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(54) **AIR CUSHION WITH MULTISTAGE SHOCK-ABSORBING ASSEMBLY AND FABRICATING METHOD**

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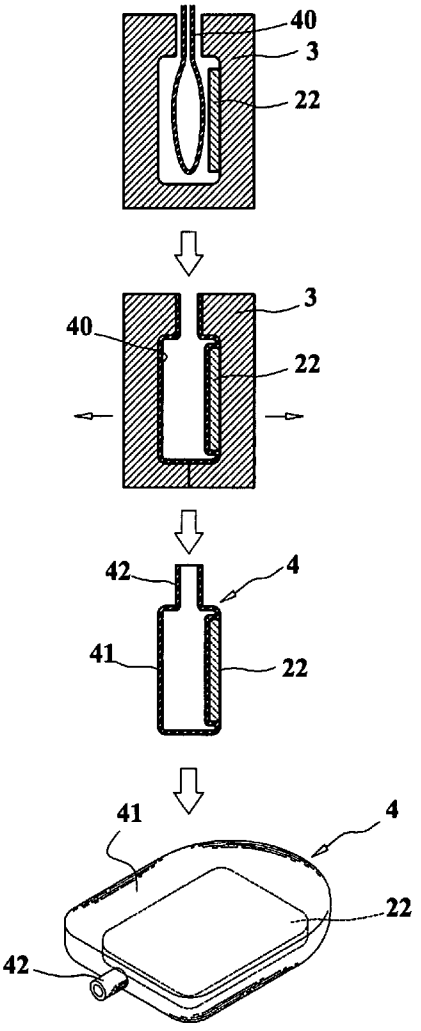
(57) **ABSTRACT**

An air cushion connected at least a cushioning element in a vertical stack configuration for absorbing both lighter and heaver heel impacts sequentially in a shoe mid-sole. The air cushion may be an air bladder with tying element, resilient pad or the combination thereof The fabrication method of the present invention includes the steps of blowing a melting inflatable bladder or tube together with a cushioning element in a blowing mold, inflating the melting inflatable bladder with air in high pressure, so as to form a bladder with a passage way that confirming the inner shape of the blowing mold, and blowing air into the bladder in a preset pressure; and thereafter sealing the passage way for forming an air cushion with multistage shock-absorbing assembly.



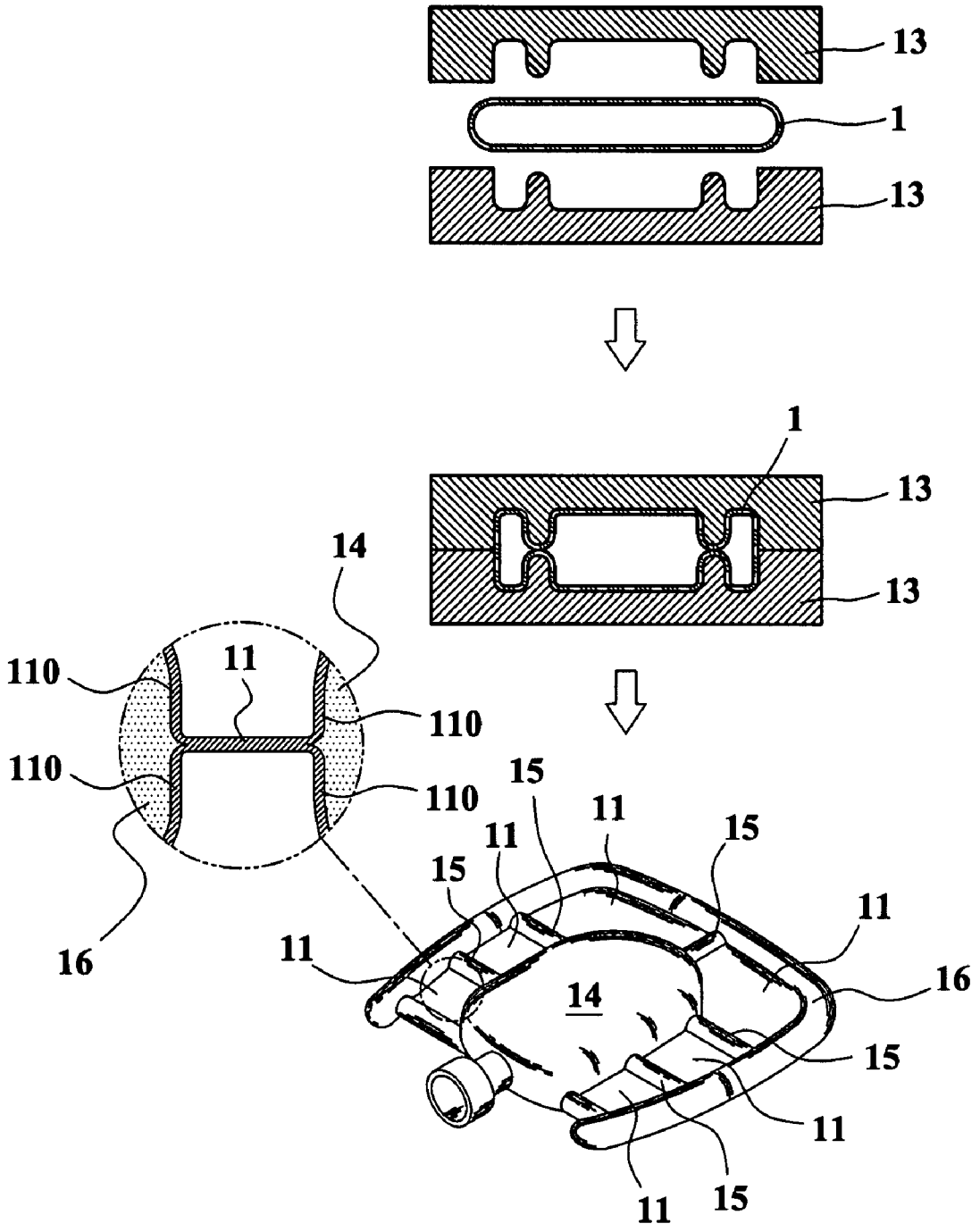


FIG. 1 (PRIOR ART)

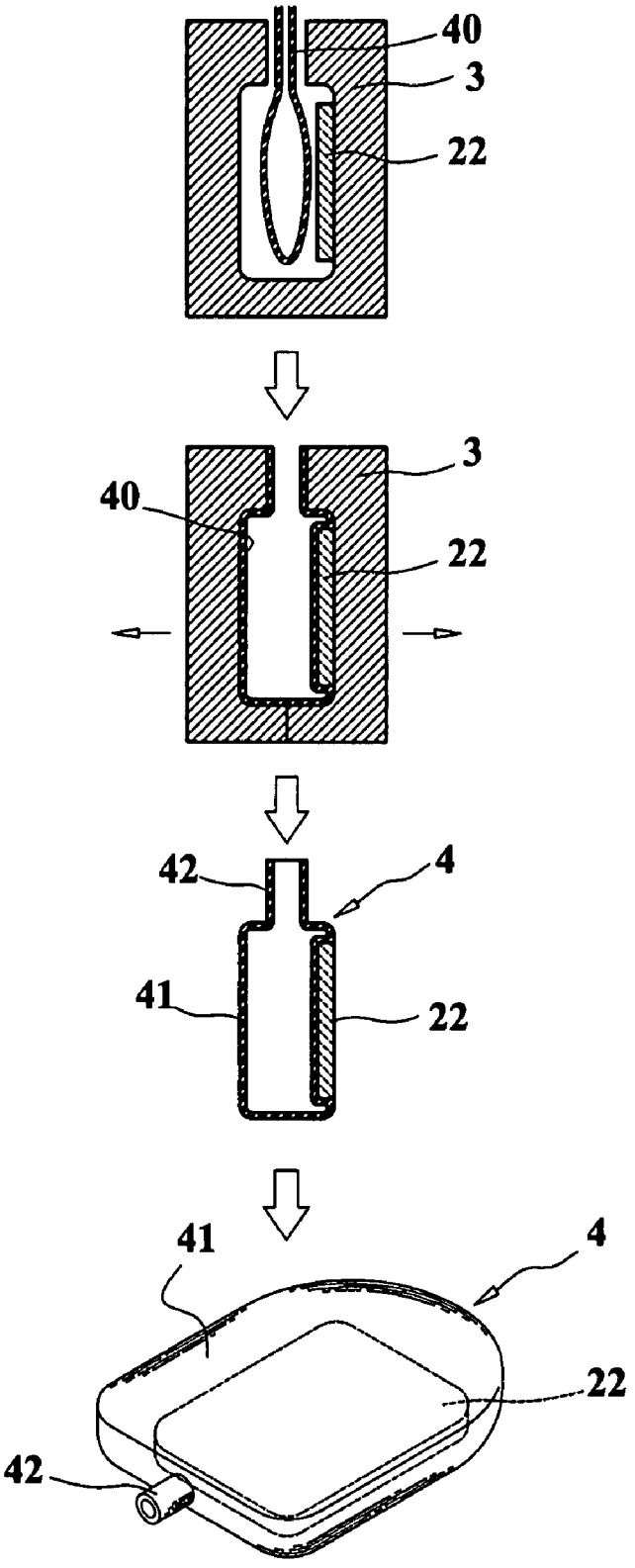


FIG. 2

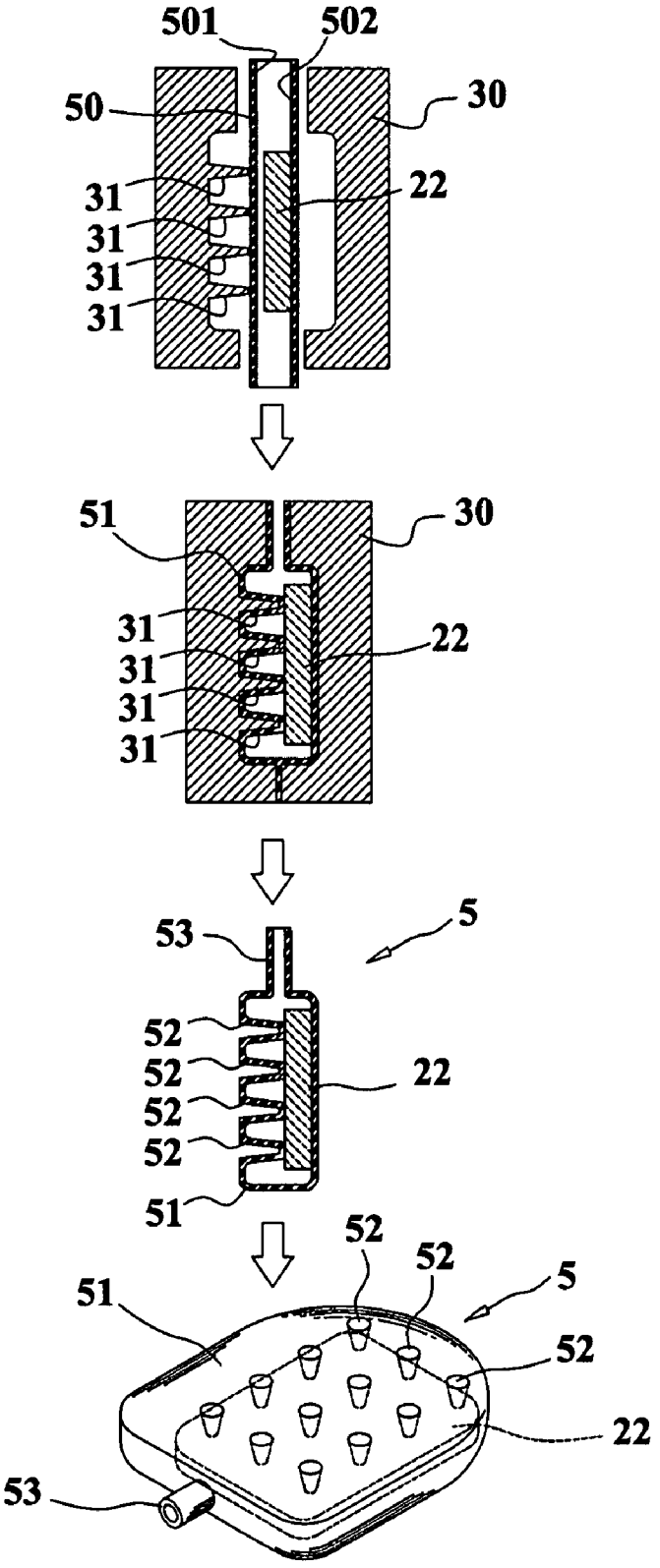

501
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FIG. 3

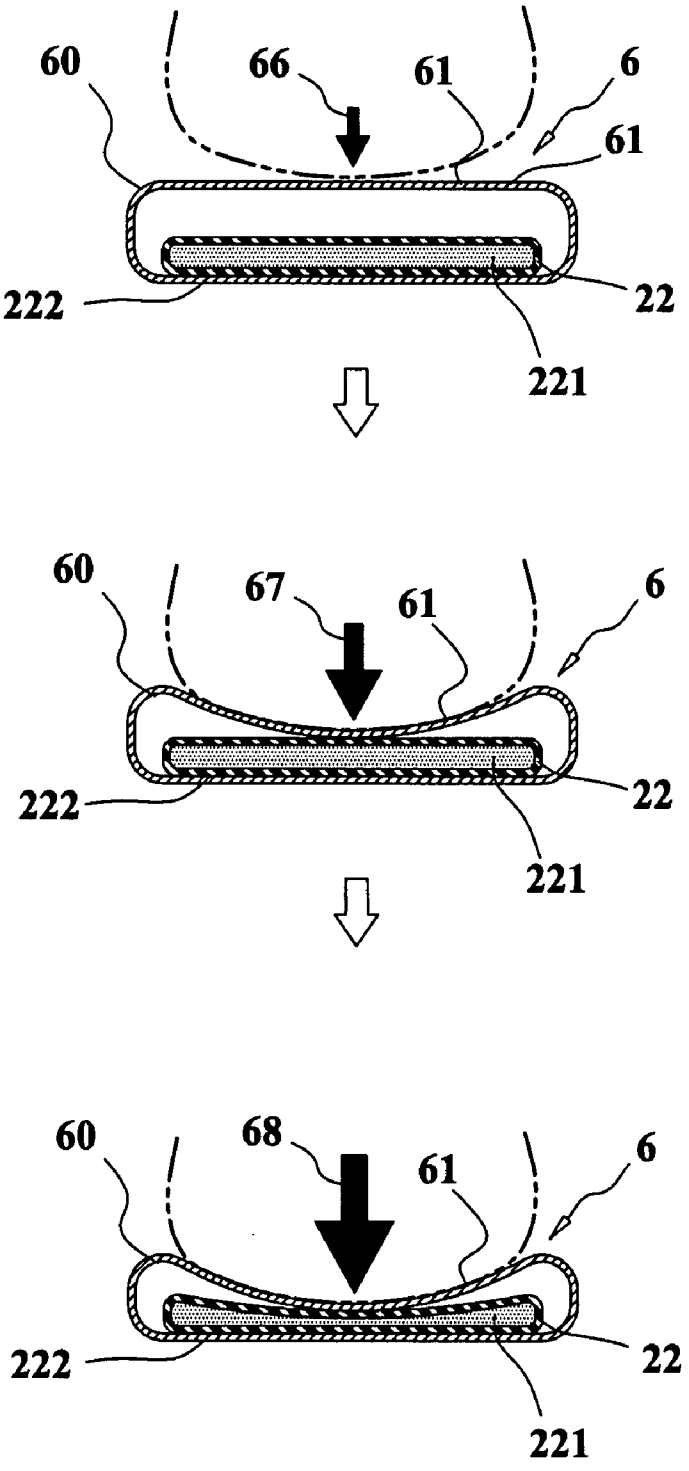


FIG. 4

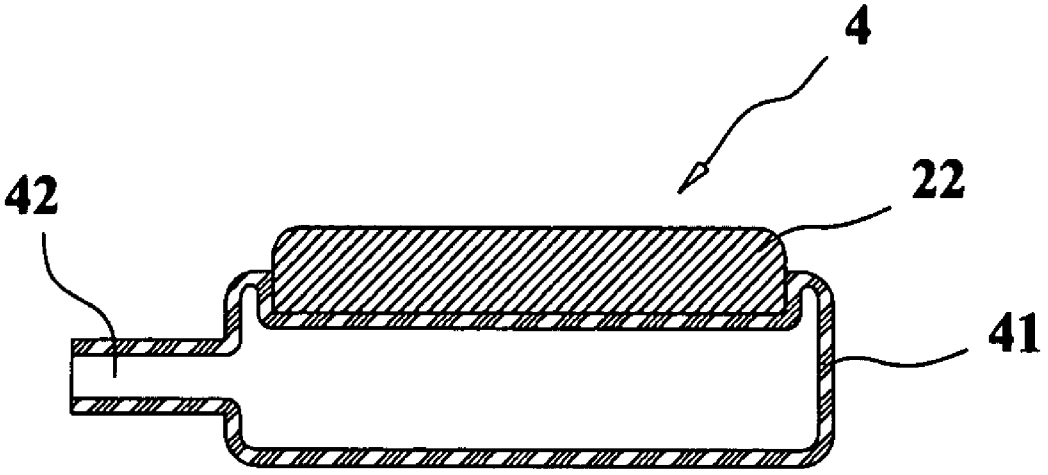


FIG. 5

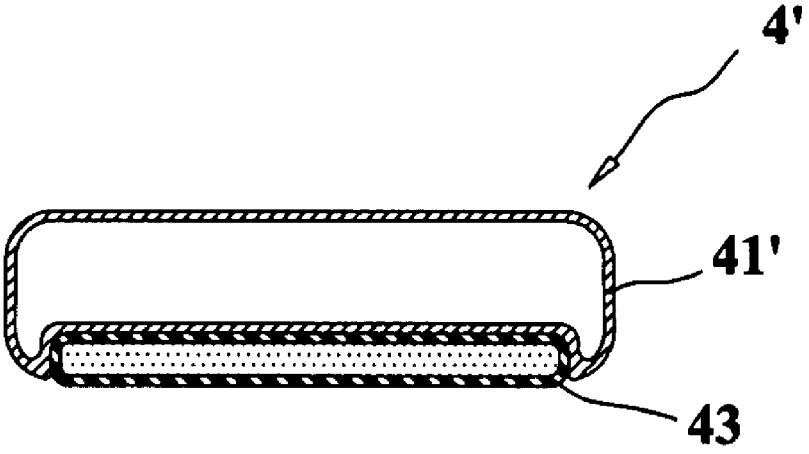


FIG. 6

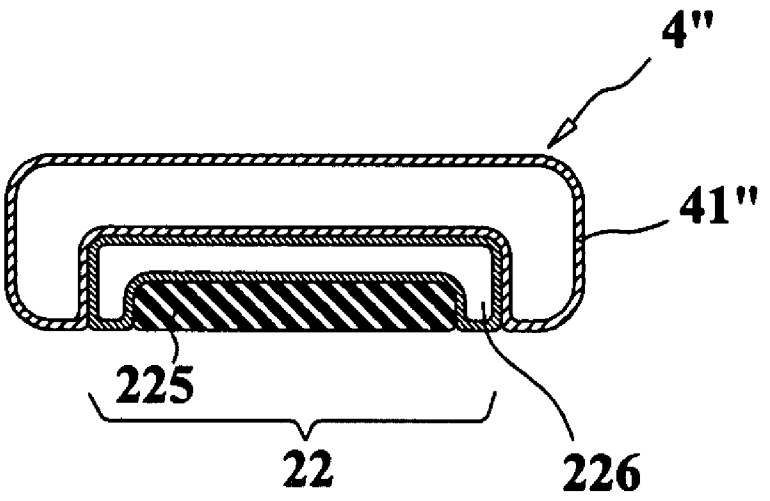


FIG. 7

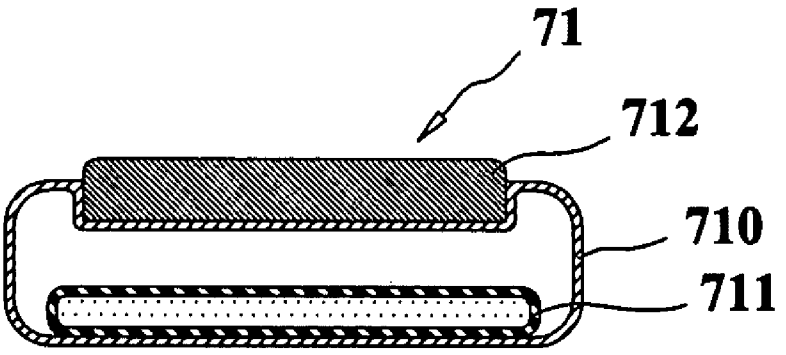


FIG. 8

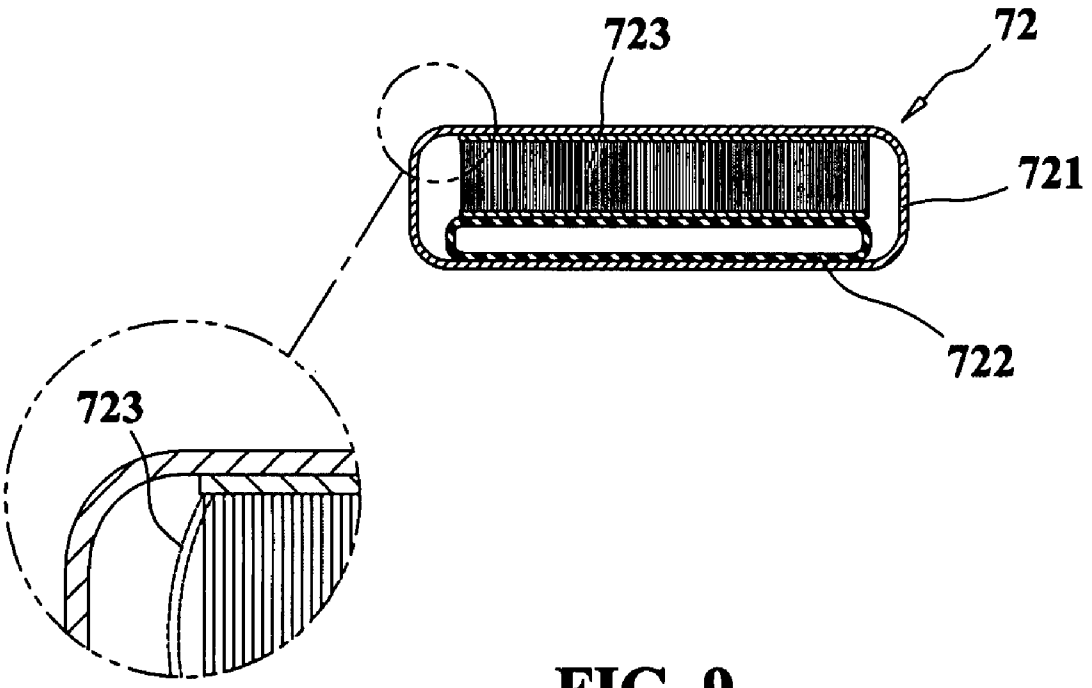


FIG. 9

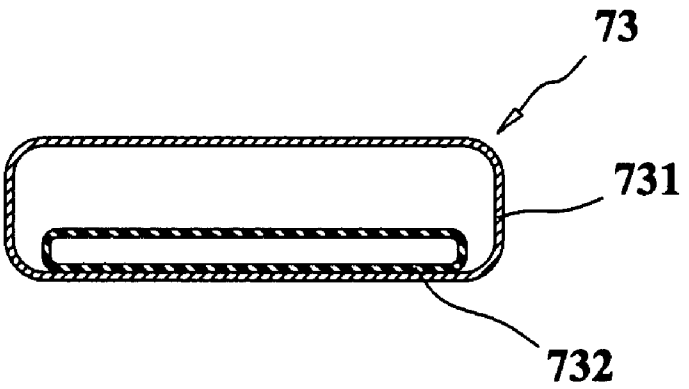
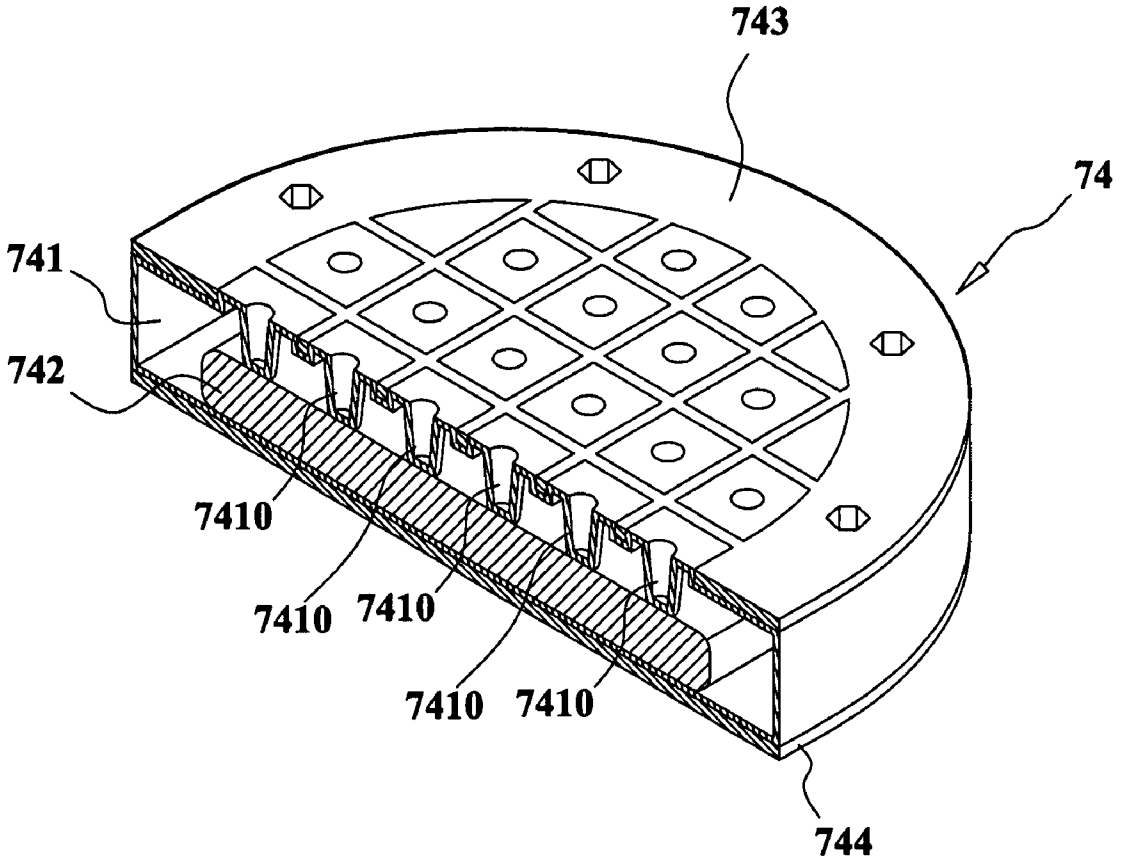


FIG.10


743
74
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742
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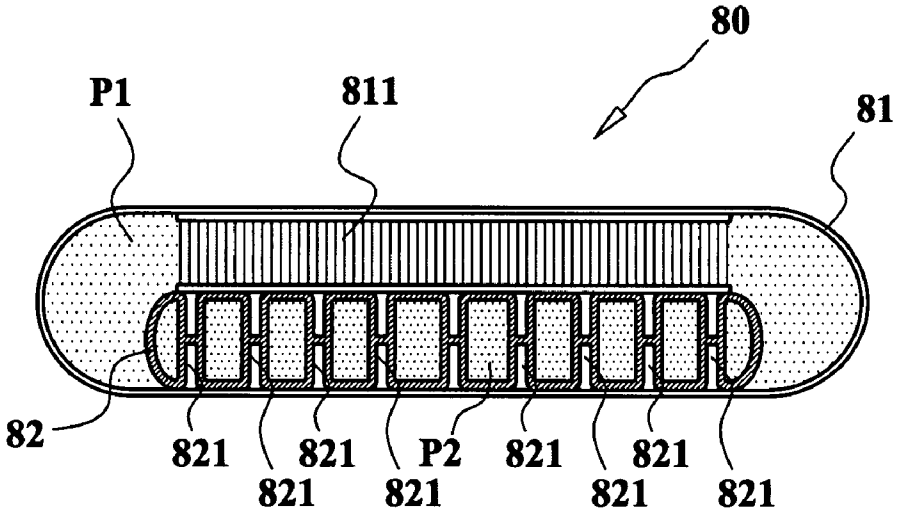
7410
744

FIG.11


80
P1
811
81
82
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P2
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FIG.12

AIR CUSHION WITH MULTISTAGE SHOCK-ABSORBING ASSEMBLY AND FABRICATING METHOD

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to an air cushion assembly adapted for absorbing heel impacts in a shoe mid-sole and in particular, to an air cushion assembly having an air bladder associated with a cushioning element in a vertical stack configuration that capable of absorbing more than one range of heel impacts against the ground.

DESCRIPTION OF THE RELATED ART

[0002] For most runners, initial foot impact occurs in the heel region. Therefore, the heel strike cushioning material, which is contained principally in the mid-sole of a running shoe, must have a firmness which provides for proper impact cushioning for a person of about average weight.

[0003] U.S. Design Pat. No. 297,980 to Sugiyama describes a cushioning for a shoe mid-sole comprised essentially of one cell having partition walls therein.

[0004] U.S. Pat. Nos. 4,342,157 and 4,472,890 to Gilbert describes the use of liquid-filled shock absorbing cushions in the heel portion and forefoot portion of a shoe. Typical liquids include water, glycerin, and mineral oil.

[0005] When the runner is heavy, the heel cushioning material may "bottom out" before heel impact is completely absorbed, and shock-related injuries can result. On the other hand, if the cushioning material is too soft poor lateral foot stability may result in injuries.

[0006] A considerable forces generated during athletic activities require that the sole of an athletic shoe provide enhanced protection and shock absorption for the feet, ankles and legs of the wearer. For example, impacts which occur during walking have been known to generate forces of up to 1-½ times the body weight at normal walking speed, running activities up to 2-3 times the body weight of an individual.

[0007] For providing an air cushion with wider range of impact absorption, an easier conventional fabrication method of air cushion is shown in FIG. **1**, including the steps of preparing a larger bladder **1**, putting the larger bladder **1** in a hot pressing mold **13** for forming a plurality of ribs **11** which divides the larger bladder into smaller bladders **14**, **15**, and **16** in a substantially horizontal configuration for providing a plurality of cushioning areas.

[0008] However, the total cushioning area of the smaller bladders **14**, **15**, and **16** is less than the original of the larger bladder **1**, and the ribs **11** form a plurality of vertical walls **110** around each of the small bladders **14**, **15**, and **16** that may cause the wearer feel pain when some smaller bladders **14** in the central portion become bottom out under some heavy heel impact.

[0009] The smaller bladder **14** in central area can be made softer to comfort the heel of the wearer during taking a normal walking exercise; however this would cause the smaller bladder **14** tends to bottom out in normal running activity. If the smaller bladder **14** contains a higher inner pressure to provide adequate shock absorption for running, it would cause the wearer feels it is too hard and suffers a pain from the bladder **14** in a normal walking.

[0010] In order to perfect the heel cushion in different athletic activities, such as walking and running, there is a need to improve the cushioning function at shoe mid-sole.

SUMMARY OF THE INVENTION

[0011] In order to perfect the heel cushioning design for athletic activities, the present invention provides an air cushion assembly and a fabrication method for producing such a cushion assembly. The air cushion assembly according to the present invention contains an air bladder associated with a cushioning element in a vertical stack configuration, so as to absorb a lighter heel impact and heavier heel impact sequentially.

[0012] The air bladder of the air cushion assembly may contain a lower inner pressure for providing a softer shock absorption during a wearer taking walking exercise, and the cushioning element may be an air bladder with higher inner pressure or a cushion which made from a resilient element for absorbing some other heavier heel impacts, such as running or playing ball, or the likes.

[0013] The fabrication method of the present invention may include the steps of blowing a melting inflatable bladder or tube together with a cushioning element in a blowing mold, inflating the melting inflatable bladder with air in high pressure, so as to form a bladder with a passage way that confirming the inner shape of the blowing mold, and blowing air into the bladder in a preset inner pressure; and thereafter sealing the passage way for forming an air cushion with multistage shock-absorbing assembly.

[0014] Further scope of the applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings, which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

[0016] FIG. **1** is a schematic view showing the steps of an easier method for producing an air cushion in a prior art.

[0017] FIG. **2** is a schematic view showing the steps of a fabrication method according to an embodiment of the present invention.

[0018] FIG. **3** is a schematic view showing the steps of a fabrication method according to an alternative embodiment of the present invention.

[0019] FIG. **4** is a schematic view showing the variety of deformation in different impact loading, explaining the reason to associate an air bladder to a cushioning element in a vertical stack configuration.

[0020] FIG. **5** is a cross-sectional view showing an alternative embodiment the present invention.

[0021] FIG. **6** is a cross-sectional view showing another alternative embodiment the present invention.

[0022] FIG. **7** is a cross-sectional view showing a further alternative embodiment the present invention.

[0023] FIG. **8** is a cross-sectional view showing a further alternative embodiment the present invention.

[0024] FIG. **9** is a cross-sectional view showing a further alternative embodiment the present invention.

[0025] FIG. **10** is a cross-sectional view showing a further alternative embodiment the present invention.

[0026] FIG. **11** is a cross-sectional view showing a further alternative embodiment the present invention.

[0027] FIG. **12** is a cross-sectional view showing a further alternative embodiment the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] Referring to FIGS. **2** and **5**, a fabrication method according to the present invention includes the steps of inserting a melting inflatable bladder **40** or tube (not shown) together with a cushioning element **22** in a blowing mold **3**, inflating the melting inflatable bladder **40** with an air in high pressure, so as to form a bladder **41** with a passage way **42** that confirming the inner shape of the blowing mold **3**, and blowing air into the bladder **41** in a first inner pressure; and thereafter sealing the passage way **42** for forming a first air cushion **4** which connects the cushioning element **22** on one side.

[0029] The melting inflatable bladder **40** has an upper side and a lower side. Preferably, the cushioning element **22** may have glue or adhesive layer for bonding itself onto the lower side of the melting inflatable bladder **40**. However, in an alternative embodiment as shown in FIG. **3**, the cushioning element **22** is connected inside the melting inflatable tube **50** or bladder (not shown) and disposed into the blowing mold **30** together. The melting inflatable tube **50** comprises a first inner wall **501** and a second inner side **502**.

[0030] The inner surface of the blowing mold **30** may comprise a plurality of inward protruding portions **31** for forming a bladder **51** with a plurality of indents or holes **52** and a passage way **53**. While blowing air into the bladder **51** in a preset pressure; and thereafter sealing the passage way **53**, it is forming an air cushion **5** with multistage shock-absorbing assembly. The walls of the indents or holes **52** have one end connected with the cushioning element **22**, so as to inhibit bulging effect and keep the air cushion **5** in a predetermined shape.

[0031] Referring to FIG. **4**, an air cushion **6** of an embodiment of the present invention for absorbing heel impacts in different athletic activities. The air cushion **6** has a cushioning element **22** connected within an air bladder **60** at the bottom side **222** thereof, to form a vertical stack configuration for providing cushioning force against the heel impacts sequentially. The cushioning element **22** can be a resilient pad which contains a second cushioning material **221**, such as liquid, gel cushioning material, air in high pressure, granules cushioning material, polyester elastomer or the like.

[0032] The air bladder **60** has a upper surface **61** for absorbing some lighter impacts **66** and **67** in walking exercise. When a wearer is walking, the heel strike yielding a plurality of impacts ranging from 0 to 1.5 times the body weight, therefore the heel imposes the impacts **66** or **67** onto the upper surface **61**. As the upper surface **61** provides cushioning effect on the heel with no rib, therefore the wearer would feel comfortable without paining by the ribs and the vertical walls of the conventional air cushion as being depicted in FIG. **1**.

[0033] When the wearer is running or taking some other strenuous activities, the impact **68** may increase up to 2-3 times the body weight, this causes the air bladder **60** to be bottom out and deforms the upper portion of the cushioning element **22**. By this way, while the air bladder **60** is bottom out, the cushioning element **22** provides a cushioning force to protect the heel from injury.

[0034] Referring to FIG. **6**, an air cushion **4'** comprises a first air bladder **41'** and a resilient pad **43**. The air bladder **41'** provides a softer cushioning force for cushioning lighter impacts from a wearer's walking exercise until being bottom out, and provides cushioning force together with the resilient pad **43** to absorb some stronger impacts from running or some other strenuous athletic activities.

[0035] Referring to FIG. **7**, an alternative embodiment of air cushion **4"** comprises a first air bladder **41"** and a cushioning element **22** in a vertical stack configuration. The cushioning element **22** comprises a resilient pad **225** combined or attached with a second air bladder **226** which contains a second inner pressure. The first air bladder **41"** contains a first inner pressure relatively lower than the second inner pressure thereby to absorb the impact on wear's heel from walking until being bottom out; and thereafter to absorb even more stronger impact together with the second air bladder **226**. Once the first air bladder **41"** and the second air bladder **226** are sequentially becoming bottom out, the resilient pad **225** provides a resilient force to buffer the impact, thereby to protect the wearer from possible lower extremity injuries.

[0036] Referring to FIG. **8**, an alternative embodiment of air cushion **71** with multistage shock-absorbing assembly, comprises an air bladder **710** with a cushioning element **711** disposed therein, and a resilient pad **712** attached thereon. The cushioning element **711** may be a bladder filled with gel, foam, a particulate material, a liquid, or the like. The resilient pad **712** may be an air bladder, a polyester elastomer, fabric, a bladder filled with gel, foam, a particulate material, a liquid, or the like.

[0037] Referring to FIG. **9**, a further alternative embodiment of air cushion **72** with multistage shock-absorbing assembly, comprises a first air bladder **721**, a second air bladder **722**, and a plurality of tying elements **723**, that connected therebetween in a vertical stack configuration. The second air bladder **722** has one side attached to the inner wall of the first air bladder **721**, and other side connected to the inner wall of the first air bladder **721** via the plurality of tying elements **723**, so as to keep the outer surface in flatten or in a predetermined shape without bulging out accidentally. The plurality of tying elements **723** can be a pile of yarns or fabric which is glued between the inner wall of the and the first air bladder **721** and the outside of the second air bladder **722** for eliminating possible bulging effect on outside of the air cushion **72**.

[0038] Referring to FIGS. **4** and **10**, a simplified alternative embodiment of air cushion **73** with multistage shock-absorbing assembly, comprises a first air bladder **731** encapsulated in a second air bladder **732** in a vertical stack configuration.

[0039] Referring to FIG. **11**, a refined alternative embodiment of air cushion **74** with multistage shock-absorbing assembly, comprises a first air bladder **741**, a cushioning element **742**, a upper frame **743**, and a base frame **744** in a vertical stack configuration.

[0040] Referring to FIG. **11**, the cushioning element **742** may be resilient pad attached on the lower inner side of the first air bladder **741**. The first air bladder **741** is contained the cushioning element **742** and can be fixed between the upper frame **743** and the base frame **744**. The first air bladder **741** is formed with a plurality inward protruded walls **7410** connected with the outer surface of the cushioning element **742** for acting as tying element to eliminate bulging of the upper surface of the air cushion **74**.

[0041] Referring to FIG. **12**, the cushioning element **80** with multistage shock-absorbing assembly, comprises a first air bladder **81**, a tying element **811**, and a second air bladder **82**. The tying element **811** is connected between the inner side of the first air bladder **81** which has a first passage way for fill into a first inner pressure P**1**, and the outside of the second air bladder **82**. The second air bladder **82** has a plurality of tying elements **821** formed therein, and a second passage way for fill compressible fluid into a second inner pressure P**2**. Preferably, the second inner pressure P**2** of the second air bladder **82** is relative higher than the first inner pressure P**1**, thereby to absorb lighter impacts in normal walking exercise by the first air bladder **81**, and absorb even more heaver impacts in running or strenuous athletic activity together with the second air bladder **82**.

[0042] The tying elements **821** may be a plurality of inward protruding walls which connect the upper and lower inner walls of the second air bladder **82** and keep the outer surface of the second air bladder **82** in a predetermined shape.

[0043] The inward protruding walls functioning as tying elements **821** may be formed by a blowing mold with small pins that forming a plurality of indent or small holes on the second air bladder **82**.

[0044] While the invention has been described by way of example and in terms of preferred embodiments, it is to be understood that the invention is not limited thereto. On the contrary, it is intended to cover various modifications and similar arrangements and procedures, and the scope of the appended claims therefore should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements and procedures.

What is claimed is:

1. An air cushion with multistage shock-absorbing assembly, comprsing:
- a first air bladder, having an inner wall which contains a first inner pressure;
- a tying element, having an upper side which is connected to the inner wall of the first air bladder; and
- a cushioning element, having an upper side connected to the tying element and a lower side connected to the inner wall of the first air bladder, thereby to form a vertical stack configuration for absorbing heel impact in a mid-sole sequentially.

2. The air cushion with multistage shock-absorbing assembly of claim **1**, wherein the cushioning element is a resilient pad.

3. The air cushion with multistage shock-absorbing assembly of claim **2**, wherein the tying element is a plurality of inward protruding walls formed on the inner wall of the first air bladder, connected to the upper side of the cushioning element for keeping the first air bladder in a predetermined shape.

4. The air cushion with multistage shock-absorbing assembly of claim **1**, wherein the tying element is a pile of yarns, fabric or fibers which is glued between the first air bladder and the cushioning element, for keeping the first air bladder in a predetermined shape.

5. The air cushion with multistage shock-absorbing assembly of claim **1**, further comprising a upper frame and a base frame for fixing the first air bladder therebetween.

6. The air cushion with multistage shock-absorbing assembly of claim **1**, wherein the cushioning element is a second air bladder which contains a second inner pressure.

7. The air cushion with multistage shock-absorbing assembly of claim **6**, wherein the second air bladder contains a tying element formed with a plurality of inward protruding walls for keeping the second air bladder in a predetermined shape thereof.

8. An air cushion with multistage shock-absorbing assembly, comprising:
- a first air bladder, having an upper side and a lower side, and containing a first inner pressure therein; and
- a cushioning element, having an upper side connected to the lower side of first air bladder, thereby to form a vertical stack configuration for absorbing heel impact in a mid-sole.

9. The air cushion with multistage shock-absorbing assembly of claim **8**, wherein the cushioning element is a second air bladder which contains a second air pressure.

10. The air cushion with multistage shock-absorbing assembly of claim **9**, further including a resilient pad connected on the upper side of the first air bladder.

11. The air cushion with multistage shock-absorbing assembly of claim **8**, wherein the cushioning element comprises a second air bladder and a resilient pad.

12. The air cushion with multistage shock-absorbing assembly of claim **8**, wherein the cushioning element is a resilient pad.

13. The air cushion with multistage shock-absorbing assembly of claim **8**, wherein the cushioning element is a bladder containing a gel.

14. The air cushion with multistage shock-absorbing assembly of claim **8**, wherein the cushioning element is a bladder containing a granules cushioning material.

15. A method for fabricating an air cushion with multistage shock-absorbing assembly, comprising the steps of:
- inserting a melting inflatable tube and a cushioning element in a blowing mold;
- inflating the melting inflatable tube with an air in high pressure, so as to form a first bladder with a passage way that confirming the inner shape of the blowing mold; and
- blowing air into the bladder in a first inner pressure; and thereafter sealing the passage way for forming an air cushion which connects the cushioning element on one side thereof.

16. The method of claim **15**, wherein the melting inflatable tube is formed with a first inner side and a second inner side, and the steps of the method further include a step of connecting the cushioning element on the second inner side of the melting inflatable tube.

17. The method of claim **16**, wherein the steps further include connecting a second air bladder and a resilient pad to form as the cushioning element before connecting the cushioning element on the second inner side of the melting inflatable tube.

18. The method of claim **15**, wherein the first bladder has an upper side and a lower side, and the steps of the method

further include a step of connecting the cushioning element on the lower side of the first bladder.

19. The method of claim **18**, wherein the steps further include connecting a second air bladder and a resilient pad to form as the cushioning element before connecting the cushioning element on the lower side of the first bladder.

* * * * *