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(54) **SHOES CAPABLE OF BUFFERING SHOCK BY AIR CIRCULATION**

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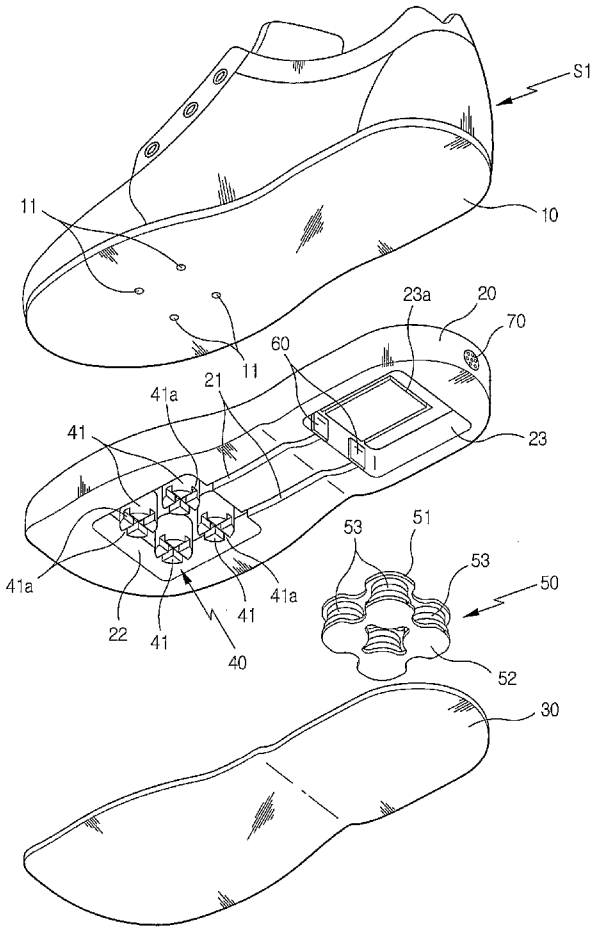
(57) **ABSTRACT**

The present invention relates to an air-circulation type shock buffering footwear which can absorb and alleviate a shock applied on a foot, allow the air ventilation through the inside and give a pleasant and comfortable feeling to the wearer for many hours. The inventive shoe comprises the first and second air rooms formed respectively in the front and rear of and on the underside of the middle sole layer, said first and second air rooms communicating with each other through passages; a plurality of sucking holes formed in the inner sole layer to communicate with throughholes of the first air room; the first and second buffering members respectively incorporated in the first and second air rooms for both alleviating shock and circulating the air; the first check valve disposed in the front of the second air room to open or close the passages; and the second check valve disposed in the rear of the second check valve to communicate with the outside so as to discharge the air.



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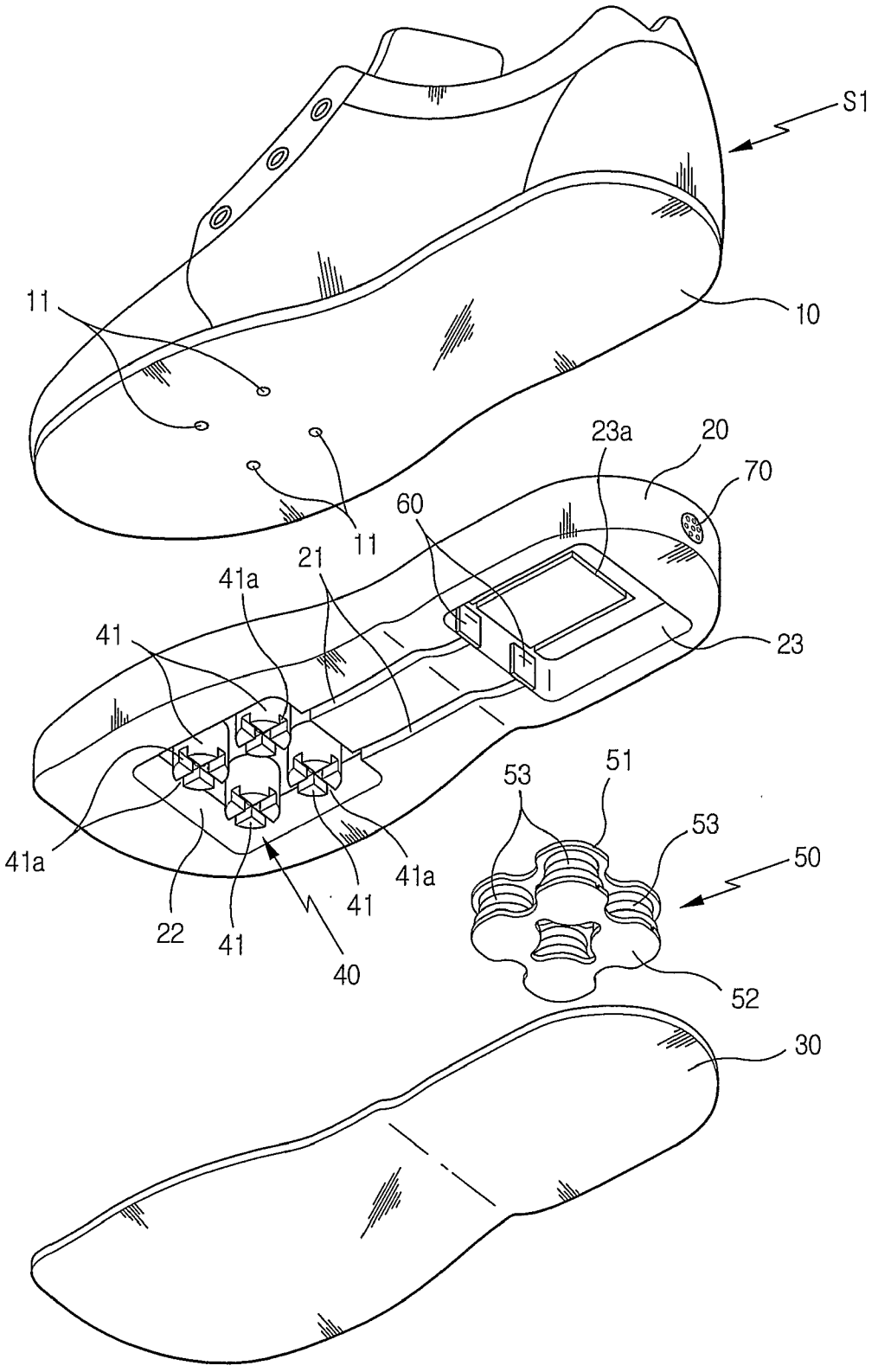
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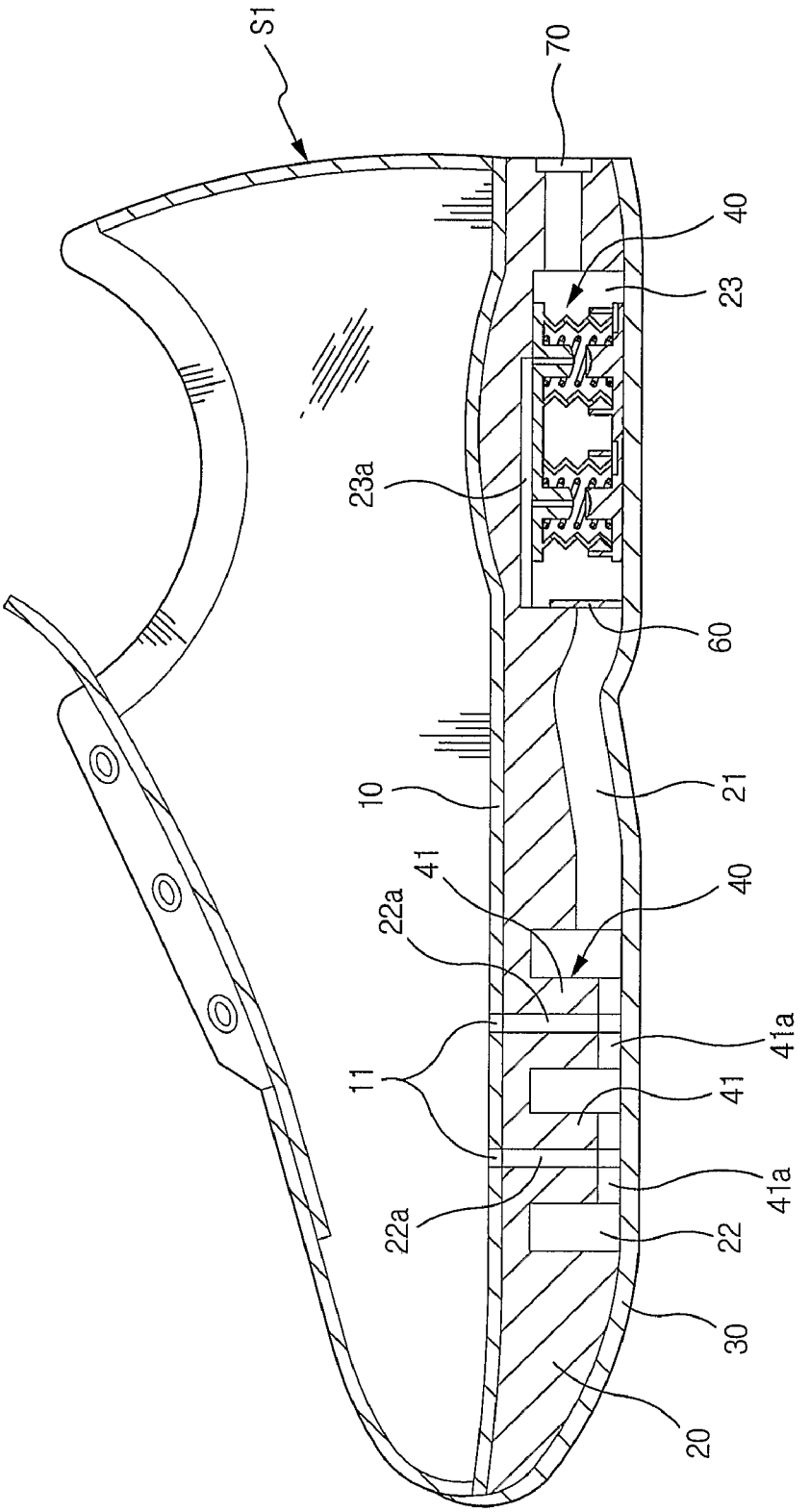
Fig.2



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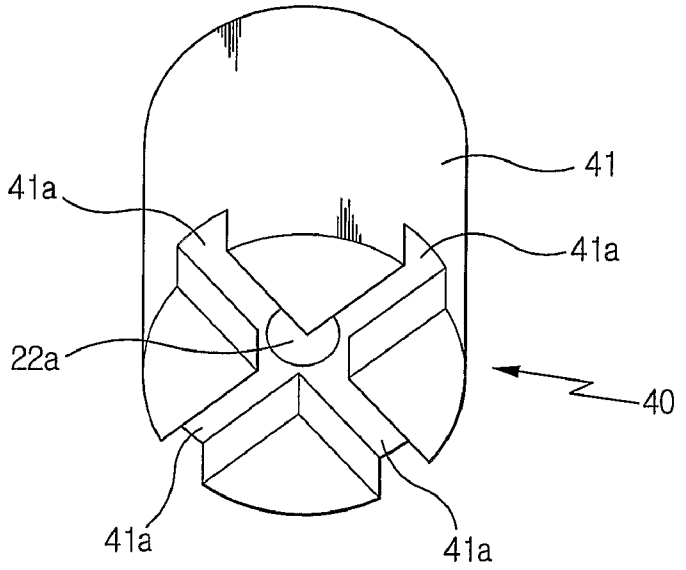

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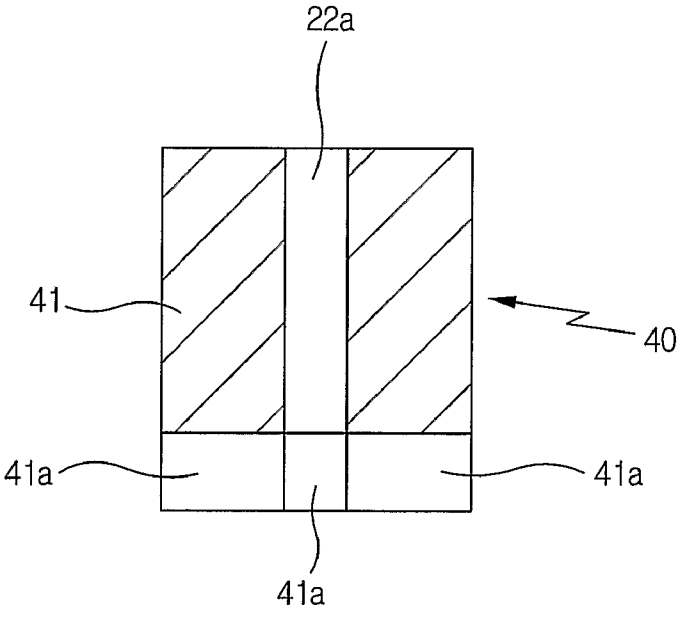

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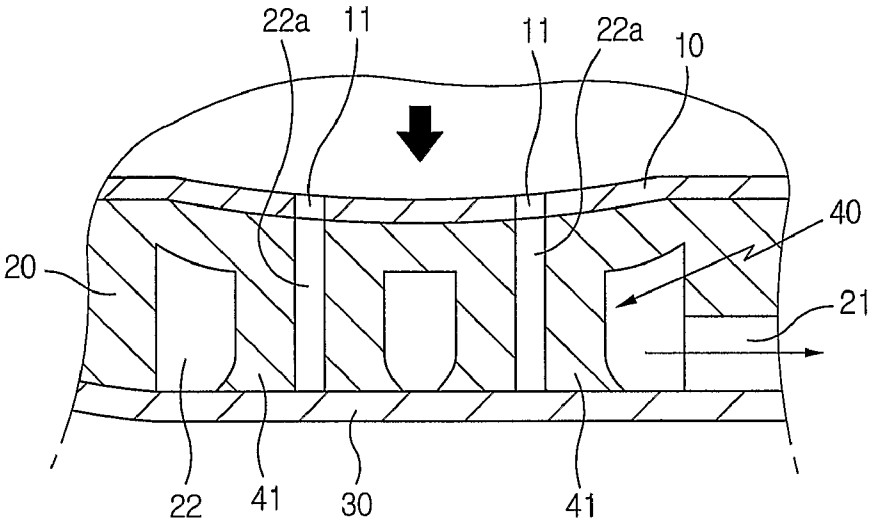
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Fig.6

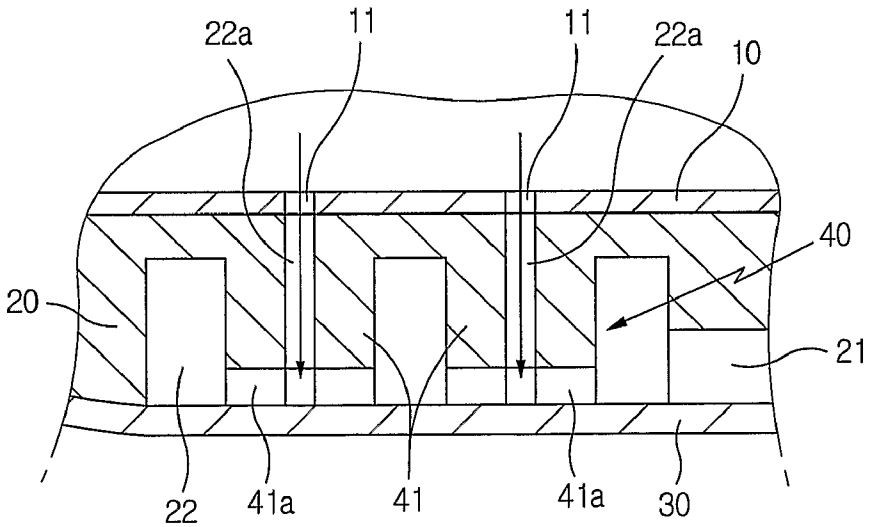
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Fig.7

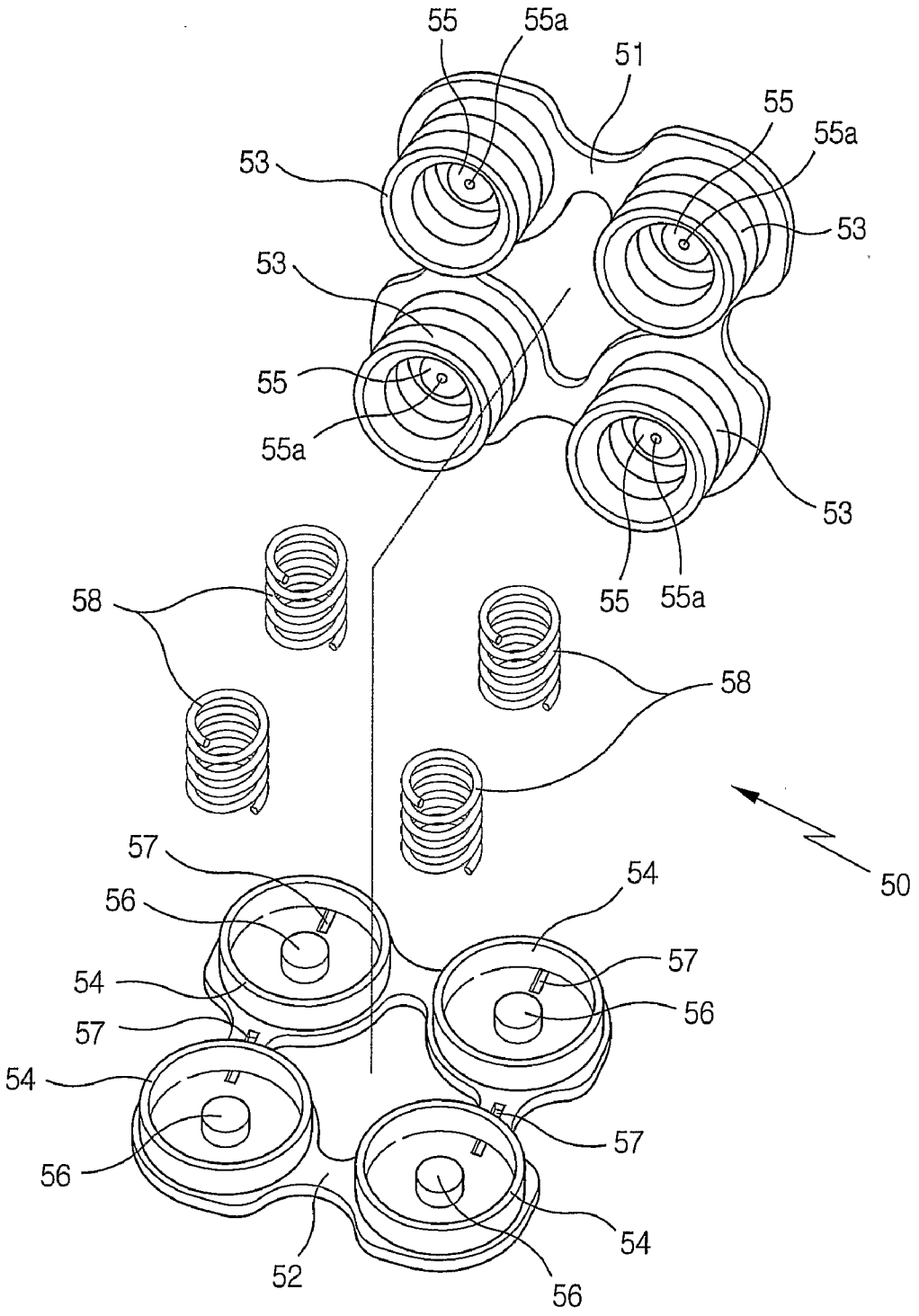
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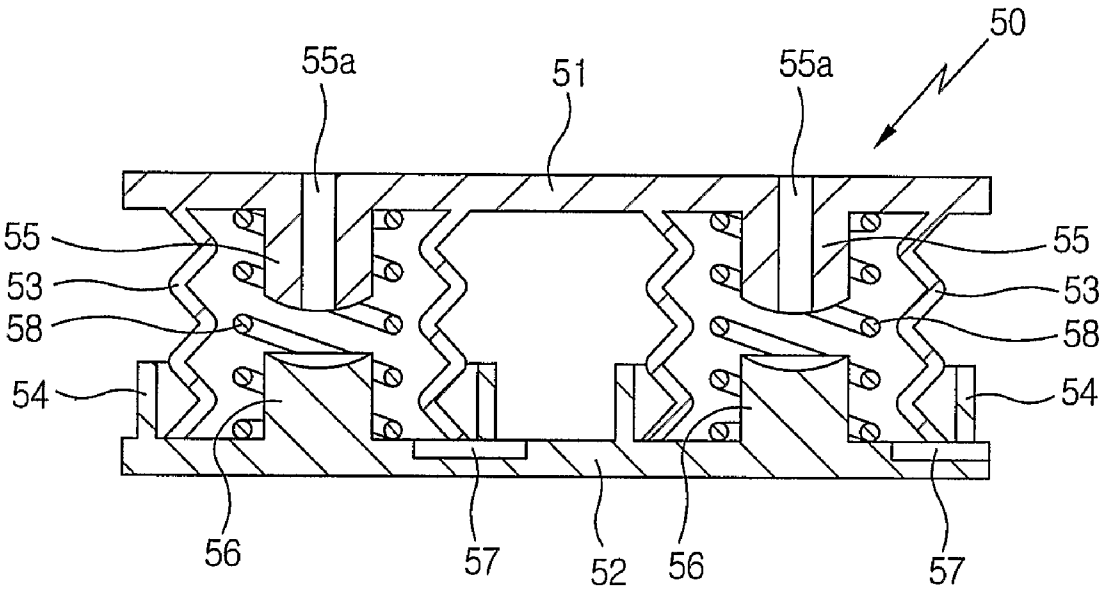
Fig.8



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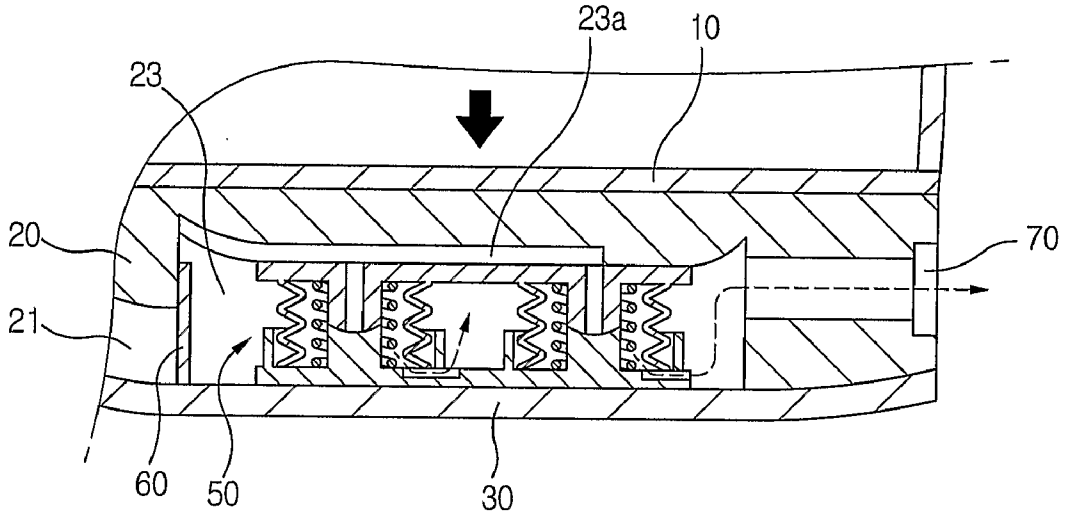

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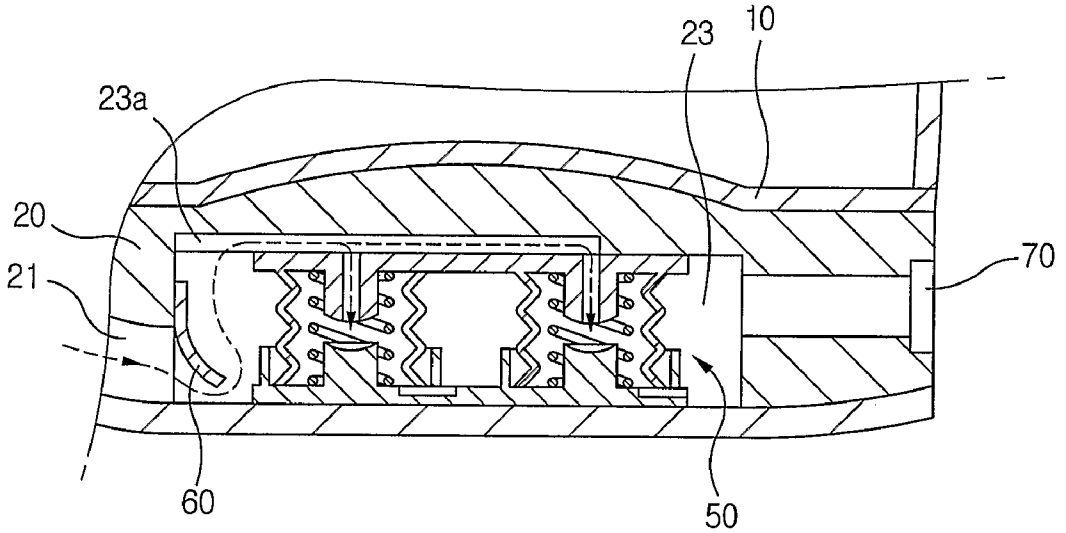

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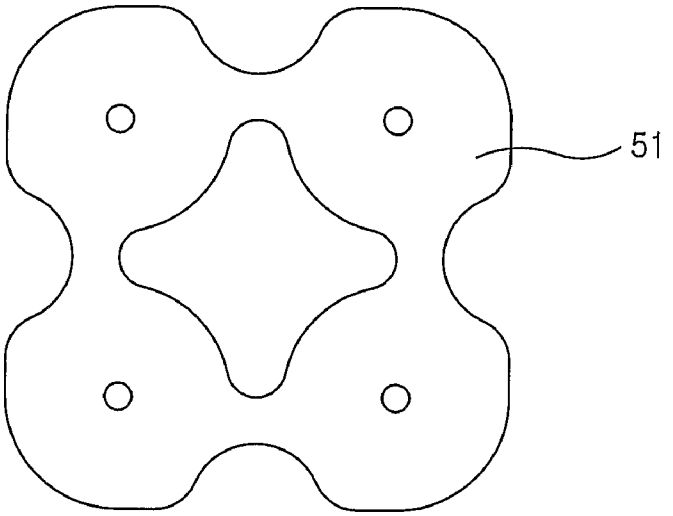

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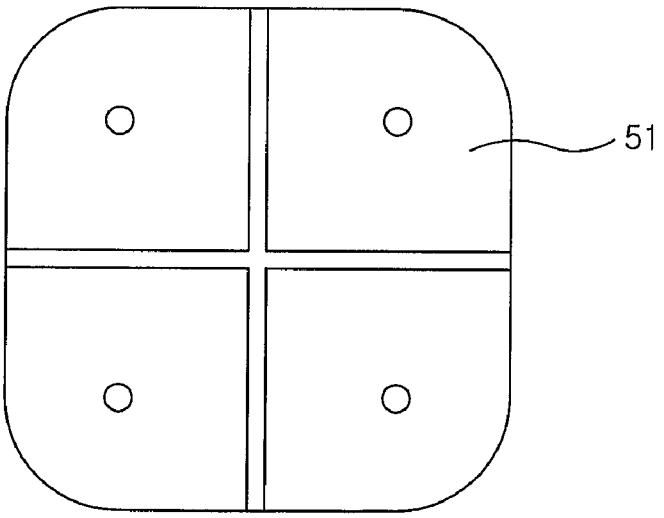

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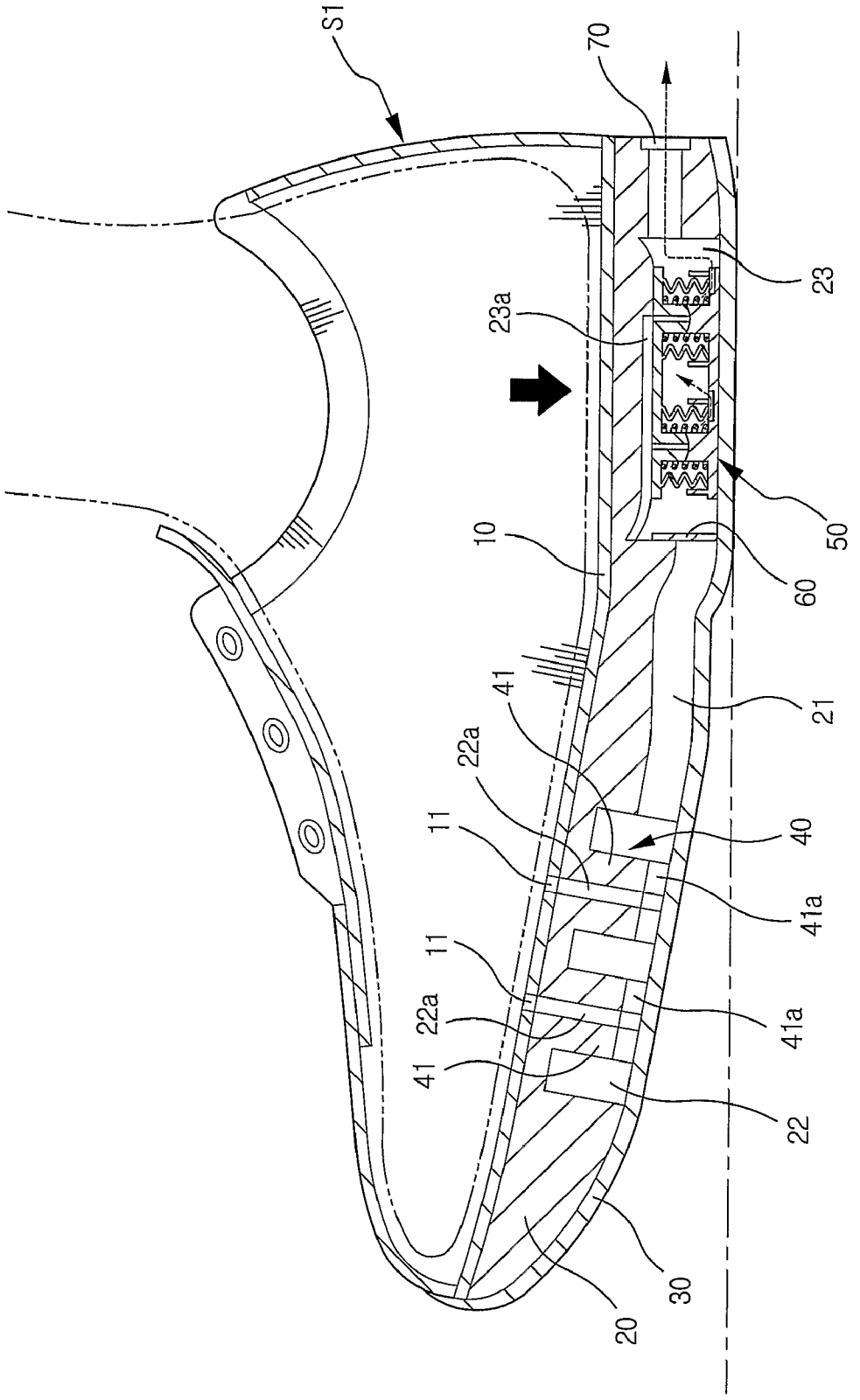

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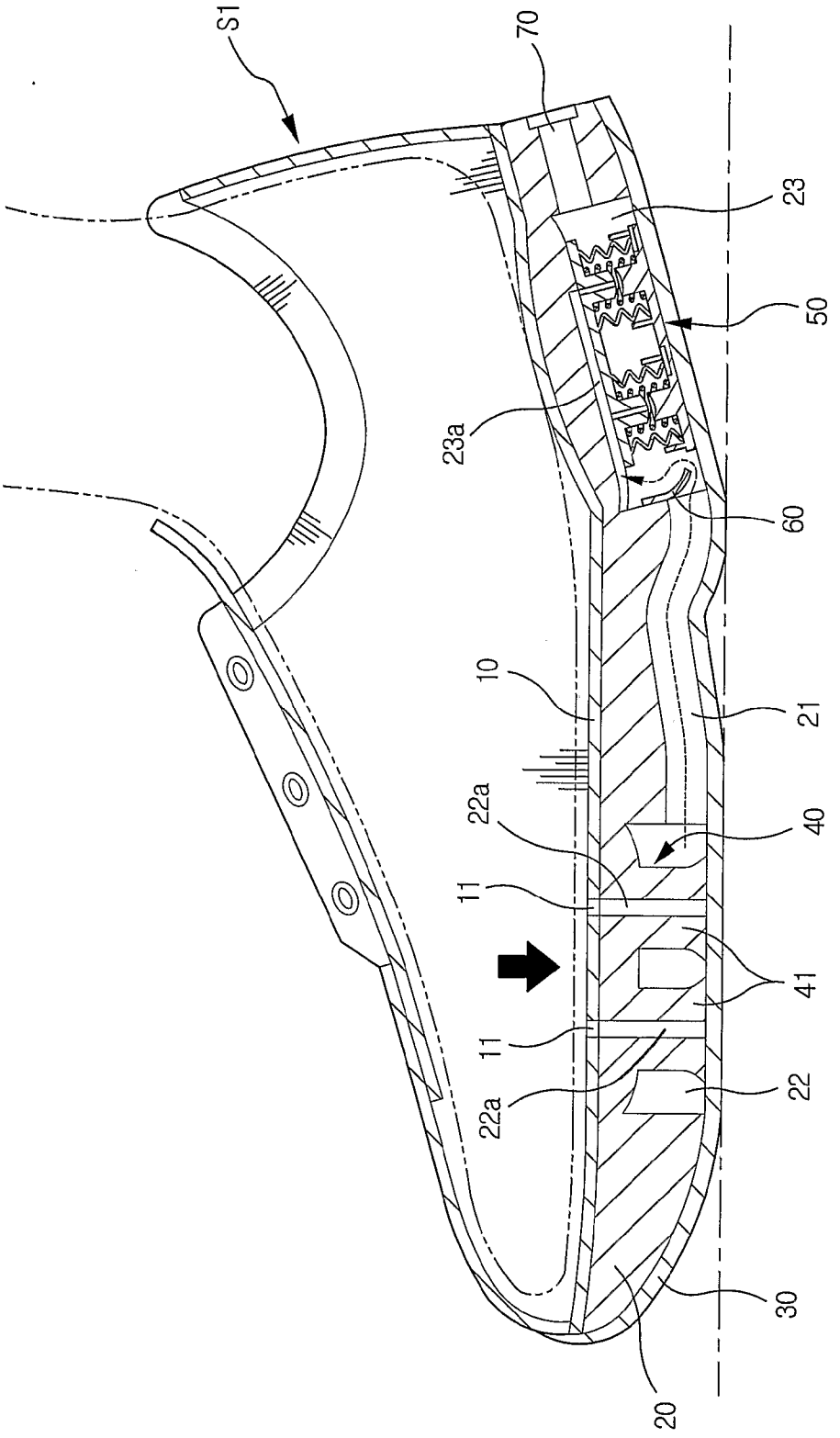

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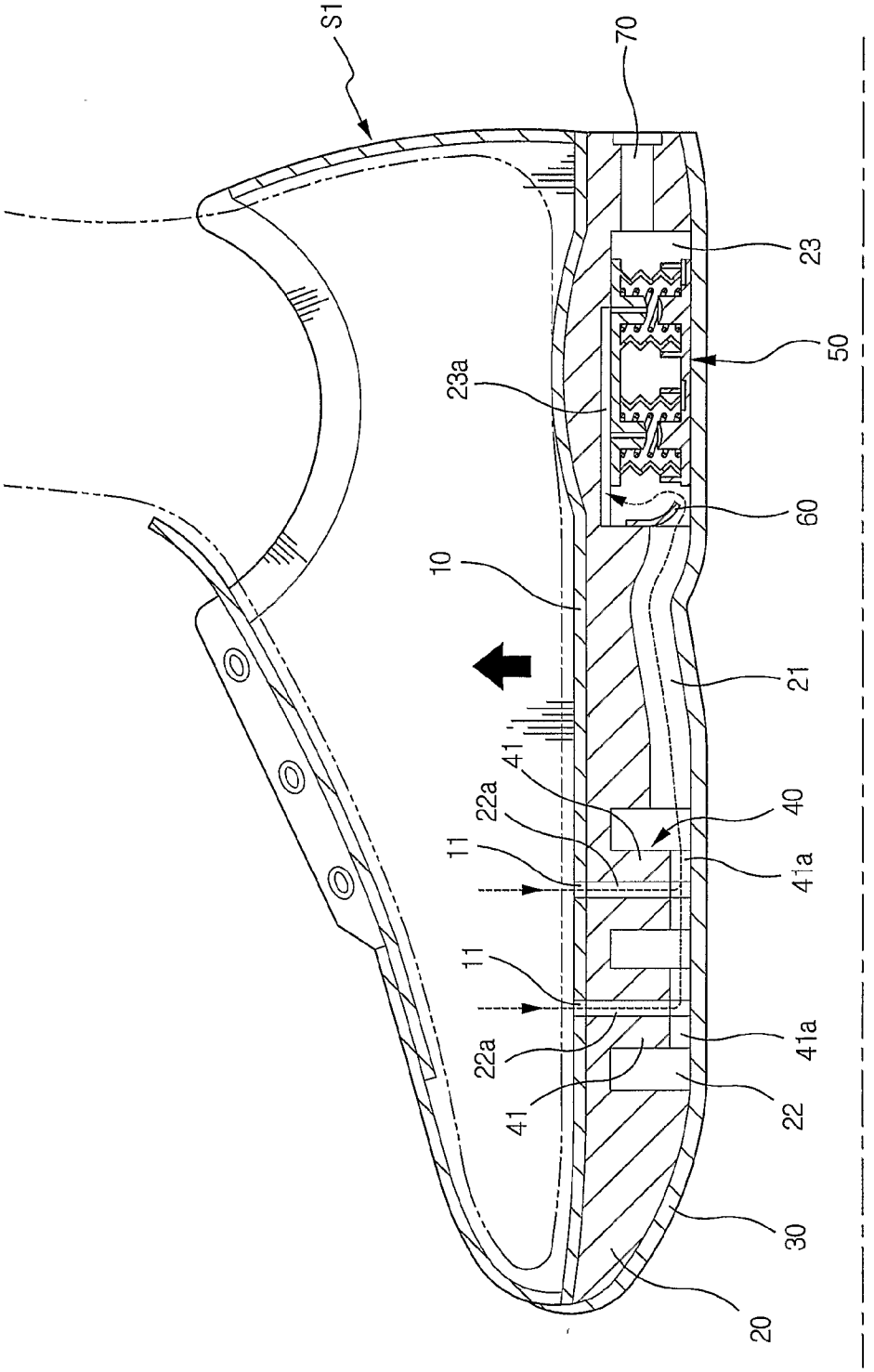

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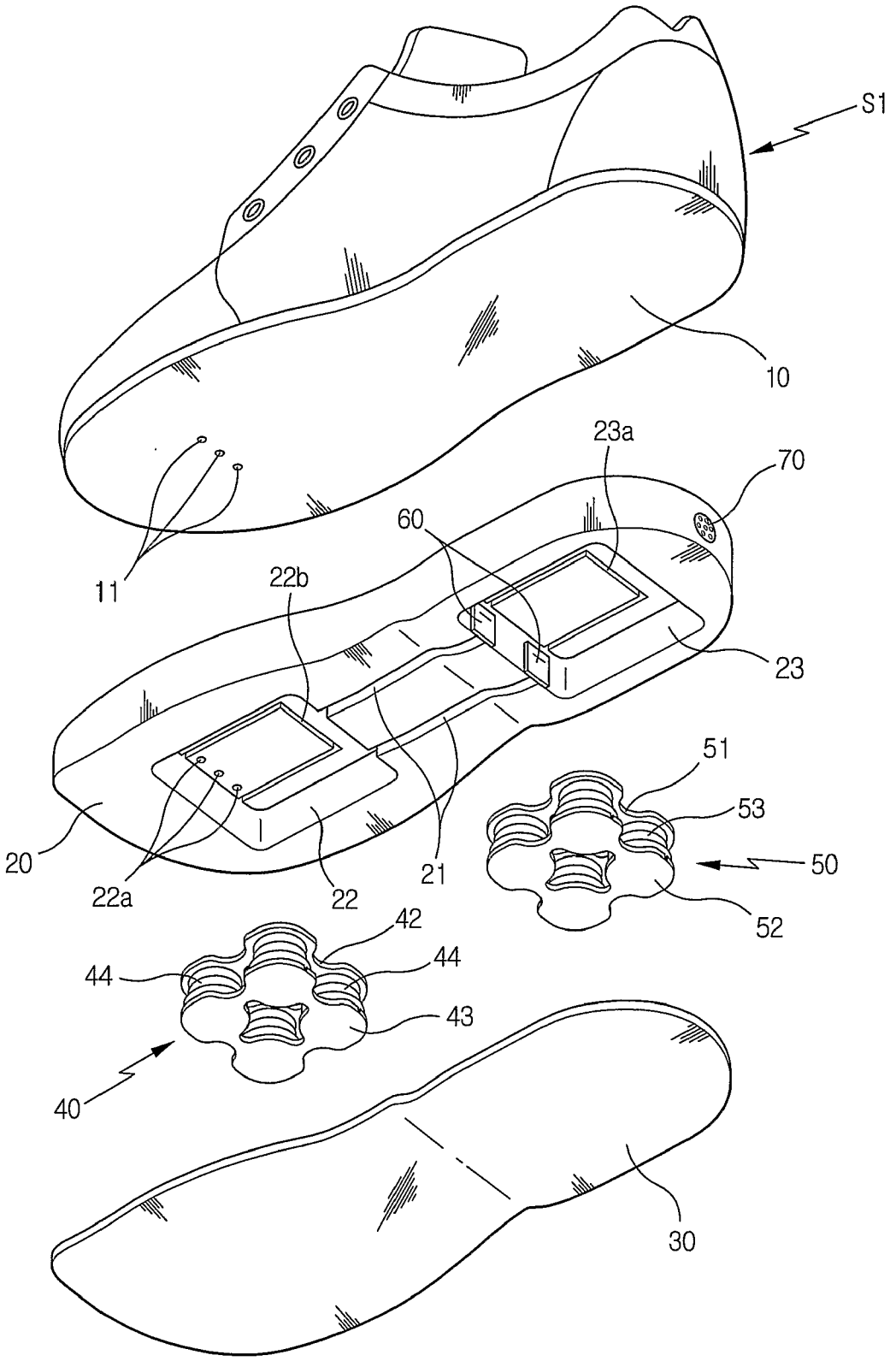

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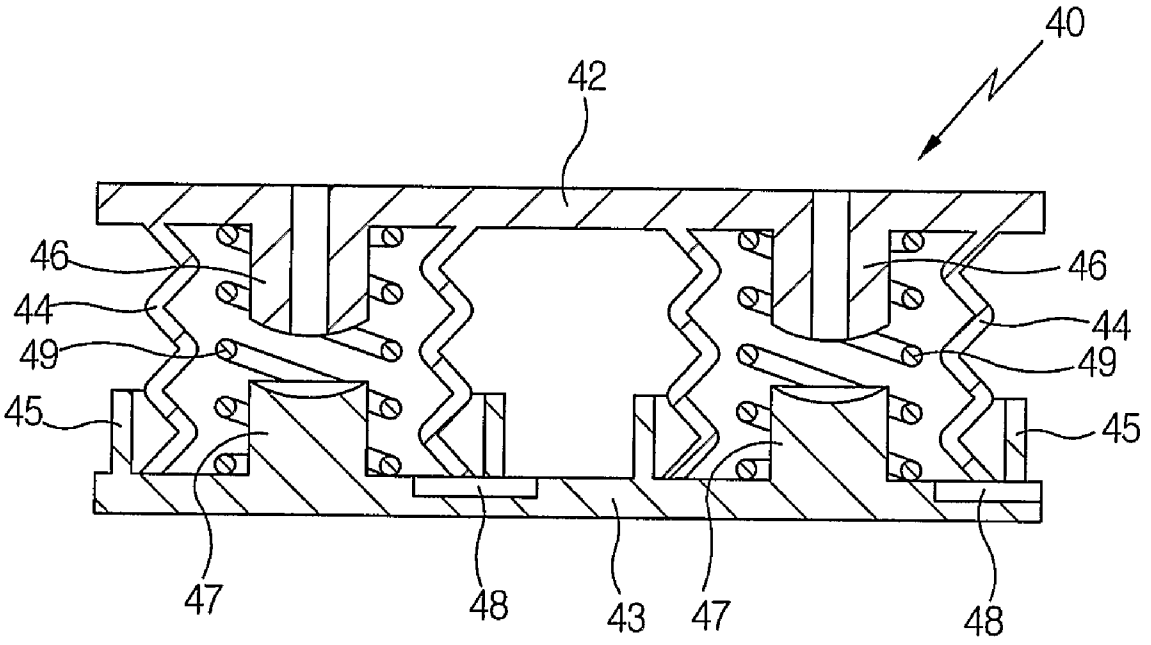

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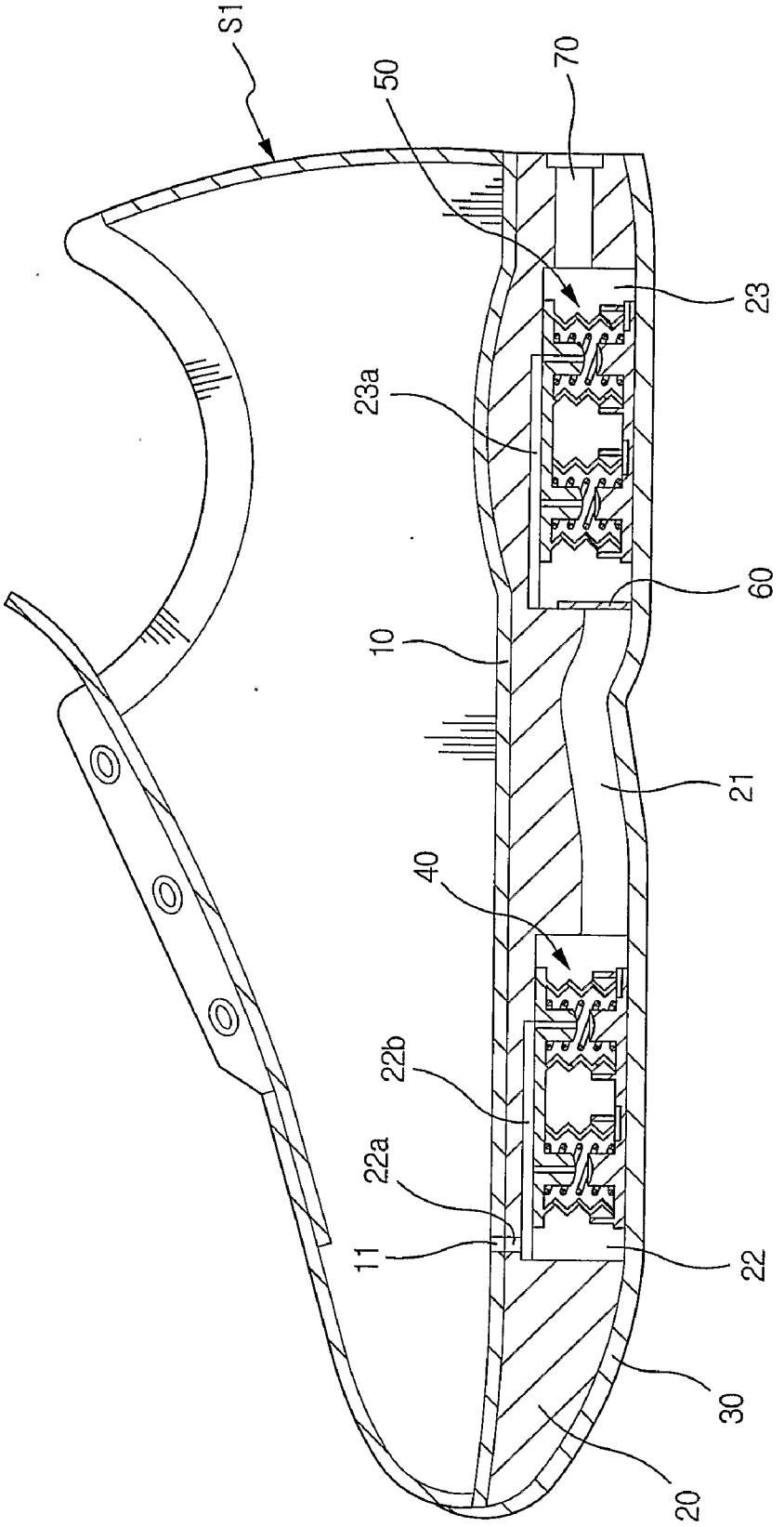

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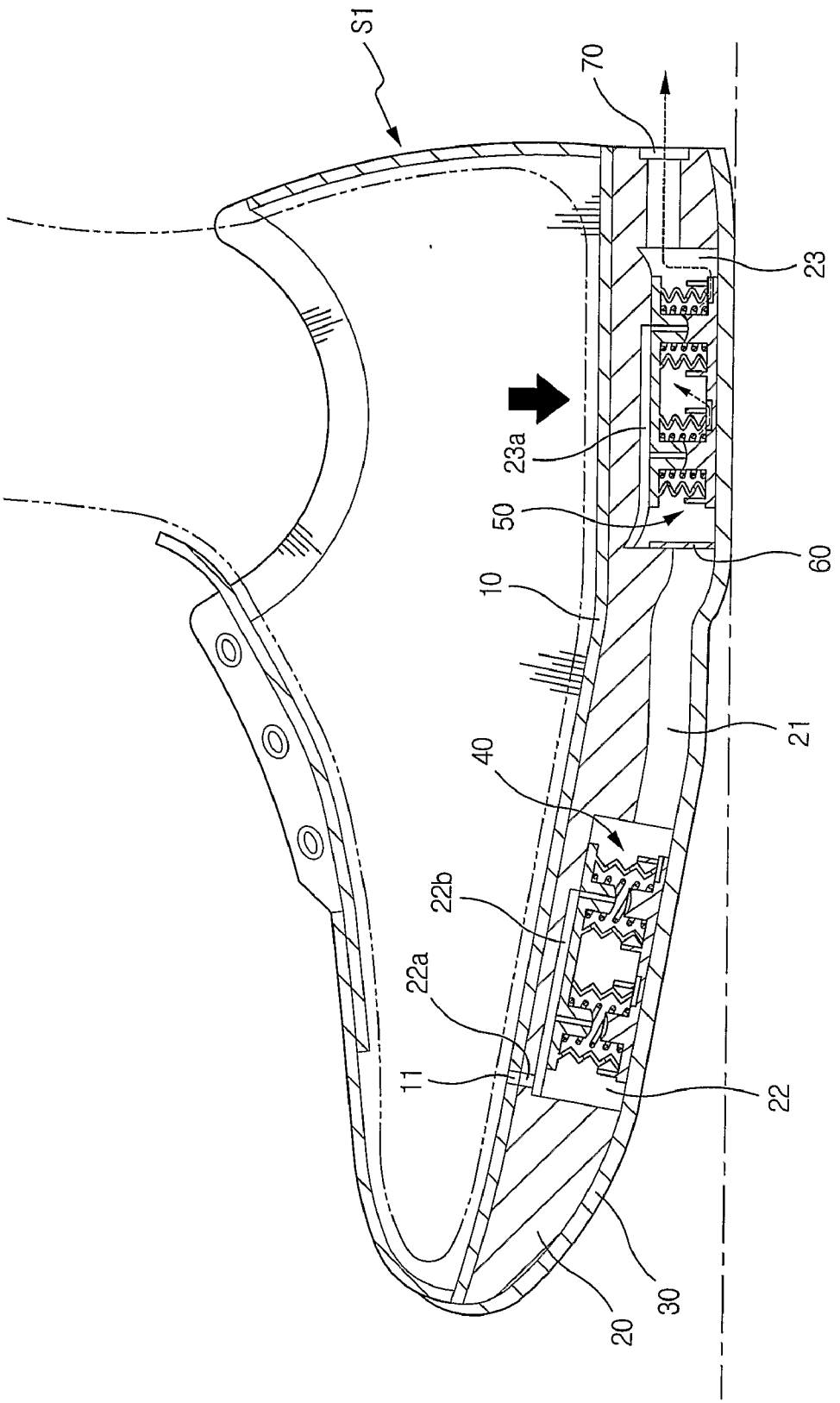

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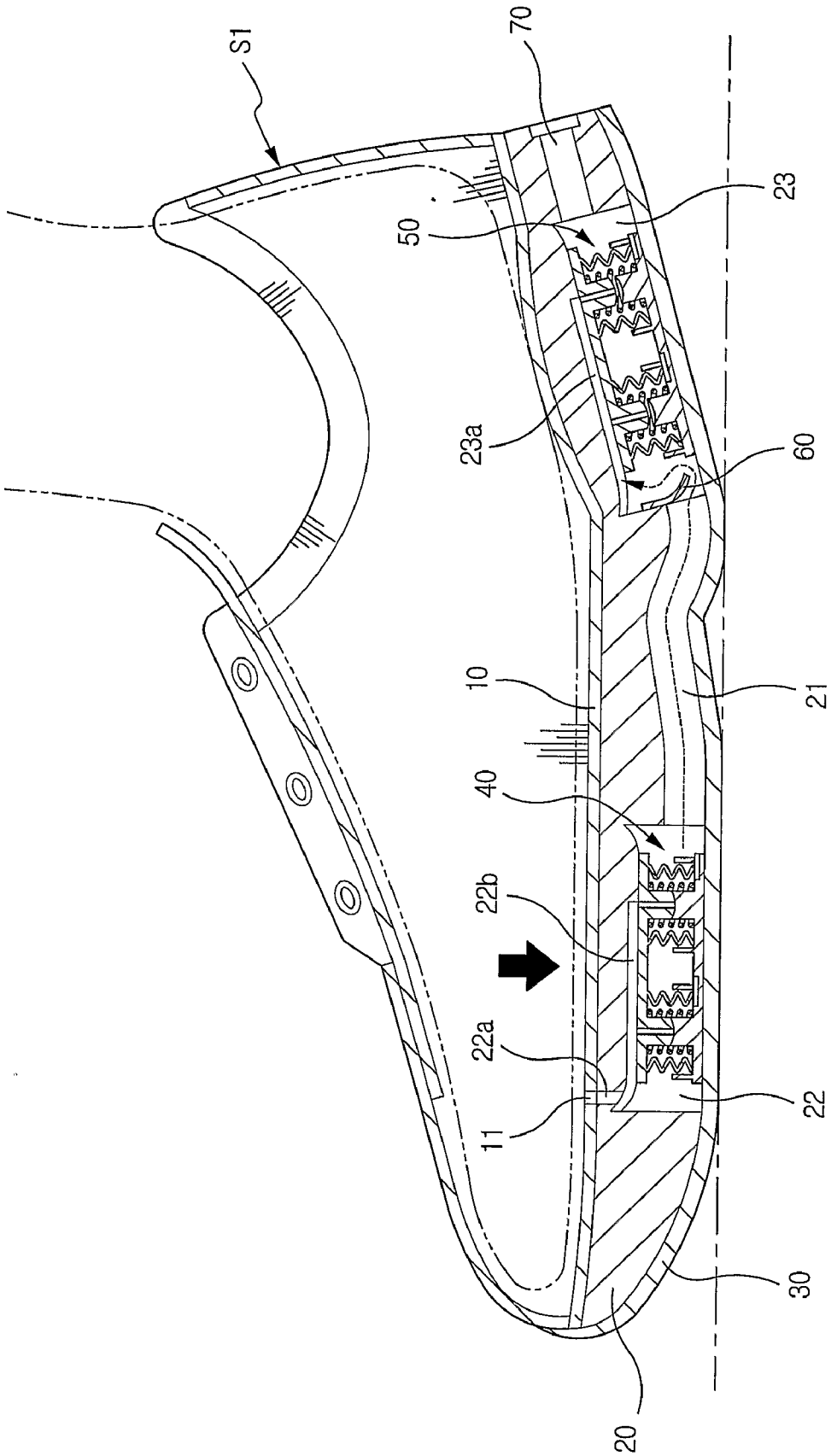

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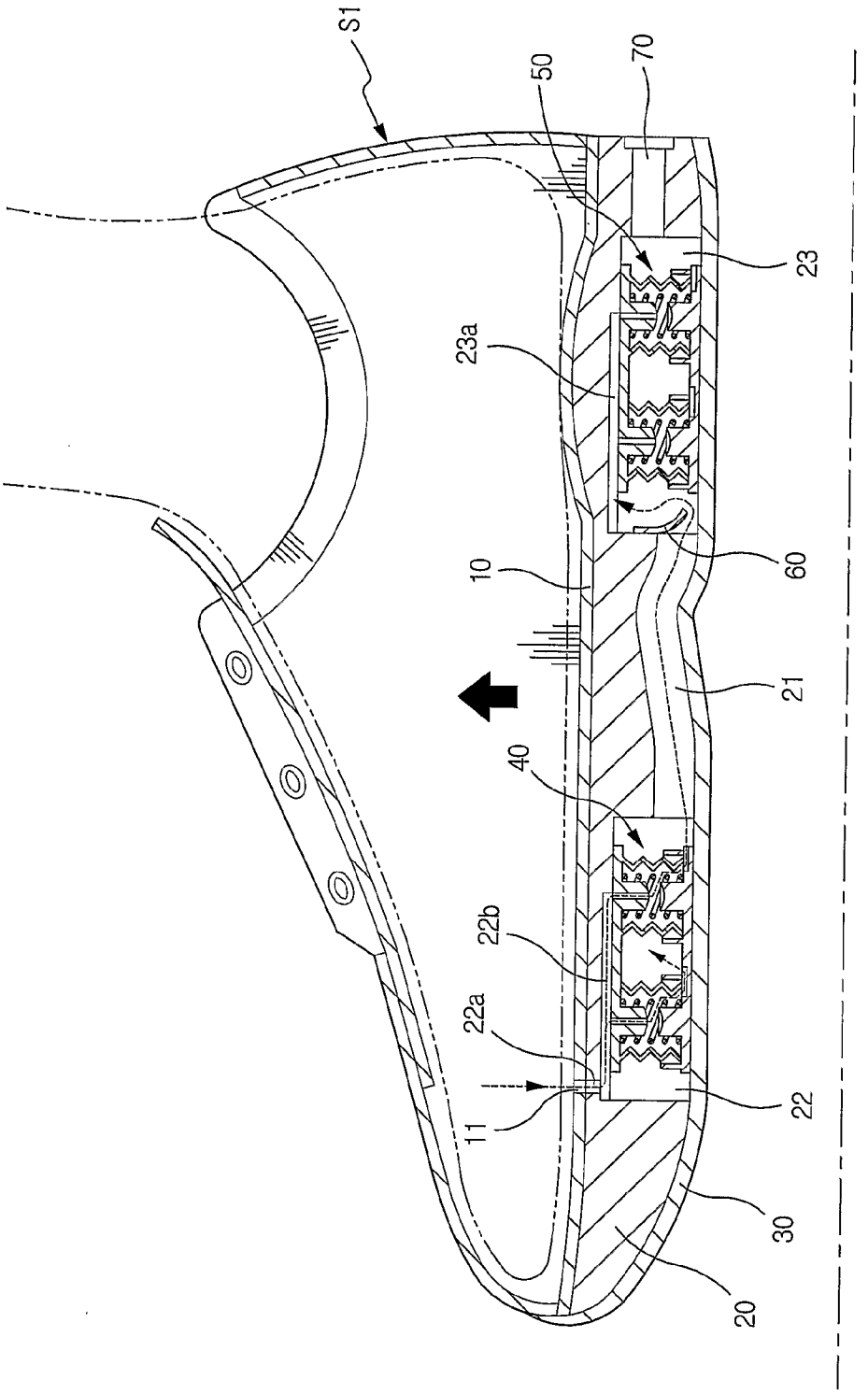

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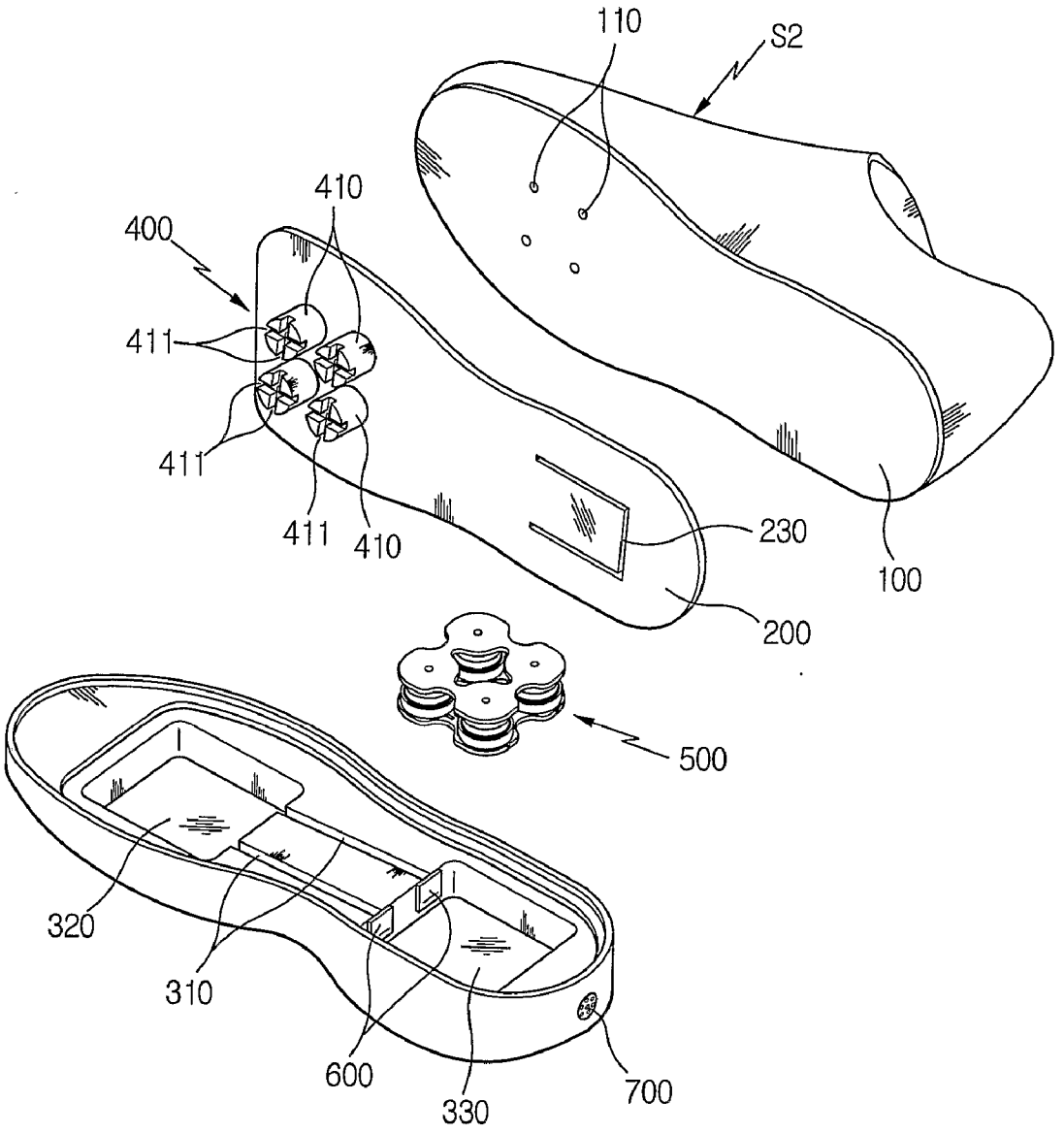
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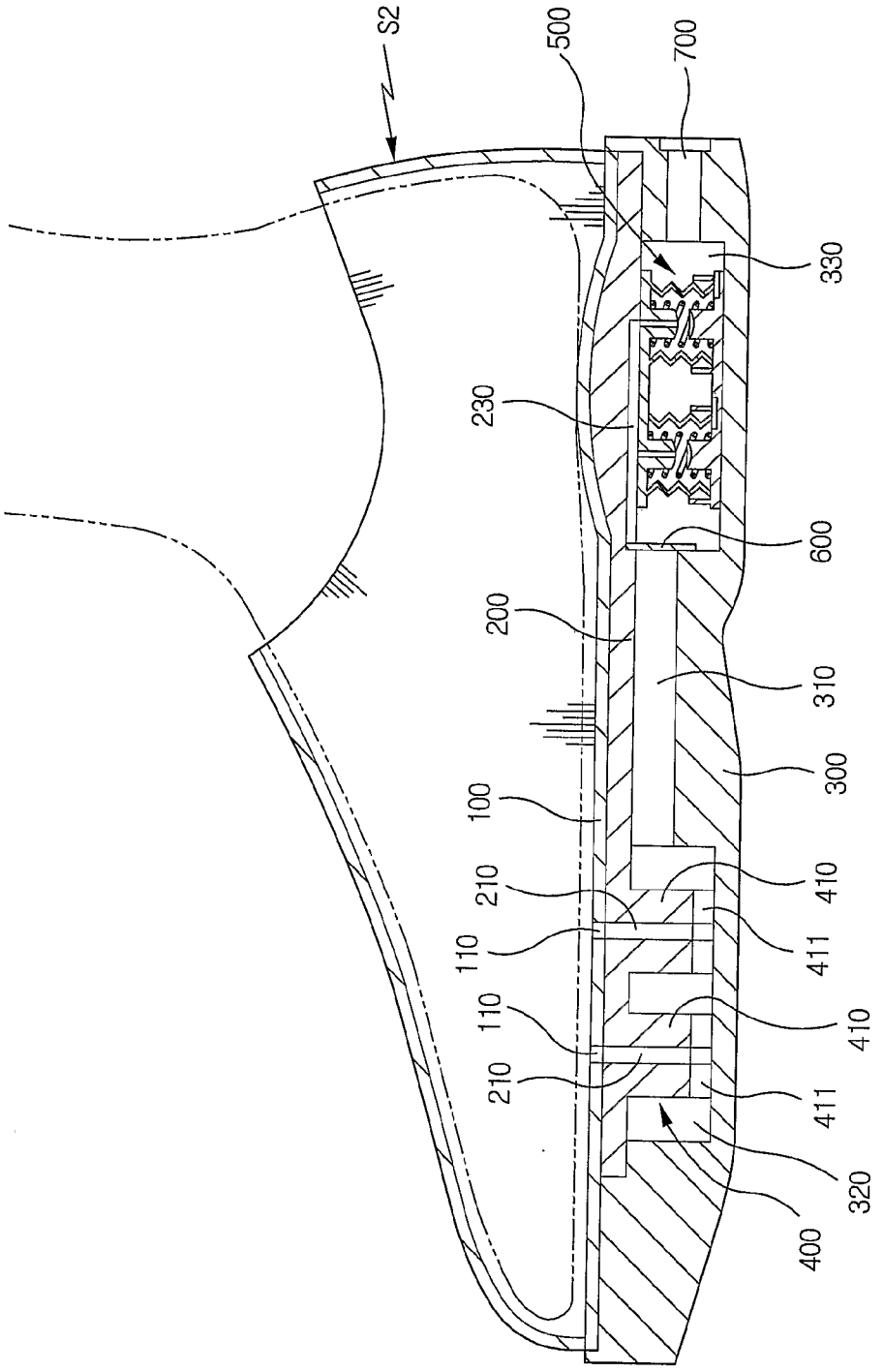
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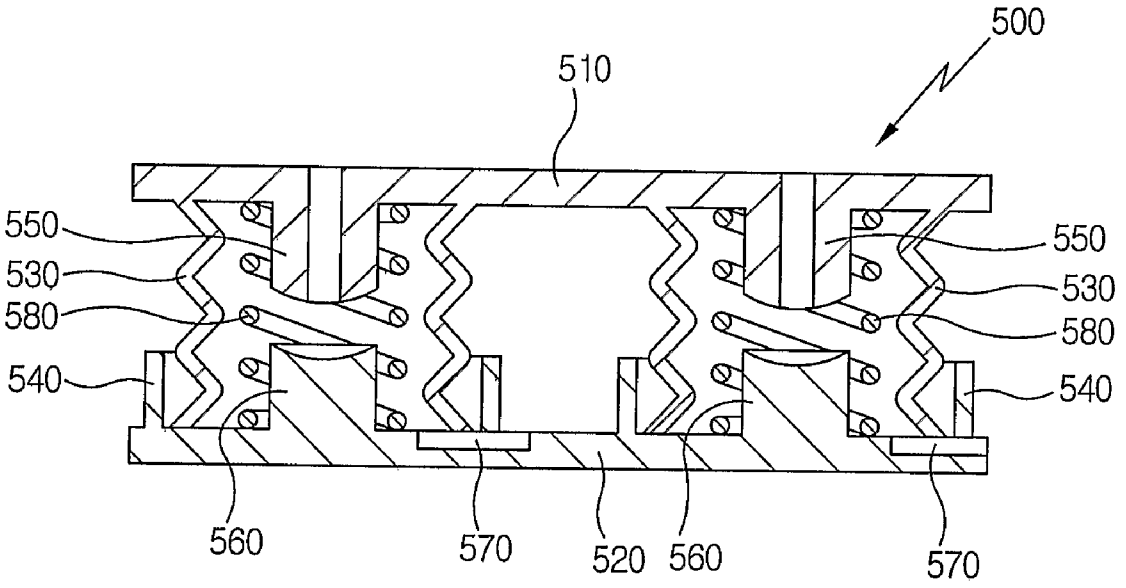
Fig.24



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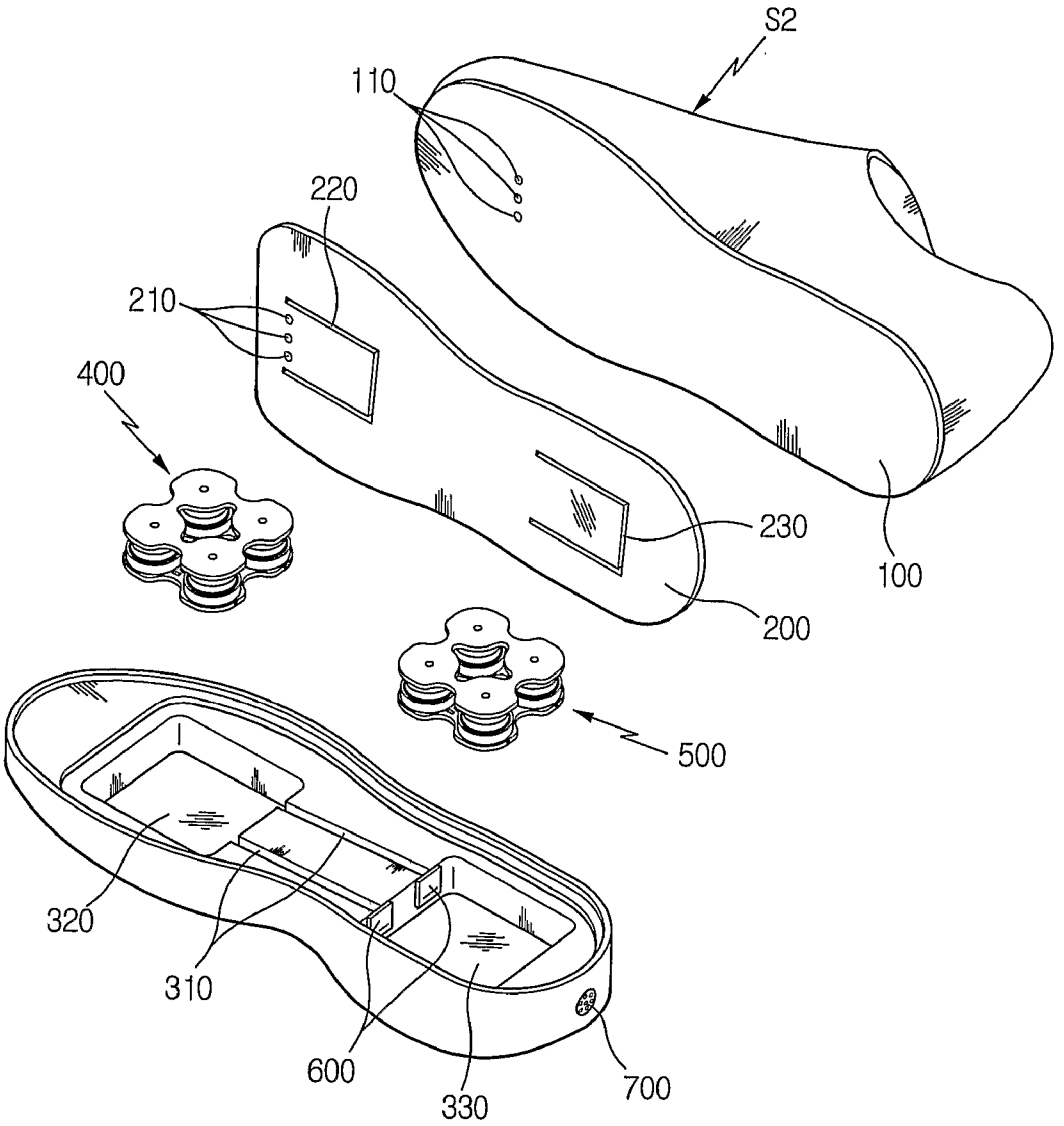

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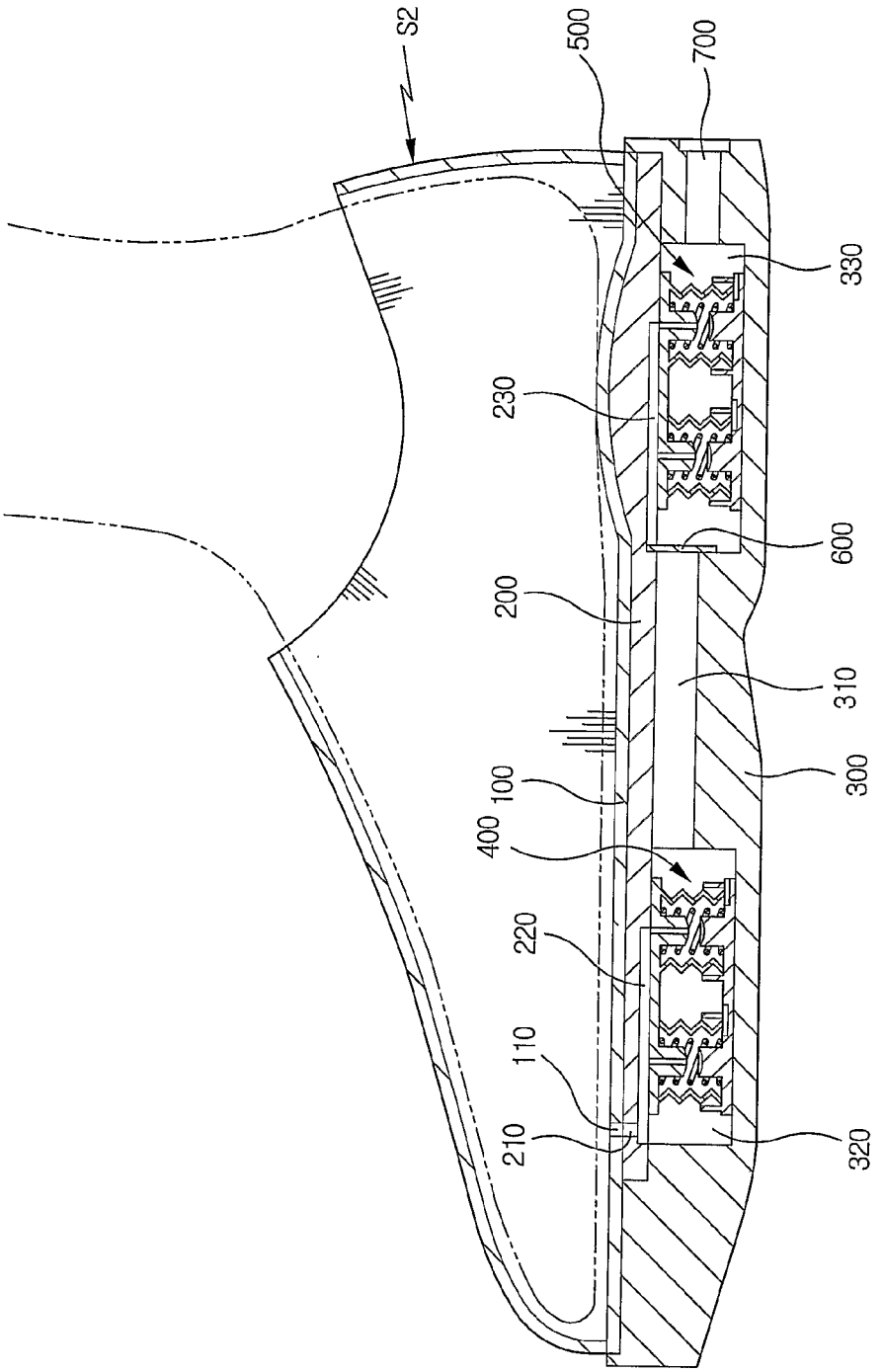

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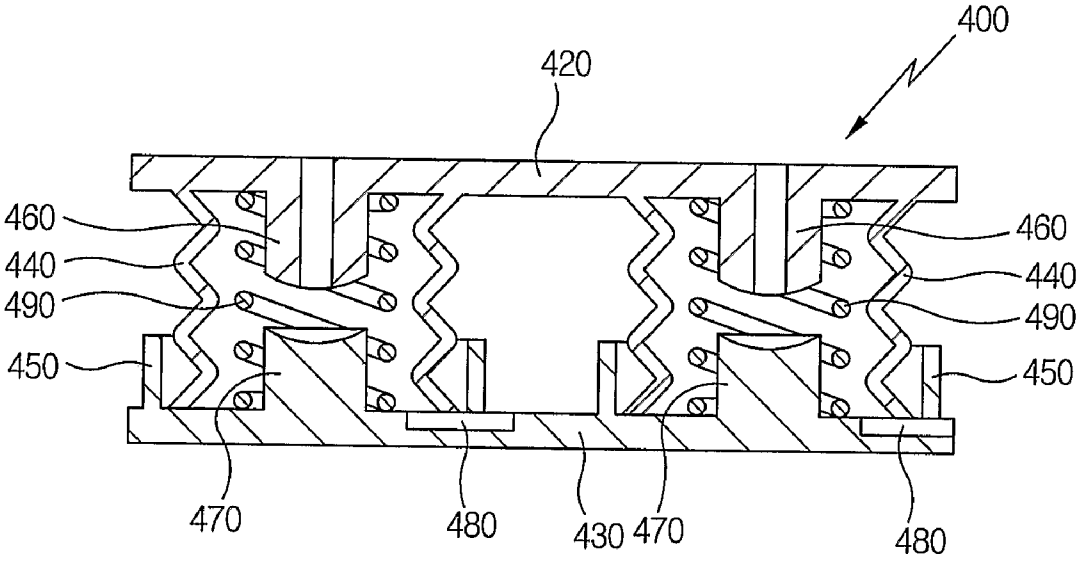

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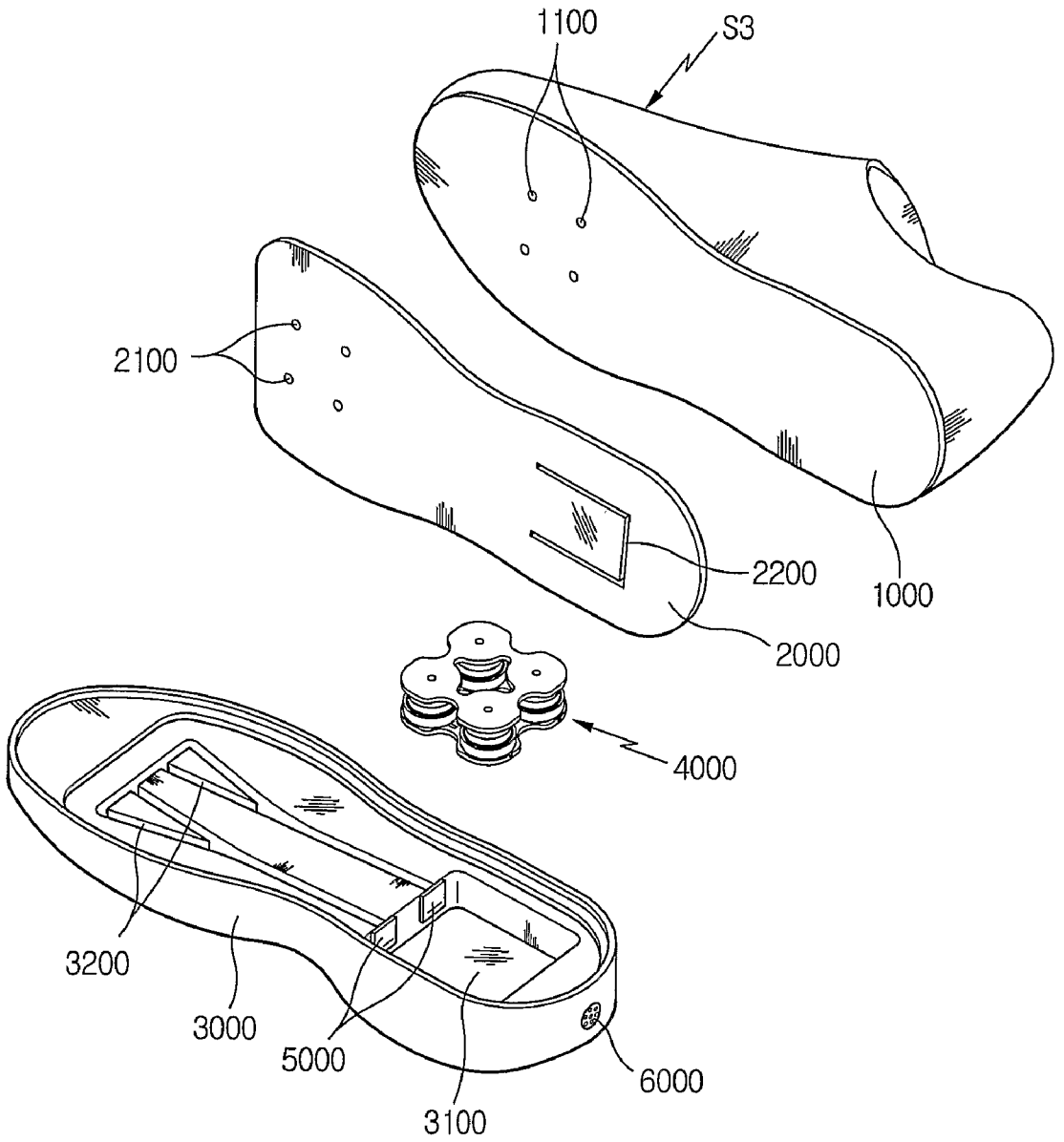

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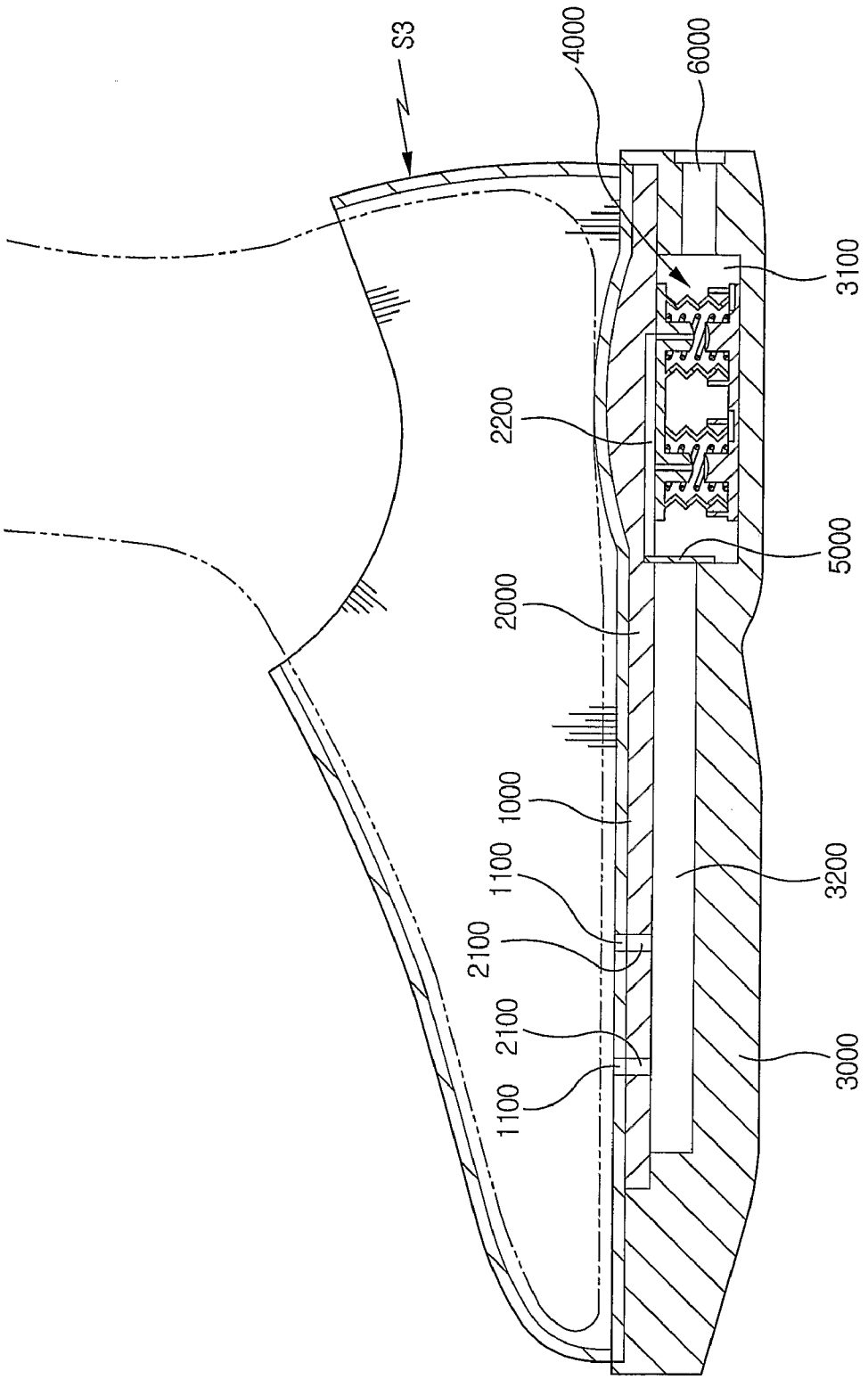
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Fig.30

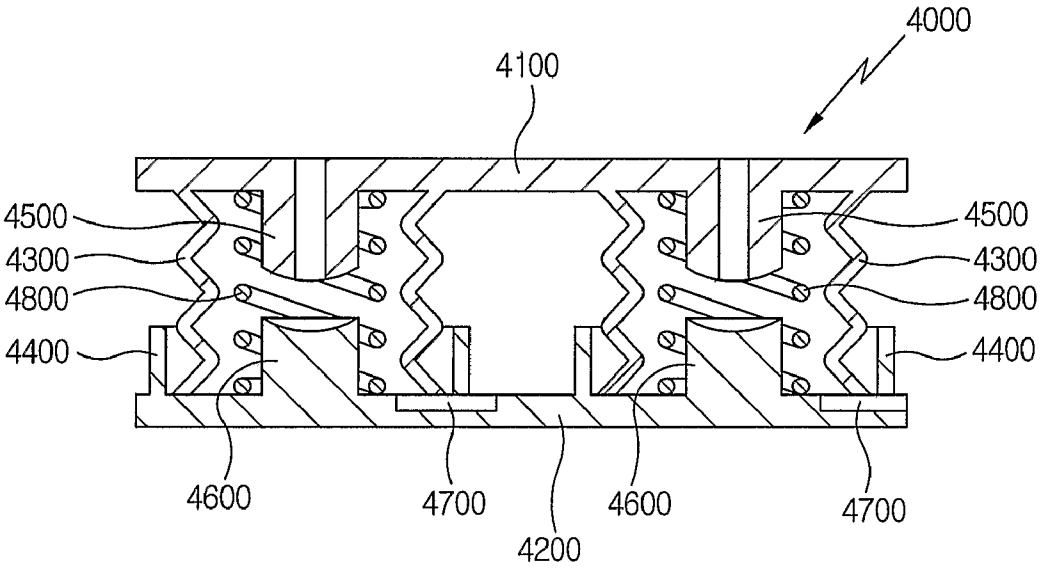
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Fig.31

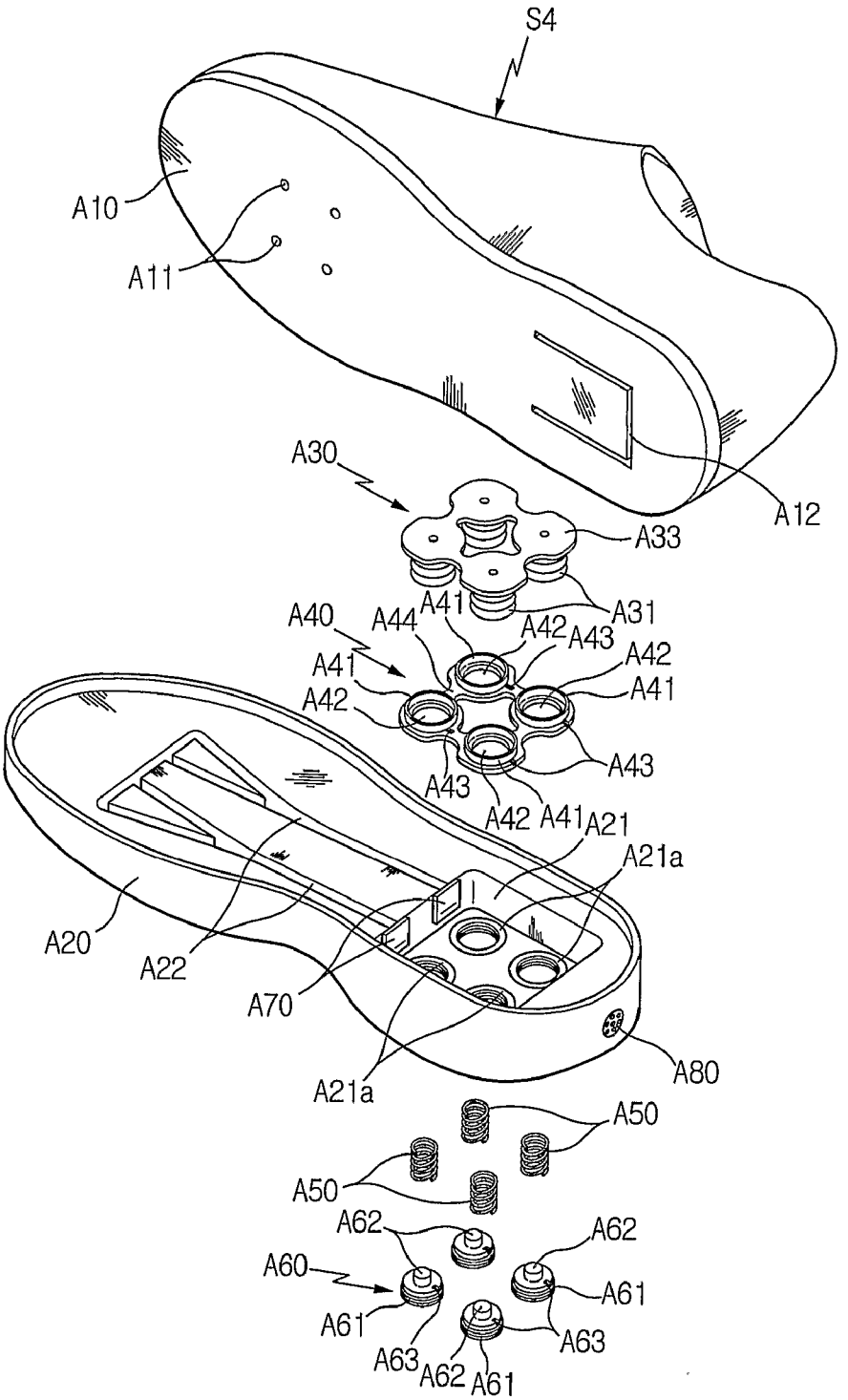
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Fig.32

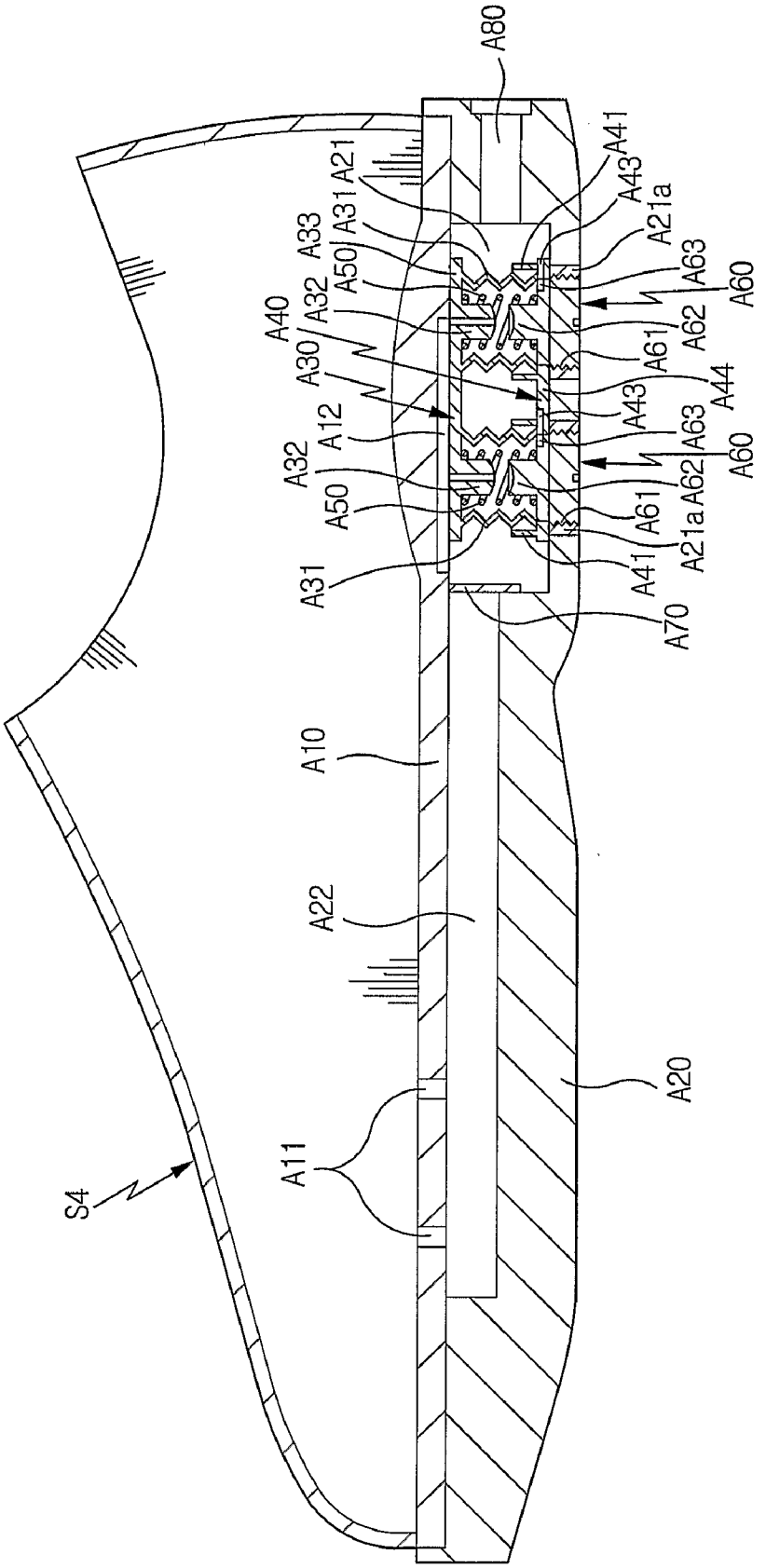
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Fig.33

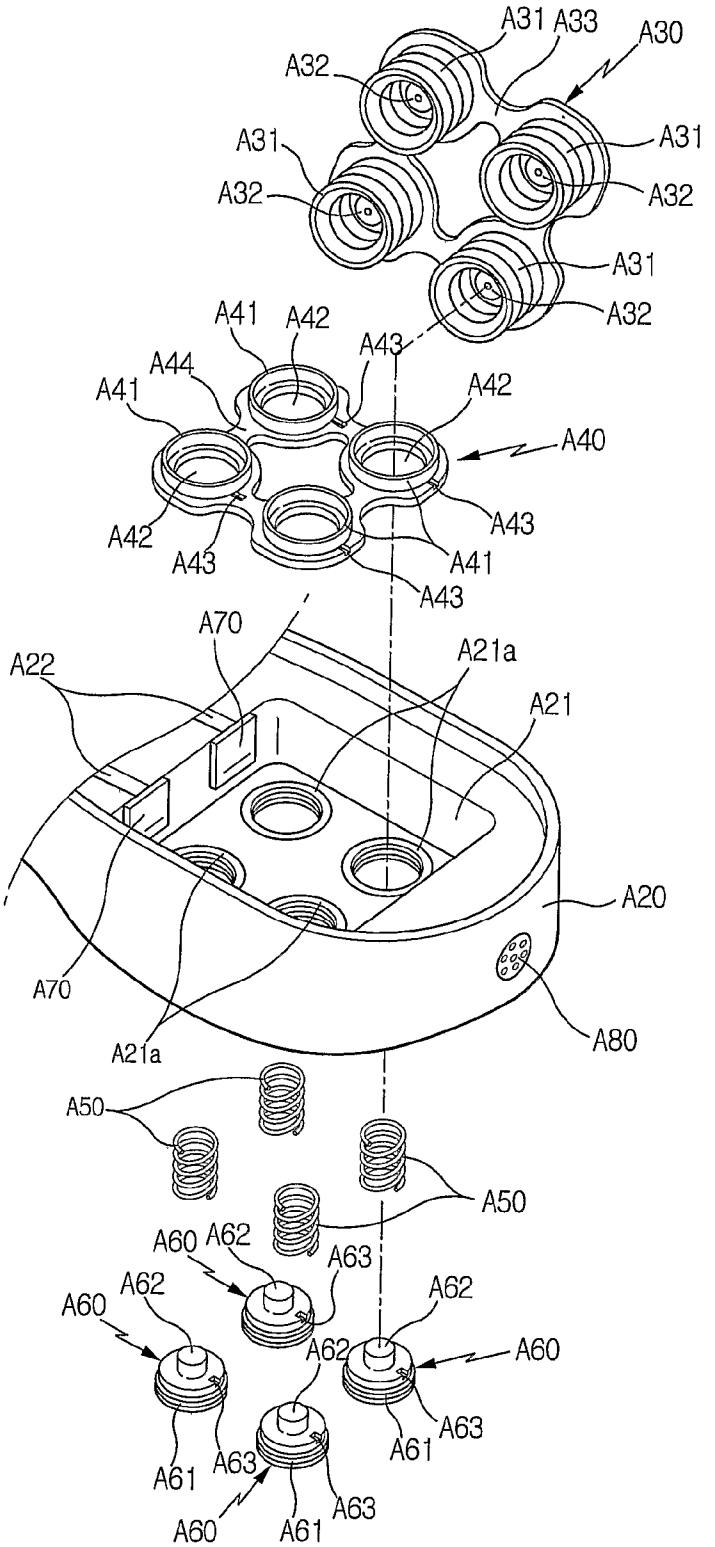
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Fig.34

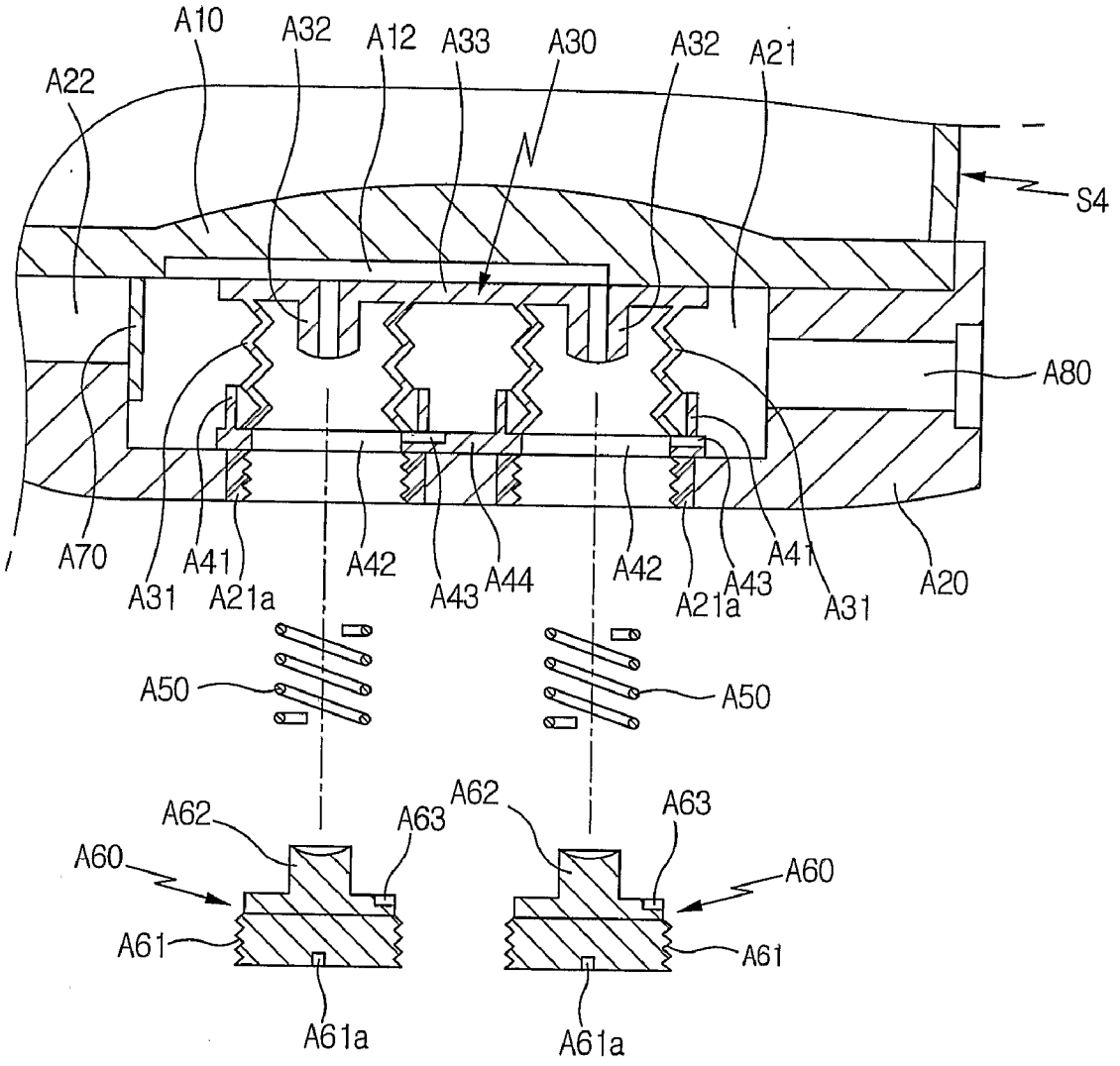
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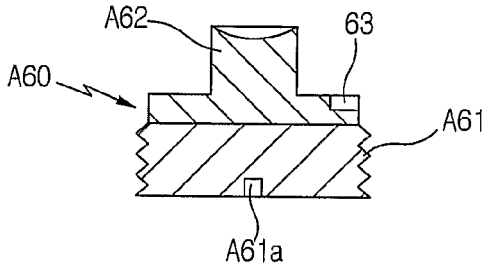
Fig.35



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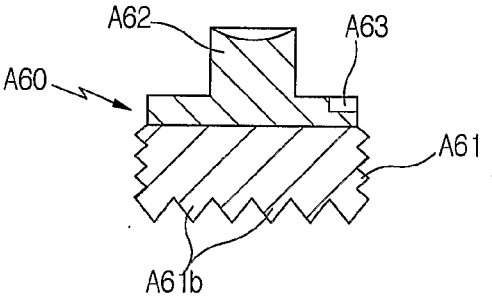

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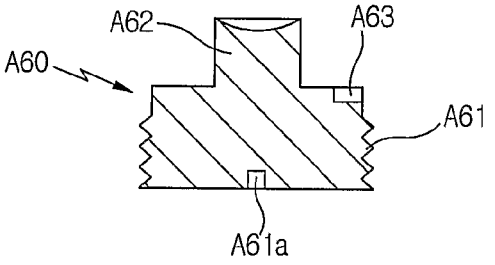

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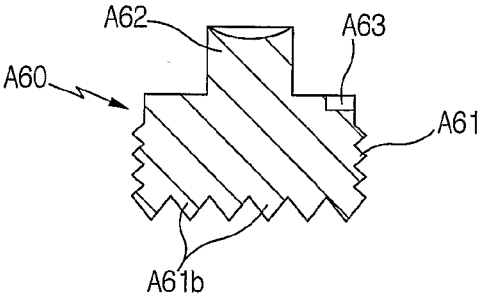

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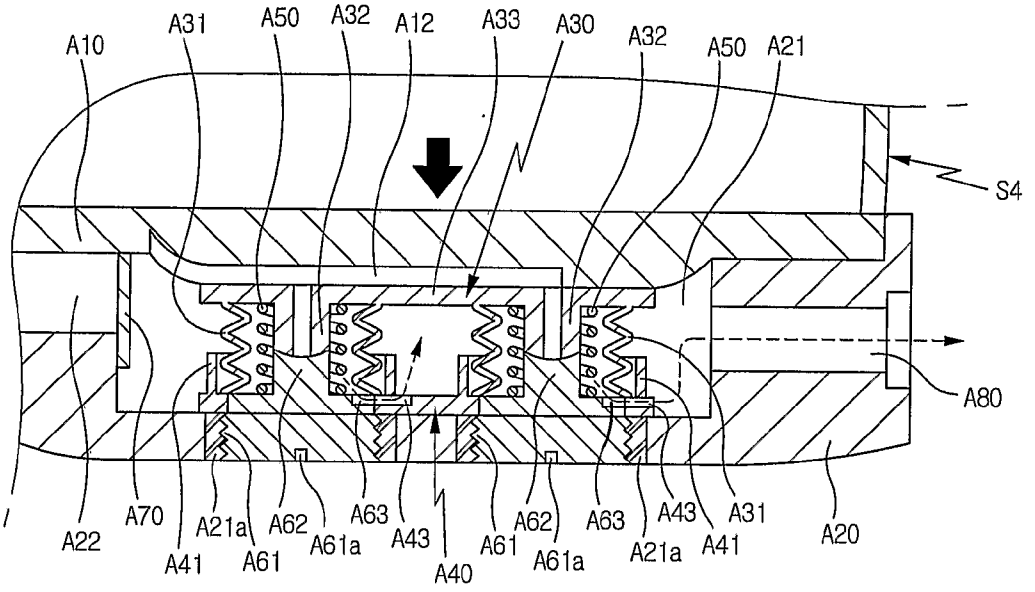
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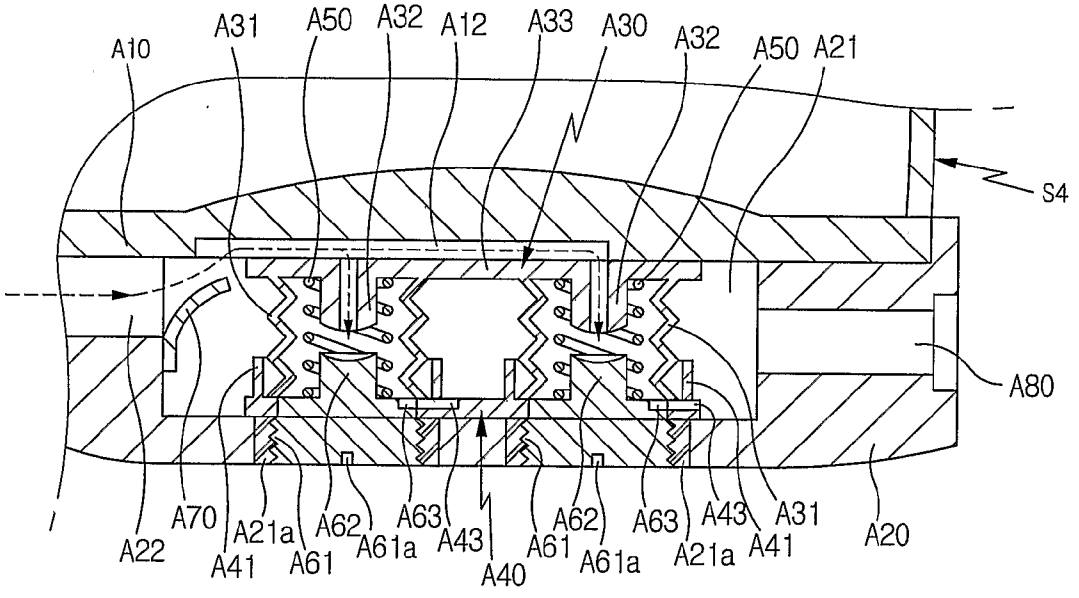
Fig.40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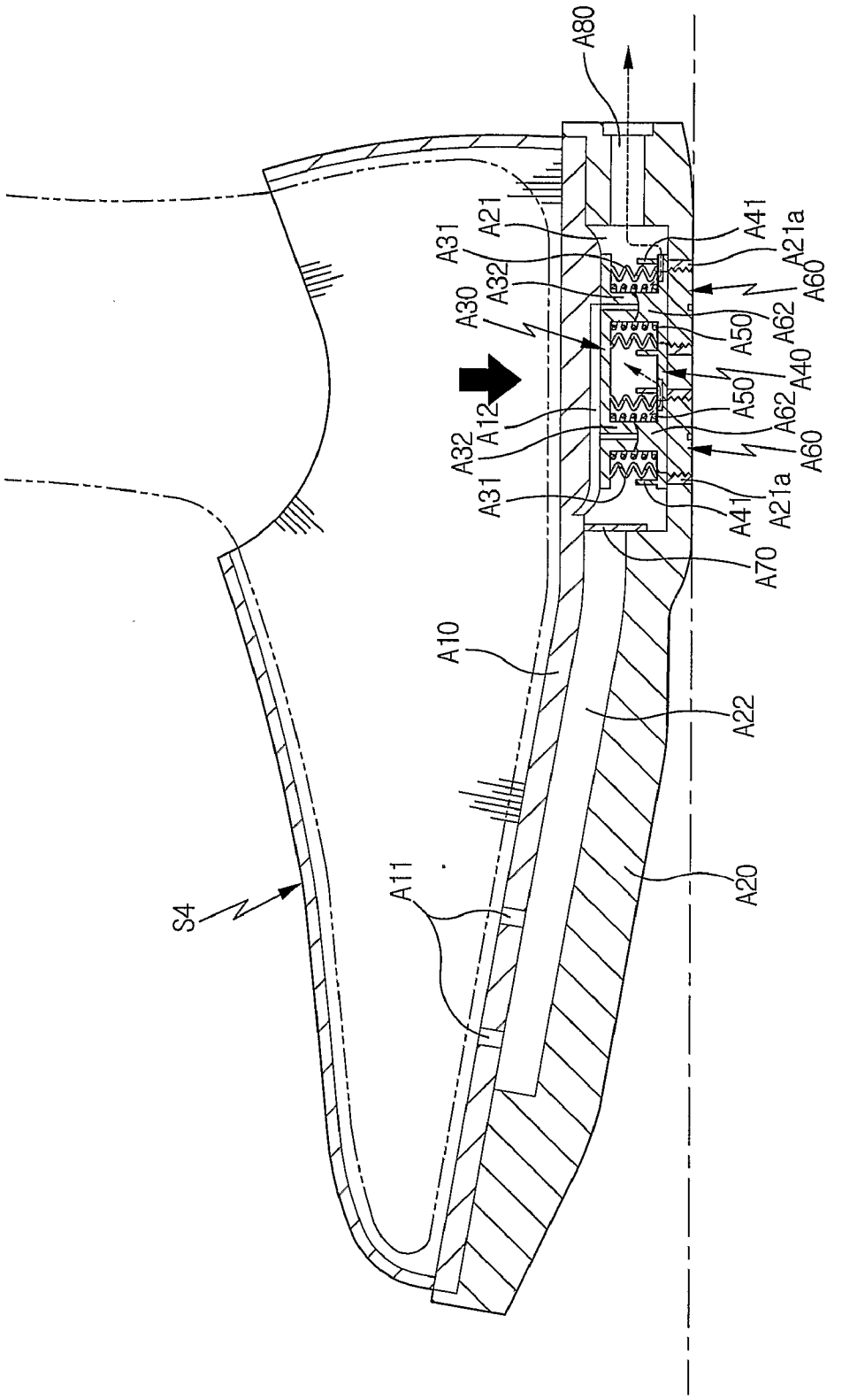
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Fig. 42

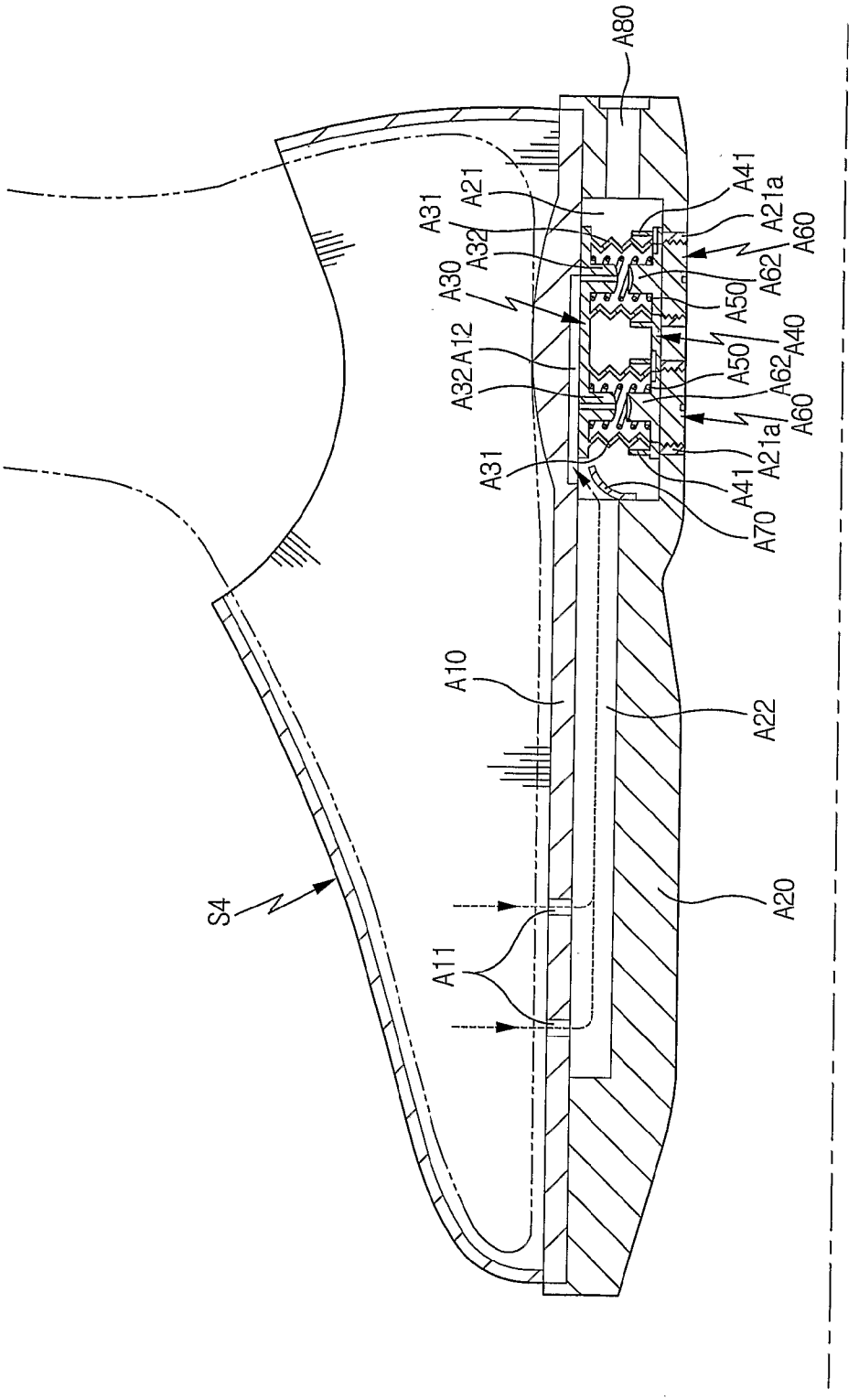
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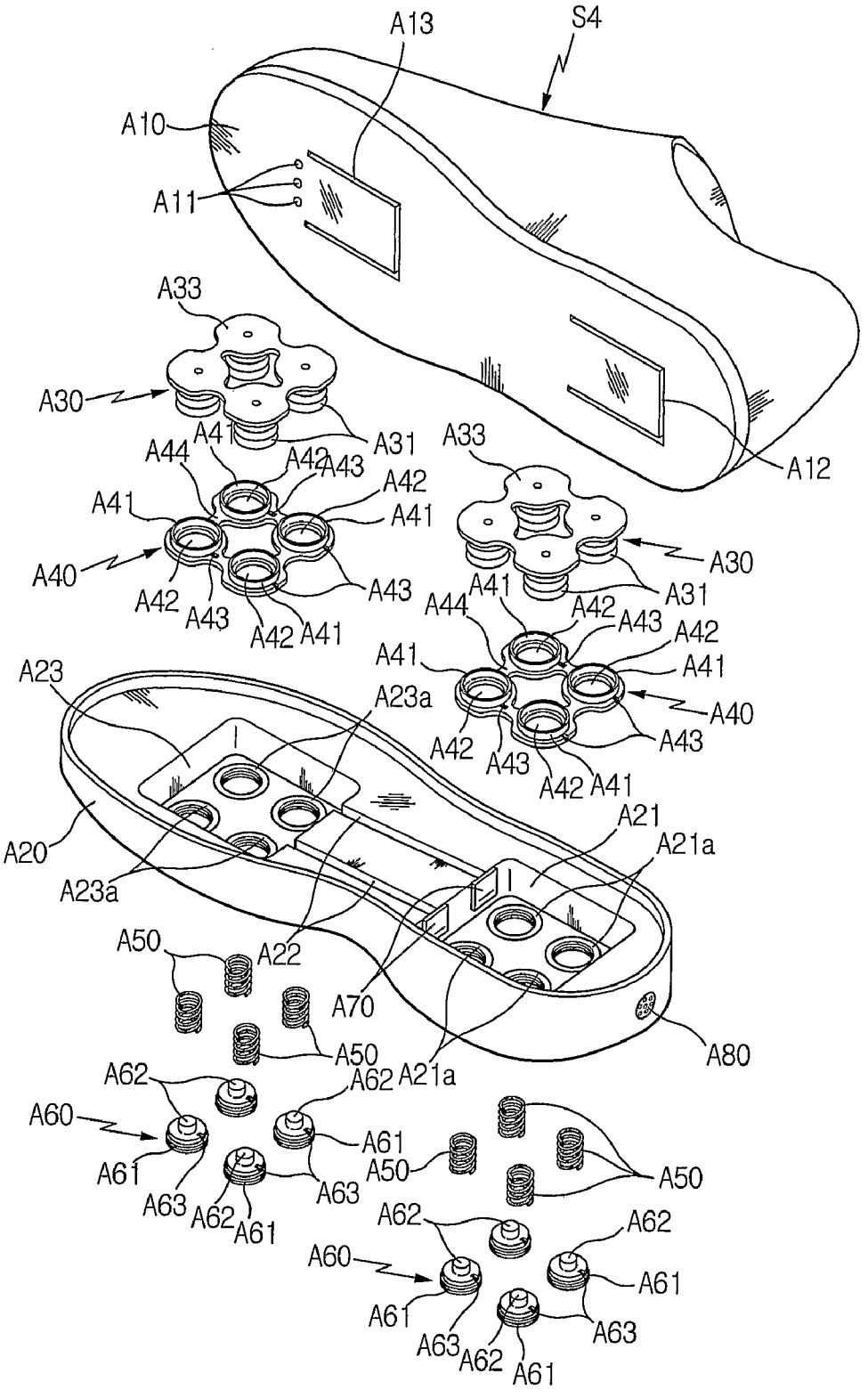
Fig.43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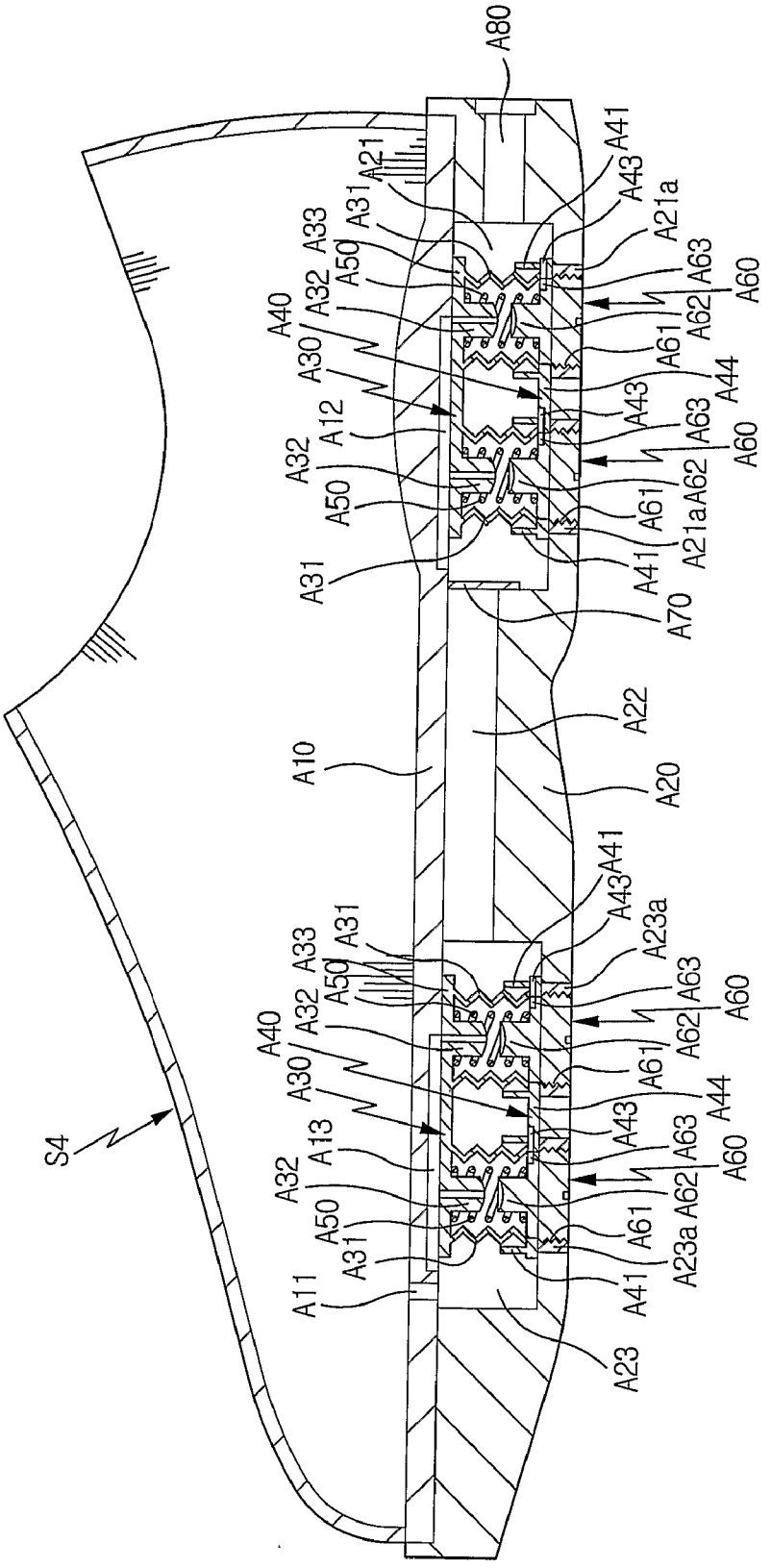
A60
A61
A61
A63
A63
A62
A61

Fig. 44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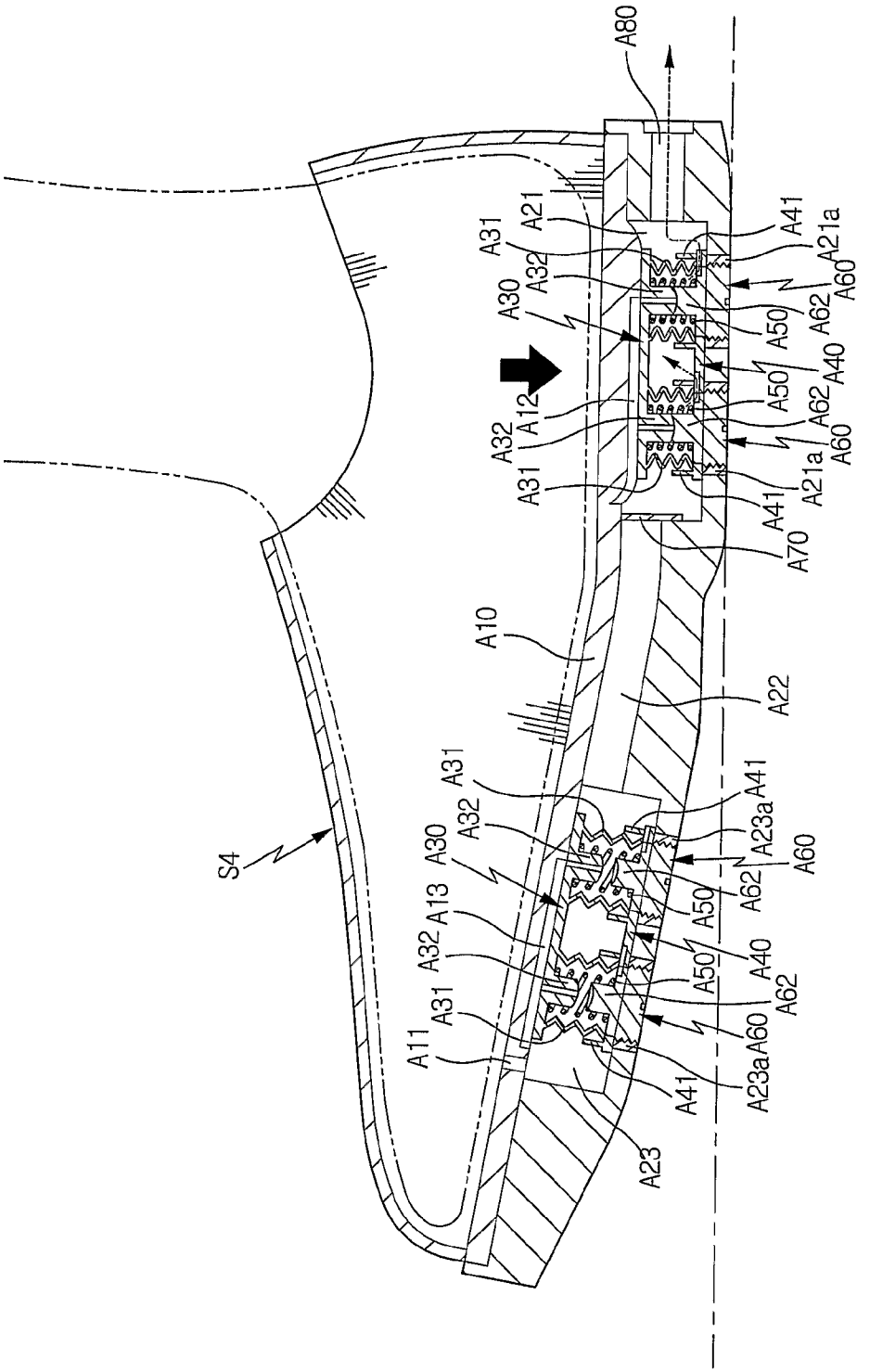
A41
A43
A21
A31
A21a
A33
A50
A63
A32
A62
A60
A40
A30
A61
A44
A12
A43
A32
A63
A60
A50
A62
A61
A21a
A41
A31
A70
A22
A10
A20
A41
A43
A23a
A31
A33
A50
A63
A32
A60
A40
A62
A30
A61
A44
A13
A43
A63
A32
A60
A50
A62
A61
A23a
A31
A41
A11
A23
S4

Fig. 45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A41
A21a
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A30
A62
A50
A40
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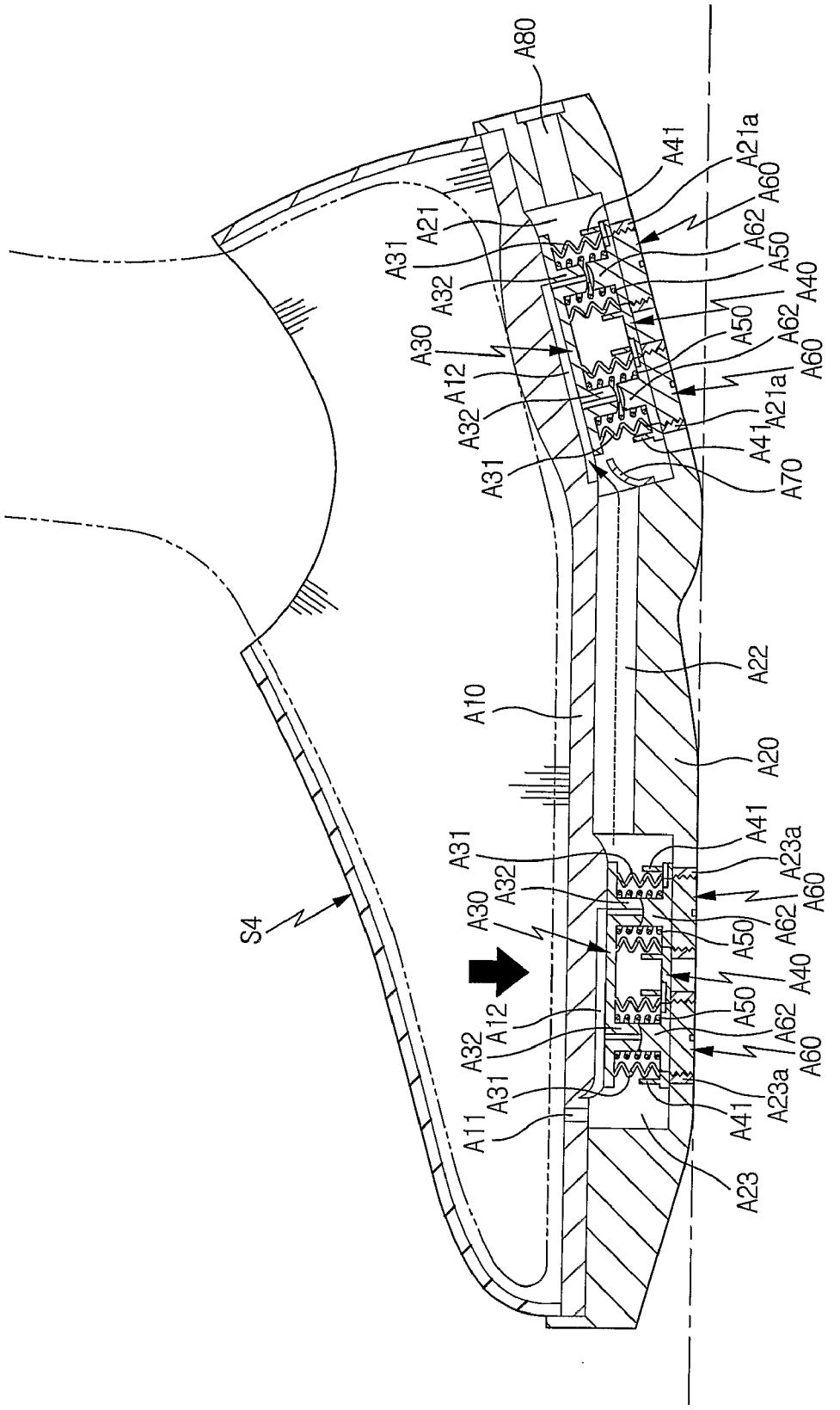
A70
A10
A22
A11
A13
A23a
A23
S4

Fig.46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A62
A50
A40
A21
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A32
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A70
A10
A22
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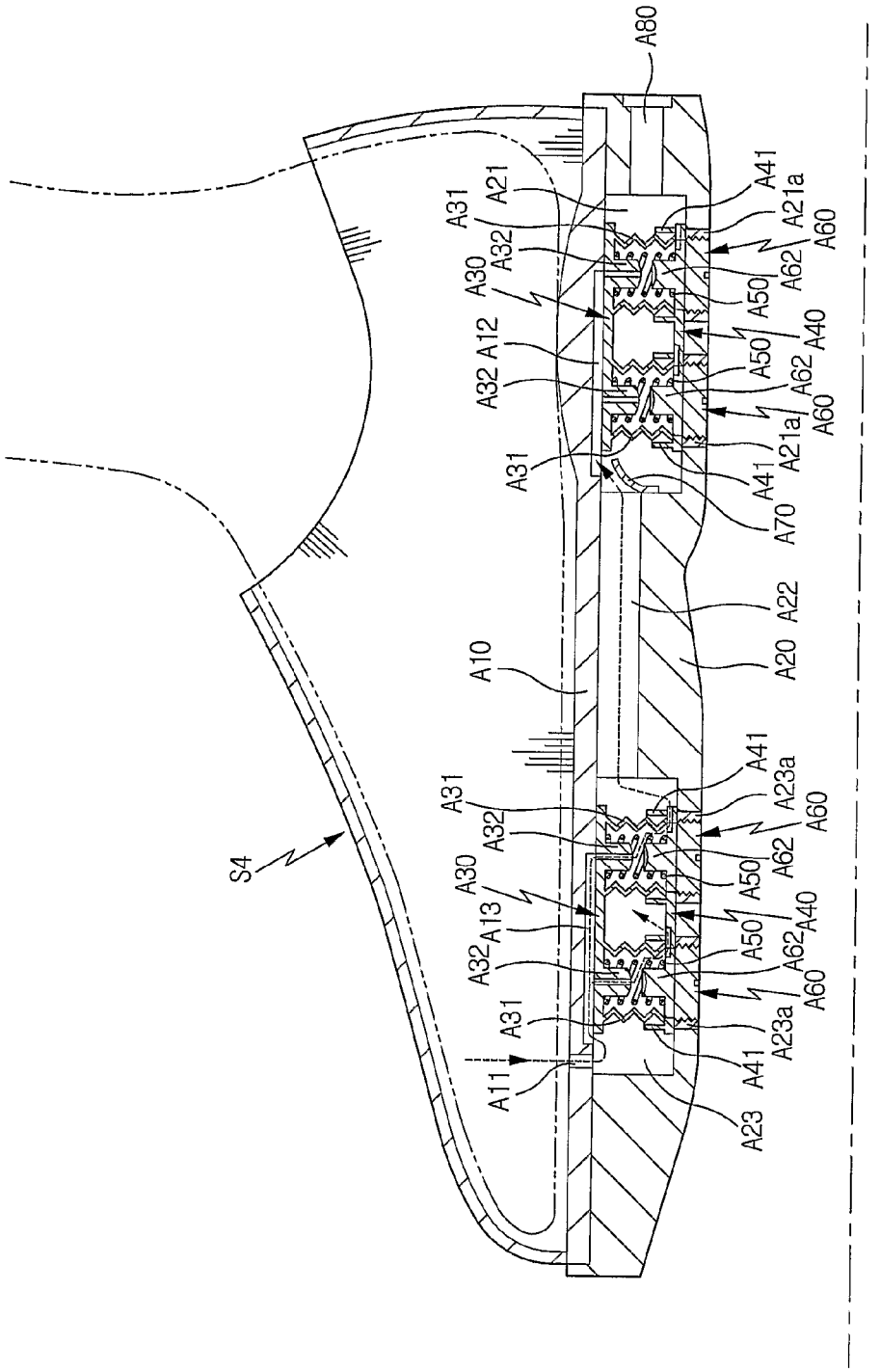
A23a
A11
A23
S4

Fig.47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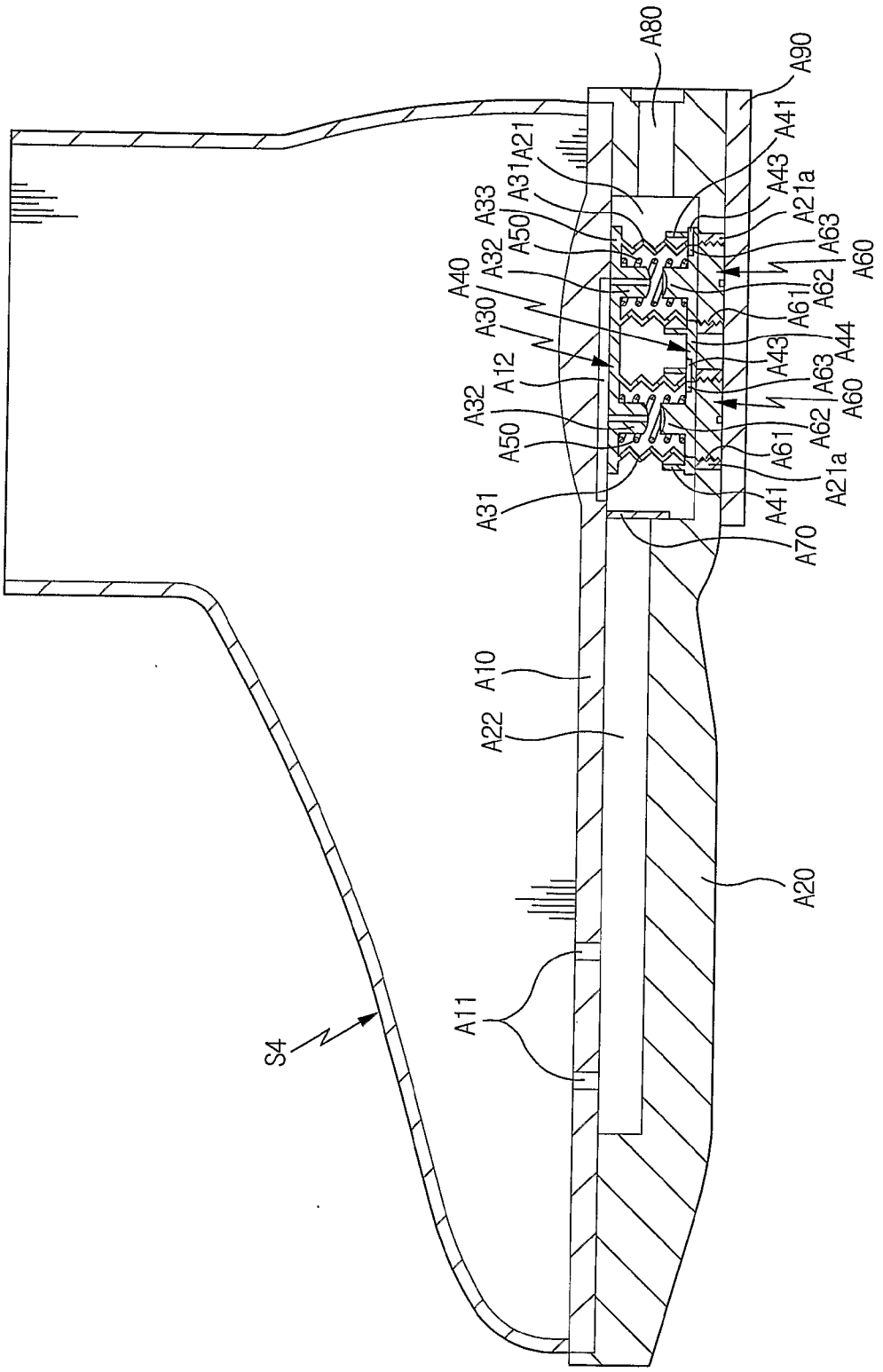
A21a
A60
A30
A32
A62
A50
A12
A40
A70
A22
A20
A10
A23a
A13
A11
A23
S4

Fig. 48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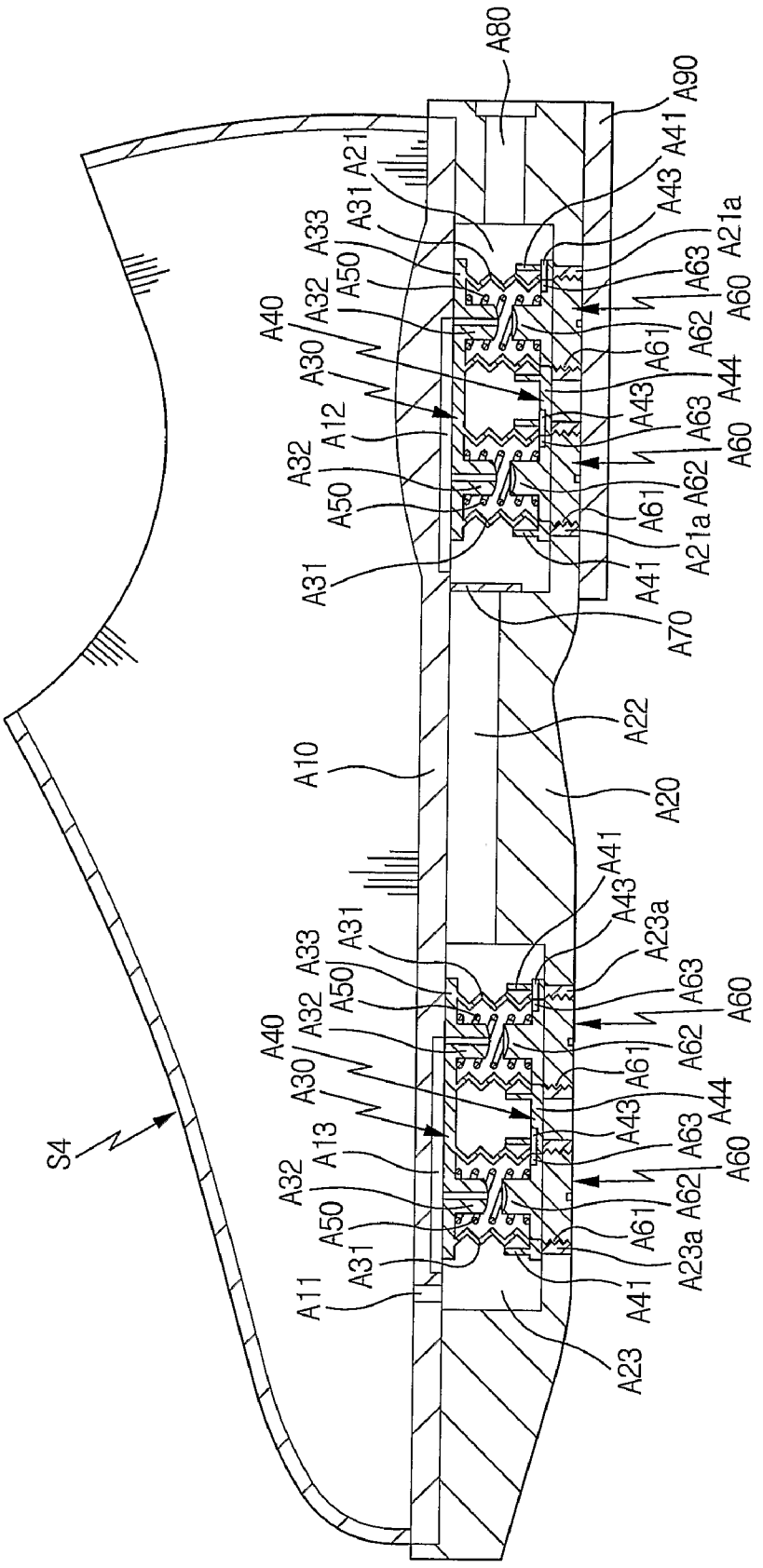
A90
A41
A43
A21a
A63
A60
A62
A61
A44
A21
A31
A33
A50
A32
A40
A30
A12
A70
A10
A22
A20
A11
S4

Fig.49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A43
A21
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A33
A21a
A50
A63
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A60
A40
A62
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A44
A12
A43
A63
A32
A60
A50
A62
A61
A21a
A31
A41
A70
A22
A10
A20
A41
A43
A31
A23a
A33
A63
A50
A60
A32
A40
A62
A61
A30
A44
A43
A13
A63
A60
A32
A62
A50
A61
A31
A23a
A11
A41
A23
S4

Fig.50

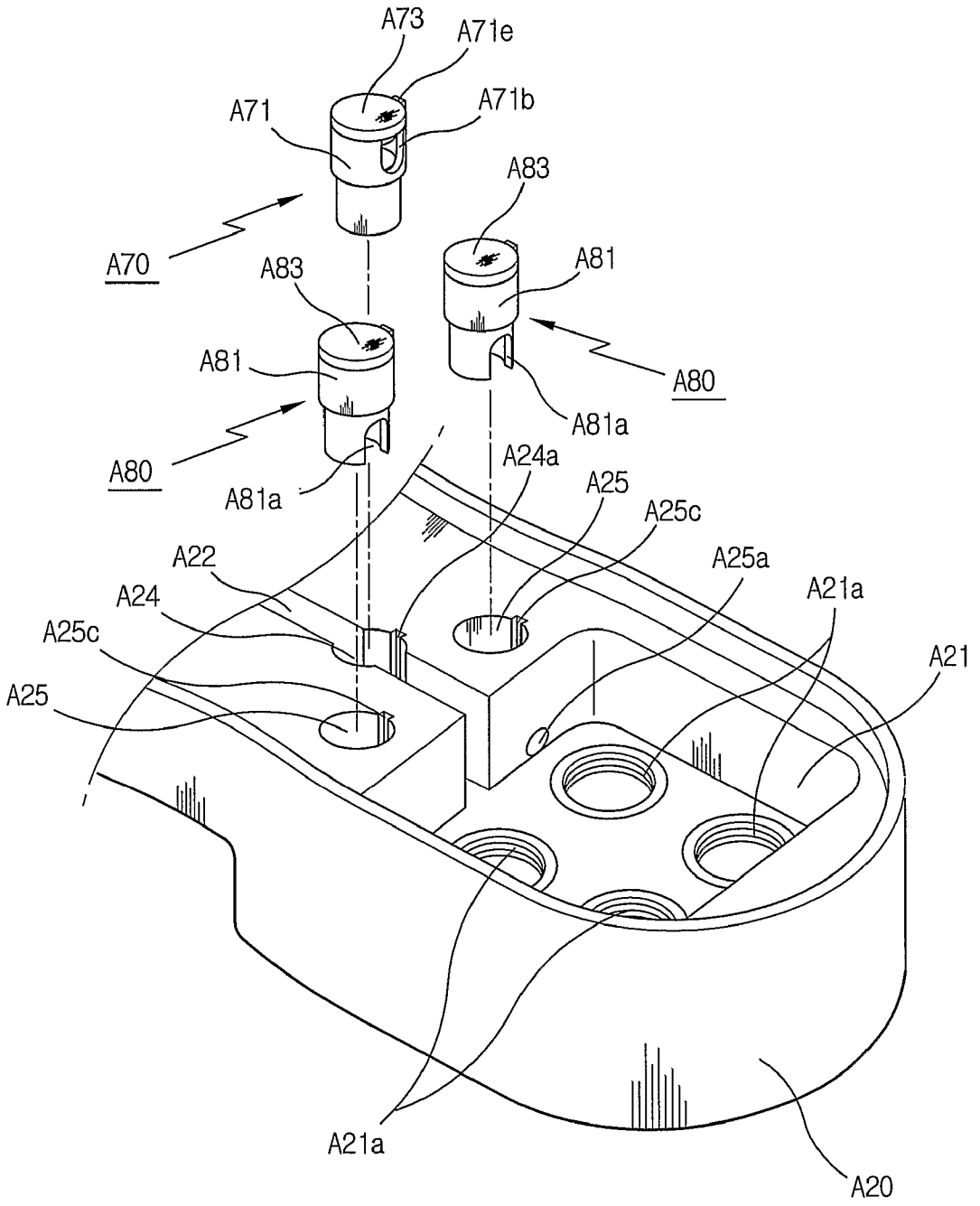

A73
A71e
A71
A71b
A83
A70
A83
A81
A81
A80
A80
A81a
A81a
A24a
A25
A25c
A22
A25a
A24
A21a
A25c
A21
A25
A21a
A20

Fig.51

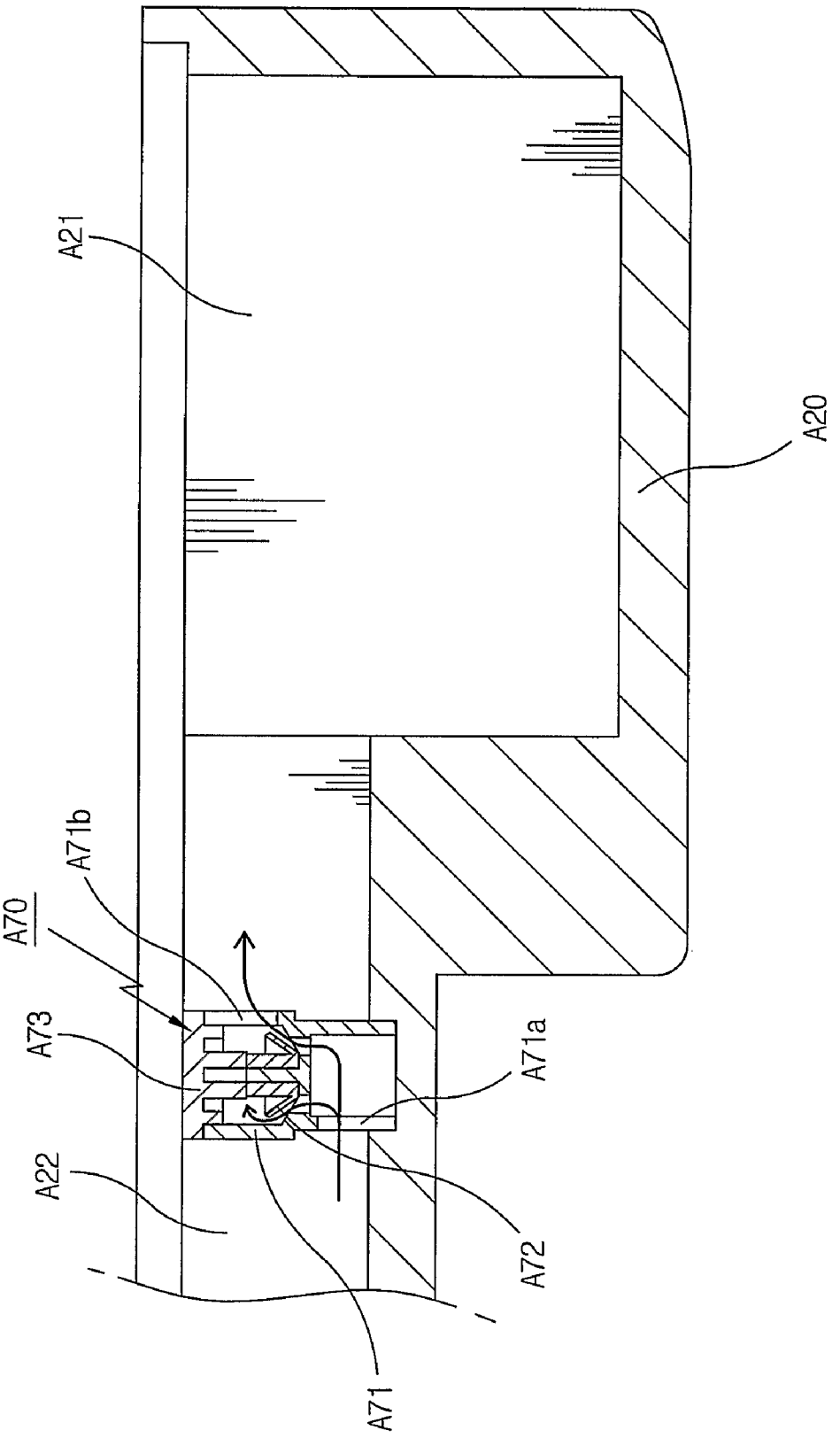


Fig.52

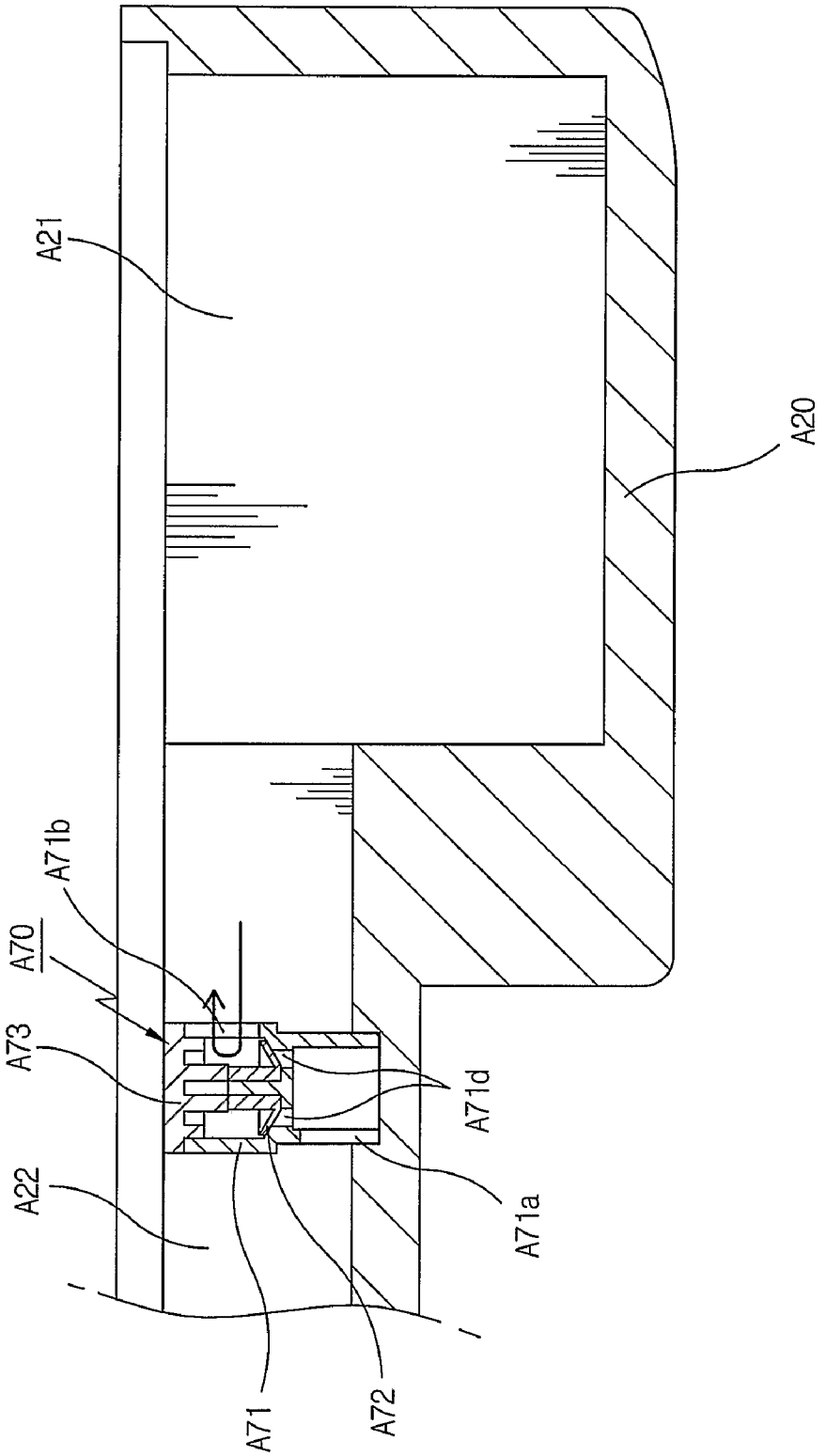


Fig.53

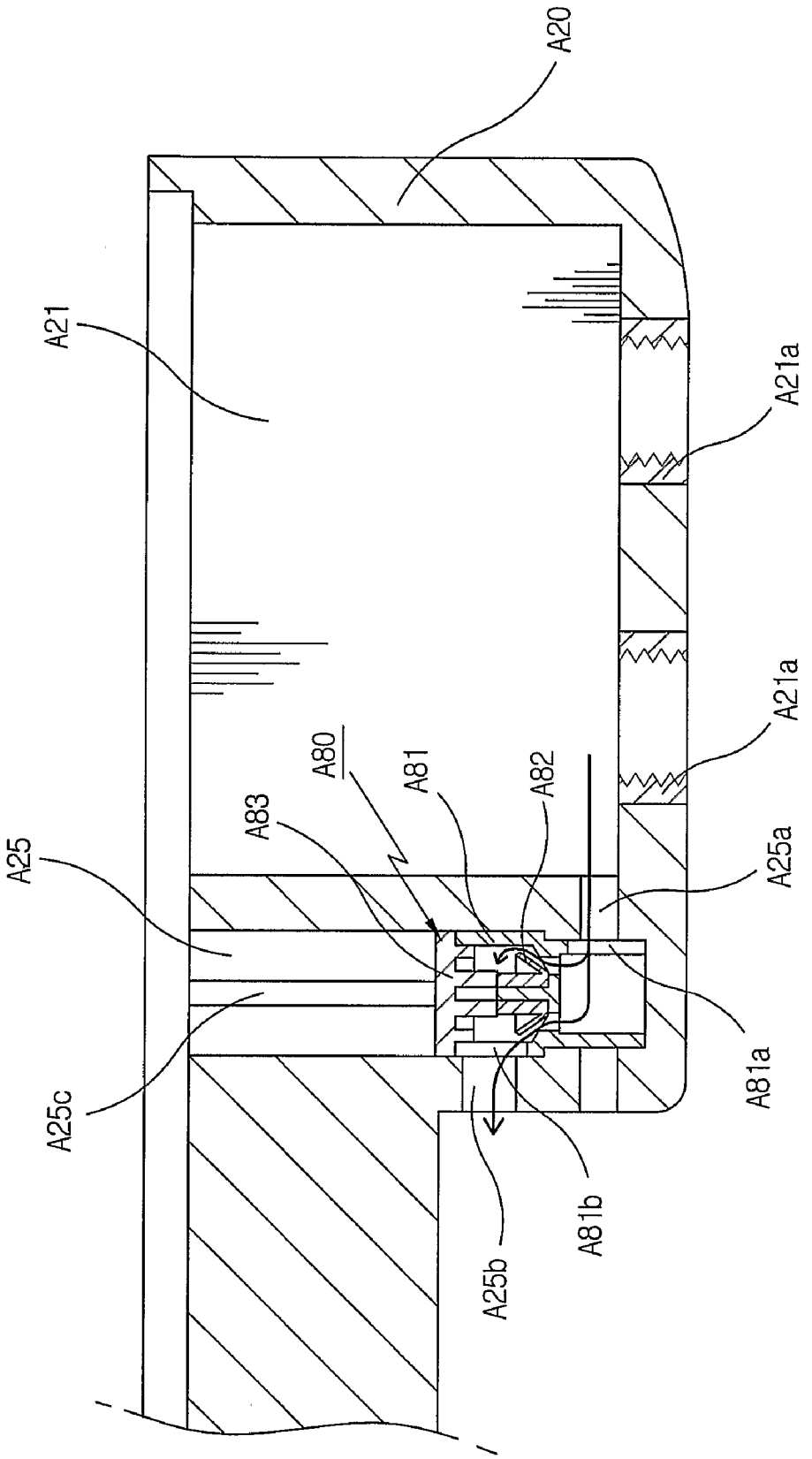


Fig.54

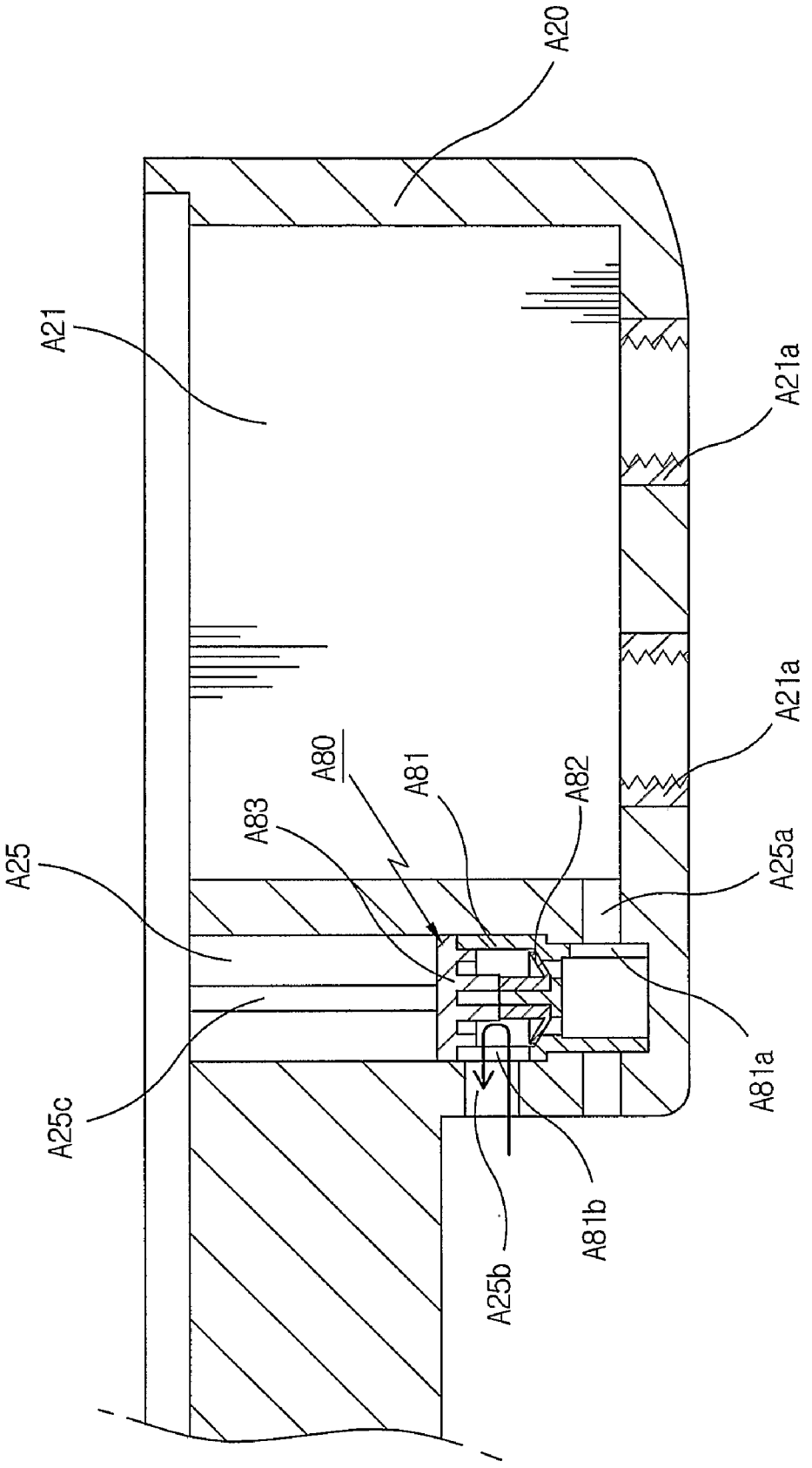


Fig.55

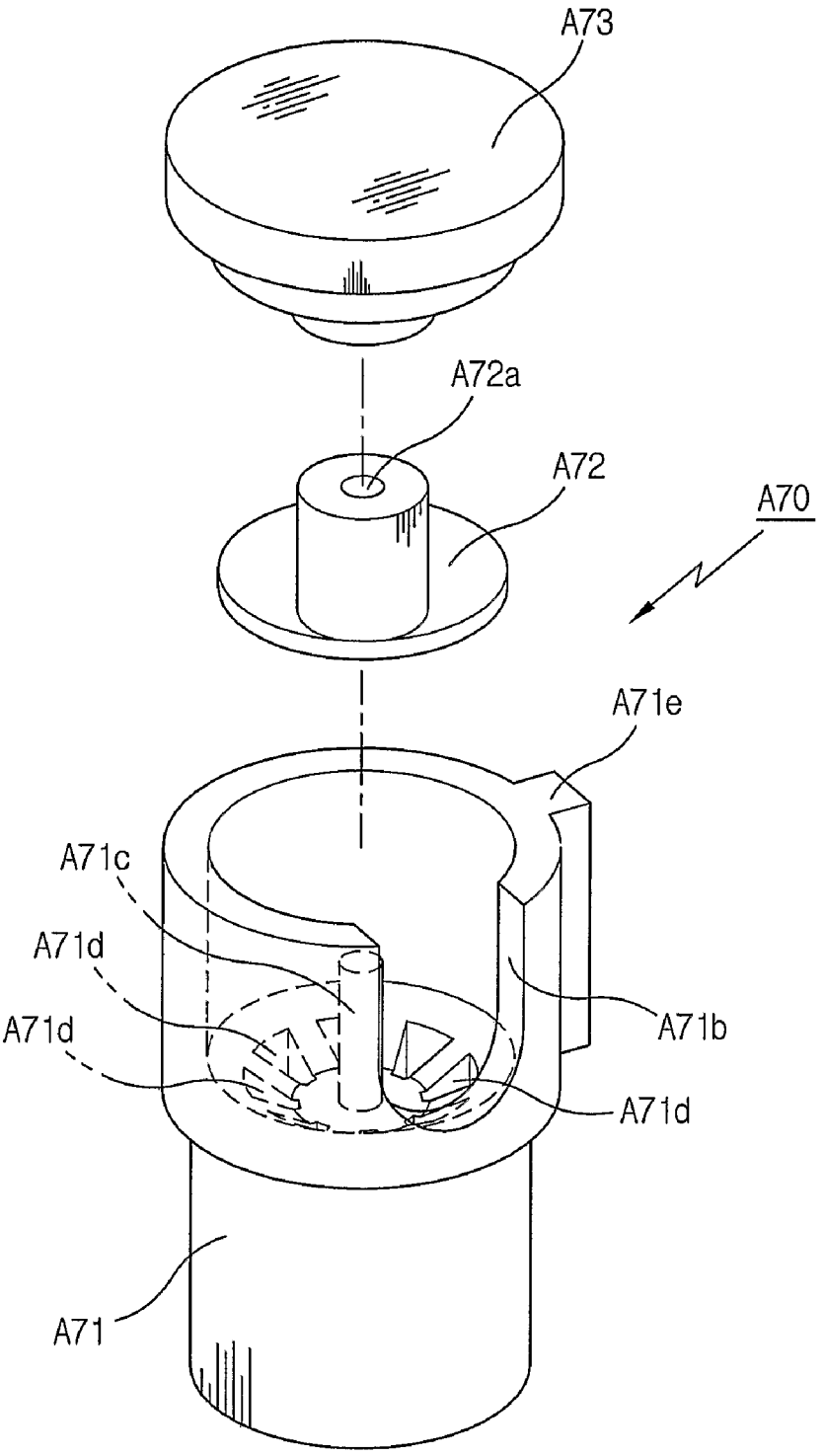


Fig.56

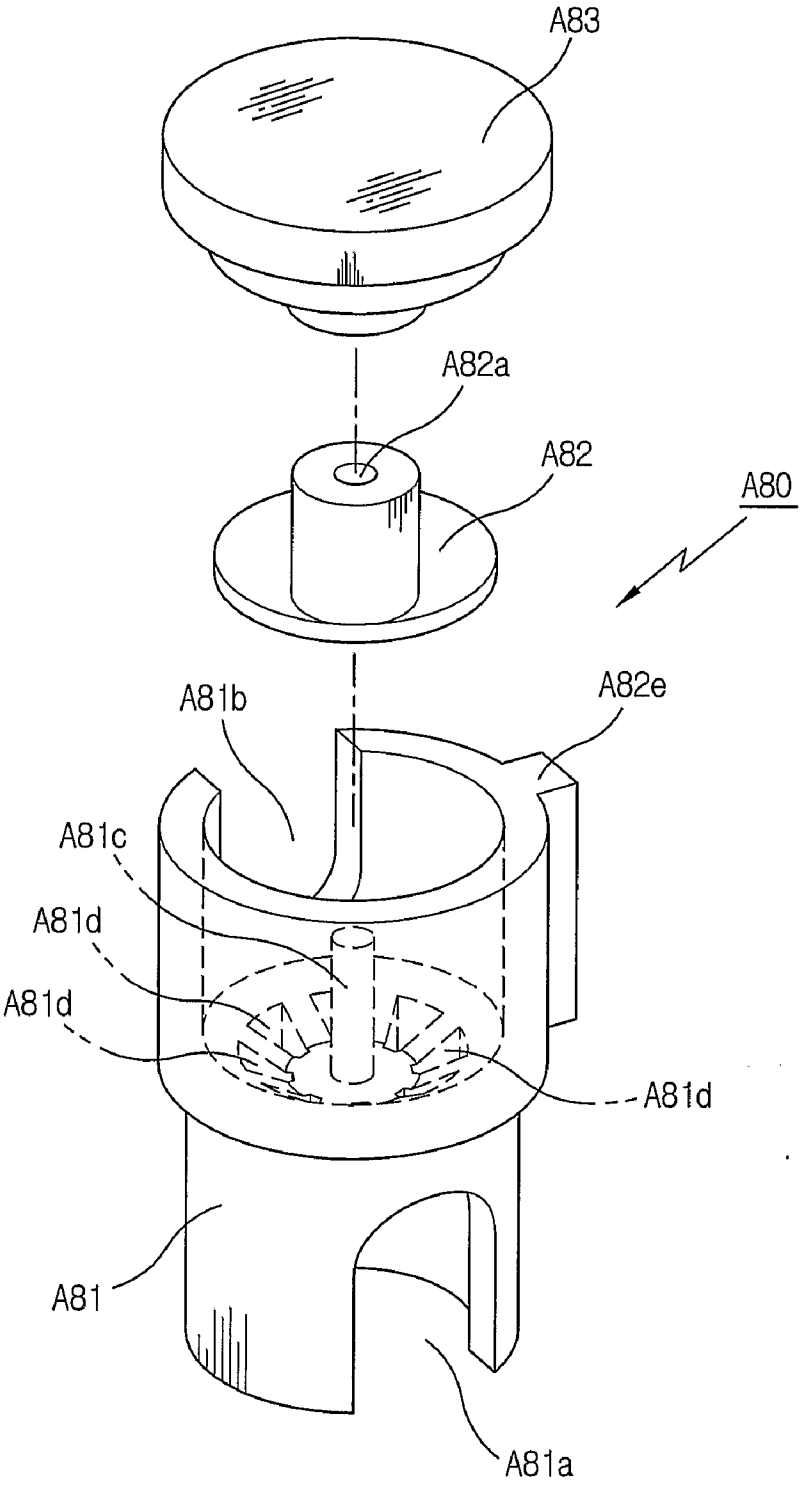


Fig.57

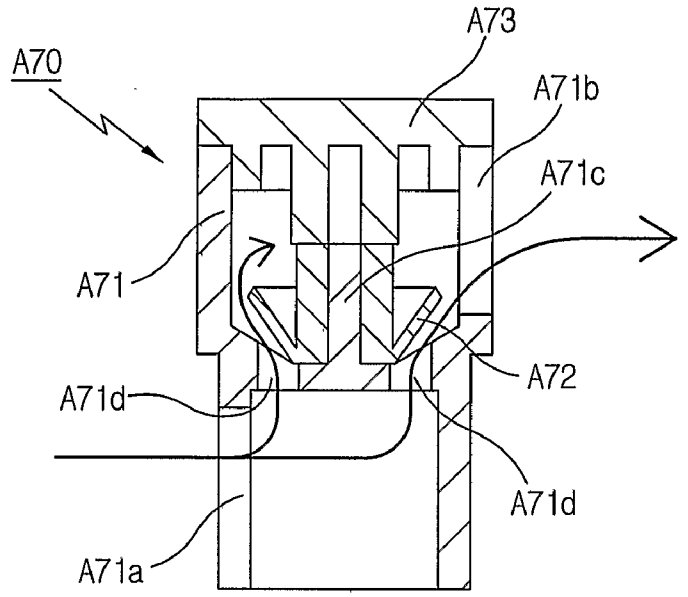

A70
A73
A71b
A71c
A71
A72
A71d
A71d
A71a

Fig.58

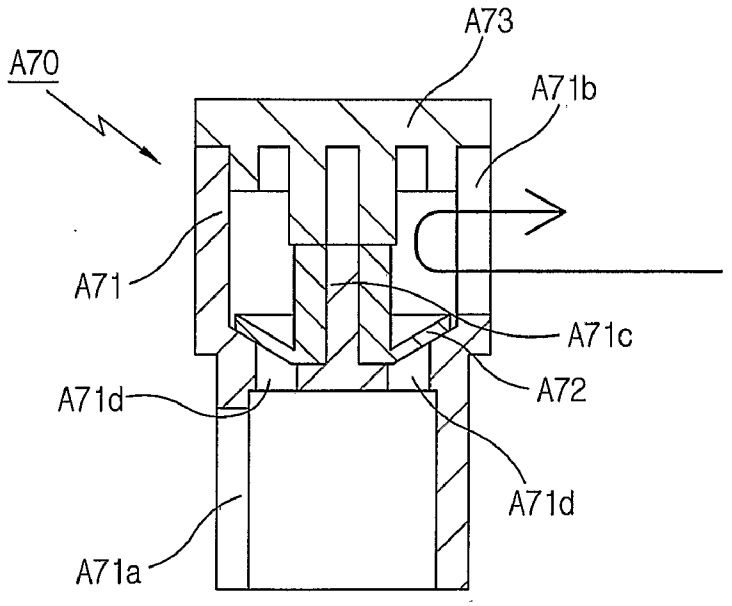

A70
A73
A71b
A71
A71c
A72
A71d
A71d
A71a

Fig.59

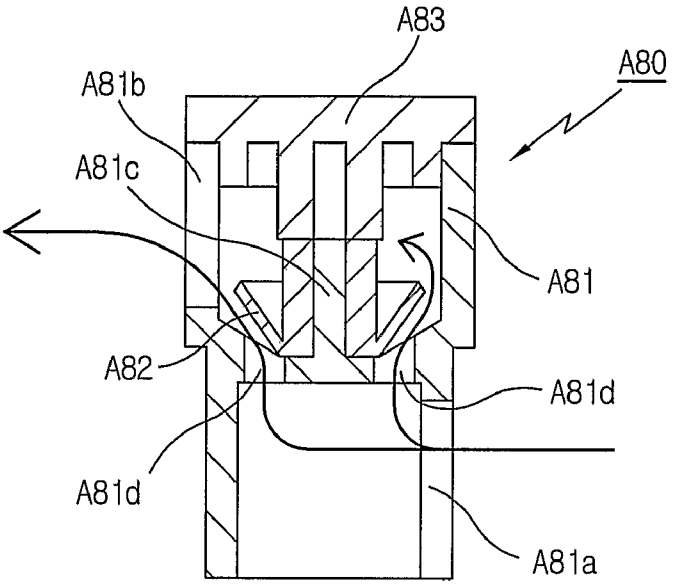
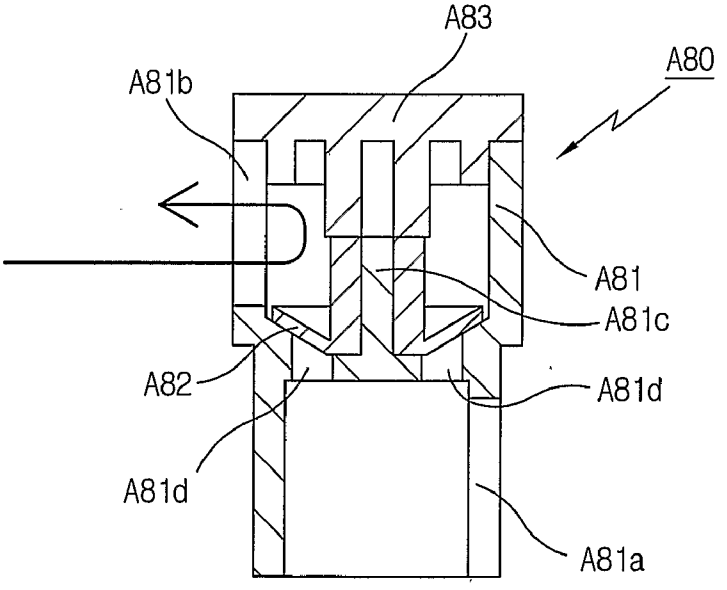

A83
A80
A81b
A81c
A81
A82
A81d
A81d
A81a

Fig.60


A83
A80
A81b
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A81c
A82
A81d
A81d
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SHOES CAPABLE OF BUFFERING SHOCK BY AIR CIRCULATION

TECHNICAL FIELD

[0001] The present invention relates to a footwear to put feet in, and more specifically to an air-circulation type shock buffering footwear, which can absorb and alleviate the shock applied on the feet of a wearer during a walk or run, through the interior of which air ventilation is smoothly performed during a walk or jogging and which a wearer can wear for a long time in a comfortable condition.

BACKGROUND ART

[0002] Generally, the footwear is used to put feet in for walking, is indispensable in daily life and is classified into several tens of kinds, wherein the footwear comprises, according to the use and function, sporting shoes, ordinary shoes, slippers, basketball shoes, football shoes, golf shoes, military shoes, and mountain-climbing boots etc.

[0003] Recently, shoes which became more comfortable and could help the health by the addition of various functions are being developed.

[0004] On the other hand, the modern persons actually live with various physical problems such as corpulence due to insufficient exercise and over-nourishment.

[0005] These days, many persons are seen to take exercise like jogging in parks and the like in the morning for the improvement in health, wherein the joggers wear relatively light footwear and training suit.

[0006] However, conventional shoes had the problem in that buffering function to prevent undue shock from being applied to the leg joints lacked during walking or running, thus doing harm to cartilages of joints and spine. The conventional shoes also had the problem that its cushioning action was construction-wise poor to cause early fatigue of feet and was not suited for increasing quantity of exercise, giving no much help to health improvement. Specially, the shock originating from the body weight of a wear was directly transferred to the feet when walking or running so as to increase the feeling of tiredness as time lapsed.

[0007] Further, the inward ventilation did not occur due to the original design in the conventional shoes, resulting in the problem of fast stagnation of sweat. Furthermore, drying the sweat gathered on feet could not be conducted to make it impossible to avoid the bacteria proliferation including mold, with the result that the problem of smelling on feet or generation of water-eczema arose.

SUMMARY OF INVENTION

[0008] The present invention was created to resolve the problem with the conventional art as described above. The object of the invention is to provide an air-circulation type shock buffering footwear, wherein the shock applied on the feet of a wear during walking or running is absorbed so as to decrease the feet tiredness and simultaneously to double exercise quantity and additionally the ventilation into the interior of footwear is smoothly conducted during walking or running so as to remove the foot smell and simultaneously to prevent the generation of athlete's foot and thus to allow the wear to wear the footwear in pleasant condition for a long time.

[0009] To achieve the above-described object, the present invention provides according to an aspect that the first and second air rooms are formed in the front and rear positions under the middle sole layer, the first and second air rooms communicating with each other through passages, the inner shoe layer is perforated with a plurality of sucking holes communicating with the first air room, the first and second air rooms are provided with the first and second buffering member for alleviating shock and for circulating air, the first check valve is installed for opening and closing the passages in the front of the second air room, and the second check valve for discharging air to the outside is installed in the rear of the second air room.

BRIEF DESCRIPTION OF DRAWINGS

[0010] FIGS. **1** to **21** relate to the first embodiment of the invention, wherein

[0011] FIG. **1** shows the exploded perspective view of the invention,

[0012] FIG. **2** shows the cross section of the invention,

[0013] FIG. **3** shows the perspective view illustrating the first buffering member,

[0014] FIG. **4** shows a cross section of FIG. **3**,

[0015] FIGS. **5** and **6** show the cross sections illustrating FIG. **3** at the different operating states,

[0016] FIG. **7** shows the exploded perspective view illustrating the second buffering member,

[0017] FIG. **8** shows a cross section of FIG. **7** after assembly,

[0018] FIGS. **9** and **10** show the cross sections illustrating FIG. **7** at the different operating states,

[0019] FIG. **11** shows the plan view of a top plate of the second buffering member,

[0020] FIG. **12** shows the plan view of a top plate of the second buffering member according to an embodiment varied from FIG. **11**,

[0021] FIGS. **13**, **14** and **15** show the cross sections illustrating the operating states of the invention,

[0022] FIG. **16** shows the exploded perspective view illustrating a variant of the first embodiment,

[0023] FIG. **17** shows the cross section illustrating a different first buffering member,

[0024] FIG. **18** shows the cross section of FIG. **16**,

[0025] FIGS. **19**, **20** and **21** show the cross sections illustrating the operating states of FIG. **16**,

[0026] FIGS. **22** to **27** relate to the second embodiment of the invention, wherein

[0027] FIG. **22** shows the exploded perspective view of the invention,

[0028] FIG. **23** shows the cross section of the invention,

[0029] FIG. **24** shows the cross section illustrating the second buffering member,

[0030] FIG. **25** shows the exploded perspective view illustrating a variant of the second embodiment,

[0031] FIG. **26** shows the cross section of FIG. **25**,

[0032] FIG. **27** shows the cross section illustrating a different first buffering member,

[0033] FIGS. **28** to **30** relate to the third embodiment of the invention, wherein

[0034] FIG. **28** shows the exploded perspective view of the invention,

[0035] FIG. **29** shows the cross section of the invention,

[0036] FIG. **30** shows the cross section illustrating the buffering member,

[0037] FIGS. **31** to **60** relate to the fourth embodiment of the invention, wherein

[0038] FIG. **31** shows the exploded perspective view of the invention,

[0039] FIG. **32** shows the cross section of the invention,

[0040] FIG. **33** shows the exploded perspective view of the essential part of the invention,

[0041] FIG. **34** shows the partly-separated cross section of the essential part of the invention,

[0042] FIGS. **35**, **36**, **37** and **38** show the cross sections illustrating various embodiments of the supporting member,

[0043] FIGS. **39** and **40** show the cross sections illustrating the different operating states of the buffering member,

[0044] FIGS. **41** and **42** show the cross sections illustrating the different operating states of the invention,

[0045] FIG. **43** shows the exploded perspective view illustrating a variant embodiment,

[0046] FIGS. **45**, **46** and **47** show the cross sections illustrating the operating states of FIG. **44**,

[0047] FIGS. **48** and **49** show the cross section illustrating a variant embodiment,

[0048] FIG. **50** shows the exploded perspective view illustrating a variant embodiment,

[0049] FIGS. **51** and **52** show the cross sections illustrating the operating states of the first check valve according to FIG. **50**,

[0050] FIGS. **53** and **54** show the cross sections illustrating the operating states of a second check valve according to FIG. **50**,

[0051] FIGS. **55** and **56** show the exploded perspective views of the first check valve and a second check valve,

[0052] FIGS. **57** and **58** show the enlarged cross sections illustrating the operating states of the first check valve, and

[0053] FIGS. **59** and **60** show the enlarged cross sections illustrating the operating states of a second check valve.

DISCLOSURE OF INVENTION

[0054] The technical construction of the invention according to preferred embodiments of the invention is described in detail below by referring to the accompanying drawings.

[0055] An air-circulation type shock buffering footwear according to the first embodiment of the invention, which is provided with an inner sole layer **10**, a middle sole layer **20** and a bottom sole piece **30**, is characterized, as shown in FIGS. **1** to **21**, in that the footwear S**1** includes further the first and second air rooms **22** and **23** formed respectively in the front and rear of and on the underside of the middle sole layer **20**, said first and second air rooms communicating with each other through passages **21**; a plurality of sucking holes **11** formed in the inner sole layer **10** to communicate with through-holes **22***a* of the first air room **22**; the first and second buffering members **40** and **50** respectively incorporated in the first and second air rooms **22** and **23** for both alleviating shock and circulating the air; the first check valve **60** disposed in the front of the second air room **23** to open or close the passages **21**; and the second check valve **70** disposed in the rear of the second check valve **23** to communicate with the outside so as to discharge the air.

[0056] The shoe S**1**, like most of other shoes, comprises an inner sole layer **10**, a middle sole layer **20** and a bottom sole piece **30**, wherein the shoe S**1** may be in varied size depending on the age, sex and foot size of a user. Although the constructional characteristics of the shoe S**1** according to the first embodiment of the invention can be applied to all sorts of footwear, it is most preferably applicable to the sporting shoe.

[0057] The sucking holes **11** are perforated in the front of the inner sole layer, wherein these holes communicate with through-holes **22***a* of the first air room **22**. Fresh air is introduced into a number of sucking holes **11** formed on the inner sole layer **10** when the wearer walks.

[0058] The above-described passages **21** are formed midway on the underside of the middle sole layer **20**, wherein the both ends of the passages **21** communicate with the first and second air rooms **22** and **23** respectively. The passages **21** are formed on the both sides of the middle sole layer **20**.

[0059] The first air room **22** is formed in the front underside of the middle sole layer **20**, wherein plural through-holes **22***a* are formed on the top of the first air room **22** to communicate with the sucking holes **11** of the inner sole layer **10** and the first air room **22** is provided with the first buffering member **40**.

[0060] The second air room **23** is formed in the rear underside of the middle sole layer **20** to communicate with the first air room **22** through the passages **21**, wherein the first check valve **60** to open or close the passages **21** when a wearer walks is disposed in the front of the second air room **23**, while the second check valve **70** is disposed in the rear of the second air room **23** in order to discharge the air outside. Here, the second air room **23** is provided with the second buffering member **50**.

[0061] The first buffering member **40** is incorporated in the first air room **22** to alleviate possible shock during walking and simultaneously to circulate the air, wherein the first buffering member **40** according to this embodiment of the invention, as shown in FIGS. **1** to **15**, which communicates with the through-holes **22***a* of the first air room **22**, includes downward several flexible thick-walled buffering tubes **41** formed with plural cutout parts **41***a*. The buffering tubes **41** are formed integrally with the middle sole layer **20** and the bottoms of the buffering tubes **41** are adhered to the top of a bottom sole piece **30**.

[0062] Accordingly, when the front part of a wearer's foot sole presses the middle sole layer **20** when the man walks,

as shown in FIGS. **5** and **14**, the buffering tubes **41** are caused to compress to absorb and alleviate shock and further the lower portions of the respective buffering tubes **41** are spreaded or collapsed outward by means of many, or four in Figures, cutout parts **41***a* and their bottom sides contact tightly the top surface of the bottom sole piece **30** so as to block the bottom of the through-holes **22***a*. At this instant, although a part of the air in the first air room is discharged, due to the pressure, to the passages **21**, the outside air cannot be introduced due to the closure of through-holes **22***a*.

[**0063**] The first buffering member **40** according to a variant embodiment, as shown in FIGS. **16** to **21**, is characterized in that this member comprises plural corrugated tubes **44** and guiding tubes **45** formed respectively to correspond to a top and bottom plate **42** and **43** and combined with each other; sucking tubes **46** projecting into the corrugated tubes **44**; projections **47** projecting inside the guiding tubes **45** to open and close the sucking tubes **46**; passages **48** formed on the top of the bottom plate **43** to communicate with the guiding tubes **45**; and springs **49** housed inside the corrugated tubes **44** and further the first air room **22** is formed with a passage **22***b* to communicate with the sucking tubes **45**.

[**0064**] The first buffering member **40** according to this variant embodiment will be explained more fully in the next section of the second buffering member **50**, because its construction and operation are identical to the second one.

[**0065**] The second buffering member **50**, which is housed in the second air room **23** to both alleviate shock and circulate air, is characterized in that this member comprises plural corrugated tubes **53** and guiding tubes **54** formed respectively to correspond to a top and bottom plate **51** and **52** and combined with each other; sucking tubes **55** projecting into the corrugated tubes **53**; projections **56** projecting inside the guiding tubes **54** to open and close the sucking tubes **55**; passages **57** formed on the top of the bottom plate **52** to communicate with the guiding tubes **54**; and springs **58** housed inside the corrugated tubes **53**, and additionally the second air room **23** is formed with a passage **23***a* to communicate with the sucking tubes **55**.

[**0066**] The top and bottom plates **51** and **52** are made of a pliable flexible material wherein the top plate **51** is adhered to the second air room **23** and the bottom plate **52** is adhered to the bottom sole piece **30**. The top plate **51** is so constructed as to have a central opening as seen in FIG. **11** in order to render pliability to corrugated tubes **53** and to reduce its weight. The plate **51** may be constructed to have a recess in the form of + as seen in FIG. **12**, if required. On the other hand, the bottom plate **52** is formed in conformity with the top plate **51**.

[**0067**] The corrugated tubes **53** are formed in plurality integrally with and under the top plate **51**, so that these corrugated tubes **53** may be compressed and expanded to absorb and damp any shock during walking.

[**0068**] The guiding tubes **54**, which are formed in plurality integrally with and on the bottom plate **52**, act to guide the compression and expansion motions of the corrugated plates **53**.

[**0069**] The sucking tubes **55**, which project inside and integrally with the corrugated tubes **53**, are each formed, at the center thereof, with a sucking hole **55***a* to communicate with a passage **23***a* of the second air room **23**. The bottoms of sucking tubes **55** are to be in a round form.

[**0070**] The projections **56** projecting integrally with and inside the guiding tubes **54** act to open or close the sucking tubes **55** during walking and act as stoppers to separate the spacing of the top and bottom plates **51** and **52**. The top of a projection **56** is formed concavely.

[**0071**] The passages **57** formed on the top of the bottom plate **52** to communicate with the guiding tubes **54** act to discharge the air at the compression cycle of the corrugated tubes **53**.

[**0072**] The above-described springs **58** housed in corrugated tubes **53** act to give elasticity to them.

[**0073**] On the other hand, the passage **23***a* of the second air room **23** is formed in the form of '⊃' so as to communicate with the passages **55***a* of the sucking tubes **55**, wherein the passage **23***a* performs the role of sucking air at the expansion cycle of the corrugated tubes **53**.

[**0074**] Accordingly, when the rear part of a wearer's foot sole is pressed on the middle sole layer **20** during a walk, as seen FIGS. **9**, **13** and **19**, the corrugated tubes **53** are contracted by the pressure to absorb and damp the shock, and the sucking holes **55***a* are blocked because of the tight contact of the projections **56** with the sucking tubes **55**, so that the compressed air in the second air room **23** is discharged to the outside through the second check valve **70**. At this time, although the air in the second air room **23** is discharged to the outside through the second check valve **70**, fresh air is not introduced into this second room because the pressure in this room causes the first check valve **60** to close.

[**0075**] The first check valve **60** disposed in the front of the second air room **23** acts to close or open the passages **21** during a wearer's walking, wherein this check valve **60** closes the passages **21** at the time of compression of the second air room **23** and opens the passages **21** at the time of expansion of the second air room **23**.

[**0076**] The second check valve **70** is disposed in the rear of the second air room **23** in a manner of communicating with the outside to discharge the inside air, wherein this check valve **70** is opened at the time of the second air room **23** being compressed to discharge the air outward and on the other hand, this check valve **70** is closed to prevent the air discharge during the period when the second air room **23** is in expansion cycle.

[**0077**] The overall operation of the air-circulation type shock absorbing footwear according to the first embodiment of the invention, constructed as above, is described in detail below.

[**0078**] In the normal time when the shoe S**1** is not put on by a person, the first and second air rooms **22** and **23** stay in expanded state due to the inherent elasticity of the first and second shock buffering members **40** and **50**.

[**0079**] When a person walks or runs with the shoes S**1** on, the first and second air rooms **22** and **23** including the first and second buffering members **40** and **50** are elastically compressed and expanded to perform the shock buffering function as well as the air circulation function.

[**0080**] First, when the rear part of the wearer's foot sole is pressed on the second air room **23** during walking, as seen

in FIGS. **13** and **19**, the second air room **23** is compressed due to the downward pressing, with the result that the corrugated tubes **53** and springs **58** of the second buffering member **50** are compressed to absorb the shock and concurrently the pressurized air in the second air room **23** is discharged to the outside through the second check valve **70**, as indicated by the arrow mark, while the passages **21** are closed because the first check valves **60** are firmly touched to the passages **21** due to the pressure of pressurized air in the second room **23**. At this moment, the air in the corrugated tubes **53**, which air is pressurized mostly by the decreased inside volume of these tubes **53**, is discharged to the second air room **23** through passages **57**, while the sucking holes **55***a* are shut at the limit because the projections **56** are touched with the sucking tubes **56**.

[**0081**] Next, when the front part of the wearer's foot sole is pressed on the first air room **22** during walking, as seen in FIGS. **14** and **20**, the first air room **22** is subjected to the compression, with the result that the first buffering member **40** is compressed to absorb and damp the shock and concurrently a part of the air pressurized in the first air room **22** is discharged to the passages **21** to open partially the first check valve **60**. At the same time, the buffering tubes **41** of the first buffering member **40** are contracted so as to collapse the bottom parts of buffering tubes **41** to thereby close through-holes **22***a*, whereby the sucking holes **11** on the inner sole layer **10** are closed with respect to the outside air. That is, the external air is not introduced into the shoe, because the sucking holes **11** together with through-holes **22***a* are shut.

[**0082**] On the other hand, when the shoe S**1** is completely isolated from the ground during walking, as seen in FIGS. **15** and **21**, the first and second air rooms **22** and **23** are returned to the original expanded state due to the restoring force of the first and second buffering members **40** and **50**, with the result that the sucking force due to lean air is generated in the second air room **23** because of the expansion of corrugated tubes **53** and springs **58** in the second buffering member **50**. At the same time, because the first check valves **60** are automatically opened by the sucking force generated in the second air room **23**, the second air room **23** is communicated with the first air room **22** via passages **21** and the second check valve **70** maintains its closed state. At this moment, the sucking force is automatically generated in the corrugated tubes **53** which were expanded by the restoring force, while sucking holes **55***a* are opened due to the separation of the projections **56** from the sucking tubes **55**.

[**0083**] Further, sucking force is generated as the first air room **22** in conjunction with the first buffering member **40** returns to the original expanded state, simultaneously the through-holes **22***a* being opened, so that the fresh air is introduced into the first air room **22** through the sucking holes **11** on the inner sole layer **10**. Such fresh air having entered the first air room **22** is naturally introduced to the second air room **23** through the passages **21**, whereby the fresh air can circulate continuously through the inside of the shoe S**1** when the shoe wearer walks.

[**0084**] An air-circulation type shock buffering footwear according to the second embodiment of the invention, which footwear is provided with an inner sole layer **100**, a middle sole layer **200** and a bottom sole piece **300**, is characterized, as shown in FIGS. **22** to **27**, in that the footwear S**2** includes further the first and second air rooms **320** and **330** formed respectively in the front and rear of and above the bottom sole piece **300**, the first and second air rooms communicating with each other through passages **310**; a plurality of sucking holes **110** and **210** formed on the inner and middle sole layers **100** and **200** to communicate with the first air room **320**; the first and second buffering members **400** and **500** respectively incorporated in the first and second air rooms **320** and **330** for both alleviating shock and circulating air; the first check valve **600** disposed in the front of the second air room **330** to open or close the passages **310**; and the second check valve **700** disposed in the rear of the second air room **330** so as to communicate with the outside to discharge the air.

[**0085**] Here, the shoe S**2**, like most of other shoes, comprises an inner sole layer **100**, a middle sole layer **200** and a bottom sole piece **300**, wherein the shoe S**2** may be in varied size depending on the age, sex and foot size of a user. Although the constructional characteristics of the shoe S**2** according to the second embodiment of the invention can be applied to all sorts of footwear, it is most preferably applicable to the ordinary low shoes.

[**0086**] The sucking holes **110** and **210** are perforated in the front of the inner and middle sole layers **100** and **200** and connected to each other, wherein these holes communicate with the first air room **320** formed on the bottom sole layer **300**. Fresh air is introduced through a number of sucking holes **110** formed on the inner sole layer **100** when the wearer walks.

[**0087**] The above-described passages **310** are formed in the top middle locations of the bottom sole piece **300**, wherein the both ends of the passages **310** communicate with the first and second air rooms **320** and **330** respectively. The passages **310** are formed on the both sides of the bottom sole piece **300**.

[**0088**] The first air room **320** is formed in the front top of the bottom sole piece **300**, and encloses the first buffering member **400**.

[**0089**] The second air room **330** is formed in the rear top of the bottom sole piece **300** to communicate with the first air room **320** through the passages **310**, wherein the first check valve **600** to open or close the passages **310** when a wearer walks is disposed in the front of the second air room **330**, while the second check valve **700** is disposed in the rear of the second air room **330** in order to discharge the air outside. Here, the second air room **330** is provided with the second buffering member **500**.

[**0090**] The first buffering member **400** is incorporated in the first air room **320** to alleviate possible shock during walking and simultaneously to circulate the air, wherein the first buffering member **400** according to this embodiment of the invention, as shown in FIGS. **22** and **23**, which communicates with the sucking holes **210** of the middle sole layer **200**, includes downward several flexible thick-walled buffering tubes **410** formed, at the lower ends thereof, with plural cutout parts **411**. The buffering tubes **410** are formed integrally with the middle sole layer **200** and the bottoms of the buffering tubes **410** are adhered to the bottom of the first air room **320**.

[**0091**] Accordingly, when the front part of a wearer's foot sole presses the middle sole layer **200** when the man walks,

the buffering tubes **410** are caused to be compressed to absorb and alleviate shock and further the lower portions of the respective buffering tubes **410** are spreaded or collapsed outward by means of many cutout parts **411** and so their bottom sides contact tightly the bottom of the first air room **320** so as to block the sucking holes **210**. At this instant, although a part of the air in the first air room **320** is discharged, due to somewhat higher air pressure, to the passages **310**, the outside air cannot be introduced due to the closure of sucking holes **210**.

[**0092**] The first buffering member **400** according to a variant embodiment, as shown in FIGS. **26** and **27**, is characterized in that this member **400** comprises plural corrugated tubes **440** and guiding tubes **450** formed respectively to correspond to a top and bottom plate **420** and **430** and combined mutually; sucking tubes **460** projecting inside the corrugated tubes **440**; projections **470** projecting inside the guiding tubes **450** to open and close the sucking tubes **460**; passages **480** formed on the top of the bottom plate **430** to communicate with the guiding tubes **450**; and springs **490** housed inside the corrugated tubes **440**, and additionally a passage **220** is formed on the underside of the middle sole layer **200** to communicate with the sucking tubes **460**.

[**0093**] The first buffering member **400** according to this variant embodiment will not be explained again, because its construction and operation are identical to the second buffering member **50** of the first embodiment.

[**0094**] The second buffering member **500**, which is housed in the second air room **330** to both alleviate shock and circulate air, is characterized in that this member **500** comprises plural corrugated tubes **530** and guiding tubes **540** formed respectively to correspond to a top and bottom plate **510** and **520** and combined mutually; sucking tubes **550** projecting inside the corrugated tubes **530**; projections **560** projecting inside the guiding tubes **540** to open and close the sucking tubes **550**; passages **570** formed on the top surface of the bottom plate **520** to communicate with the guiding tubes **540**; and springs **580** housed inside the corrugated tubes **530**, and additionally a passage **230** is formed on the underside of the middle sole layer **200** to communicate with the sucking tubes **550**.

[**0095**] The description of the second buffering member **500** according to this variant embodiment is omitted, because its structure and operation is the same as that of the first embodiment.

[**0096**] The first check valve **600** disposed in the front of the second air room **330** acts to close or open the passages **210** during a wearer's walking, wherein this check valve **600** closes the passages **210** at the time of the second air room **330** being pressurized or compressed and opens the passages **210** at the time of the second air room **330** being depressurized or expanded.

[**0097**] The second check valve **700** is disposed in the rear of the second air room **330** in a manner of communicating with the outside to discharge the inside air, wherein this check valve **700** is opened at the time of the second air room **330** being compressed to discharge the air outward and on the other hand, this check valve **700** is closed to prevent the air discharge during the period of expansion cycle.

[**0098**] The overall operation of the air-circulation type shock absorbing footwear according to the second embodiment of the invention, constructed as above, is described below.

[**0099**] In the normal time when the shoe S**2** is not put on by a person, the first and second air rooms **320** and **330** stay in expanded state due to the inherent elasticity of the first and second shock buffering members **400** and **500**.

[**0100**] When a person walks or runs with the footwear S**2** on, the first and second air rooms **320** and **330** including the first and second buffering members **400** and **500** are elastically compressed and expanded to perform the shock buffering function as well as the air circulation function.

[**0101**] First, when the rear part of the wearer's foot sole is pressed on an inner sole layer **100** and a middle sole layer **200** during walking, the second air room **330** is compressed, with the result that the corrugated tubes **530** and springs **580** of the second buffering member **500** are compressed to absorb the shock and concurrently the pressurized air in the second air room **330** is discharged to the outside through the second check valve **700**, while the passages **310** are closed because the first check valves **600** are firmly thrust to the passages **310** by the pressurized air in the second room **330**. At this moment, the air in the corrugated tubes **530**, which air was pressurized mostly by the decreased inside volume of these tubes **530**, is discharged to the second air room **330** through passages **570**, while the sucking tubes **550** come to be shut at the limit because the projections **560** are brought into contact with the sucking tubes **550**.

[**0102**] Next, when the front part of the wearer's foot sole is pressed on an inner sole layer **100** and a middle sole layer **200** during walking, the first air room **320** is subjected to the compression, with the result that the first buffering member **400** is compressed to absorb and damp the shock and concurrently a part of the air pressurized in the first air room **320** is discharged to the passages **310** to open partially the first check valve **600**. At the same time, the buffering tubes **410** of the first buffering member **400** are contracted so as to collapse the bottom parts of buffering tubes **410** on the bottom piece to thereby block the latter, whereby the sucking holes **210** are closed together with the sucking holes **110** on the inner sole layer **100**. That is, the external air is not introduced into the shoe, because the sucking holes **110** and **210** are shut off.

[**0103**] On the other hand, as the subsequent step, when the shoe S**2** is completely isolated from the ground during walking, the first and second air rooms **320** and **330** are returned to the original expanded state due to the restoring force of the first and second buffering members **400** and **500**, with the result that a sucking force due to the lean air with respect to the outer atmosphere is generated in the second air room **330** because of the expansion or increased volume of corrugated tubes **530** in the second air room **330**. At the same time, because the first check valve **60** is automatically opened by the sucking force generated in the second air room **330**, the second air room **330** is communicated with the first air room **320** via passages **310** and the second check valve **700** maintains its closed state due to the still sub-atmospheric pressure in this room **330**. At this moment, the sucking force is present in the corrugated tubes **530** which were expanded by the restoring force, while sucking tubes **550** are unblocked due to their separation from the projections **560**.

[0104] Further, sucking force is also generated as the first air room **320** in conjunction with the first buffering member **400** returns to the original expanded state due to the opened state in the passages **310**, simultaneously the sucking holes **210** becoming unblocked or opened, so that the fresh air is introduced into the first air room **320** through the sucking holes **110** on the inner sole layer **100**. Such fresh air having entered the first air room **320** is naturally introduced to the second air room **330** through the passages **310**, whereby the fresh air can circulate steadily through the inside of the shoe S**2** when the shoe wearer walks.

[0105] An air-circulation type shock buffering footwear according to the third embodiment of the invention, which is provided with an inner sole layer **1000**, a middle sole layer **2000** and a bottom sole piece **3000**, is characterized, as shown in FIGS. **28** to **30**, in that the footwear S**3** includes further an air room **3100** formed on the rear top of the bottom sole piece **3000**; plural passages **3200** extending from the air room **3100** to front locations; plural sucking holes **1100** and **2100** formed in a front location of the inner and middle sole layers **1000** and **2000** in manner of communicating with the passages **3200**; a buffering member **4000** incorporated in the air room **3100** for both alleviating shock and circulating air; the first check valve **5000** disposed in the front of the air room **3100** to open or close the passages **3200**; and the second check valve **6000** disposed in the rear of the air room **3100** so as to communicate with the outside to discharge the air.

[0106] Here, the shoe S**3**, like most of other shoes, is provided with an inner sole layer **1000**, a middle sole layer **2000** and a bottom sole piece **3000**, wherein the shoe S**3** may be in varied size depending on the age, sex and foot size of a user. Although the constructional characteristics of the shoe S**3** according to the third embodiment of the invention can be applied to all sorts of footwear, it is most preferably applicable to the ordinary low shoes.

[0107] The sucking holes **1100** and **2100**, in the aligned manner, are perforated in a front location of the inner and middle sole layers **1000** and **2000** to be connected to each other, and communicated with the passages **3200** formed on the bottom sole layer **3000**. Fresh air is introduced through a number of sucking holes **1100** formed on the inner sole layer **1000** when the wearer walks.

[0108] The above-described air room **3100** are formed on the top rear location of the bottom sole piece **3000**, wherein the first check valve **5000** is installed in the front of the air room **3100** to open or close the passages **3200** during walking while the second check valve **6000** is installed in the rear of the air room **3100** to discharge the air to the outside. A buffering member **4000** is disposed in the air room **3100**.

[0109] The passages **3200** formed on the top of the bottom sole piece **3000** extend lengthily forward from sole center and communicate with the air room **3100**. The arrangement of the passages **3200** is shown in FIG. **28**.

[0110] The buffering member **4000**, which is disposed in the air room **3100** to both alleviate shock and take part in air circulation, is characterized in that this member **4000** comprises plural corrugated tubes **4300** and guiding tubes **4400** formed respectively to correspond to a top and bottom plate **4100** and **4200** and combined with each other; sucking tubes **4500** projecting inside the corrugated tubes **4300**; projections **4600** projecting inside the guiding tubes **4400** to open and close the sucking tubes **4500**; passages **4700** formed on the top of the bottom plate **4200** to communicate with the guiding tubes **4400**; and springs **4800** housed inside the corrugated tubes **4300**, and additionally a passage **2200** to communicate with the sucking tubes **4500** is formed on the underside of the middle sole layer **2000**.

[0111] The further description of this buffering member **4000** is omitted, because its structure and operation are the same as those of the second buffering member **50** in the first embodiment of the invention.

[0112] The first check valve **5000** disposed in the front of the air room **3100** acts to close or open the passages **3200** during a wearer's walking, wherein this check valve **5000** closes the passages **3200** at the time of the air room **3100** being compressed and opens the passages **3200** at the time of the air room **3100** being expanded.

[0113] The second check valve **6000** is disposed in the rear of the air room **3100** in a manner of communicating with the outside to discharge the inside air, wherein this check valve **6000** is opened at the time of the air room **3100** being compressed to discharge the air outward and on the other hand, this check valve **6000** is closed to prevent the air discharge during the period of expansion cycle.

[0114] The overall operation of the air-circulation type shock absorbing footwear according to the third embodiment of the invention, constructed as above, is described in detail below.

[0115] In the normal time when the shoe S**3** is not put on by a person, the air room **3100** maintains the expanded state by the elasticity of the buffering members **4000**.

[0116] When a person walks or runs with the shoes S**3** on, both the shock buffering action and air circulation action are performed mainly by the air room **3100** and buffering member **4000** based on the elasticity through repeated compressions and expansions.

[0117] First, when the rear part of the wearer's foot sole is pressed on the inner and middle sole layer **1000** and **2000** during walking, the air room **3100** is caused to compress to result in the compression of the corrugated tubes **4300** and springs **4800** of the buffering member **4000** so as to absorb the shock. At the same time, the pressurized air in the air room **3100** is discharged to the outside through the second check valve **6000**, while the passages **3200** come to be blocked because the first check valve **5000** is firmly pushed to the passages **3200** due to the pressure of pressurized air in the air room **3100**. At this moment, the air in the corrugated tubes **4300**, which air is pressurized mostly by the decreased inside volume of these tubes **4300**, is discharged to the air room **3100** through passages **4700**, while the sucking tubes **4500** are shut because the projections **4600** are touched with these sucking tubes **4500**.

[0118] Next, when the shoe S**3** is completely isolated from the ground during walking, the air room **3100** is returned to the original expanded state due to the restoring force of the buffering member **4000**, with the result that the sucking force is generated in the air room **3100** because of the expansion of corrugated tubes **4300** in the buffering member **4000**. At the same time, because the first check valves **5000** is automatically opened by the sucking force generated in

the air room **3100**, the air room **3100** is communicated with the passages **3200** and the second check valve **6000** maintains its closed state. At this moment, the sucking force is automatically generated in the corrugated tubes **4300** by the restoring force, while sucking tubes **4500** are opened due to their separation from the projections **4600**.

[**0119**] In addition, as indicated above, the passages **3200** are communicated with the air room **3100** through the opened first check valve **5000**, causing the external fresh air to flow in the passages **3200** through sucking holes **1100** and **2100**. The fresh air penetrated in the passages **3200** is naturally flowed into the air room **3100** due to the sucking force, whereby the fresh air can steadily enter and circulate through the inside of shoes S**3** in which the wearer's feet are positioned.

[**0120**] An air-circulation type shock buffering footwear according to the fourth embodiment of the invention is characterized, as shown in FIGS. **31** to **60**, in that the footwear S**4** provided with an inner sole layer A**10** and a bottom sole piece A**20** includes further plural sucking holes A**11** perforated in the front locations of the inner sole layer A**10** and a passage A**12** formed in the rear underside of the inner sole layer A**10**; an air room A**21** formed on the rear top of the bottom sole piece A**20**, said air room being provided with plural nuts A**21***a* vertically extending through the bottom piece, and passages A**22** extending toward the front starting from the air room A**21**; a buffering member A**30** disposed on the air room A**21**, said buffering member being provided with plural corrugated tubes A**31** and sucking tubes A**32**; a prop member A**40** disposed under the buffering member A**30**, said prop member being provided with plural guiding tubes A**41**, assembling holes A**42** and passages A**43**; plural springs A**50** inserted in the corrugated tubes A**31**, said springs having been introduced through the assembling holes A**42**; plural supporting members A**60** fitted in the assembling holes A**42**, each of said supporting members being provided with a screw A**61** to engage with the nut A**21***a*, a projection A**62** to open or close a sucking tube A**32** and a passage A**63**; and first check valves A**70** disposed in the air room A**21** to open or close the passages A**22** and a second check valve A**80** to discharge air to the outside.

[**0121**] Here, the shoe S**4**, like most of other shoes, is provided with an inner sole layer A**10** and a bottom sole piece A**20**, wherein this shoe S**4** may be in varied size depending on the age, sex and foot size of a user. Although the constructional characteristics of the shoe S**4** according to the fourth embodiment of the invention can be applied to all sorts of footwear, this kind of shoe is specially applicable to military shoes.

[**0122**] The sucking holes A**11** are perforated in a front location of the inner sole layer A**10** and are communicated with the passages A**22** formed on the bottom sole piece A**20**. At this time, fresh air is introduced in the sucking holes A**11** formed on the inner sole layer A**10** when a wearer is walks.

[**0123**] The passage A**12** is formed in the rear underside of the inner sole layer A**10** and is formed approximately in the form of '⊃' so as to communicate with the respective sucking tubes A**32**, wherein this passage A**12** acts to suck or collect the air when the corrugated tubes A**31** of the buffering member A**30** expand and contract.

[**0124**] The air room A**21** is formed on the rear top of the bottom sole piece A**20** which is provided with plural nuts A**21***a*, these nuts having been inserted through the thickness of the bottom piece and extending vertically. The first check valves A**70** are disposed in the air room A**21** to open or close the passages A**22** and the second check valve A**80** positioned in the rear or side of the air room A**21** serves to discharge air to the outside. The air room A**21** is provided with a buffering member A**30**, prop member A**40** and springs A**50**.

[**0125**] The passages A**22** extends lengthily toward the front, starting from approximate middle points on the top surface of the bottom sole piece A**20**, the middle points agreeing with the first check valves A**70** of the air room A**21**, so that the passages A**22** are communicated with the air room A**21**. The passages A**22** have the form as shown in FIG. **31**.

[**0126**] The buffering member A**30** is disposed on the air room A**21** to absorb shock and take a part in air circulation when a wearer walks or runs, wherein this buffering member comprises plural corrugated tubes A**31**; plural sucking tubes A**32** projecting inside the corrugated tubes A**31**, the sucking tubes A**32** communicating with the passage A**12**; and a top plate A**33** formed on and integrally with the several corrugated tubes A**31** and sucking tubes A**32**. The buffering member A**30** is made of a pliable flexible material.

[**0127**] The corrugated tubes A**31** formed, in a plurality, under and integrally with the top plate A**33** act to absorb and alleviate shock during a walk through expansions and contracts.

[**0128**] The sucking tubes A**32** formed integrally with and projecting inside the corrugated tubes A**31** have their interiors, i.e. sucking holes to communicate with the passage A**12** of the inner sole layer A**10**. The lower ends of sucking tubes A**32** are formed convexly.

[**0129**] The prop member A**40** disposed under the buffering member A**30** acts to support the corrugated tubes A**31**, wherein this prop member comprises plural guiding tubes A**41** so formed as to receive the corrugated tubes A**31**, several assembling holes A**42** formed in the guiding tubes A**41**, the assembling holes A**42** communicating with the corresponding nuts A**21***a*, a bottom plate A**44** formed integrally with and under the guiding tubes A**41** and adhered to the bottom sole layer A**20**, and several passages A**43** formed on the top surface of the bottom plate A**44** so as to communicate with the guiding tubes A**41** and to run outward beyond the guiding tubes A**41**. The prop member A**40** is made of a pliable and flexible material.

[**0130**] The guiding tubes A**41**, in a plurality, formed integrally with and on the top of the bottom plate A**44** act to guide the compression and expansion motion of the corrugated tubes A**31** during a walk.

[**0131**] The assembling holes A**42** perforated vertically inside the guiding tubes A**41** are formed to facilitate the replacement of the springs A**50** and are fitted with the supporting members A**60**.

[**0132**] The passages A**43** formed on the top surface of the bottom plate A**44** so as to communicate with the guiding tubes A**41** run outward beyond the guiding tubes A**41** to perform the discharge of the pressurized air from the corrugated tubes A**31** at the compression cycle.

[**0133**] The springs A**50** disposed in the corrugated tubes A**31** of the buffering member A**30** act to add the elasticity to the corrugated tubes A**31**.

[0134] The supporting members A60 are screw-assembled, in a detachable manner, to the nuts A21*a* of the air room A21 to support the springs A50 and to facilitate the replacement of springs if required. Each of these supporting members A60 comprises a screw part A61 to engage with a nut A21*a*, a projection A62 formed on the top of the screw A61 to open or close a sucking tube A32 and a passage A63 in the communicating relation with a passage A43 of the prop member A40.

[0135] The screws A61 are formed integrally with the projections A62 to complete the supporting members A60 or the screws A61 are attached to the projections A62, wherein the screws A61 are screw-connected to the nuts A21*a* in the air room A21 detachably. Accordingly, the replacement of the springs A50 can be easily performed by disconnecting the screws A61.

[0136] The projections A62 act to open or close the sucking tubes A32 during walking and act as stoppers to regulate the spacing between the top and bottom plates A33 and A34. The top of a projection A62 is formed concavely.

[0137] The passages A63 formed on the top of the supporting members A60 to communicate with the passages A43 act to discharge the air at the compression cycle of the corrugated tubes A31.

[0138] On the other hand, whereas FIGS. 35, 36, 37 and 38 show various embodiments of supporting member A60, the supporting member A60 is characterized, according to an embodiment, in that the screw A61 is formed, at its bottom, with a recess A61*a*, as shown in FIGS. 35 and 37, to help tighten and loosen the screw A61. A coin, driver etc. could be fitted in the recess A61*a*.

[0139] The supporting member A60 is characterized, according to another embodiment, in that the screw A61 is formed, at its bottom, with a slippage preventing irregularity A61*b*, as shown in FIGS. 36 and 38, to prevent slippage during a walk or jump. A tool like a coin, driver etc. could be fitted in a valley on the irregularity A61*b* in assembling or disassembling.

[0140] The supporting member A60 is characterized, according to still other embodiment, in that a screw A61 made separately is attached to the underside of a supporting member A60, as shown in FIGS. 35 and 36. In this case, the supporting member A60 is made of plastics like urethane, while the screw A61 is made of a metal like aluminium.

[0141] The supporting member A60 is characterized, according to still other embodiment, in that a supporting member A60 and a screw A61 are formed integrally, as shown in FIGS. 37 and 38. In this case, the supporting member A60 is made either of plastics like urethane or of a metal like aluminium.

[0142] Accordingly, when the rear part of a wearer's foot sole is pressed on the inner sole layer A10 during a walk, as seen FIGS. 39 and 41, the corrugated tubes A31 and springs A50 of the buffering member A30 are compressed by the pressure to absorb and damp the shock, and the projections A62 of supporting members A60 are tightly touched to the sucking tubes A32 of the buffering member A30, so that the sucking tubes A32 are closed, while the compressed air in the air room A21 is discharged to the outside through the second check valve A80. At this time, although the air in the air room A21 is discharged to the outside through the second check valve A80, fresh air is not yet introduced into this air room because the pressure in this room causes the first check valve A70 to be closed.

[0143] Further, as described above, springs A50 can be easily replaced when needed, e.g. a troubled spring can be exchanged by a new one, because the screws A61 of supporting members A60 are screw-connected detachably to the nuts A21*a* in the air room A21. Further, the intensity of springs A50 may be appropriately matched with the body weight of shoe-wearers. Particularly, the springs A50 at different locations of shoe's sole surface may be chosen to vary in the intensity in response to the average treading force distribution of a shoe user or shoe users.

[0144] The first check valves A70 disposed in the front of the air room A21 act to close or open the passages A22 during a wearer's walking, wherein this check valves close the passages A22 at the time of compression of the air room A21 and open these passages at the time of expansion of the air room A21.

[0145] The second check valve A80 is disposed in the rear or side of the air room A21 in a manner of communicating with the outside to discharge the inside air, wherein this check valve A80 is opened at the time of the air room A21 being compressed to discharge the air outward and on the other hand, this second check valve A80 is closed to prevent the air discharge during the period when the air room A21 is in expansion cycle. It is to be noted that the second check valve A80 may be disposed on one side of the air room A21, even though it is shown as positioned in the rear of the air room A21 in the drawings.

[0146] The overall operation of the air-circulation type shock absorbing footwear according to the fourth embodiment of the invention, constructed as above, is described in detail below.

[0147] In the normal time when the shoe S4 is not put on by a person, the air room A21 maintains the expanded state due to the inherent elasticity of the corrugated tubes A31 and spring A50.

[0148] When a person walks or runs with the footwear S4 on, the air room A21 and the buffering member A30 as well as springs A50 are elastically compressed and expanded to perform the shock buffering function as well as the air circulation function.

[0149] First, when the rear part of the wearer's foot sole is pressed on the inner sole layer A10 during walking, as shown in FIG. 41, the air room A21 is compressed to result in the compression of the corrugated tubes A31 and springs A50 of the buffering member A30 so as to absorb the shock. At the same time, the pressurized air in the air room A21 is discharged to the outside through the second check valve A80, while the passages A22 come to be blocked because the first check valve A70 is firmly pushed to the passages due to the pressurized air in the air room A21. At this moment, the air in the corrugated tubes A31, which air was pressurized, is discharged to the air room A21 through passages A43 and A63, while the sucking tubes A32 are shut because the projections A62 contact these sucking tubes A32, Next, as shown in FIG. 42, when the shoe S4 is completely isolated from the ground during walking, the air room A21 is returned to the original expanded state due to

the restoring force of the corrugated tubes A31 and springs A50, with the result that sucking force is generated in the air room A21 because of the expansion of corrugated tubes A31 and springs A50 in the buffering member A30. At the same time, because the first check valves A70 is automatically opened by the sucking force generated in the air room A21, the air room A21 is communicated with the passages A22, and the second check valve A80 maintains its closed state. At this moment, sucking force is automatically generated in the corrugated tubes A31 due to its restoring force, while sucking tubes A32 are opened due to their separation from the projections A62.

[0150] In addition, as indicated above, the passages A22 are communicated with the air room A21 through the opened first check valve A70, causing the external fresh air to flow in the passages A22 through the sucking holes A11 of the inner sole layer A10. The fresh air penetrated into the passages A22 is automatically flowed into the air room A21 due to the sucking force, whereby the fresh air can steadily enter and circulate throughout the inside of shoes S3 in which the wearer's feet are positioned.

[0151] Further, the springs A50 can be easily replaced when needed, e.g. a troubled spring can be exchanged by a new one, because the screws A61 of supporting members A60 are screw-connected detachably to the nuts A21*a* in the air room A21. Further, the intensity of springs A50 may be appropriately matched with the body weight of shoe-wearers. Particularly, the springs A50 at different locations of shoe's sole surface may be chosen to vary in the intensity, for optimum tension, in response to the average treading force distribution of a shoe user or shoe users.

[0152] An air-circulation type shock buffering footwear according to a variant embodiment of the invention is characterized, as shown in FIGS. 43 to 47, in that an air room A23 is formed also on the front top of the bottom sole piece A20 so as to communicate with passages A22, this air room A23 is also provided with plural nuts A23*a* vertically extending through the bottom piece, a buffering member A30 as well as a prop member A40 and springs A50 are also disposed on the air room A23, supporting members A60 are screw-assembled to the nuts A23*a* and a passage A13 is also formed on the front underside of the inner sole layer A10.

[0153] The overall operation of the air-circulation type shock absorbing footwear according to the above variant embodiment of the invention, constructed as above, is described in detail below.

[0154] In the normal time when the shoe S4 is not put on by a person, the front and rear air rooms A23 and A21 maintain the expanded state due to the inherent elasticity of the corrugated tubes A31 and springs A50 of buffering members A30 disposed in the front and rear air rooms A23 and A21.

[0155] When a person walks or runs with the footwear S4 on, the air rooms A23 and A21 and the corrugated tubes A31 as well as springs A50 are elastically compressed and expanded to perform the shock buffering function as well as the air circulation function.

[0156] First, when the rear part of the wearer's foot sole is pressed on the inner sole layer A10 during walking, as shown in FIG. 45, the rear air room A21 is compressed to result in the compression of the corrugated tubes A31 and springs A50 of the buffering member A30 in this air room so as to absorb the shock. At the same time, the pressurized air in the rear air room A21 is discharged to the outside through the second check valve A80, while the passages A22 come to be blocked because the first check valve A70 is firmly pushed to the gateways of these passages due to the pressurized air in the rear air room A21. At this moment, the air in the corrugated tubes A31, which air was pressurized, is discharged to the air room A21 through passages A43 and A63, while the sucking tubes A32 are shut because the projections A62 contact these sucking tubes A32.

[0157] Next, when the front part of the wearer's foot sole is pressed on the inner sole layer A10 during walking, as shown in FIG. 46, the front air room A23 is compressed to result in the compression of the corrugated tubes A31 and springs A50 of the buffering member A30 in this air room A23 so as to absorb the shock. At the same time, a part of the pressurized air in the front air room A23 is discharged to the passages A22 to open the first check valve A70, while the corrugated tubes A31 and springs A50 of the buffering member A30 in this air room A23 are contracted to cause the contact of the sucking tubes A32 with projections A62 to thereby close the sucking holes A11 of the inner sole layer A10. That is, although a part of the pressurized air in the air room A23 may have been discharged to the passages A22, fresh air can not enter because of the closure of sucking holes A11.

[0158] On the other hand, as shown in FIG. 47, when the shoe S4 is completely isolated from the ground during walking, the front and rear air rooms A23 and A21 are returned to the original expanded state due to the restoring force of the corrugated tubes A31 and springs A50 in the buffering members A30, with the result that sucking force is generated in the rear air room A21, to begin with, because of the expansion of the corrugated tubes A31 and springs A50 in the rear air room A21. At the same time, because the first check valves A70 is automatically opened by the sucking force generated in the air room A21, the rear air room A21 is communicated with the front air room A23 through the passages A22, and the second check valve A80 maintains its closed state. At this moment, sucking force is automatically generated in the corrugated tubes A31 due to its restoring force, while sucking tubes A32 are opened due to their separation from the projections A62.

[0159] Similarly, the front air room A23 and the corrugated tubes A31 as well as springs A50 mounted in this air room are also returned to the original expanded state, with result that the external fresh air is introduced in this front air room A23 through the sucking holes A11 on the inner sole layer A10. Then, the fresh air introduced in the front air room A23 is naturally flowed into the rear air room A21 through the passages A22, whereby the external fresh air can circulate incessantly throughout the inside of the shoe S4.

[0160] An air-circulation type shock buffering footwear according to a variant embodiment of the invention is characterized, as shown in FIGS. 48 and 49, in that an auxiliary bottom piece A90 is attached on the rear underside of the bottom sole piece A20. Although the constructional characteristics of the shoe S4 according to this embodiment can be applied to all sorts of footwear, this kind of shoe is specially applicable to low shoes or military shoes. By taking the chance of replacing the auxiliary bottom pieces

A90, incidentally the separation of supporting member A60, replacement of springs A50 and the like could be conducted.

[0161] An air-circulation type shock buffering footwear according to an other embodiment of the invention is characterized, as shown in FIGS. 50 to 60, in that the first valve installing grove A24 is formed in the rear of the passage A22, the second valve installing grooves A25 are disposed respectively on the both upper sides in the rear of the bottom sole piece A20, said second valve installing grooves each provided with a hole A25*a* communicating with the air room A21 and with a hole A25*b* communicating with the outside, the first check valve A70 is fitted in the first valve installing grove A24 and the second check valves A80 are respectively fitted in the both second valve installing grooves A25.

[0162] The above-described first check valve A70, which is mounted in the first valve installing grove A24 to open or close the passage A22, is characterized, as shown in FIGS. 55, 57 and 58, in that it comprises a housing A71 having an inlet A71*a* as well as an outlet A71*b*, a shaft pin A71*c* and spouting openings A71*d*; a valve plate A72 formed with a shaft hole A72*a*, the valve plate being intended to open or close the spouting openings A71*d*, the shaft hole receiving a shaft pin A71*c*; and a cap A73 to be combined with the housing A71 to prevent the valve plate A72 from falling-off.

[0163] The above-described housing A71 is fitted air-tight in the first valve installing grove A24, wherein the inlet A71*a* is formed on the front bottom of the housing A71, the inlet communicating with the passage A22, the outlet A71*b* is formed on the rear top of the housing A71, the outlet communicating with the air room A21, the shaft pin A71*c* projects upward at the center of the housing A71 and a plurality of spouting openings A71*d* are formed radially around the shaft pin A71*c*.

[0164] A projection A71*e* for securing position is formed protrusively on an outer side of the housing A71. The first valve installing groove A24 is provided with a projection receiving slot A24*a* to receive the projection A71*e*. Accordingly, when a housing A71 is fitted in the first valve installing groove A24, with the projection A71*e* aligned with the projection receiving slot A24*a*, at the time of assembling, simple communication of the passage A22 with the inlet A71*a* and of the air room A21 with the outlet A71*b* can be easily achieved.

[0165] The valve plate A72 is made of a flexible rubber material to open or close the spouting openings A71*d*, wherein the valve plate A72 is formed, at its center, with the shaft hole A72*a* in which the shaft pin A71*c* is to fitted, as seen in FIG. 55. The valve plate A72 is positioned on the spouting openings A71*d*.

[0166] The cap A73 is fitted in the top part of the housing A71 to prevent the valve plate A72 from falling-off.

[0167] The operation of the first check valve A70 constructed as above is described. First, as shown in FIGS. 52 and 58, when the air room A21 is pressed during a walk, the resulting pressurized air causes the valve plate A72 of the first check valve A70 to be pressed down firmly on the spouting openings A71*d*, so that the spouting openings A71*d* are closed to thereby block the passage A22, whereby the pressurized air in the air room can not be discharged to the passage A22, However, when the air room A21 is expanded due to the material elasticity during a walk so as to generate the sucking force here, the valve plate A72 is retreated upward from the spouting openings A71*d* so as to open the latter, whereby the spouting openings A71*d* maintain the opened state. Therefore, the fresh air flowing in the passage A22 is naturally flowed in the air room A21 where the sucking force is now present.

[0168] The above-described second check valves A80, which are respectively mounted in the both second valve installing groves A25 to discharge the air, is characterized, as shown in FIGS. 56, 59 and 60, in that it comprises a housing A81 having an inlet A81*a* as well as an outlet A81*b*, a shaft pin A81*c* and spouting openings A81*d*; a valve plate A82 formed with a shaft hole A82*a*, the valve plate being intended to open or close the spouting openings A81*d*, the shaft hole receiving a shaft pin A81*c*; and a cap A83 to be combined with the housing A81 to prevent the valve plate A82 from falling-off.

[0169] The above-described housings A81 are fitted air-tight in the second valve installing groves A25 on both sides. In FIG. 56, the inlet A81*a* is formed on the rear bottom of the housing A81, the inlet communicating with the air room A21 through a hole A25*a*, the outlet A81*b* is formed on the front top of the housing A81, the outlet communicating with the outside through a hole A25*b*, the shaft pin A81*c* projects upward at the center of the housing A81 and a plurality of spouting openings A81*d* are formed radially around the shaft pin A81*c*.

[0170] A projection A81*e* for securing position is formed protrusively on an outer side of a housing A81. The second valve installing grooves A25 are each provided with a projection receiving slot A25*a* to receive a projection A81*e*. Accordingly, when a housing A81 is fitted in the second valve installing groove A25, with the projection A81*e* aligned with the projection receiving slot A25*a*, at the time of assembling, simple communication of the hole A25*a* with the inlet A81*a* and of the hole A25*b* with the outlet A81*b* can be easily achieved.

[0171] The valve plates A82 are made of a flexible rubber material to open or close the spouting openings A81*d*, wherein the valve plates A82 are each formed, at its center, with a shaft hole A82*a* in which a shaft pin A81*c* is to fitted, as seen in FIG. 56. The valve plates A82 are positioned on the spouting openings A81*d*.

[0172] The caps A83 are each fitted in the top part of the housing A81 to prevent the valve plate A82 from falling-off.

[0173] The operation of the second check valves A80 constructed as above is described. First, as shown in FIGS. 53 and 59, when the air room A21 is pressed during a walk, the resulting pressurized air causes the valve plates A82 of the second check valves A80 to be retreated from the spouting openings A81*d*, so that the spouting openings A81*d* are opened, whereby the pressurized air is discharged to the outside through the outlets A81*b* and holes A25*b*. However, when the air room A21 is expanded due to the elastic restoring force of the material during a walk so as to generate the sucking force, as shown in FIGS. 54 and 59, the valve plates A82 are attracted down firmly to the spouting openings A81*d* so as to close the latter, whereby no more air is discharged to the outside. At this time, for example, the water or other impurities can not penetrate inside. Particu-

larly, the water can not penetrate inside the shoes S4, even when the rear part of the shoes is dipped in the water during a walk.

[0174] The air-circulation type shock buffering footwear according to various embodiments as described above has the advantages of having shock absorbing and buffering action and so reducing the fatigue of the wearer's feet owing to good cushion when the person walks or runs, helping to improve the health by increasing exercise quantity based on the construction, and preventing a variety of adults' diseases caused by the lack in exercise.

[0175] In addition, the air-circulation type shock buffering footwear has the advantage that the fresh external air can flow in the interior of the footwear to realize a smooth ventilation when the wearer walks or jumps so as to remove the smell on the feet and to prevent the athlete's foot, with the result that the wearer can wear the footwear in a pleasant and comfortable condition for many hours.

1. An air-circulation type shock buffering footwear, with an inner sole layer (**10**), a middle sole layer (**20**) and a bottom sole piece (**30**), characterized, in that the footwear (S1) includes further the first and second air rooms (**22** and **23**) formed respectively in the front and rear of and on the underside of the middle sole layer (**20**), said first and second air rooms communicating with each other through passages (**21**); a plurality of sucking holes (**11**) formed in the inner sole layer (**10**) to communicate with through-holes (**22***a*) of the first air room (**22**); the first and second buffering members (**40** and **50**) respectively incorporated in the first and second air rooms (**22** and **23**) for both alleviating shock and circulating the air; the first check valve (**60**) disposed in the front of the second air room (**23**) to open or close the passages (**21**); and the second check valve (**70**) disposed in the rear of the second check valve (**23**) to communicate with the outside so as to discharge the air.

2. The air-circulation type shock buffering footwear according to claim 1, wherein the first buffering member (**40**) communicates with through-holes (**22***a*) of the first air room (**22**), and comprise downward flexible buffering tubes (**41**) formed with plural cutout parts (**41***a*).

3. The air-circulation type shock buffering footwear according to claim 2, wherein the buffering tubes (**41**) are formed integrally with the middle sole layer (**20**).

4. The air-circulation type shock buffering footwear according to claim 1, wherein the first buffering member (**40**) comprises a plurality of corrugated tubes (**44**) and guiding tubes (**45**) formed respectively to correspond to a top and bottom plate (**42** and **43**) and combined with each other; sucking tubes (**46**) projecting into the corrugated tubes (**44**); projections (**47**) projecting inside the guiding tubes (**45**) to open or close the sucking tubes (**46**); passages (**48**) formed on the top of the bottom plate (**43**) to communicate with the guiding tubes (**45**); and springs (**49**) disposed inside the corrugated tubes (**44**) and the first air room (**22**) is formed with a passage (**22***b*) to communicate with the sucking tubes (**45**).

5. The air-circulation type shock buffering footwear according to claim 1, wherein the second buffering member (**50**) comprises a plurality of corrugated tubes (**53**) and guiding tubes (**54**) formed respectively to correspond to a top and bottom plate (**51** and **52**) and combined with each other; sucking tubes (**55**) projecting into the corrugated tubes (**53**); projections (**56**) projecting inside the guiding tubes (**54**) to open or close the sucking tubes (**55**); passages (**57**) formed on the top of the bottom plate (**52**) to communicate with the guiding tubes (**54**); and springs (**58**) disposed inside the corrugated tubes (**53**) and the second air room (**23**) is formed with a passage (**23***a*) to communicate with the sucking tubes (**55**).

6. An air-circulation type shock buffering footwear with an inner sole layer (**100**), a middle sole layer (**200**) and a bottom sole piece (**300**), characterized in that the footwear (S2) includes further the first and second air rooms (**320** and **330**) formed respectively in the front and rear of and on the bottom sole piece (**300**), the first and second air rooms communicating with each other through passages (**310**); a plurality of sucking holes (**110** and **210**) formed respectively in the inner and middle sole layers (**100** and **200**), said sucking holes communicating with the first air room (**320**); the first and second buffering members (**400** and **500**) respectively disposed in the first and second air rooms (**320** and **330**) for both alleviating shock and circulating the air; the first check valve (**600**) disposed in the front of the second air room (**330**) to open or close the passages (**310**); and the second check valve (**700**) disposed in the rear of the second air room (**330**) to communicate with the outside so as to discharge the air.

7. The air-circulation type shock buffering footwear according to claim 6, wherein the first buffering member (**40**) communicates with the sucking holes (**210**) of the middle sole layer (**200**), and comprise downward flexible buffering tubes (**410**) formed with plural cutout parts (**411**).

8. The air-circulation type shock buffering footwear according to claim 7, wherein the buffering tubes (**410**) are formed integrally with the middle sole layer (**200**).

9. The air-circulation type shock buffering footwear according to claim 6, wherein the first buffering member (**400**) comprises a plurality of corrugated tubes (**440**) and guiding tubes (**450**) formed respectively to correspond to a top and bottom plate (**420** and **430**) and combined with each other; sucking tubes (**460**) projecting into the corrugated tubes (**440**); projections (**470**) projecting inside the guiding tubes (**450**) to open or close the sucking tubes (**460**); passages (**480**) formed on the top of the bottom plate (**430**) to communicate with the guiding tubes (**450**); and springs (**490**) disposed inside the corrugated tubes (**440**) and a passage (**220**) is formed on the underside of the middle sole layer (**200**) to communicate with the suction tubes (**460**).

10. The air-circulation type shock buffering footwear according to claim 6, wherein the second buffering member (**500**) comprises a plurality of corrugated tubes (**530**) and guiding tubes (**540**) formed respectively to correspond to a top and bottom plate (**510** and **520**) and combined with each other; sucking tubes (**550**) projecting into the corrugated tubes (**530**); projections (**560**) projecting inside the guiding tubes (**540**) to open or close the sucking tubes (**550**); passages (**570**) formed on the top of the bottom plate (**520**) to communicate with the guiding tubes (**540**); and springs (**580**) disposed inside the corrugated tubes (**530**) and a passage (**230**) is formed on the underside of the middle sole layer (**200**) to communicate with the suction tubes (**550**).

11. An air-circulation type shock buffering footwear with an inner sole layer (**1000**), a middle sole layer (**2000**) and a bottom sole piece (**3000**), characterized in that the footwear (S3) includes further an air room (**3100**) formed in the rear top of the bottom sole piece (**3000**); a plurality of passages (**3200**) extending from the air room (**3100**) toward the front;

a plurality of sucking holes (**1100** and **2100**) formed in the front of the inner and middle sole layers (**1000** and **2000**) in a manner of communicating with the passages (**3200**); a buffering member (**4000**) incorporated in the air room (**3100**) for both alleviating shock and circulating air; the first check valve (**5000**) disposed in the front of the air room (**3100**) to open or close the passages (**3200**); and the second check valve (**6000**) disposed in the rear of the air room (**3100**) so as to communicate with the outside to discharge the air.

12. An air-circulation type shock buffering footwear provided with an inner sole layer (A**10**) and a bottom sole piece (A**20**), characterized in that the footwear (S**4**) includes further a plurality of sucking holes (A**11**) perforated in the front of the inner sole layer (A**10**) and a passage (A**12**) formed on the rear underside of the inner sole layer (A**10**); an air room (A**21**) formed on the rear top of the bottom sole piece (A**20**), said air room being provided with plural nuts (A**21***a*) vertically extending through the bottom sole piece, and passages (A**22**) extending toward the front, starting from the air room (A**21**); a buffering member (A**30**) disposed on the air room (A**21**), said buffering member being provided with plural corrugated tubes (A**31**) and sucking tubes (A**32**); a prop member (A**40**) disposed under the buffering member (A**30**), said prop member being provided with plural guiding tubes (A**41**), assembling holes (A**42**) and passages (A**43**); a plurality of springs (A**50**) inserted in the corrugated tubes (A**31**) said springs having been introduced through the assembling holes (A**42**) a plurality of supporting members (A**60**) fitted in assembling holes (A**42**), each of said supporting members being provided with a screw (A**61**) to engage with a nut (A**21***a*), a projection (A**62**) to open or close a sucking tube (A**32**) and a passage (A**63**); and first check valves (A**70**) disposed in the air room (A**21**) to open or close the passages (A**22**) and a second check valve (A**80**) to discharge air to the outside.

13. The air-circulation type shock buffering footwear according to claim 12, wherein a recess (A**61***a*) is formed on the bottom of each of the screws (A**61**) of the supporting members (A**60**) for easy screwing or unscrewing.

14. The air-circulation type shock buffering footwear according to claim 12, wherein a slippage preventing irregularity (A**61***b*) is formed protrusively on the bottom of each of the screws (A**61**) of the supporting members (A**60**).

15. The air-circulation type shock buffering footwear according to claim 12, wherein the supporting members (A**60**) are formed integrally with the screws (A**61**).

16. The air-circulation type shock buffering footwear according to claim 12, wherein an air room (A**23**) is formed also on the front top of the bottom sole piece (A**20**) so as to communicate with passages (A**22**), this air room (A**23**) is also provided with plural nuts (A**23***a*) vertically extending through the bottom piece, a buffering member (A**30**) as well as a prop member (A**40**) and springs (A**50**) are also disposed on the air room (A**23**), supporting members (A**60**) are screw-assembled to the nuts (A**23***a*) and a passage (A**13**) is also formed on the front underside of the inner sole layer (A**10**).

17. He air-circulation type shock buffering footwear according to claim 12 or 16, wherein an auxiliary bottom piece (A**90**) is attached on the rear underside of the bottom sole piece (A**20**).

18. The air-circulation type shock buffering footwear according to claim 12 or 16, wherein the first valve installing grove (A**24**) is formed in the rear of a passage (A**22**), the second valve installing grooves (A**25**) are disposed respectively on the both upper sides in the rear of the bottom sole piece (A**20**), said second valve installing grooves each provided with a hole (A**25***a*) communicating with the air room (A**21**) and with a hole (A**25***b*) communicating with the outside, the first check valve (A**70**) is fitted in the first valve installing grove (A**24**) and the second check valves (A**80**) are respectively fitted in the both second valve installing grooves (A**25**).

19. The air-circulation type shock buffering footwear according to claim 18, wherein the first or second check valve (A**70** or A**80**) comprises a housing (A**71** or A**81**) having an inlet (A**71***a* or **81***a*) as well as an outlet (A**71***b* or A**81***b*), a shaft pin (A**71***c* or A**81***c*) and spouting openings (A**71***d* or A**81***d*); a valve plate (A**72** or A**82**) formed with a shaft hole (A**72***a* or A**82***a*), the valve plate being intended to open or close the spouting openings (A**71***d* or A**81***d*), the shaft hole receiving a shaft pin (A**71***c* or A**81***c*); and a cap (A**73** or A**83**) to be combined with the housing (A**71** or A**81**) to prevent the valve plate (A**72** or A**82**) from falling.

20. The air-circulation type shock buffering footwear according to claim 18, wherein a projection (A**71***e* or A**81***e*) for securing position is provided protrusively on one side of the outer surface of the housing (A**71** or A**81**), and the first or second valve installing groove (A**24** or A**25**) is formed with a projection receiving slot (A**24***a* or A**25***c*) to receive the projection (A**71***e* or A**81***e*).

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