

Springing element for shoe soles, shoe sole and shoe having such element

5 The invention relates to a springing element for shoe soles, consisting of at least one resilient cap or dome-like member.

 Various types of springing elements as described hereinbefore are known, which find application in the field of footwear, e.g. of sports footwear, and have the purpose of absorbing shocks deriving from athletic activities. Other examples of such type of shoes are those designed to be worn for long periods of time, which are to have so-called "relax" features. A discharge system, i.e. a system that can remove overstresses on the lower part of the locomotor system is the best solution to drastically reduce strains on articulations, meniscuses, tendons, muscles and bones. Typically, one or more of said springing elements are provided in the insole region, i.e. the one interposed between the underfoot member and the actual sole member, which is in contact with the ground. These elements are typically applied in the heel zone and in the plantar zone, i.e. in those subjected to the highest impact strain.

 According to a particularly simple arrangement, the springing effect may be obtained by providing a combination of one or more superposed and glued layers made of one or more elastic materials. As an alternative thereto, elastic inserts may be provided in

the forms of chambers containing a fluid having suitable properties, e.g. air. A different arrangement provides the use of helical springs, particularly made of steel or plastic, or of elastic cylinders, particularly made of polymers, which also provide a fairly good reactivity. According to another arrangement, the springing element has the form of a cap or dome or of an arched washer with a big central hole. The cap is made from a relatively elastic material, and the central hole helps to provide the element with a relative resilience. In order to increase resilience, another embodiment provides that the hole is surrounded by a ring of resilient tabs, which increase the swinging action. According to a different arrangement, the springing element may be composed of a plurality of hollow members, particularly having a cylindrical shape made of an elastomer, and connected to each other by bridges of material. Each of the cylindrical elements has such an internal shape as to generate two superposed chambers, which communicate by a duct having a much smaller diameter than the two chambers, thereby reducing the speed of the air flow from one chamber to the other and creating the desired shock absorbing effect, due to the pressure caused by the walking action. The joined elastic cylinders are positioned in the insole region with their axes perpendicular to the sole. In accordance with an additional improvement, a plurality of domes are provided, in the form of elastic pads made of a solid material having suitable resilience properties.

While the various arrangements as proposed above allow a fairly good shock absorbing effect as regards simple walking or sports activities, they have several drawbacks, which are addressed by this invention.

5 First, most of the proposed arrangements are quite expensive and difficult to manufacture, particularly due to the use of highly specific materials, to the need of providing complex structures or even air cushions. In this particular case, it shall be noted
10 that an extensive use might reduce efficiency of said cushions and an accidental hole thereon might cause the shoe to lose all of its functions. Also, according to the proposed arrangements, the shock absorbing effect might be insufficient or excessive. Moreover, most
15 prior art arrangements may cause walking instability due to an excessive shock absorbing effect, and to the lack of means for limiting the springing stroke.

Therefore, the invention has the object of providing, by simple and inexpensive means, a springing
20 element for soles as described herein, as well as a sole and a shoe which allow to obviate the above drawbacks, while providing an enhanced or improved functionality, whereby the dynamic behavior of the shoe may be optimally adapted to physiological functional
25 needs. Another object is to predetermine a limited springing stroke, thereby reducing the local instability effect caused by the element. By limiting the springing stroke, a very important additional object is achieved, i.e. a certain local compression or
30 massage-like action on the plantar part, to reduce

fatigue and assist microcirculation, whose reduced speed often causes tiredness. In a few cases, the provision of therapeutic shoes might be desired, for instance to address vascular problems, like the serious
5 vascular problems of diabetic patients. A customizable positioning of the springing element is also desired, at least within certain limits, as related to specific needs or particular anatomic conformations. A further object is to allow an increased air circulation within
10 the shoe or air exchange with the outside, to provide obvious foot comfort enhancement advantages.

The invention achieves the above purposes by providing a springing element as described hereinbefore, which has at least one notch, but
15 preferably at least two transverse notches which form a cross-shaped notch. This notch allows to divide the cap into at least four independent limbs or sectors which are joined together along the base edge of the cap.

According to a preferred embodiment of the
20 invention, the cross-shaped notch may be positioned at the center, to divide the cap into four identical sectors. Moreover, the two notches which form the cross-shaped notch may have the same width.

Advantageously, especially relative to prior art,
25 the element may have means for limiting the resilience range of the sectors defined by the cross-shaped notch. As reminded above, this allows to limit the instability sensation due to the springing action and have a massage-like return action on the plantar part.

30 These means for limiting the resilience range may

be provided by the facing edges of the sectors along the notches in combination with the width thereof. Hence, as will be more clearly apparent from the drawings, when a certain flexing compression is reached, at least some or all of the sector edges come to contact with each other, thereby creating a "dome" effect, i.e. an optimized force discharge, and stop the elastic stroke.

The element may have any size and shape, e.g. the shape of a cone or truncated cone or combinations of shapes of cones, truncated cones and/or sectors of a sphere or spheroid. According to a preferred embodiment, it may have the shape of a sector of a spheroid, with an elongated and essentially elliptic plan shape.

The plan shape of the element may have a longer and a shorter symmetry axes, with the longer axis being preferably oriented in the longitudinal direction of the shoe or in the front to back direction of the foot. Specific anatomic and/or therapeutic needs might require one or more different orientations.

The height of the element may be greater than width, i.e. the dimension parallel to the bearing base, so that a proper stability sensation is transmitted to the user.

The element may be made of one or more relatively rigid, though intrinsically elastic materials, such as plastic and/or metal, particularly harmonic steel or combinations of materials.

In order to obtain a particular elastic behavior,

the element may have a multilayer laminar composition, or be made of a single homogeneous material.

Advantageously, the element is smaller than a shoe sole and its thickness substantially has the same order
5 of magnitude as the sole thickness.

According to an advantageous improvement, the dome-like element may have a flat base edge, or an outer peripheral annular flange whereby the element may be laid on and/or fastened to the sole, e.g. by gluing
10 or the like.

According to another advantageous improvement, the element may have means to increase the flexibility, i.e. resilience of one or more sectors. These means may consist of one or more lateral facing widened parts or
15 recesses of the notch edges. These recesses may be obtained, for instance, by providing a number of holes, particularly four, each at an end of each of the notches which form the cross-shaped notch, and whose diameter is slightly greater than the width of each
20 notch. This essentially reduces the angular extension of the area whereby each sector is connected to the basis of the dome and increases the bending potential of each sector.

The springing element may be provided in
25 combination with a sole, one or more of said springing elements being arranged in predetermined patterns between two superposed sole layers, i.e. an upper layer, so-called underfoot, and a lower layer, which forms the actual sole.

30 Advantageously, the one or more springing elements

may be disposed with the convex side turned toward the underfoot, so as to provide a massage-like action on the sole of the foot, as desired.

The springing elements may be evenly arranged over
5 the surface of the sole, or mainly concentrated or
exclusively disposed in a few partial zones of the
sole, in response to specific strains over the sole
surface and/or to particular therapeutic massage needs.
Particularly, they may be provided mainly or
10 exclusively in the heel and/or in the plantar zone.

According to another highly advantageous
improvement of the invention, means for locally
increasing the massage-like action of the dome on the
sole of the foot may be provided.

15 In accordance with a preferred embodiment of the
invention, these means may consist of a pushbutton-like
element, positioned at the crossing point of the two
notches which form the cross-shaped notch, which has
such a size as to lay over the corner area of each
20 sector to simultaneously act on all sectors.

This pushbutton may be held in position by a stem
which starts from an intermediate, particularly central
point of the bottom face thereof. The stem extends
perpendicularly downwards to an extent essentially
25 corresponding to the thickness of the sectors and ends
with a widened retaining head which rests on the bottom
faces of the sectors.

Elastically compressible support means may be
provided between the bottom face of the pushbutton and
30 the sector area whereon it lays, which means are made

of a rubber material or the like, and particularly consisting of at least one O-ring element, designed to also provide an elastic connection in the contact area between the button and the small dome and to generate a
5 further limited instability.

The button may have any suitable shape for concentrating the micro-massage action but, according to a preferred embodiment, it has a top dome-like face, so that the massage-like action may be better
10 concentrated. The shoe may be arranged to have all springing elements or only some of them provided with the pushbutton, not only to allow a proper walking support, but also to customize the above mentioned massage-like action.

15 The springing element may consist of combinations of two or more cap-like elements, made of the same or different materials and having the same or different curvatures, alternated in a predetermined order.

To this end, associated pumping means may be
20 provided to increase air circulation inside the shoe, which means are advantageously controlled by the compression stroke run by the springing element. In accordance with a preferred embodiment, these means consist of an additional dome-like element, made of a
25 resilient material, which is relatively soft and airtight, such as rubber or the like.

The pumping element may be complementary in shape to the springing element and be enclosed therein, in such a manner as to rest on the inner walls of the
30 springing element.

Obviously, all the springing elements of a shoe sole or only some of them may have the internal pumping member.

According to a preferred embodiment of the invention, which will be described in greater detail hereafter, the springing element has the form of a combined element, i.e. composed of a plurality of springing elements or members, having the characteristics as described hereinbefore, and joined together by a structure.

The springing members may be connected to each other to form composite, possibly prefabricated springing elements, arranged all along the sole or only over some portions thereof.

The composite springing elements may be made by overlapping composite springing elements provided with a plurality of coincident springing members, having different shapes and/or a materials and/or characteristics. Within a combined springing element, the springing members may be identical or different, either individually or in groups, as regards materials, elastic properties and sizes, whereby, for instance, the springing action may be customized in relation with the different areas of the plantar zone.

The springing members which form the combined element may be interconnected by bridges of material in the form of flat ribs or the like, particularly made of the material which forms the springing members, so that fabrication may be simplified and costs thereof may reduced. Nevertheless, the small domes may be also used

as individual separate elements.

The bridges for connecting the springing members may be arranged to be at least partly grooved, like connecting channels, with the concavity turned
5 downwards, i.e. having the same orientation as the concavity of the springing members.

Similarly, at least some of the pumping members may be interconnected by a structure of bridges, again made of the same material as the pumping members.

10 The pumping members may be interconnected by grooved bridges having the form of connecting channels, whose concavity has the same orientation as the pumping members, to form a combined air pumping element. The function of these channels is to provide passageways
15 from one pumping member to the other, thereby allowing to balance the presence of air in the various areas beneath the sole of the foot. Non connected elements may be also provided. The main purpose is to create an air blow to improve circulation within the shoe.
20 Further, negative and positive pressures are alternated in the shoe, for an increased air exchange with the outside.

Advantageously, the combined springing element and the combined pumping element may have complementary
25 shapes, so that the former may be laid over the latter to cause the pumping action.

The springing elements either in the form of separate domes or of a combined springing element having channel-like connecting elements, may be
30 disposed on a support plate.

According to a preferred embodiment, which will be described in greater detail in the description of the drawings, the support plate may be a saddle member to be slidably engaged on another support and guide
5 member, which may be permanently fastened to the top face of the shoe sole.

Particularly, the support plate may have, at each of its two opposite side edges, a saddle member to be slidably engaged in one of the two opposite side edges
10 of the guide member, which preferably has an essentially flat shape.

The sliding plate and/or the support element may have removable position lock means.

These means may be at least two lugs, preferably
15 two rows of lugs, and preferably having a rounded shape, disposed on the bottom face of the support plate, each row being provided in the proximity of one of the two saddle-like side edges, and two corresponding rows of recesses, disposed on the top
20 face of the support element, or vice versa, so that the support plate may be snap-fitted at predetermined locations, here again to allow shoe customization, as regards the spring and/or massage-like action.

The support element may be arranged to be secured
25 inside an enclosure of a sole, particularly in the heel zone. This enclosure has such a size as to allow the sliding plate to slide from front to back on the support element, i.e. is slightly longer than the latter, with reference to the longitudinal direction.

30 The support element may be secured to the sole in

a lifted position, e.g. by means of fastening feet, to allow the support plate to slide.

This invention also relates to a shoe which, as is known, typically includes a sole part which is formed
5 by the combination of at least two superposed layers, the so-called underfoot and the actual sole, and an upper part. The invention obviously also relates to the sole.

One or more springing elements with the
10 characteristics as described above may be provided between the underfoot and the sole.

These elements may extend in a lifted position relative to the lower layer of the sole, essentially to an extent corresponding to the resilience range
15 thereof.

Advantageously, the underfoot may be removably anchored to the sole, at least in the zones of the enclosures for the above movable springing elements, so that these enclosures may be accessed for displacement
20 and adjustment thereof.

The shoe may also have a heel which causes the sole, and the shoe in general, to be slanted. In this case, the springing element/s may be themselves slanted, particularly in the heel zone, with reference
25 to the horizontal bearing surface, and more particularly, have the same inclination as the sole, whereby the inclination of the foot on the shoe may be partly or wholly compensated. In some particular cases, the springing elements may have a different,
30 particularly opposite inclination, with respect to the

sole.

The advantages of this invention are apparent from the above, and consist in allowing to provide a shoe which has an effective springing and shock absorbing system, and may be also used for the above interesting and effective therapeutic applications. The springing element used herein is fabricated simply and inexpensively, and allows to walk comfortably, while avoiding the instability effects provided by the shoes having prior art springing elements.

Further characteristics and improvements will form the subject of the dependent claims.

The characteristics of the invention and the advantages derived therefrom will be more apparent from the following detailed description of the drawings annexed not by way of limitation, in which:

Fig. 1 is a top plan view of the springing element of the invention.

Fig. 2 is a sectional view with reference to the shorter axis of symmetry of the element as shown in Fig. 1, in an essentially uncompressed condition.

Fig. 3 is the same view as Fig. 2, with the element in an end of compression stroke condition.

Fig. 4 is a sectional view of the detail of the pushbutton application area.

Fig. 5 is a top plan view of the springing element with the pushbutton.

Figs. 6 and 7 are two different perspective views of a combined springing element, a combined pumping element and the corresponding sliding support element,

in a disassembled condition.

Fig. 8 shows the same elements as Figs. 6 and 7 in a partly assembled condition.

Fig. 9 shows the same elements as Figs. 6 and 7 in
5 an assembled condition.

Fig. 10 is a sectional view of the heel part of a shoe with the elements as shown in Figs. 6 and 7 inserted therein.

Fig. 11 is the same view as Fig. 10, the springing
10 elements being fastened in a different manner.

Fig. 12 is a sectional view of the heel part of a shoe whose sole has an inclined profile.

Referring to Fig. 1, a springing element according to the invention includes a cap, dome, or arched
15 washer-like member 1. Obviously, this shape shall be intended without limitation. The springing member may also have spheroid shapes or arched non-round shapes like cones, truncated cones or combined shapes. The dome-like member 1 is made of one or more relatively
20 rigid but resilient materials, such as plastic or metal. The preferred embodiment as shown in the Figures, has the shape of a sector of a spheroid, and an elongated plan shape. The plan shape has longer and shorter axes of symmetry, denoted as AA' and BB' in
25 Fig. 1 and, as shown in Figures 6 to 12, when the element is inserted in the shoe the longer axis AA' is oriented in the longitudinal direction of the shoe and in the front-to-back direction of the foot. Different orientations may be obviously provided to address
30 particular springing needs and/or particular shoe

conformations.

At the center of the cap 1, two transverse notches 2, 3 are provided, whose profile substantially corresponds to the two axes of symmetry AA' and BB', and which form a cross-shaped notch. This cross shaped notch 2, 3 allows to divide the cap 1 into four independent and identical sectors 4 which are joined together along the base edge of the cap 1. As the sectors 4 bend, the springing element accomplishes its shock absorbing function. The position of the cross-shaped notch 2, 3, as shown in Fig. 1 is only a preferred arrangement, while notches having different profiles and/or positions may be also provided. The dashed lines outline another possible notch 5 which is angularly staggered with respect to the notch 2, 3, and may be provided as an alternative thereto or in combination therewith. Several different arrangements may be also provided, e.g. a division of the dome 1 into three sectors by a notch which has no cross-like shape but a Y or T-shape.

The two notches 2, 3 have a constant width which defines, as will be apparent hereafter, the resilience range limit of the sectors 4. The dome 1 may have a flattened base edge, i.e. a peripheral outer annular flange, denoted as 6 in Figures 2 and 3, whereby the springing element may be laid on and/or fastened on the top surface of a sole or of any support plate 7 (Figs. 6 and 7). The members may be arranged in any manner over the sole surface and may follow predetermined patterns, adapted both to the physiological features of

the user and to the specific use of the shoe.

In order to further enhance the flexibility properties of the sectors 4, at each end of each of the notches 2, 3 which form the cross-shaped notch, a hole 5 8 is provided, whose diameter is slightly longer than the width of each notch 2, 3 and such as to create pairs of lateral widened or recessed portions of the edges of the notches 2, 3. This actually reduces the angular extension of the area which connects each 10 sector 4 to the basis of the dome 1, in such a manner as to locally weaken each sector 4 and increase the resilience thereof.

Referring now to Figures 2 and 3, the behavior of the springing element is shown, upon compression 15 thereof. In Figures 2 and 3, the element is shown in combination with and beneath a schematic compression surface 9, i.e. generally the underfoot. In fact, the element, as mentioned above, is designed to be inserted in the insole between the actual sole 10 and the 20 underfoot 9. In Fig. 2 the element is shown in an essentially uncompressed condition, whereby the facing edges of the sectors 4 along the notch 3 are substantially parallel. When the element is subjected to a compression force, as denoted by the arrow of Fig. 25 3, typically the foot pressure on the underfoot 9, the width of the notch 3 decreases and the edges of the sectors 4 come at least partly in contact with each other, thereby stopping the elastic range. It shall be noted that, in this end of compression stroke condition 30 a real dome effect is reconstructed, so that no further

give may be provided. It shall be further noted that this provides a possible return effect on the sole of the foot in the form of a pleasurable massage-like effect.

5 Referring now to Figures 4 and 5, a highly advantageous improvement of the invention may include a pushbutton element 11 which has the function to locally increase the micromassage action of the dome 1 on the sole of the foot. The pushbutton has a circular shape
10 with a substantially flat bottom surface 111, which rests on the corner area of each sector 4 and simultaneously acts on all sectors. On the other hand, the top surface 211 has the form of a dome, so that the massage-like action is better concentrated. An O-ring
15 member is provided between the bottom face 111 of said pushbutton 11 and the region whereat the latter rests on the sectors 4, said O-ring being made of an elastically compressible material, like rubber or the like. The pushbutton 11 is held in position by a stem
20 13 which starts from the center of the bottom face 211 of the button 11, which stem 13 extends perpendicularly downwards to an extent which essentially corresponds to the thickness of the sectors 4 and ends by a widened retaining head 14 which rests on the bottom faces of
25 the sectors 4. The button 11 may be made from one piece and be applied by a downward press fitting action, or may be made of two pieces, and the widened head 14 may be applied after introducing the stem and be secured in any manner, for instance by gluing or the like.

30 Referring now to Figures 6 to 12, a preferred

embodiment of the invention is shown in the form of a combined springing element which includes a plurality of elements having the characteristics as described hereinbefore. The described element is particularly
5 designed to be applied in the heel zone 15 and comprises a plurality of caps 1 (particularly three) arranged over a support plate 7. The caps 1 communicate with each other by grooves 16 whose concavities have the same orientation as the concavities of the domes 1.
10 The element composed of the plate 7, the domes 1 and the grooves 16 may be obtained by simple molding and further negative deformation on one side of the plate 7 and positive deformation thereof on the opposite side, followed by notching and drilling of the domes 1, or in
15 any other manner.

The support plate 7 has, at the two opposite side edges, a slide member 107 to be slidably engaged in one of the two opposite side edges of a support and guide member 17, typically another plate 17.

20 Two rows or rounded lugs 18 are provided on the bottom face of the sliding support plate 7. Each row is disposed at one of the two side saddle-like edges 107. The support and guide member 17 also has two corresponding rows of recesses 117 on its top face,
25 which are designed to cooperate with the lugs 18 in such a manner that the support plate 16 may be snap fitted at predetermined locations. By this arrangement, the massage-like action may be advantageously customized and localized in response to individual
30 needs. In Fig. 10, the above sliding member is shown

inside an enclosure 19 provided in the heel zone 15 of a shoe. It shall be noted that the support member 17 is fitted on feet 20 which help the plate 7 with the springing domes 1 to slide in the front-to-back direction. The adjustment is made by lifting the underfoot 9 upwards. Conversely, in Fig. 11, an additional layer 21 made of a different material with respect to the heel, for instance a soft material to enhance the comprehensive springing action, is provided between the springing elements and the top face of the housing 19. Fig. 12 shows the fact that the above described device may be also combined with a shoe with a slanted heel 15.

Referring back to Figs. 6 and 7, a highly advantageous improvement is shown, which allows a proper air circulation inside the shoe and a certain air exchange with the outside. A combined air pumping element is provided, which is composed of a plurality of domes 122 (particularly three), made of a resilient material, which is relatively soft and airtight, such as rubber or the like. The pumping domes 122 are interconnected by grooved bridges 222, which form connecting channels and whose concavity has the same orientation as the pumping domes 122. The pumping domes 122 are complementary in shape to the springing domes 1 and the grooved bridges 222 for interconnecting the pumping domes 122 are complementary in shape to the grooves 16 of the sliding plate 7. Therefore, the combined pumping element 22 is complementary in shape to all the concavities of the plate 7, whereby it can

be inserted beneath the latter in such a manner that, when the springing domes 1 is deformed, the air pumping domes 122 are also simultaneously deformed. The element may be simply placed beneath the sliding plate 7 and
5 rest on the top face of the support member 17. The channels 222 allow the passage from one dome 122 to the other and improve the general balance. Obviously, separate pumping domes 122 may be provided, even in combination with separate springing domes 1, i.e. when
10 the latter are not secured onto a support plate 7.

The springing elements may be either separated or combined in the form of one or more composite springing elements, in predetermined positions and/or arrangements, even different from the ones described
15 above. Obviously, the sole may have, in combination therewith, other individual or combined layers, either in the form of multilayer laminates or in the form of elements composed of several different parts. Still in combination therewith, the sole according to the
20 invention may also have one or more inserts for providing it with particular functional features, such as stiffening and/or shock-absorbing and/or other inserts.

Obviously, the invention is not limited to the
25 embodiments described and illustrated herein, but may be greatly varied, without departure from the guiding principle disclosed above and claimed below.

CLAIMS

1. A springing element for shoe soles, consisting of at least one resilient cap- or dome-like member (1), characterized in that it has at least one notch, but preferably two transverse notches (2, 3) which form a cross-shaped notch, which notch (2, 3) divides the cap (1) into at least four independent limbs or sectors (4) communicating with each other along the base edge of the cap (1).
2. An element as claimed in claim 1, characterized in that the cross-shaped notch (2, 3) is positioned at the center, to divide the cap (1) into four identical sectors (4).
3. An element as claimed in claims 1 and 2, characterized in that the two notches (2, 3) which form the cross-shaped notch have the same width.
4. An element as claimed in one or more of the preceding claims, characterized in that it has means (11) for limiting the resilience range of the sectors (4) defined by the cross-shaped notch (2, 3).
5. An element as claimed in one or more of the preceding claims, characterized in that said means for limiting the resilience range are provided by the facing edges of the sectors (4) along the notches (2, 3) in combination with the width thereof whereby, when a certain flexing compression is reached, at least some or all of the edges of the sectors (4) come to contact with each other, thereby restricting the elastic range.
6. An element as claimed in one or more of the preceding claims, characterized in that it may have any

size and shape, particularly the shape of a sector of a spheroid, with an elongated and essentially elliptic plan shape.

7. An element as claimed in one or more of the preceding claims, characterized in that it has a plan shape with a longer (AA') and a shorter (BB') symmetry axes, the longer axis (AA') being preferably oriented in the longitudinal direction of the shoe or in the front to back direction of the foot.

8. An element as claimed in one or more of the preceding claims, characterized in that, characterized in that it has the shape of a cone or truncated cone or combinations of shapes of cones, truncated cones and/or sectors of a sphere or spheroid.

9. An element as claimed in one or more of the preceding claims, characterized in that its height dimensions are greater than its length dimensions, i.e. parallel to the support base.

10. An element as claimed in one or more of the preceding claims, characterized in that it is made of one or more relatively rigid but intrinsically elastic materials, such as plastic and/or metal.

11. An element as claimed in one or more of the preceding claims, characterized in that it has a multilayer laminar composition, or is made of a single homogeneous material.

12. An element as claimed in one or more of the preceding claims, characterized in that it has a smaller size as compared with a shoe sole (9, 10).

13. An element as claimed in one or more of the

preceding claims, characterized in that its thickness is substantially of the same order of magnitude as the thickness of a sole (9, 10).

14. An element as claimed in one or more of the
5 preceding claims, characterized in that it has a flat base edge, i.e. an outer peripheral annular flange (6) for supporting and/or fastening the element.

15. An element as claimed in one or more of the preceding claims, characterized in that it has means
10 (8) for enhancing the flexibility of one or more sectors (4).

16. An element as claimed in one or more of the preceding claims, characterized in that said means consist of one or more lateral facing widened parts or
15 recesses of the notch edges.

17. An element as claimed in one or more of the preceding claims, characterized in that said recesses are obtained by providing a number of holes (8), particularly four, each at an end of each of the
20 notches (2, 3) which form the cross-shaped notch, and whose diameter is slightly greater than the width of each notch (2, 3).

18. An element as claimed in one or more of the preceding claims, characterized in that it is provided
25 in combination with a sole (9, 10), one or more of said springing elements being arranged in predetermined patterns between two superposed sole layers (9, 10), i.e. an upper layer, so-called underfoot (9), and a lower layer, which forms the actual sole (10).

30 19. An element as claimed in one or more of the

preceding claims, characterized in that the springing elements are disposed with the convex side turned toward the underfoot (9), so as to provide a massage-like action on the sole of the foot, as desired.

5 20. An element as claimed in one or more of the preceding claims, characterized in that the springing members are distributed evenly over the surface of the sole (9, 10) or are more concentrated or solely
10 disposed in a few partial areas of the sole (9, 10), depending on the way strains are arranged over the surface of the sole (9, 10), and/or in response to particular therapeutic massage requirements.

21. An element as claimed in one or more of the preceding claims characterized in that the members are
15 more or solely concentrated in the heel (10) and/or plantar zones.

22. An element as claimed in one or more of the preceding claims, characterized in that means (11) are provided for locally increasing the massage-like action
20 of the dome (1) on the sole of the foot.

23. An element as claimed in one or more of the preceding claims, characterized in that said means consist of a pushbutton-like element (11), positioned at the crossing point of the two notches (2, 3) which
25 form the cross-shaped notch, which has such a size as to lay over the corner area of each sector (4) to simultaneously act on all sectors (4).

24. An element as claimed in one or more of the preceding claims, characterized in that said pushbutton
30 (11) is held in position by a stem (13) which starts

from an intermediate, particular central point of the bottom face (111) of the button (11), which stem (13) extends perpendicularly downwards to an extent which essentially corresponds to the thickness of the sectors (4) and ends by a widened retaining head (14) which rests on the bottom faces of the sectors (4).

25. An element as claimed in one or more of the preceding claims, characterized in that elastically compressible support means are provided between the bottom face (111) of the pushbutton (11) and the sector area (4) whereon it lays, which means are made of a rubber material or the like, and particularly consist of at least one O-ring element (12).

26. An element as claimed in one or more of the preceding claims, characterized in that said pushbutton (11) may have any suitable shape but preferably has a top dome-like face (211), so that the massage-like action may be better concentrated.

27. An element as claimed in one or more of the preceding claims, characterized in that it may consist of combinations of two or more cap-like elements, made of the same and/or different materials and having the same or different curvatures, alternated in a predetermined order.

28. An element as claimed in one or more of the preceding claims, characterized in that associated pumping means are provided to increase air circulation inside the shoe, which means are controlled by the compression stroke run by the springing element.

29. An element as claimed in one or more of the

preceding claims, characterized in that said means consist of an additional dome-like element (122), made of a resilient material, which is relatively soft and airtight, such as rubber or the like.

5 30. An element as claimed in one or more of the preceding claims, characterized in that the pumping element (122) is complementary in shape to the springing element (1) and is enclosed therein, in such a manner as to rest on the inner walls of the springing
10 element (1).

31. An element as claimed in one or more of the preceding claims, characterized in that each springing element of a shoe sole (9, 10) or only some of them have the internal pumping member (122).

15 32. A springing element characterized in that it is a combined element, composed of a plurality of springing elements or members as claimed in one or more of the preceding claims, which members are joined together by a structure.

20 33. An element as claimed in claim 32, characterized in that the springing members are interconnected so that they form composite springing elements having an extension equal to the whole sole (9, 10) or only corresponding to a few areas of the
25 sole (9, 10).

34. An element as claimed in claims 32 and 33, characterized in that each springing member is formed by superposing two or more different caps or domes made of different materials or having different
30 characteristics and/or shapes or in that the composite

springing elements are formed by superposing composite springing elements provided with a plurality of coincident springing members having different shapes and/or materials and/or characteristics.

5 35. An element as claimed in one or more of claims 32 to 34, characterized in that, in a combined springing element, the springing members may be equal or different both individually and in groups, as regards materials, elastic properties and sizes.

10 36. An element as claimed in one or more of claims 32 to 35, characterized in that the springing members which form the combined element are interconnected by bridges of material in the form of flat ribs or the like, particularly made of the material which forms the
15 springing members.

 37. An element as claimed in one or more of claims 32 to 36, characterized in that the bridges for connecting the springing members are at least partly grooved, like connecting channels (16), with the
20 concavity turned downwards, i.e. having the same orientation as the concavity of the springing members.

 38. An element as claimed in one or more of claims 32 to 37, characterized in that at least some of the pumping members (122) are interconnected by a structure
25 of bridges (222) of material, particularly of the same material as the pumping members (122).

 39. An element as claimed in one or more of claims 32 to 38, characterized in that the pumping members (122) are interconnected by grooved bridges having the
30 form of connecting channels (222), whose concavity has

the same orientation as the pumping members (122), to form a combined air pumping element (22).

40. An element as claimed in one or more of claims 32 to 39, characterized in that the combined springing
5 element and the combined pumping element (22) have complementary shapes, so that the former may be laid over the latter to cause the pumping action thereof.

41. An element as claimed in one or more of claims 1 to 31, characterized in that one or more of the
10 springing elements may be disposed on a support plate (7).

42. An element as claimed in one or more of claims 32 to 40, characterized in that the combined springing element having channel-like connecting elements may be
15 disposed on a support plate (7).

43. An element as claimed in one or more of the preceding claims, characterized in that the support plate (7) is a saddle member to be slidably engaged on another support and guide member (17), which may be
20 permanently fastened to the top face of the shoe sole (10).

44. An element as claimed in one or more of the preceding claims, characterized in that the support plate (7) has, at each of its two opposite side edges,
25 a saddle member (107) to be slidably engaged in one of two opposite side edges of the guide member (17), which preferably has an essentially flat shape.

45. An element as claimed in one or more of the preceding claims, characterized in that the sliding
30 plate (7) and/or the support element (17) have means

(18, 117) for removably locking the position of the plate (7).

46. An element as claimed in one or more of the preceding claims, characterized in that said means are
5 at least two lugs (18), but preferably two rows of lugs (18), and preferably having a rounded shape, disposed on the bottom face of the support plate (7), each row being provided in the proximity of one of the two saddle-like side edges (107), and two corresponding
10 rows of recesses (117), disposed on the top face of the support element (107), or vice versa, so that the support plate (7) is snap-fitted at predetermined locations.

47. An element as claimed in one or more of the
15 preceding claims, characterized in that the support element (17) is arranged to be secured inside an enclosure (19) of a sole (10), particularly in the heel zone (15), which enclosure (19) has such a size as to allow the sliding plate (7) to slide from front to
20 back.

48. An element as claimed in one or more of the preceding claims, characterized in that the support element (17) is secured to the sole (10) in a lifted position, particularly by means of fastening feet (20),
25 to allow the support plate (7) to slide.

49. A shoe, including a sole part which is formed by the combination of at least two superposed layers, the so-called underfoot (9) and the actual sole (10), and an upper part, characterized in that one or more
30 springing elements as claimed in one or more of the

preceding claims are provided between the underfoot (9) and the sole (10).

50. A shoe as claimed in claim 49, characterized in that one or more springing elements are oriented
5 with the longer axis in the longitudinal direction of the shoe or in the front-to-back direction of the foot.

51. A shoe as claimed in claims 49 and 50, characterized in that the springing members are distributed evenly over the surface of the sole (10) or
10 are more concentrated or solely disposed in a few partial areas of the sole (10), depending on the way strains are arranged over the surface of the sole (10), and/or in response to particular therapeutic massage requirements.

15 52. A shoe as claimed in one or more of claims 49 to 51, characterized in that the springing elements are more or solely concentrated in the heel (15) and/or plantar zones.

53. A shoe as claimed in one or more of claims 49
20 to 52, characterized in that the springing elements extend in a lifted position relative to the lower layer (10) of the sole, essentially to an extent corresponding to the resilience range thereof.

54. A shoe as claimed in one or more of claims 49
25 to 53, characterized in that the springing elements are at least partly provided in recessing enclosures (19) or recesses of the sole (10).

55. A shoe as claimed in one or more of claims 49
to 54, characterized in that the springing elements are
30 at least partly secured in such a manner that they can

be moved, particularly in the front-to-back direction, to customize the micromassage action.

56. A shoe as claimed in one or more of claims 49 to 55, characterized in that the underfoot (9) is
5 removably anchored to the sole (10), at least in the zones of the enclosures (19) for the movable springing elements, so that these enclosures (19) may be accessed for displacement and adjustment thereof.

57. A shoe as claimed in one or more of claims 49
10 to 56, characterized in that it has a heel (15) that causes the sole (10), and the shoe, to be slanted.

58. A shoe as claimed in one or more of claims 49 to 57, characterized in that the springing element/s may be slanted, particularly in the heel zone (15),
15 with reference to the horizontal bearing surface, and more particularly, have the same inclination as the sole (10).

59. A shoe as claimed in one or more of claims 49 to 58, characterized in that the springing element/s
20 have a different, particularly opposite inclination, with respect to the sole (10).

60. A shoe sole, including two superposed layers, the so-called underfoot (9) and the actual sole (10), characterized in that one or more springing elements as
25 claimed in one or more of claims 1 to 48 are provided between the two layers (9, 10).

61. A shoe sole as claimed in claim 60, characterized in that the one or more springing elements are disposed with the longer axis oriented in
30 the longitudinal direction of the sole.

62. A shoe sole as claimed in claims 60 and 61, characterized in that the springing elements are distributed evenly over the surface of the sole (10) or are more concentrated or solely disposed in a few
5 partial areas of the sole (10), depending on the way strains are arranged over the surface of the sole (10), and/or in response to particular therapeutic massage requirements.

63. A shoe sole as claimed in one or more of
10 claims 60 to 62, characterized in that the elements are more or solely concentrated in the heel (15) and/or plantar zones.

64. A shoe sole as claimed in one or more of claims 60 to 63, characterized in that the springing
15 elements extend in a lifted position relative to the lower layer (10) of the sole, essentially to an extent corresponding to the resilience range thereof.

65. A shoe sole as claimed in one or more of claims 60 to 64, characterized in that the springing
20 elements are at least partly provided in recessing enclosures (19) or recesses of the sole.

66. A shoe sole as claimed in one or more of claims 60 to 65, characterized in that the springing
25 elements are at least partly secured in such a manner that they can be moved, particularly in the front-to-back direction, to customize the micromassage action.

67. A shoe sole as claimed in one or more of claims 60 to 66, characterized in that the underfoot
30 (9) is removably anchored to the actual sole (10), at least in the zones of the enclosures (19) for the

movable springing elements, so that these enclosures (19) may be accessed for displacement and adjustment thereof.

5 68. A shoe sole as claimed in one or more of claims 60 to 67, characterized in that it has a heel (15) that causes the sole (10), and the shoe, to be slanted.

10 69. A shoe sole as claimed in one or more of claims 60 to 68, characterized in that the springing element/s may be slanted, particularly in the heel zone (15), with reference to the horizontal bearing surface, and more particularly, have the same inclination as the sole (10).

15 70. A shoe sole as claimed in one or more of claims 60 to 69, characterized in that the springing element/s have a different, particularly opposite inclination, with respect to the sole (10).

20 71. A springing element for shoe soles, a shoe sole and a shoe, wholly or partly as described, illustrated and for the purposes stated herein.