out 79 above the forefoot 80 and extending generally

from about the instep 81 towards the toe end 82 of the shoe. A tongue 83 underlies the cut out. A lace 84 passes through multiple eyelets 85 from the toe end of the cut out to the instep end. The lace passes from each eyelet on the outside of the shell to each eyelet on the inside of the shell on the opposite side of the cut out. The lace is tied in the conventional manner. Slidably disposed within cavities in the medial and lateral sides of the reislient compressible elastomer sole 77 are stabilizing plates 87. The upper ends of the plates 87 extend upwardly from collapsible studs 88 in sole 77 and are slidably received in boxes 89 located on the sides of the shoe 76. The plates are located within upwardly collapsible studs extending below the tread of the sole and can slide upwardly in the cavities in response to upward loading of the studs and sole such as occurs in foot strike or weight bearing between the foot, shoe and contact surface. The slidable plates provide lateral stability for the shoe and foot during foot strike. A bar 90 is located on the outside of each side of the cut out in the shell between the lace and the shell at alternate eyelets and between the eyelets and the cut out. A strap 91 is secured on the central area of each bar 90 by a rivet or the like and passes in a downwardly and rearwardly inclined direction and through a slot 92 on the outside of each box 89. The strap 91 then passes through a slot 93 in each plate 87 and under a semirigid movable footbed 94 located in the interior of the shell. The footbed may be non-movable.

In use, the foot is placed inside the shoe and the lace tightened and tied to establish an initial close fit of the shoe in the unweighted condition. Tightening the lace pulls the bar upwardly and inwardly pulling the plates downwardly until the slots in the plates and boxes coincide. Foot strike collapses the studs pushing the plates upwardly in the boxes. There is relative shortening of the strap betwen the boxes and the cut out tightening the lace, narrowing the cut out and elevating the footbed. Thus, there is reduced movement between the foot and the shoe and redistribution of the shock load.

Referring to Figs. 14—16 in still another embodiment, a shoe 100 has a lower sole 101 and an upper shell 102. The upper shell of the shoe includes a conventional v-shaped cut out 103 above the forefoot 104. A tongue 105 underlies the cut out. A lace 106 passes through eyelets 107 from the toe end of the cut out to the instep end. The lace passes from the eyelet on the outside of the shell to each eyelet on the inside of the shell on the opposite side of the cut out. The lace is tied in the conventional manner. The lace also passes through eyelets 108 in finger like projections of a strap 109 located on each side of the cut out at alternate eyelet 108 positions. The strap passes downwardly and rearwardly to a slot 110 located in the heel counter 111 and upper shell 102 above the level of the upper surface of the lower sole. The strap then passes slidably through slot 110 and under a semirigid footbed 112. Resilient compressible material 113 or a gas chamber lies between the footbed and the lower sole. Alternatively, separate strap ends pass through slots in the side of the footbed and attach to the inner side of the heel counter on the same side of the shoe or pass under the footbed and attach to the opposite heel counter wall.

In use, the foot is placed inside the shoe and the lace is tightened and tied on the upper shell to establish a close comfortable fit. As the lace is tightened, the footbed is elevated from the lower sole. The strap length and slot height are predetermined to elevate the footbed a predetermined distance above the sole when the strap and shell eyelets coincide in position. During foot strike, the footbed is lowered toward the sole pulling the lace and strap downwardly and rearwardly tightening the upper shell on the foot. As a result, a portion of the impulse shock load of foot strike is distributed from the bottom of the sole of the foot to the side and top of the foot. The dynamic tightening on the heel, midfoot and forefoot allows a less critical fit in the shop and reduced foot slippage in the shoe and consequent micro injury and energy loss.

Referring to Figs. 17—20 in still another embodiment, a shoe 125 has a lower sole 126 and upper shell 127. The upper shell of the shoe includes a conventional V-shaped cut out 128 generally above the forefoot 129. A tongue 130 underlies the cut out. A lace 131 secured to the upper shell passes through eyelets 132 from the toe end of the cut out to the instep end. The lace passes from each eyelet on the outside of the shell to each eyelet on the inside of the shell on the opposite side of the cut out. The lace is tied in the conventional manner. The lace also passes through eyelets 133 in finger like projections of straps 134 and 135 located on each side of the cut out between eyelet 132 positions. The straps which may have elastic segments 139 and which may in an alternative embodiment pass through slots in the side of the shoe and over the instep, pass downwardly and rearwardly to slots 136 located in the sides of resilient compressible lower sole 126. The straps then pass between upper and lower complimentary meshing folded or corrugated surfaces of an elastomer sole section or between plates 137 and 138 embedded in the resilient lower sole 126. The folded plates can be located in the shell or at the surface interface between the shell and sole or in the sole and include a large interface surface. Each strap is attached by a rivet 139 or the like to the upper corrugated plate on the opposite side of the shoe. The corrugated plates are preferably constructed of a semirigid plastic to allow some flexibility during foot strike. The plates are preferably riveted at 140 to form stabilizing hinged plates. The upper plate includes rigid or semirigid downwardly extending plate members 141 shiftable relative to the lower sole. The plate members 141 slide in slots 142 in the resiliently compressible lower sole as the sole is compressed during foot strike weighting. This provides lateral stability

during foot strike weighting and allows the potential vertical compression of the lower sole shock absorber available for energy absorption.

In use, the foot is placed inside of the shoe and the lace is tightened and tied on the upper shell to establish a close comfortable fit. Because of the dynamic fitting system, the shoe is easier to fit than a conventional sport shoe. As the lace is tightened, the straps 134 and 135 are held in a tightly drawn position. During weighting, the straps are pulled downwardly and rearwardly tightening the upper shell on the foot. The shock load impulse of foot strike is distributed to the midfoot and forefoot while the shoe is dynamically tightened on the wearer's foot.

Details have been disclosed to illustrate the invention in a preferred embodiment of which adaptations and modifications within the spirit and scope of the invention will occur to those skilled in the art. The scope of the invention is limited only by the following claims.

Claims

1. A flexible sole shoe comprising an upper shell (3; 50), a lower sole (2; 49) secured to the upper shell, and tightening means (27; 52) for increasing the tightness of the fit of the shoe on a foot of a user, further comprising means (19; 51) for sensing when the user of the shoe temporarily applies increased weight to the sole upon touching a support surface of the shoe, wherein

the tightening means (27; 52) is responsive to said sensing means for temporarily increasing the tightness of the fit of the shoe, as the user temporarily applies the increased weight to the sole, wherein

the tightening means comprises a strap-like element extending from the sensing means over the instep and forefoot and connecting on the opposite end to said sensing means,

the lower sole (2; 49) is a resilient sole, and wherein there is provided an insert (14; 51) which is movably arranged within the shoe to be lowered toward said sole (2; 49) and which is connected with said sensing means.

2. A flexible sole shoe comprising an upper shell (34), a lower sole (33) secured to the upper shell, and tightening means (35) for increasing the tightness of the fit of the shoe on a foot of a user, further comprising

means (41) for sensing when the user of the shoe temporarily applies increased weight to the sole upon touching a support surface for the shoe,

wherein the tightening means (35) is responsive to said sensing means for temporarily increasing the tightness of the fit of the shoe, as the user temporarily applies increased weight to the sole, wherein the tightening means comprises a strap-like element extending from the upper shell over the instep and forefoot and connecting on the opposite end to said upper shell,

the lower sole (33) is a resilient sole, and wherein said sensing means comprises at least one elongated pivot bar member (41) which is pivoted at said sole (33).

3. A flexible sole shoe comprising an upper shell (58; 78; 102; 127), a lower sole (57; 77; 191; 126) secured to the upper shell, and tightening means (68; 91; 109; 134) for increasing the tightness of the fit of the shoe on a foot of a user, further comprising

means (64; 87; 112; 137; 138) for sensing when the user of the shoe temporarily applies increased weight to the sole upon touching the support surface for the shoe,

wherein the tightening means is responsive to said sensing means for temporarily increasing the tightness of the fit of the shoe, as the user temporarily applies increased weight to the sole,

wherein the tightening means comprises a strap-like element extending from the sensing means and connecting on the opposite end to said upper shell,

the lower sole (57; 77; 101; 126) is a resilient sole, and

wherein there is provided an insert (64; 87; 112; 137; 138) which is movable arranged within the shoe to be moved relative to said sole (57; 77; 101; 126) and which is connected with said sensing means.

4. A flexible sole shoe comprising an upper shell (3; 34; 50; 58; 78; 102; 127), a lower sole (2; 33; 49; 57; 77; 101; 126), secured to the upper shell, and tightening means (27; 35; 52; 68; 91; 109; 134) for increasing the tightness of the fit of the shoe on a foot of a user, further comprising means (19; 41; 51; 64; 87; 112; 137; 138) for sensing when the user of the shoe temporarily applies increased weight to the sole upon touching a support surface of the shoe, wherein the tightening means is responsive to said sensing means for temporarily increasing the tightness of the fit of the shoe, as the user temporarily applies increased weight to the sole, wherein the tightening means comprises a strap-like element extending from the sensing means over the instep and forefoot and is connected on the opposite end to said sensing means, the lower sole (2; 33; 49; 57; 77; 101; 126) in a resilient shoe, and wherein there is provided a sensing member (19; 41; 51; 64; 87; 112; 137; 138) which is movably arranged to be moved through movement of the foot towards the lower surface of the shoe.

5. A flexible sole shoe comprising an upper shell (50; 58; 78; 102; 127), a lower sole (49; 57; 77; 101; 126), secured to the upper shell, and tightening means (52; 68; 91; 109; 134) for increasing the tightness of the fit of the shoe on a foot of a user, further comprising means (51; 64; 87; 112; 137; 138) for sensing when the user of the shoe temporarily applies increased weight to the sole upon touching a support surface for the shoe,

wherein the tightening means is responsive to said sensing means for temporarily increasing the tightness of the fit of the shoe, as the user temporarily applies increased weight to the sole, wherein the tightening means comprises a strap-

like element connected to said shell and extending to said sensing means; the lower sole (49; 57; 77; 101; 126) is a resilient sole, and wherein there is relative shortening of the strap-like element as the foot moves towards the lower surface of the shoe.

6. A flexible sole shoe comprising an upper shell (3; 50; 58; 78; 102; 127), a lower sole (2; 49; 57; 77; 101; 126), secured to the upper shell, and tightening means (27; 52; 68; 91; 109; 134) for increasing the tightness of the fit of the shoe on a foot of a user, further comprising means (19; 51; 64; 87; 112; 137; 138) for sensing when the user of the shoe temporarily applies increased weight to the sole upon touching a support surface for the shoe, wherein the tightening means is responsive to said sensing means for temporarily increasing the tightness of the fit of the shoe, as the user temporarily applies increased weight to the sole, wherein the tightening means comprises a strap-like element connected to said shell and connected on the opposite end to said sensing means; the lower sole (27; 52; 68; 91; 109; 134) is a resilient sole, and wherein there is provided a sensing member (19; 51; 64; 87; 112; 137; 138) which is movably arranged entirely above the lower surface of the shoe.

7. Shoe according to one of the preceding claims including adjusting means (29; 46; 55; 74; 84; 106; 131) for varying the degree to which the tightness of the fit is increased by the tightening means.

8. Shoe according to one of the preceding claims wherein a strap-like element (35; 68; 91; 109; 134) engages the upper surface of the shoe.

9. Shoe according to one of the preceding claims wherein a strap is connected with a heel counter (53; 67).

10. Shoe according to one of the preceding claims wherein a strap is connected with a shoe lace (84; 106; 131).

11. Shoe according to one of the preceding claims wherein there is provided a footbed (17; 94) and wherein the sensing means (19; 87) extends above the footbed.

12. Shoe according to one of the preceding claims wherein a sensing means (19; 51; 64; 87; 112; 137; 138) is located entirely within the shoe.

Patentansprüche

1. Schuh mit flexibler Sohle, enthaltend einen oberen Schaft (3; 50), eine untere Sohle (2; 49), die an dem oberen Schaft befestigt ist, und Festzieheinrichtungen (27; 52) zum Vergrößern der Festigkeit des Sitzes des Schuhs an einem Fuß eines Benutzers, weiterhin enthaltend

eine Einrichtung (19; 53) zum Erfühlen, wenn der Benutzer des Schuhs vorübergehend erhöhtes Gewicht auf die Sohle beim Berühren einer Abstützfläche für den Schuh aufbringt, wobei

die Festzieheinrichtung (27; 52) auf die genannte Fühleinrichtung anspricht, um vorübergehend die Festigkeit des Sitzes des Schuhs zu steigern, wenn der Benutzer vorübergehen das erhöhte Gewicht auf die Sohle aufbringst, wobei die Festzieheinrichtung ein laschenförmiges Element enthält, das sich von der Fühleinrichtung über den Rest und den Vorderfuß erstreckt und an entgegengesetzten Ende mit der Fühleinrichtung verbunden ist,

die untere Sohle (2; 49) eine elastische Sohle ist, und wobei ein Einsatz (14; 51) vorgesehen ist, der beweglich innerhalb des Schuhs angeordnet ist, um gegen die Sohle (2; 49) abgesenkt zu werden, und der mit der Fühleinrichtung verbunden ist.

2. Schuh mit flexibler Sohle, enthaltend einen oberen Schaft (34), eine untere Sohle (33), die an dem oberen Schaft befestigt ist, und eine Festzieheinrichtung (35) zum Steigern der Festigkeit des Sitzes des Schuhs an einem Fuß eines Benutzers, weiterhin enthaltend

eine Einrichtung (41) zum Erfühlen, wenn der Benutzer des Schuhs vorübergehend vergrößertes Gwicht auf die Sohle beim Berühren einer Trägerfläches für den Schuh aufbringt,

wobei die Festzieheinrichtung (35) auf die genannte Fühleinrichtung anspricht, um vorübergehend die Festigkeit des Sitzes des Schuhs zu steigern, wenn der Benutzer vorübergehend erhöhtes Gewicht auf die Sohle aufbringt, wobei die Festzieheinrichtung ein laschenförmigers Element enthält, das sich von dem oberen Schaft über den Rist und den Vorderfuß erstreckt und am entgegengesetzten Ende mit dem oberen Schaft verbunden ist,

die untere Sohle (33) eine elastische Sohle ist, und wobei die Fühleinrichtung wenigstens ein längliches Schwenkstabelement (41) enthält, das an der Sohle (33) schwenkbar gelagert ist.

3. Schuh mit flexibler Sohle, enthaltend einen oberen Schaft (58; 78; 102; 127), eine untere Sohle (57; 77; 101; 126), die an dem oberen Schaft befestigt ist, und eine Festzieheinrichtung (68; 91; 109; 134) zum Steigern der Festigkeit des Sitzes des Schuhs an einem Fuß einem Benutzers, weiterhin enthaltend

eine Einrichtung (64; 87; 112; 137; 138) zum Erfühlen, wenn der Benutzer des Schuhs vorübergehend vergrößertes Gewicht auf die Sohle beim Berühren einer Abstützfläche für den Schuh aufbringt,

wobei die Festzieheinrichtung auf die genannte Fühleinrichtung anspricht, um vorübergehend die Festigkeit des Sitzes des Schuhs zu steigern, wenn der Benutzer vorübergehend vergrößertes Gewicht auf die Sohle aufbringt, wobei die Festzieheinrichtung ein laschenförmiges Element enthält, das sich von der Fühleinrichtung erstreckt und am entgegengesetzten Ende mit dem oberen Schaft verbunden ist,

die untere Sohle (57; 77; 101; 126) eine elastische Sohle ist, und wobei ein Einsatz (64; 87; 112; 137; 138) vorgesehen ist, der innerhalb des Schuhs beweglich angeordnet und relativ zu der Sohle (57; 77; 101; 126) bewegt wird und mit der Fühleinrichtung verbunden ist.

4. Schuh mit flexibler Sohle, enthaltend einen oberen Schaft (3; 34; 50; 58; 78; 102; 127), eine

untere Sohle (2; 33; 49; 57; 77; 101; 126), die an dem oberen Schaft befestigt ist, und eine Festzieheinrichtung (27; 35; 52; 68; 91; 109; 134) zum Steigern der Festigkeit des Sitzes des Schuhs an einem Fuß eines Benutzers, weiterhin enthantend eine Einrichtung (19; 41; 51; 64; 87; 112; 137; 138) zum Erfühlen, wenn der Benutzer des Schuhs vorübergehend erhöhtes Gewicht auf die Sohle aufbringt beim Berühren einer Abstützfläche für den Schuh, wobei die Festzieheinrichtung auf die Fühleinrichtung anspricht, um vorübergehend die Festigkeit des Sitzes des Schuhs zu steigern, wenn der Benutzer vorübergehend erhöhtes Gewicht auf die Sohle aufbringt, wobei die Festzieheinrichtung ein laschenförmiges Element enthält, das sich von der Fühleinrichtung über den Rist und den Vorderfuß erstreckt und am entgegengesetzten Ende mit der Fühleinrichtung verbunden ist, die untere Sohle (2; 33; 49; 57; 77; 101; 126) eine elastische Sohle ist und wobei ein Fühlelement (19; 41; 51; 64; 87; 112; 137; 138) vorgesehen ist, das beweglich angeordnet ist, um durch Bewegung des Fußes gegen die Unterweite des Schuhs bewegt zu werden.

5. Schuh mit flexibler Sohle, enthaltend einen oberen Schaft (50; 58; 78; 102; 127), eine untere Sohle (49; 57; 77; 101; 126), die an dem oberen Schaft befestigt ist, und eine Festzieheinrichtung (52; 68; 91; 109; 134) zum Steigern der Festigkeit des Sitzes des Schuhs an einem Fuß eines Benutzers, weiter enthaltend eine Einrichtung (51; 64; 87; 112; 137; 138) zum Erfühlen, wenn der Benutzer des Schuhs vorübergehend erhöhtes Gewicht auf die Sohle beim Berühren einer Abstützfläche für den Schuh aufbringt,

wobei der Festzieheinrichtung auf die Fühleinrichtung anspricht, um vorübergehend die Festigkeit des Sitzes des Schuhs zu steigern, wenn der Benutzer vorübergehend erhöhtes Gewicht auf die Sohle aufbringt, wobei die Festzieheinrichtung ein laschenförmiges Element enthält, das mit dem Schaft verbunden ist und sich zu der Fühleinrichtung erstreckt; die untere Sohle (49; 57; 77; 101; 126) ist eine elastische Sohle, und wobei eine relative Verkürzung des laschenförmigen Elements stattfindet, wenn der Fuß sich gegen die Unterseite des Schuhs bewegt.

6. Schuh mit flexibler Sohle, enthaltend einen oberen Schaft (3; 50; 58; 78; 102; 127), eine untere Sohle (2; 49; 57; 77; 101; 126), die an dem oberen Schaft befestigt ist und eine Festzieheinrichtung (27; 52; 68; 91; 109; 134) zum Steigern der Festigkeit des Sitzes des Schuhs an einem Fuß einem Benutzers, weiterhin enthaltend eine Einrichtung (19; 51; 64; 87; 112; 137; 138) zum Erfühlen, wenn der Benutzer des Schuhs vorübergehend erhöhtes Gewicht auf die Sohle beim Berühren einer Abstützfläche für den Schuh aufbringt, wobei die Festzieheinrichtung auf die Fühleinrichtung anspricht, um vorübergehend die Festigkeit des Sitzes des Schuhs zu teigern, wenn der Benutzer vorübergehend erhöhtes Gewicht auf die Sohle aufbringt, wobei die Festzieheinrichtung ein laschenförmiges Element enthält, das mit dem Schaft verbunden ist und an entgegengesetzten Ende mit der Fühleinrichtung verbunden ist; die untere Sohle (27; 52; 68; 91; 109; 134) ist eine elastische Sohle, und wobei ein Fühlelement (19; 51; 64; 87; 112; 137; 138) vorgesehen ist, das beweglich vollständig über der Unterseite des Schuhs angeordnet ist.

7. Schuh nach einem der vorhergehenden Ansprüche, enthaltend eine Einstelleinrichtung (29; 46; 55; 74; 84; 106; 131) zum Variieren des Ausmaßes, auf das die Festigkeit des Sitzes durch die Festzieheinrichtung gesteigert wird.

8. Schuh nach einem der vorhergehenden Ansprüche, bei dem ein laschenförmiges Element (35; 68; 91; 109; 134) an der Oberseite des Schuhs angreift.

9. Schuh nach einem der vorhergehenden Ansprüche, bei dem eine Lasche mit einer Fersenstütze (53; 67) verbunden ist.

10. Schuh nach einem der vorhergehenden Ansprüche, bei welchem eine Lasche mit eine Schuhsenkel (84; 106; 131) verbunden ist.

11. Schuh nach einem der vorhergehenden Ansprüche, bei dem ein Fußbett (17; 94) vorgesehen ist und die Fühleinrichtung (19; 87) sich über das Fußbett erstreckt.

12. Schuh nach einem der vorhergehenden Ansprüche, bei dem eine Fühleinrichtung (19; 51; 64; 87; 112; 137; 138) vollständig innerhalb des Schuhs angeordnet ist.

Revendications

1. Chaussure à semelle flexible, comprenant une coquille supérieure (3; 50), une semelle inférieure (2; 49) fixée à la coquille supérieure et un moyen de serrage (27; 52) destiné à accroître le serrage de l'emboîtement de la chaussure sur le pied d'un utilisateur, comprenant en outre un moyen (19; 51) pour détecteur l'application temporaire, par l'utilisateur de la chaussure, d'un poids accru sur la semelle lors de la rencontre de la chassure avec une surface de support,

chaussure dans laquelle le moyen de serrage (27; 52) est sensible audit moyen de détection de façon à augmenter temporairement le serrage de l'emboîtement de la chaussure lorsque l'utilisateur applique temporairement le poids accru sur la semelle, le moyen de serrage comprenant un élément en forme de courroie s'étendant à partir du moyen de détection et au-dessus du cou-de-pied et de l'avant-pied et relié par son extrémité opposée audit moyen de détection,

dans laquelle la semelle inférieure (2; 49) est une semelle élastique et dans laquelle il est prévu une pièce rapportée (14; 51) qui est disposée de façon mobile à l'intérieur de la chassure de manière à être abaissée vers ladite semelle (2; 49) et qui est reliée audit moyen de détection.

2. Chaussure à semelle flexible, comprenant une coquille supérieure (34), une semelle inférieure (33) fixée à la coquille supérieure et un moyen de serrage (35) destiné à accroître le serrage de l'emboîtement de la chaussure sur le pied d'un utilisateur, comprenant en outre un moyen (41) pour détecter l'application tempo-

raire, par l'utilisateur de la chaussure, d'un poids acru sur la semelle lors de la rencontre de la chaussure avec une surface de support,

chaussure dans laquelle le moyen de serrage (35) est sensible audit moyen de détection de façon à augmenter temporairement le serrage de l'emboîtement de la chaussure lorsque l'utilisateur applique temorairement le poids accru sur la semelle, le moyen de serrage comprenant im élément en forme de courroie s'étendant à partir de la coquille supérieure et au-dessus du cou-de-pied et de l'avant-pied et relilé par son extrémité opposée à ladite coquille supérieure.

dans laquelle la semelle inférieure (33) est une semelle élastique et dans laquelle ledit moyen de détection comprend au moins un élément allongé (41) en forme de barre pivotante et articulé sur ladite semelle (33).

3. Chaussure à semelle flexible, comprenant une coquille supérieure (58; 78; 102; 127), une semelle inférieure (57; 77; 101; 126) fixée à la coquille supérieure et un moyen de serrage (68; 91; 109; 134) destiné à accroître le serrage de l'emboîtement de la chaussure sur le pied d'un utilisateur, comprenant en outre un moyen (64; 87; 112; 137; 138) pour détecter l'application temporaire, par l'utilisateur de la chaussure, d'un poids accru sur la semelle lors de la rencontre de la chaussure avec une surface de support,

chaussure dans lequelle le moyen de serrage est sensible audit moyen de détection de façon à augmenter temporairement le serrage de l'emboîtement de la chaussure lorsque l'utilisateur applique temporairement le poids accru sur la semelle, le moyen de serrage comprenant un élément en forme de courroie s'étendant à partir du moyen de détection et relié par son extrémité opposée à ladite coquille supérieure.

dans laquelle la semelle inférieure (57; 77; 101; 126) est une semelle élastique et dans laquelle il est prévu une piéce rapportée (64; 87; 112; 137; 138) qui est disposée de façon mobile à l'intérieur de la chaussure de manière à être déplacée par rapport à ladite semelle (57; 77; 101; 126) et qui est relié audit moyen de détection.

4. Chaussure à semelle flexible, comprenant une coquille supérieure (3; 34; 50; 58; 78; 102; 127), une semelle inférieure (2; 33; 49; 57; 77; 101; 126) fixée à la coquille supérieure et un moyen de serrage (27; 35; 52; 68; 91; 109; 134) destiné à accroître le serrage de l'emboîtement de la chaussure sur le pied d'un utilisateur, comprenant en outre un moyen (19; 41; 51; 64; 87; 112; 137; 138) pour détecter l'application temporaire, par l'utilisateur de la chaussure, d'un poids accru sur la semelle lors de la rencontre de la chaussure avec une surface de support,

chaussure dans laquelle le moyen de serrage est sensible audit moyen de détection de façon à augmenter temporairement le serrage de l'emboîtement de la chaussure lorsque l'utilisateur applique temporairement le poids accru sur la semelle, le moyen de serrage comprenant un élément en forme de courrole s'étendant à partir du moyen de détection et au-dessus du cou-de-pied et de l'avant-pied et relié par son extrémité opposée audit moyen de détection,

dans laquelle la semelle inférieure (2; 33; 49; 57; 77; 101; 126) est une semelle élastique et dans laquelle il est prévu un organe de détection (19; 41; 51; 64; 87; 112; 137; 138) disposé de façon mobile de manière à être déplacé lors du déplacement du pied vers la surface inférieure de la chaussure.

5. Chaussure à semelle flexible, comprenant une coquille supérieure (50; 58; 78; 102; 127), une semelle inférieure (49; 57; 77; 101; 126) fixée à la coquille supérieure et un moyen de serrage (52; 68; 91; 109; 134) destiné à accroître le serrage de l'emboîtement de la chaussure sur le pied d'un utilisateur, comprenant en outre un moyen (51; 64; 87; 112; 137; 138) pour détecter l'application temporaire, par l'utilisateur de la chaussure, d'un accru sur la semelle lors de la rencontre de la chaussure avec une surface de support.

chaussure dans laquelle le moyen de serrage est sensible audit moyen de détection de façon à augmenter temporairement le serrage de l'emboîtement de la chaussure lorsque l'utilisateur applique temporairement le poids accru sur la semelle, le moyen de serrage comprenant un élément en forme de courroie relié à ladite coquille et s'étendant jusqu'au moyen de détection,

dans laquelle la semelle inférieure (49; 57; 77; 101; 126) est une semelle élastique et dans laquelle il se produite raccourcissement relatif de l'élément en forme de courroie à mesure que le pied se déplace vers la surface inférieure de la chaussure.

6. Chaussure à semelle flexible comprenant une coquille supérieure (3; 50; 58; 78; 102; 127), une semelle inférieure (2; 49; 57; 77; 101; 126) fixée à la coquille supérieure et un moyen de serrage (27; 52; 68; 91; 109; 134) destiné à accroître le serrage de l'emboîtement de la chaussure sur le pied de l'utilisateur, comprenant en outre un moyen (19; 51; 64; 87; 112; 137; 138) pour détecter l'application temporaire, par l'utilisateur de la chaussure, d'un poids accru sur la semelle lors de la rencontre de la chaussure avec une surface de support,

chaussure dans laquelle le moyen de serrage est sensible audit moyen de détection de façon à augmenter temporairement le serrage de l'emboîtement de la chaussure lorsque l'utilisateur applique temporairement le poids accru sur la semelle, le moyen de serrage comprenant un élément en forme de courroie relié à ladite coquille et, par l'extrémité opposée, audit moyen de détection;

dans laquelle la semelle inférieure (27; 52; 68; 91; 109; 134) est une semelle élastique et dans laquelle il est prévu un organe de détection (19; 51; 64; 87; 112; 137; 138) qui est entièrement disposé de façon mobile au-dessus de la surface inférieure de la chaussure.

7. Chaussure selon l'une des revendications précédentes, comprenant un moyen de réglage (29; 46; 55; 74; 84; 106; 131) destiné à faire varier la mesure dans laquelle le moyen de serrage augmente le serrage de l'emboîtement.

8. Chaussure selon l'une des revendications précédentes, dans laquelle un élément en forme

de courroie (35; 68; 91; 109; 314) est en contact avec la surface supérieure de la chaussure.

9. Chaussure selon l'une des revendications précédentes, dans laquelle une courroie est reliée à un contre-talon (53; 67).

10. Chaussure selon l'une des revendications précédentes, dans laquelle une courroie est reliée à un lacet de chaussure (84; 106; 131).

11. Chaussure selon l'une des revendications précédentes, dans laquelle il est prévu un appui-pied (17; 94) et dans laquelle le moyen de détection (19; 87) s'étend au-dessus de l'appui-pied.

12. Chaussure selon l'une des revendications précédentes, dans laquelle un moyen de détection (19; 51; 64; 87; 112; 137; 138) est situé entièrement à l'intérieur de la chaussure.

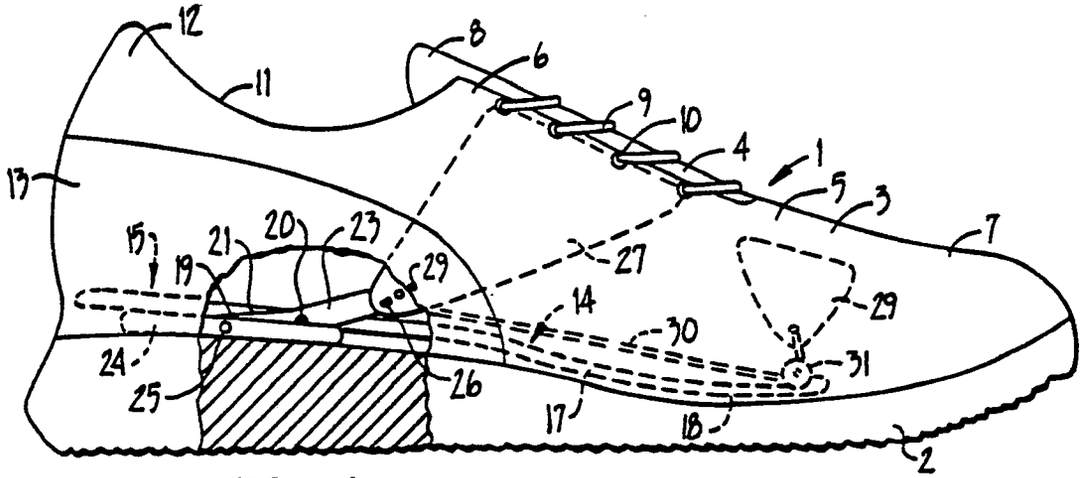


FIG.__1.

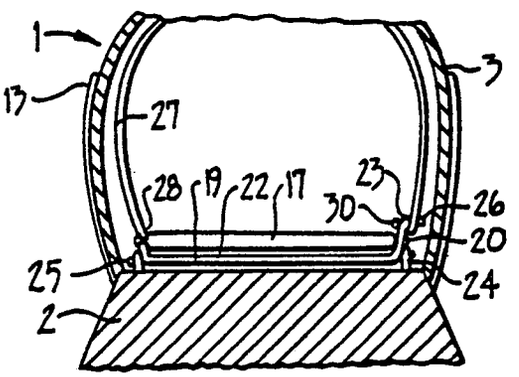


FIG.__3.

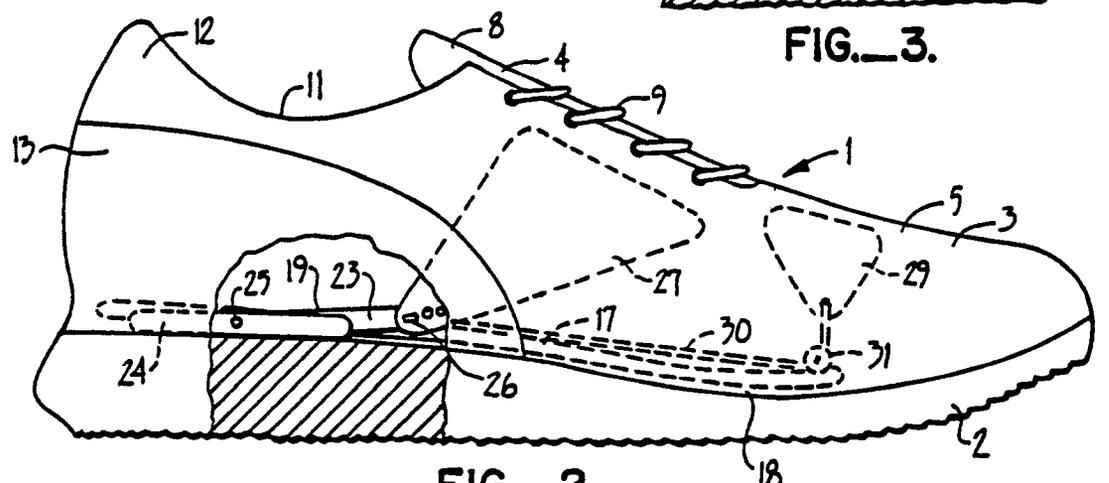


FIG.__2.

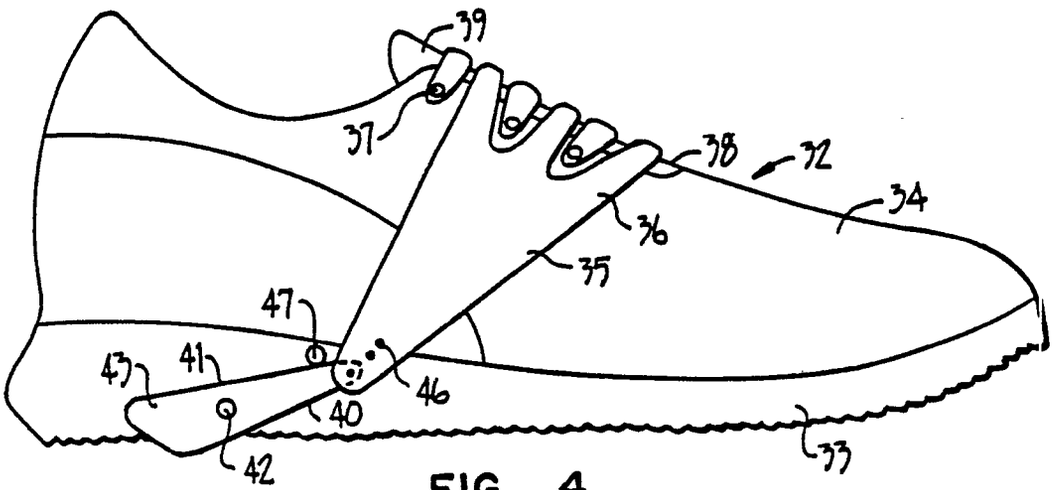


FIG. 4.

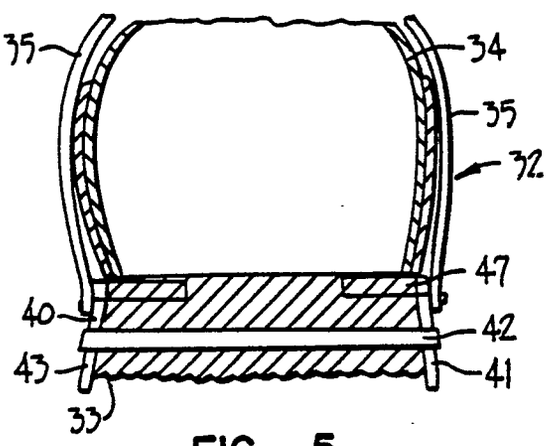


FIG. 5.

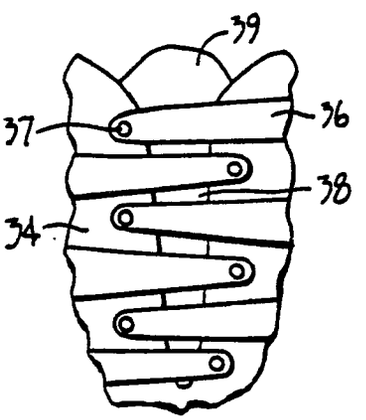


FIG. 6.

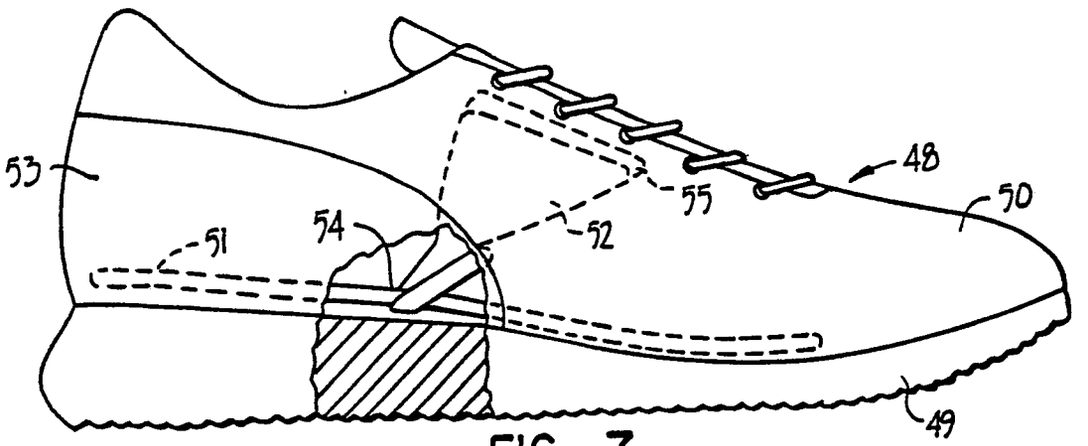


FIG._7.

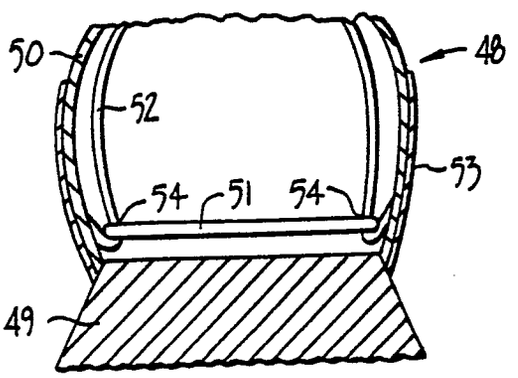


FIG._8.

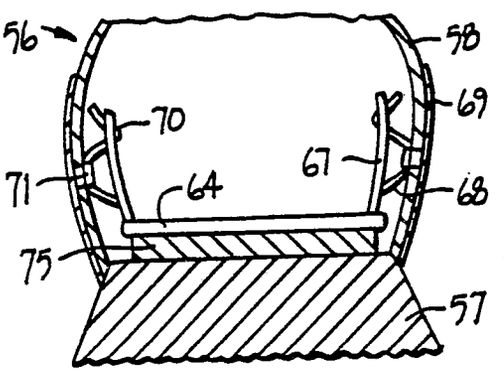


FIG._10.

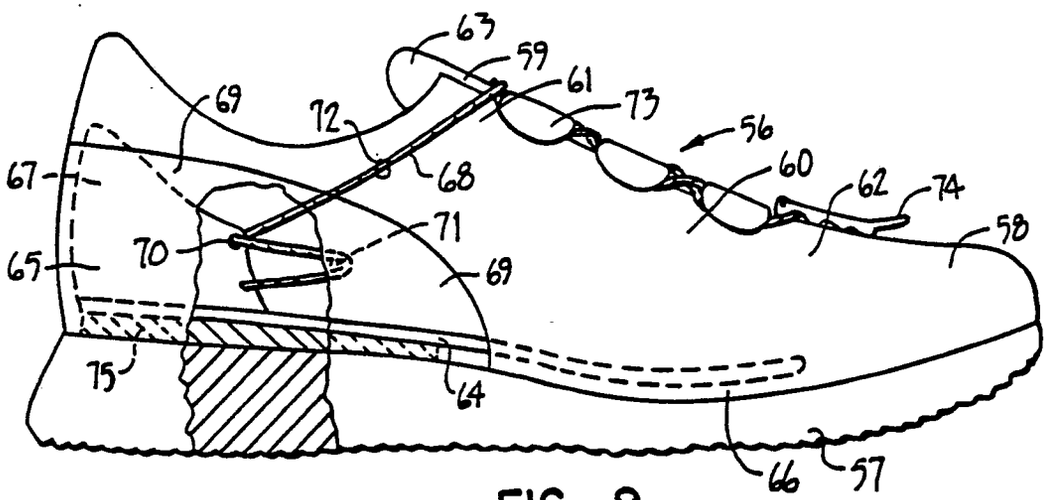


FIG._9.

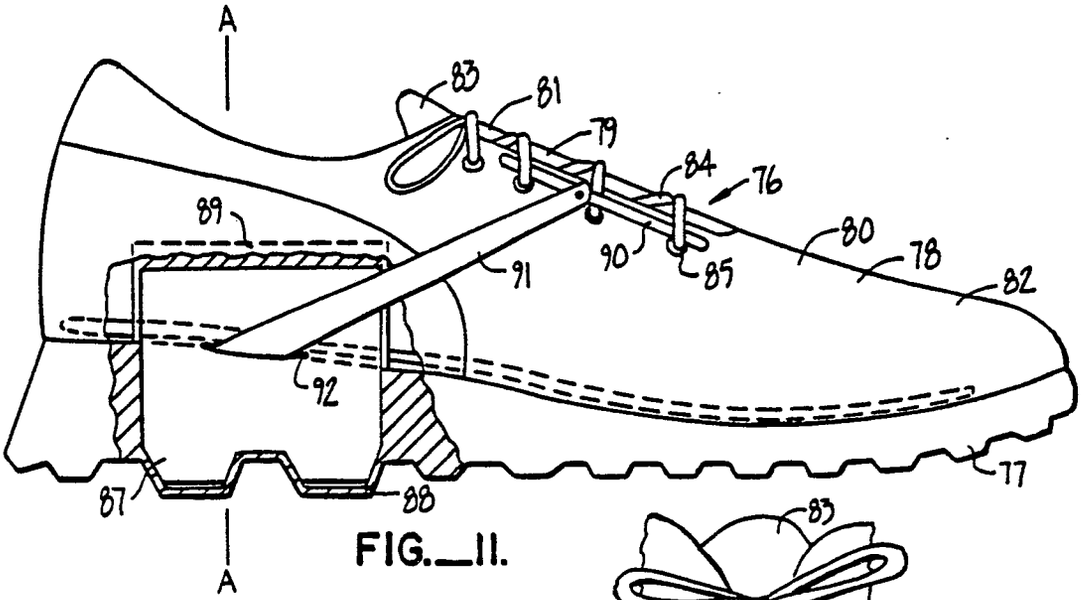


FIG._11.

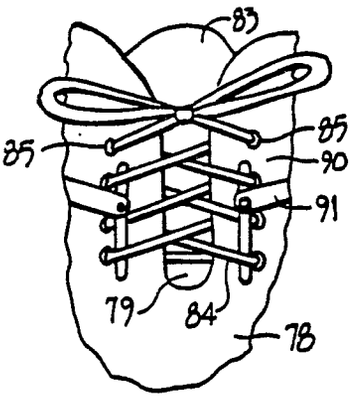


FIG._13.

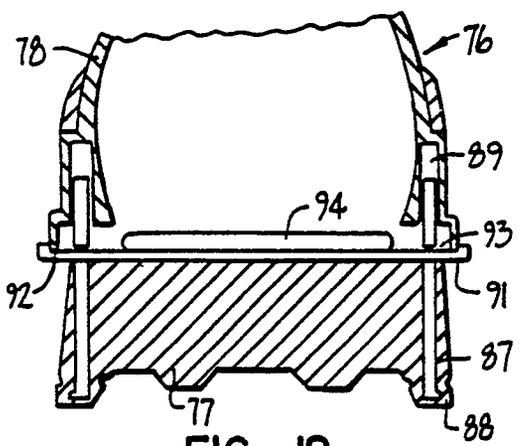


FIG._12.

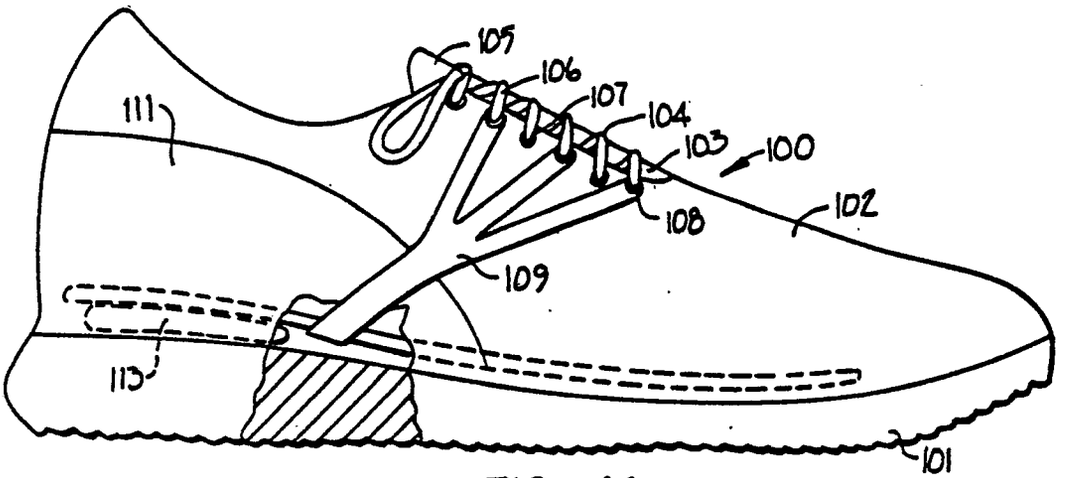


FIG._14.

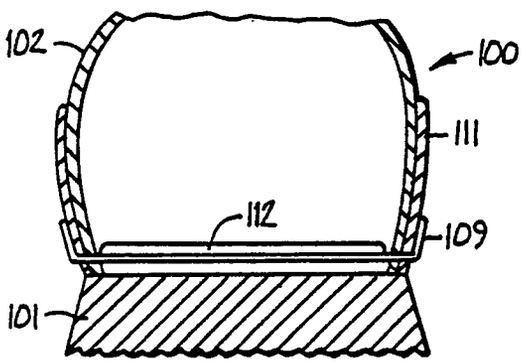


FIG._15.

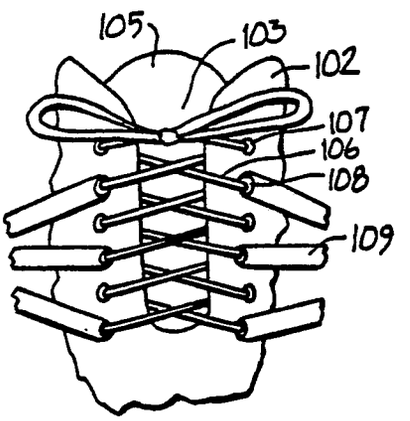


FIG._16.

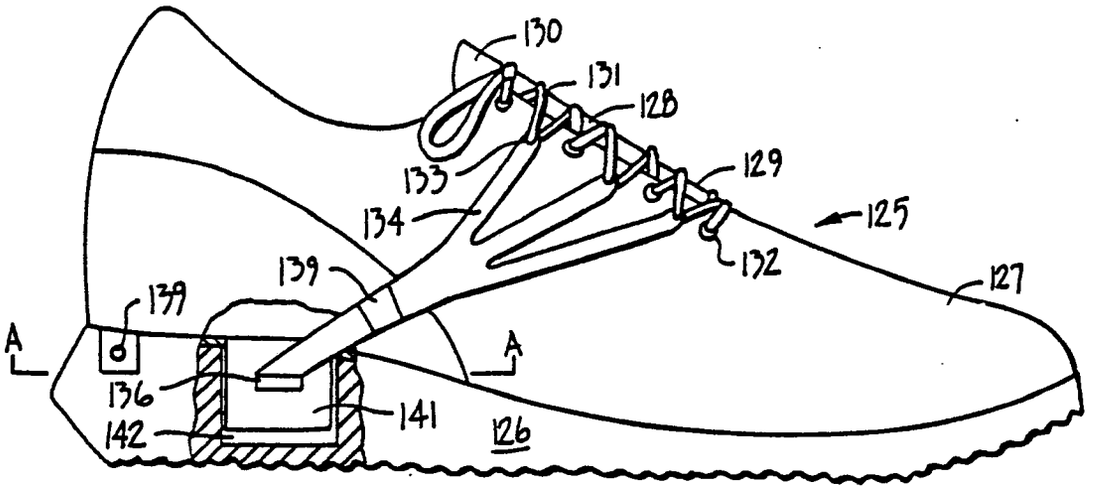


FIG._17.

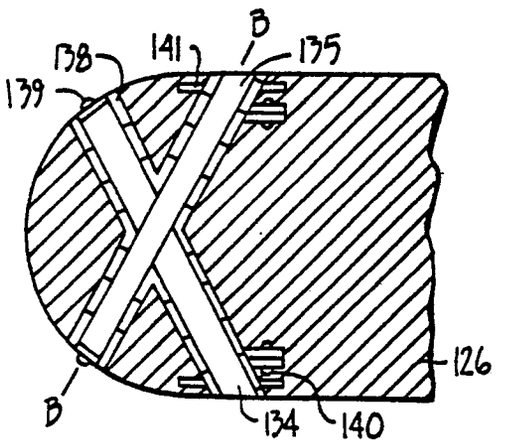


FIG._18.

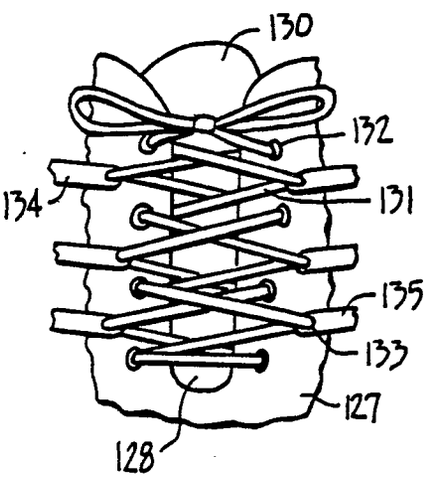


FIG._19.

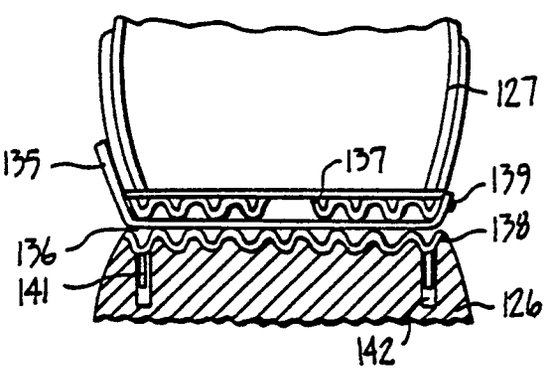


FIG._20.