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(54) **UNIVERSAL ANTI-COLLISION STRUCTURE OF SAFETY HELMET**

(57) A universal anti-collision structure of safety helmet includes a shell body (10), a filling body (30) and an elastic carrier body (40) enclosed in and assembled with the shell body (10). The elastic carrier body (40) has multiple walls (49) defining multiple well-shaped structure sections (45) with a geometrical configuration. The peripheral section of each well-shaped structure section (45) is formed with wing sections (46) (protruding toward the center of the well-shaped structure section (45)). Accordingly, the well-shaped structure section (45) is de-

fined with a first section (41), a second section (42) and a subsidiary section (43) connected between the first and second sections (41, 42). The filling body (30) is bonded with the shell body (10) and the elastic carrier body (40) to together form an integrated assembly (100). The elastic carrier body (40) can be flexibly deformed in accordance with different head configurations so as to fully enclose the head, cushion, absorb and transmit the external impact force as well as enhance the comfortableness and snugness in wear.

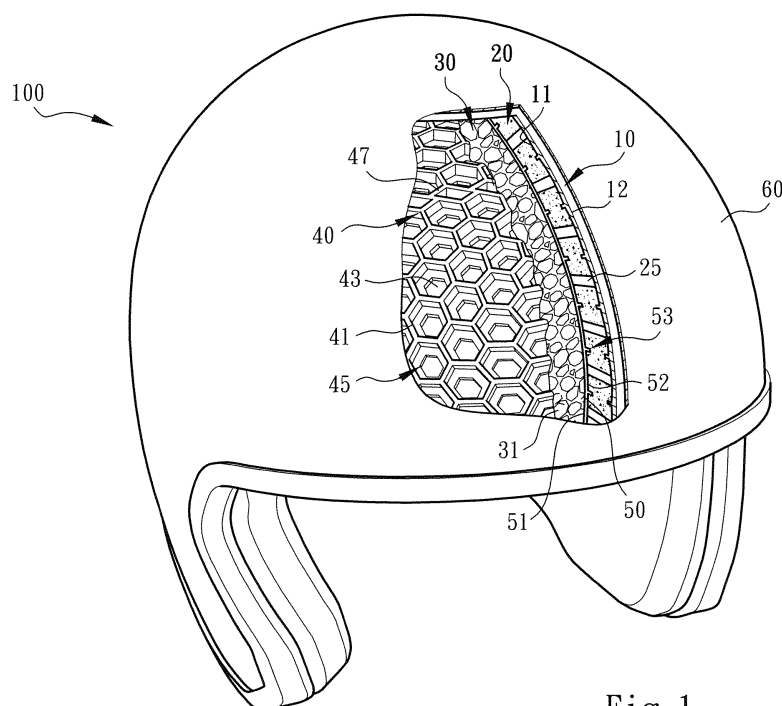


Fig. 1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to a universal anti-collision structure of safety helmet, and more particularly to a universal anti-collision structure of safety helmet, which employs (cushion foam) filling body connected with a shell body and an elastic carrier body. The elastic carrier body has multiple walls as a skeleton structure. The walls define multiple well-shaped structure sections with a geometrical configuration. The filling body is bonded with the shell body and the elastic carrier body to together form a complex integrated assembly.

2. Description of the Related Art

[0002] A conventional safety helmet structure includes a plastic shell body and an anti-impact filling body formed of foam material by heating. The plastic shell body tightly encloses and adheres to the foam filling body to form the safety helmet structure.

[0003] In the structural form of such kind of safety helmet, the outer plastic shell serves to resist against the thrust-type impact of an alien object. Also, when bearing the external impact, the foam filling material serves to cushion the impact force and distributively transmit the impact force so as to achieve a protection effect for the wearer's head.

[0004] It is known that a thin layer of lining is generally disposed in an innermost position of the conventional helmet as a cushion between the helmet and a wearer's head. The lining is generally made of a fabric. With respect to the structural property and application of the thin layer of lining, it is troublesome to additionally dispose the lining in the safety helmet because the number of the assembling steps is increased. Moreover, the material property of the thin layer of lining leads to that the comfortableness of a helmet wearer can be hardly effectively enhanced and the mugginess of the wearer in long-term wear cannot be reduced.

[0005] As well known by those who are skilled in this field, due to the limitation of the structural form and property of the thin layer of lining, in order to more fully enclose the wearer's head and enhance the snugness in wear of the helmet, in practice, it is necessary to manufacture many different specifications of helmet products in accordance with the sizes of the heads of the wearers. This obviously leads to increase of the manufacturing cost. Such condition is not what we expect.

[0006] Still with respect to the structural form and application of the thin layer of lining of the safety helmet, even though various sizes of conventional helmet products are provided for different wearers, the helmet and the thin layer of lining still cannot truly fully enclose and snugly attach to the wearer's head in accordance with

the head configurations or the arched faces of the wearer's head.

[0007] That is, even though various sizes or specifications of conventional safety helmets are provided for different wearers, the helmets still fail to completely conform to the three-dimensional head configurations or the arched faces of the wearer's head. As a result, the helmet can hardly fully enclose the wearer's head and the snugness in wear of the helmet is deteriorated. Therefore, when an external impact force is applied to the helmet, the protection and security effect provided by the helmet for the wearer's head will be affected.

[0008] To speak representatively, the conventional safety helmet has some shortcomings in design of the structure and the manufacturing process. Also, in practice, some problems existing in the assembling structures of the outer shell body or plastic shell, the inner structure body and the thin layer of lining of the conventional safety helmet. To overcome the above shortcomings, it is necessary to redesign the assembling structures and connection relationship between the shell body or plastic shell and the foam material layer or the thin layer of lining of the conventional safety helmet so as to simplify the manufacturing process and change the safety helmet into a different one. The redesigned safety helmet has more ideal protection ability and better comfortableness in wear. Accordingly, the distribution and transmission pattern of the external impact force are changed to improve the shortcomings of the conventional safety helmet.

[0009] It is found that the conventional safety helmet structure has some shortcomings that it is troublesome to additionally dispose the lining in the safety helmet because the number of the assembling steps is increased and the comfortableness of the helmet wearer in wear can be hardly enhanced. In addition, the texture of the conventional helmet fails to elastically conform to different three-dimensional head configurations or arched faces and sizes of the heads of the wearers. As a result, the helmet can hardly fully enclose the wearer's head and the snugness in wear of the helmet cannot be enhanced. Therefore, when various external impact forces (normal or lateral) are applied to the helmet, the internal structure body of the helmet can hardly effectively distribute and transmit the impact forces to every part of the entire helmet. All these shortcomings need to be improved. Moreover, the safety helmet must meet the trend to simplify manufacturing process and design lightweight and thin safety helmet structure. All these issues are not suggested or disclosed in the above reference patents.

SUMMARY OF THE INVENTION

[0010] It is therefore a primary object of the present invention to provide a universal anti-collision structure of safety helmet including a shell body, a filling body and an elastic carrier body enclosed in and assembled with the shell body. The elastic carrier body has multiple walls as a skeleton structure. The walls define multiple well-

shaped structure sections with a geometrical configuration. The peripheral section of each well-shaped structure section is formed with wing sections (protruding toward the center of the well-shaped structure section). Accordingly, the well-shaped structure section is defined with a first section, a second section and a subsidiary section connected between the first and second sections. The filling body is bonded with the shell body and the elastic carrier body to together form an integrated assembly. The structural strength of the entire assembly is enhanced and the first section (or the wall) extends in a direction to (the interior) of the filling body. The elastic carrier body can be flexibly deformed in accordance with different head configurations so as to fully enclose the head, cushion, absorb and transmit the external impact force as well as enhance the comfortableness and snugness in wear.

[0011] In the above universal anti-collision structure of safety helmet, the material of the filling body partially at least goes into the first section and/or the subsidiary section of the elastic carrier body, whereby the filling body is connected or bonded with the elastic carrier body to form an integrated structure. (The term "bonded" means that the material of the filling body is passed through or filled in and connected with the first section and the subsidiary section or the wing sections and the wall). This improves the troublesome manufacturing process of the conventional safety helmet that it is necessary to additionally assemble a thin layer of lining. In addition, the filling body is connected with the elastic carrier body to form such a texture that the elastic carrier body and the filling body provide an inter-supporting system or effect. When the shell body and the filling body bear external impact force to achieve the cushioning and shock absorption effect, the elastic carrier body also serves to distributively transmit the impact force.

[0012] In practice, the filling body is connected with the first sections and/or the subsidiary section of the elastic carrier body to form such a structure that the lower wall of the second section becomes an elastic section. The elastic section can be flexibly deformed to different extents in accordance with different sizes of the wearer's head, the three-dimensional head configurations or the arched faces of the wearer's head. Therefore, it is easy for the elastic section to fully elastically contact the wearer's head to enhance the comfortableness of the wearer's head and make the wearer's head more fully enclosed and enhance the snugness of the attachment in wear of the helmet. This improves the structural shortcomings of the conventional helmet and/or the thin layer of lining.

[0013] Especially, when the lower wall of the second section is flexibly deformed to different extents to fully elastically contact the wearer's head, an air chamber structure is set up between the well-shaped structure section (or the second section) and the wearer's head as a flexible sucker. Accordingly, the elastic carrier body is easy to fully attach to the wearer's head in accordance with the different head configurations or the arched faces

of the wearer's head to provide more ideal protection and security effect than the conventional helmet. Moreover, when responding to the external impact force, the air chamber serves to cushion and absorb the external impact force.

[0014] In the above universal anti-collision structure of safety helmet, at least one elastic structure body and/or a subsidiary shell body is disposed between the inner face of the shell body and the filling body. The elastic structure body is defined with an upper section and a lower section. The upper and lower sections of the elastic structure body are respectively formed with multiple assembling sections. The shell body and/or the subsidiary shell body are formed with multiple pivotal connection sections correspondingly assembled with the assembling sections. The filling body is bonded with the elastic structure body and the shell body and/or the subsidiary shell body to form an integrated form. The structural strength of the entire assembly is enhanced to achieve a multilayered structure and universal cushioning and external impact force (or normal impact force and rotational torque) absorption and transmission effects.

[0015] In the above universal anti-collision structure of safety helmet, the well-shaped structure section of the elastic carrier body is formed with an elastic column extending toward the filling body (or the shell body). The elastic column includes a connection end connected with the upper wall and a free end extending toward the filling body. A connection face is formed between the connection end and the upper wall of the well-shaped structure section. The free end has a contact face. The width of the cross section of the elastic column is larger than the thickness (or cross-sectional width) of the wall or the upper wall. When responding to a greater external impact force, the elastic column serves to form a breakage point on the connection face.

[0016] The present invention can be best understood through the following description and accompanying drawings, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a perspective sectional view of the present invention, showing that the shell body, the elastic structure body, the subsidiary shell body, the filling body and the elastic carrier body are assembled with each other;

Fig. 2 is a perspective view of the elastic carrier body of the present invention, showing the structures of the well-shaped structure sections and wing sections of the elastic carrier body;

Fig. 3 is an enlarged perspective sectional view of a part of the elastic carrier body of the present invention, showing the structures of the first sections, the

subsidiary sections, the second sections and the wing sections;

Fig. 4 is a plane sectional view of the present invention, showing that the shell body, the elastic structure body, the subsidiary shell body, the filling body and the elastic carrier body are assembled with each other;

Fig. 5 is an enlarged view of a part of Fig. 4;

Fig. 6 is a view according to Fig. 5, showing that an external impact force (or normal force) is applied to the assembly;

Fig. 6A is an enlarged view of a part of Fig. 6;

Fig. 7 is a view according to Fig. 5, showing that an oblique external impact force (or shear force) is applied to the assembly;

Fig. 7A is an enlarged view of a part of Fig. 7;

Fig. 8 is a perspective view of a modified embodiment of the elastic carrier body of the present invention, showing that the elastic structure body is equipped with elastic columns;

Fig. 9 is a plane view according to Fig. 8;

Fig. 10 is a plane sectional view of a modified embodiment of the present invention, showing that the shell body, the elastic structure body, the subsidiary shell body, the filling body and the elastic carrier body are assembled with each other Fig. 11 is an enlarged view of a part of Fig. 10;

Fig. 12 is a view according to Fig. 11, showing that an external impact force (or normal force) is applied to the assembly;

Fig. 12A is an enlarged view of a part of Fig. 12;

Fig. 13 is a view according to Fig. 11, showing that an oblique external impact force (or shear force) is applied to the assembly;

Fig. 13A is an enlarged view of a part of Fig. 13;

Fig. 14 is a view according to Fig. 11, showing that a greater oblique external impact force (or shear force) is applied to the assembly; and

Fig. 14A is an enlarged view of a part of Fig. 14.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Please refer to Figs. 1, 2 and 3. The universal anti-collision structure of safety helmet of the present invention is selectively exemplified with a safety helmet for sport wear. The safety helmet can be a football helmet, a hockey helmet, an engineering helmet, a mountaineering helmet, an equestrianism helmet, a bicycle helmet, a motorcycle helmet, a skiing helmet, a car racing helmet, etc. in a full face form or an open face form. The safety helmet includes a shell body 10, a filling body 30 enclosed in the shell body 10 and an elastic carrier body 40 enclosed in the shell body 10. The shell body 10, the filling body 30 and the elastic carrier body 40 are assembled with each other to form an assembly 100.

[0019] The upper section, upper side, lower section, lower side or bottom section mentioned hereinafter are referred to with the direction of the drawings as the reference direction. In addition, the part directed to the helmet wearer is defined as inner face or inner side, while the part directed away from the helmet wearer is defined as outer face or outer side.

[0020] In a preferred embodiment, the shell body 10 can be selectively made of plastic material. The shell body 10 has an inner face 11 directed to the helmet wearer and an outer face 12 directed away from the helmet wearer. The inner face 11 of the shell body 10 contacts or connects with the filling body 30. In addition, a protection layer 60 is disposed on the outer face 12 of the shell body 10. The protection layer 60 is selectively made of fiber glass, fiber carbon or the like material. The protection layer 60 serves to enhance the structural strength of the shell body 10.

[0021] As shown in the drawings, the elastic carrier body 40 is disposed in an innermost position of the safety helmet or the assembly 100 as an innermost layer (distal from the shell body 10). The elastic carrier body 40 is connected with a lower section 31 of the filling body 30. The elastic carrier body 40 is selectively made of flexible or elastic material (such as rubber or the like material). The elastic carrier body 40 has the form of a cellular texture. The lower section 31 of the filling body 30 is positioned in a position distal from the inner face 11 of the shell body.

[0022] The drawings show that the elastic carrier body 40 includes multiple walls 49 as a skeleton structure. The walls 49 define multiple well-shaped structure sections 45. The well-shaped structure sections 45 have (a cross section with) a geometrical configuration (such as a hexagonal configuration of a cellular structure). In addition, each wall 49 has wing sections 46 protruding toward two sides or a peripheral section (or a peripheral section of the well-shaped structure section 45). Accordingly, the well-shaped structure section 45 is defined with a first section 41, a second section 42 and a subsidiary section 43 between the first and second sections 41, 42. The cross section of the first section 41 or the second section

42 is larger than the cross section of the subsidiary section 43. Accordingly, the wall 49 and the wing sections 46 positioned on two sides of the wall 49 (or the skeleton structure) together form a structure with a "+++"-shaped cross section. Therefore, the elastic carrier body 40 can fully contact or enclose a wearer's head H as shown in Fig. 3 or 4.

[0023] In this embodiment, the elastic carrier body 40 includes a frame body 44 formed on the bottom section of the elastic carrier body 40. The frame body 44 extends toward an outer side of the elastic carrier body 40 (in a direction to the shell body 10) to form a structure with a U-shaped cross section. The frame body 44 serves to enclose and connect with the shell body 10 and the foam filling body 30.

[0024] The wall 49 is defined with an upper wall 47 and a lower wall 48 corresponding to the positions of the first and second sections 41, 42. By means of a mold or a molding module, the filling body 30 is bonded with the shell body 10 and the elastic carrier body 40 to form an integrated structure of the safety helmet assembly 100.

[0025] To speak more specifically, the (cushioning foam) material of the filling body 30 partially at least goes into the first section 41 and/or the subsidiary section 43 of the elastic carrier body 40, whereby the filling body 30 is connected or bonded with the elastic carrier body 40 to form an integrated structure. (The term "bonded" means that the material of the filling body 30 is passed through or filled in and connected with the first section 41 and the subsidiary section 43 or the wing sections 46 and the wall 49). Therefore, at least the first section 41 (or the upper wall 47) extends to (the interior of) the filling body 30. This improves the troublesome manufacturing process of the conventional safety helmet that it is necessary to additionally assemble a thin layer of lining.

[0026] Preferably, the material of the filling body 30 is partially filled up in the entire first section 41 and the entire subsidiary section 43 to connect with the upper wall 47 and the wing sections 46. Moreover, the elastic carrier body 40 (is assembled with the filling body 30) to form a structural form and achieve such a material property that when the elastic carrier body 40 responds to an external impact force (such as normal force or shear force), the elastic carrier body 40 is elastically deformed and/or rotationally deformed so as to cushion and absorb the external impact force and speed.

[0027] Figs. 4 and 5 show that the material of the filling body 30 partially goes into the first sections 41 and/or the subsidiary section 43. Therefore, the density of the filling body 30 in the elastic carrier body 40 (the first section 41 and/or the subsidiary section 43) is smaller than the density of the filling body 30 outside the elastic carrier body 40. The different densities of the foam structure provide different action force (or impact force) transmission, distribution, cushioning and absorption effects.

[0028] It should be noted that the filling body 30 is connected with the elastic carrier body 40 to form such a texture that the elastic carrier body 40 and the filling body

30 provide an inter-supporting system or effect. When the shell body 10 and the filling body 30 bear external impact force to achieve the cushioning and shock absorption effect, the elastic carrier body 40 also serves to distributively transmit the impact force. Accordingly, the structural strength of the entire assembly 100 is enhanced to universally or multidirectionally cushion and absorb the rotational torque and transmit the external impact force.

[0029] It should be noted that the filling body 30 is connected with the first sections 41 and/or the subsidiary section 43 to form such a structure that the lower wall 48 of the second section 42 becomes an elastic section. The elastic section can be flexibly deformed to different extents in accordance with different sizes of the wearer's head, three-dimensional head configurations or the arched faces of the wearer's head (as shown by the solid lines of Fig. 5). Therefore, the elastic section can elastically contact the wearer's head H to enhance the comfortableness of the wearer's head H and fully enclose the wearer's head H and enhance the snugness of the attachment (or the attachment area). This improves the structural shortcoming of the conventional helmet and/or the thin layer of lining.

[0030] Especially, when the lower wall 48 of the second section 42 is flexibly deformed to different extents to fully elastically contact the wearer's head H, an air chamber structure is set up between the well-shaped structure section 45 (or the second section 42) and the wearer's head H. The air chamber structure provides a sucking effect as a flexible sucker. Accordingly, the elastic carrier body 40 is easy to fully attach to the wearer's head H in accordance with the different head configurations or the arched faces of the wearer's head H to provide more ideal protection and security effect than the conventional helmet. Moreover, when responding to the external impact force, the air chamber serves to cushion and absorb the external impact force.

[0031] Please now refer to Figs. 4 and 5. In a modified embodiment, an elastic structure body 20 and/or a subsidiary shell body 50 are disposed between the shell body 10 and the filling body 30 to form a multilayered floatable structure.

[0032] The term "floatable" means when the parts of the assembly 100 respond to the external action force, the parts of the assembly 100 can relatively move and/or rotate within the assembly 100. For example, when the elastic structure body 20 responds to the external action force, the elastic structure body 20 can be elastically squeezed and deformed to relatively move and/or rotate between the main shell body 10 and the subsidiary shell body 50.

[0033] Preferably, the shell body 10, the filling body 30 (and/or the elastic structure body 20 and the subsidiary shell body 50) are formed with vent structures (not shown). Alternatively, there are gaps between the foam materials of the filling body 30. In this case, the vent structures or the gaps can cooperate with the well-shaped

structure sections 45 of the elastic carrier body 40 to help in enhancing the air convection of the assembly 100. This can reduce the mugginess of the user in long-term wear.

[0034] In this embodiment, the elastic structure body 20 is selectively made of flexible or elastic material such as EPS, EVA, rubber or the like material. Therefore, the elasticity ratio (or deformation amount) of the elastic structure body 20 is larger than the elasticity ratio (or deformation amount) of the filling body 30. Accordingly, the deformation and cushioning shock absorption effect of the elastic structure body 20 is enhanced.

[0035] As shown in the drawings, the elastic structure body 20 is defined with or has an upper section 21 and a lower section 22. The upper and lower sections 21, 22 of the elastic structure body 20 are respectively formed with multiple assembling sections 23. The assembling sections 23 of the elastic structure body 20 are formed with grooves 24. The grooves 24 define the assembling sections 23 to have a geometrical configuration (such as hexagonal configuration). Accordingly, the assembling sections 23 are adjacent to each other to form a cellular structure.

[0036] In this embodiment, the subsidiary shell body 50 is selectively made of plastic material. The subsidiary shell body 50 has an inner face 51 directed to the wearer and an outer face 52 directed away from the wearer. By means of a mold or a molding module, the filling body 30 is bonded with the inner face 51 of the subsidiary shell body 50. The inner face 51 of the shell body and the outer face 52 of the subsidiary shell body respectively contact or connect with the upper and lower sections 21, 22 of the elastic structure body 20.

[0037] As shown in the drawings, the inner face 51 of the shell body 10 and the outer face 52 of the subsidiary shell body 50 are respectively formed with (elastic) pivotal connection sections 13, 53. The pivotal connection sections 13, 53 of the shell body 10 and the subsidiary shell body 50 respectively have protruding walls 14, 54. The walls 14, 54 define the pivotal connection sections 13 (or 53) to have a geometrical configuration (such as hexagonal configuration). Accordingly, the pivotal connection sections 13 (or 53) are adjacent to each other to form a cellular structure. The pivotal connection sections 13, 53 are correspondingly assembled with or mortised with the assembling sections 23 of the elastic structure body 20.

[0038] In a preferred embodiment, the elastic structure body 20 has holes 25 formed on the assembling sections 23 and passing through the elastic structure body 20. A fluid can be filled in the holes 25 to adjust or change the elasticity ratio of the elastic structure body 20.

[0039] Please now refer to Figs. 6 and 6A. When an external impact force (or normal force) is applied to the assembly 100, the shell body 10, the elastic structure body 20, the filling body 30 and/or the subsidiary shell body 50 (in cooperation with the elastic carrier body 40) are elastically deformed to different extents as shown by the solid lines of Fig. 6. These components can decrease

the speed of the external impact force and together bear the external impact force to provide a cushioning and shock absorption effect. Accordingly, the external impact force is universally (or multidirectionally) distributively transmitted to the filling body 30 and/or the entire assembly 100.

[0040] After the external impact force disappears, due to the structural property of the filling body 30 (or the elastic structure body 20 and the subsidiary shell body 50) and elastic carrier body 40, the components of the assembly 100 are as restored to their home positions as possible. For example, the components of the assembly 100 are restored to their home positions as shown by the phantom lines K of Figs. 6 and 6A.

[0041] Please now refer to Figs. 7 and 7A. When an external impact force (or shear force) is applied to the assembly 100, the shell body 10, the elastic structure body 20, the filling body 30 and/or the subsidiary shell body 50 (in cooperation with the elastic carrier body 40) are elastically deformed and rotationally deformed to different extents. These components can decrease the rotational acceleration of the external impact force and respond to the linear deformation pattern of the shear force as well as together bear the external impact force to provide a cushioning and shock absorption effect. Accordingly, the external impact force is universally (or multidirectionally) distributively transmitted to the filling body 30 and/or the entire assembly 100. Accordingly, the acceleration and rotational torque caused by the external impact force are cushioned, absorbed and decreased.

[0042] After the external impact force disappears, due to the elastic deformation property of the elastic structure body 20 (and/or the filling body 30) and the elastic carrier body 40, the components of the assembly 100 are restored to their home positions. For example, the components of the assembly 100 are restored to their home positions as shown by the phantom lines K of Figs. 7 and 7A.

[0043] It should be noted that multiple or multiple layers of elastic structure bodies 20 can be disposed between the shell body 10 and the subsidiary shell body 50. Alternatively, the assembly 100 can have a structural form equipped with multiple or multiple layers of elastic carrier bodies 40.

[0044] Please now refer to Figs. 8, 9 and 10. In a modified embodiment of the elastic carrier body 40, the first section 41 (or the upper wall 47) of the well-shaped structure section 45 is formed with an elastic column 70 extending toward the filling body 30 (or the shell body 10). The elastic column 70 includes a connection end 71 connected with the upper wall 47 and a free end 72 extending toward the filling body 30. The free end 72 has a contact face 73. The contact face 73 is a concaved face. A connection face 74 is formed between the connection end 71 and the upper wall 47.

[0045] In this embodiment, the width of the cross section of the elastic column 70 is larger than the thickness of the wall 49 so as to enhance the elastic action force

of the elastic column 70.

[0046] Please refer to Figs. 10 and 11. After the elastic column 70 passes through the filling body 30 (and/or the elastic structure body 20), the contact face 73 connects with the inner face 11 of the shell body 10 and an air chamber structure is set up between the free end 72 (or the contact face 73) and the inner face 11 of the shell body 10. The air chamber structure serves as a cushion structure. When responding to the external impact force, the air chamber structure can be flexibly deformed and/or rotationally deformed to cushion and absorb the external impact force.

[0047] Please now refer to Figs. 12 and 12A. When an external impact force (or normal force) is applied to the assembly 100, the shell body 10, the elastic structure body 20, the filling body 30 and the elastic column 70 of the elastic carrier body 40 are cooperatively elastically deformed to different extents. These components can decrease the speed of the external impact force and together bear the external impact force to provide a cushioning and shock absorption effect. Accordingly, the external impact force is universally (or multidirectionally) distributively transmitted to the filling body 30 and/or the entire assembly 100.

[0048] After the external impact force disappears, due to the structural property of the filling body 30 (or the elastic structure body 20) and the elastic carrier body 40 and the elastic column 70, the components of the assembly 100 are as restored to their home positions as possible. For example, the components of the assembly 100 are restored to their home positions as shown by the phantom lines K of Figs. 12 and 12A.

Please now refer to Figs. 13 and 13A. When an external impact force (or shear force) is applied to the assembly 100, the shell body 10, the elastic structure body 20, the filling body 30, the elastic carrier body 40 and the elastic column 70 are cooperatively elastically deformed and rotationally deformed to different extents. These components can decrease the rotational acceleration of the external impact force and respond to the linear deformation pattern of the shear force as well as together bear the external impact force to provide a cushioning and shock absorption effect. Accordingly, the external impact force is universally (or multidirectionally) distributively transmitted to the filling body 30 and/or the entire assembly 100. Accordingly, the acceleration and rotational torque caused by the external impact force are cushioned, absorbed and decreased.

[0049] After the external impact force disappears, due to the elastic deformation property of the filling body 30 (and/or the elastic structure body 20) and the elastic carrier body 40 and the elastic column 70, the components of the assembly 100 are restored to their home positions. For example, the components of the assembly 100 are restored to their home positions as shown by the phantom lines K of Figs. 13 and 13A.

[0050] Please now refer to Figs. 14 and 14A. When a greater external impact force (or shear force) is applied

to the assembly 100, the shell body 10, the elastic structure body 20, the filling body 30, the elastic carrier body 40 and the elastic column 70 are cooperatively elastically deformed and rotationally deformed to different extents.

These components can decrease the rotational acceleration of the external impact force and respond to the linear deformation pattern of the shear force as well as together bear the external impact force to provide a cushioning and shock absorption effect. Accordingly, the external impact force is universally (or multidirectionally) distributively transmitted to the filling body 30 and/or the entire assembly 100. Accordingly, the acceleration and rotational torque caused by the external impact force are cushioned, absorbed and decreased.

[0051] It should be noted that the elastic carrier body 40 (and/or the elastic column 70) enclose the wearer's head in accordance with different head configurations or the arched faces of the wearer's head. This establishes the following effects:

1. The well-shaped structure sections 45 of the elastic carrier body 40 in the form of cellular structure enclose the wearer's head in accordance with different head configurations or the arched faces of the wearer's head. Therefore, every continuously arranged lower wall 48 can be flexibly deformed to different extents by different amounts to contact the head H. In this case, the elastic carrier body 40 can truly fully enclose and snugly attach to the wearer's head H. In contrast, the conventional helmet can hardly truly fully attach to the wearer's head. The fastening straps of the helmet are adjusted and tightened or loosened. This will affect the protection and security provided by the helmet for the wearer. The present invention minimizes the problem of the conventional helmet.

2. The well-shaped structure sections 45 of the elastic carrier body 40 in the form of cellular structure provide supports for the elastic columns 70. Accordingly, when the elastic columns 70 respond to a greater external impact action force (or shear force), the elastic columns 70 are flexibly deformed and/or rotationally deformed by larger amount. (Alternatively, a breakage point is formed between the connection face 74 of the elastic column with larger cross-sectional width and the upper wall 47 of the well-shaped structure section 45 with smaller cross-sectional width). The shell body 10 and the elastic structure body 20 are cooperatively relatively moved (such as linearly moved or rotated) within the assembly 100 to cushion and absorb most of the external impact force and decrease the acceleration and action force caused by the shear force or rotational torque. Moreover, the external impact force is universally (or multidirectionally) distributively transmitted to the filling body 30 and/or the entire assembly 100. Accordingly, the external impact force is hin-

dered from being transmitted to the wearer's head H so that a full protection effect is achieved. In addition, due to the elastic restoring property of the elastic structure body 20 (and/or the filling body 30) and the elastic carrier body 40 and the elastic column 70, when these components elastically restore to their home positions, these components further cushion and absorb the external impact force and speed.

To speak representatively, in comparison with the conventional helmet, the universal anti-collision structure of safety helmet of the present invention has the following advantages:

1. The assembling structures of the shell body 10, the filling body 30 and the elastic carrier body 40 have been redesigned. For example, the elastic carrier body 40 includes multiple walls 49 as a skeleton structure. The walls 49 define multiple well-shaped structure sections 45. Each wall 49 has wing sections 46 protruding toward two sides or a peripheral section of the well-shaped structure section. Accordingly, the well-shaped structure section 45 is defined with a first section 41, a second section 42 and a subsidiary section 43 between the first and second sections 41, 42. The material of the filling body 30 partially at least goes into the first section 41 and/or the subsidiary section 43 of the elastic carrier body 40, whereby the filling body 30 is connected with the elastic carrier body 40 to form an integrated structure. This is obviously different from the structural form of the conventional safety helmet.

2. The elastic carrier body 40 (is assembled with the filling body 30) to form a structural form and achieve such a material property that when the elastic carrier body 40 responds to an external impact force (such as normal force or shear force), the elastic carrier body 40 is elastically deformed and/or rotationally deformed so as to cushion and absorb the external impact force and speed. Moreover, the filling body 30 is connected with the first sections 41 and/or the subsidiary section 43 of the elastic carrier body 40 to form such a structure that the lower wall 48 of the second section 42 becomes an elastic section. The elastic section can be flexibly deformed to different extents in accordance with different sizes of the wearer's head, the head configurations or the arched faces of the wearer's head. Therefore, it is easy for the elastic section to fully elastically contact (or attach to) the wearer's head H to achieve more ideal protection and security effect than the conventional helmet. Alternatively, an air chamber structure is set up between the well-shaped structure section 45 (or the second section 42) and the wearer's head H. The air chamber structure helps the assembly 100 in cushioning and absorbing the external impact force

and enhances the comfortableness of the wearer's head H. Also, the air chamber structure makes the wearer's head H more fully enclosed and enhances the snugness of the attachment (or the attachment area). This obviously improves the shortcoming of the troublesome manufacturing process of the conventional helmet that it is necessary additionally assemble the thin layer of lining and it is impossible to effectively fully enclose the wearer's head H and enhance the comfortableness of the wearer's head H.

3. The well-shaped structure section 45 (or the upper wall 47) of the elastic carrier body 40 is formed with an elastic column 70. After the elastic column 70 passes through the filling body 30 (and/or the elastic structure body 20), the contact face 73 connects with the inner face 11 of the shell body 10 to set up an air chamber structure. When responding to the external impact force, the elastic column 70 can be flexibly deformed and/or rotationally deformed to help the assembly 100 to cushion and absorb the external impact force.

4. Furthermore, the shell body 10 is connected with the filling body 30 (or the elastic structure body 20 and the subsidiary shell body 50) and the elastic carrier body 40 to form a texture, the structural strength of which is obviously enhanced. In structural form, the manufacturing process of the safety helmet of the present invention is simplified. Also, the safety helmet is designed with a lightweight and thinned structural form to provide a more ideal protection and multidirectional cushioning effect. In addition, the safety helmet of the present invention changes the transmission and distribution pattern of the external impact force.

[0052] In conclusion, the universal anti-collision structure of safety helmet of the present invention is effective and different from the conventional safety helmet in space form. The multilayered floatable universal shock absorption structure of safety helmet of the present invention is inventive, greatly advanced and advantageous over the conventional safety helmet.

[0053] The above embodiments are only used to illustrate the present invention, not intended to limit the scope thereof. Many modifications of the above embodiments can be made without departing from the spirit of the present invention.

Claims

1. A universal anti-collision structure of safety helmet, comprising a shell body (10), a filling body (30) enclosed in the shell body (10) and an elastic carrier body (40) enclosed in the shell body (10), **characterized in** the shell body (10), the filling body (30)

and the elastic carrier body (40) being assembled with each other, the elastic carrier body (40) having multiple walls (49) as a skeleton structure, the walls (49) defining multiple well-shaped structure sections (45) with a geometrical configuration, protruding wing sections (46) being formed on a peripheral section of each well-shaped structure section (45), whereby the well-shaped structure section (45) is defined with a first section (41), a second section (42) and a subsidiary section (43) connected between the first and second sections (41, 42), the wall (49) being defined with an upper wall (47) and a lower wall (48) corresponding to the first and second sections (41, 42), the filling body (30) being bonded with the shell body (10) and the elastic carrier body (40) to together form an integrated assembly (100).

2. The universal anti-collision structure of safety helmet as claimed in claim 1, wherein the shell body (10) has an inner face (11) and an outer face (12), a protection layer (60) being disposed on the outer face (12), the inner face (11) contacting the filling body (30), the elastic carrier body (40) being disposed in an innermost position of the assembly (100) as an innermost layer, the elastic carrier body (40) being connected with a lower section (31) of the filling body (30), the lower section (31) of the filling body (30) being positioned in a position distal from the inner face (11) of the shell body (10), the well-shaped structure sections (45) of the elastic carrier body (40) forming a cellular structure with a hexagonal configuration, the cross section of at least one of the first and second sections (41, 42) being larger than the cross section of the subsidiary section (43).
3. The universal anti-collision structure of safety helmet as claimed in claim 1 or 2, wherein the wall (49) and the wing sections (46) positioned on two sides of the wall (49) together form a structure with a "+++"-shaped cross section, the material of the filling body (30) partially going to at least one of the first section (41) and the subsidiary section (43) of the elastic carrier body (40) to connect with at least one of the first section (41), the subsidiary section (43), the wing sections (46) and the wall (49), the lower wall (48) of the second section (42) forming an elastic section, whereby an air chamber structure is set up between the second section (42) of the well-shaped structure section (45) and a wearer's head (H).
4. The universal anti-collision structure of safety helmet as claimed in claim 1 or 2, wherein the elastic carrier body (40) includes a frame body (44) formed on the bottom section of the elastic carrier body (40), the frame body (44) extending toward an outer side of the elastic carrier body (40) to form a structure with a U-shaped cross section, the frame body (44) serving to enclose and connect with the shell body (10)

and the filling body (30), the density of the filling body (30) in the elastic carrier body (40) being smaller than the density of the filling body (30) outside the elastic carrier body (40).

5. The universal anti-collision structure of safety helmet as claimed in claim 3, wherein the elastic carrier body (40) includes a frame body (44) formed on the bottom section of the elastic carrier body (40), the frame body (44) extending toward an outer side of the elastic carrier body (40) to form a structure with a U-shaped cross section, the frame body (44) serving to enclose and connect with the shell body (10) and the filling body (30), the material of the filling body (30) being partially filled up in the first section (41) and the subsidiary section (43) to connect with the upper wall (47) and wing sections (46), the density of the filling body (30) in the first section (41) and the subsidiary section (43) of the elastic carrier body (40) being smaller than the density of the filling body (30) outside the elastic carrier body (40).
6. The universal anti-collision structure of safety helmet as claimed in any of claims 1 to 5, wherein at least one of an elastic structure body (20) and a subsidiary shell body (50) is disposed between the shell body (10) and the filling body (30).
7. The universal anti-collision structure of safety helmet as claimed in claim 6, wherein the elasticity ratio of the elastic structure body (20) is larger than the elasticity ratio of the filling body (30), the elastic structure body (20) being defined with an upper section (21) and a lower section (22), the upper and lower sections (21, 22) of the elastic structure body (20) being respectively formed with multiple assembling sections (23), the assembling sections (23) of the elastic structure body (20) being formed with grooves (24), the grooves (24) defining the assembling sections (23) to have a hexagonal configuration, whereby the assembling sections (23) are adjacent to each other to form a cellular structure, the subsidiary shell body (50) having an inner face (51) and an outer face (52), the filling body (30) being connected with the inner face (51) of the subsidiary shell body (50), the inner face (11) of the shell body (10) and the outer face (52) of the subsidiary shell body (50) respectively connecting with the upper and lower sections (21, 22) of the elastic structure body (20), the inner face (11) of the shell body (10) and the outer face (52) of the subsidiary shell body (50) being respectively formed with multiple pivotal connection sections (13, 53), the pivotal connection sections (13) of the shell body (10) having protruding walls (14), the walls (14) defining the pivotal connection sections (13) of the shell body (10) to have a hexagonal configuration, whereby the pivotal connection sections (13) of the shell body (10) are adjacent to each other to form a

cellular structure correspondingly assembled with the assembling sections (23) of the upper section (21) of the elastic structure body (20), the pivotal connection sections (53) of the subsidiary shell body (50) having protruding walls (54), the walls (54) defining the pivotal connection sections (53) of the subsidiary shell body (50) to have a hexagonal configuration, whereby the pivotal connection sections (53) of the subsidiary shell body (50) are adjacent to each other to form a cellular structure correspondingly assembled with the assembling sections (23) of the lower section (22) of the elastic structure body (20), the elastic structure body (20) having holes (25) formed on the assembling sections (23) and passing through the elastic structure body (20).

8. The universal anti-collision structure of safety helmet as claimed in any of claims 1 to 7, wherein the first section (41) of the well-shaped structure section (45) is formed with an elastic column (70), the elastic column (70) including a connection end (71) connected with the upper wall (47) and a free end (72) extending toward the shell body (10), the free end (72) having a contact face (73), the contact face (73) being a concaved face, a connection face (74) being formed between the connection end (71) and the upper wall (47), the width of the cross section of the elastic column (70) being larger than the thickness of the upper wall (47), an air chamber structure being set up between the contact face (73) of the free end (72) and the inner face (11) of the shell body (10).
9. The universal anti-collision structure of safety helmet as claimed in claim 7, wherein the first section (41) of the well-shaped structure section (45) is formed with an elastic column (70), the elastic column (70) including a connection end (71) connected with the upper wall (47) and a free end (72) extending toward the shell body (10), the free end (72) having a contact face (73), the contact face (73) being a concaved face, the width of the cross section of the elastic column (70) being larger than the thickness of the upper wall (47), an air chamber structure being set up between the contact face (73) of the free end (72) and the inner face (11) of the shell body (10).

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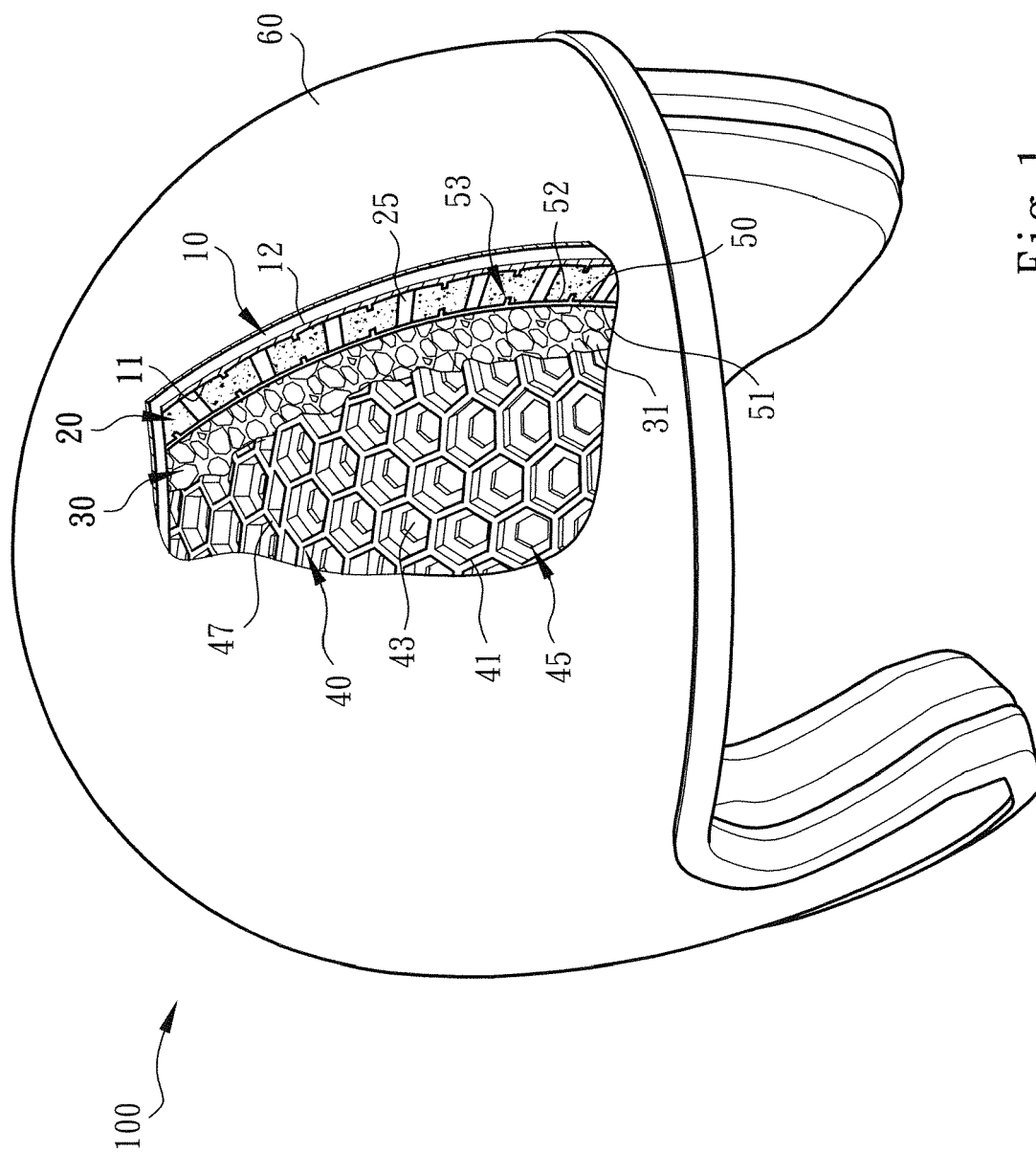


Fig. 1

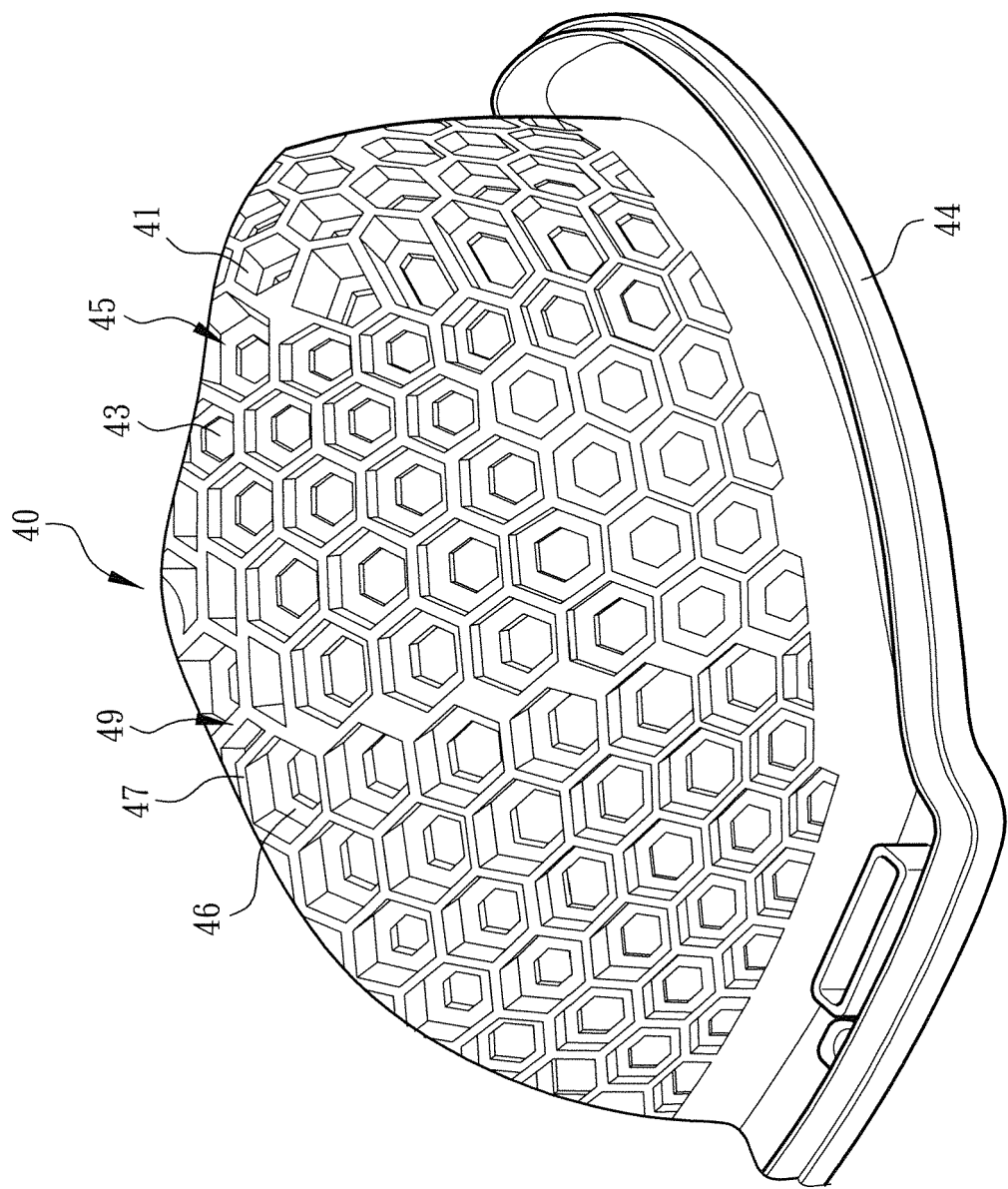


Fig. 2

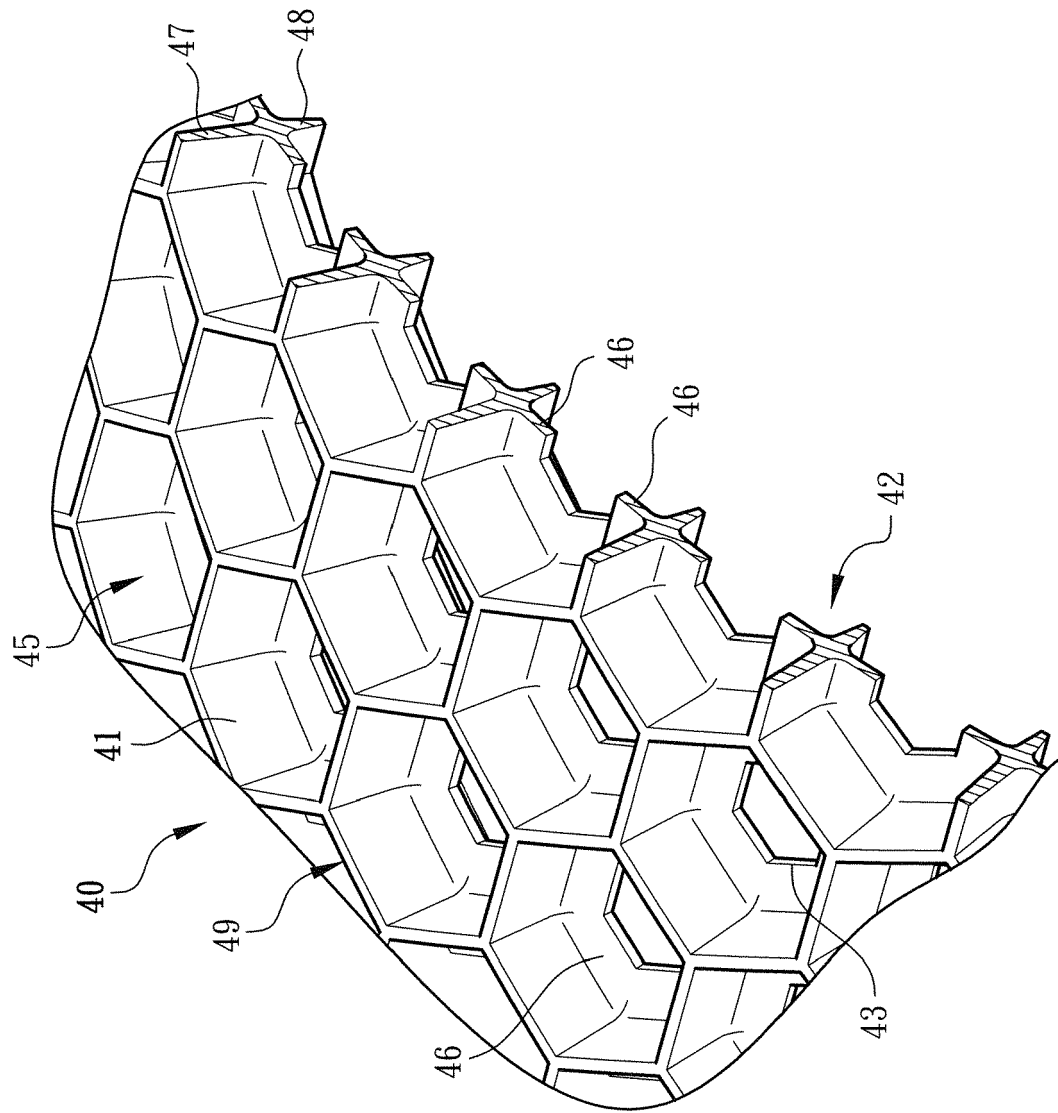


Fig. 3

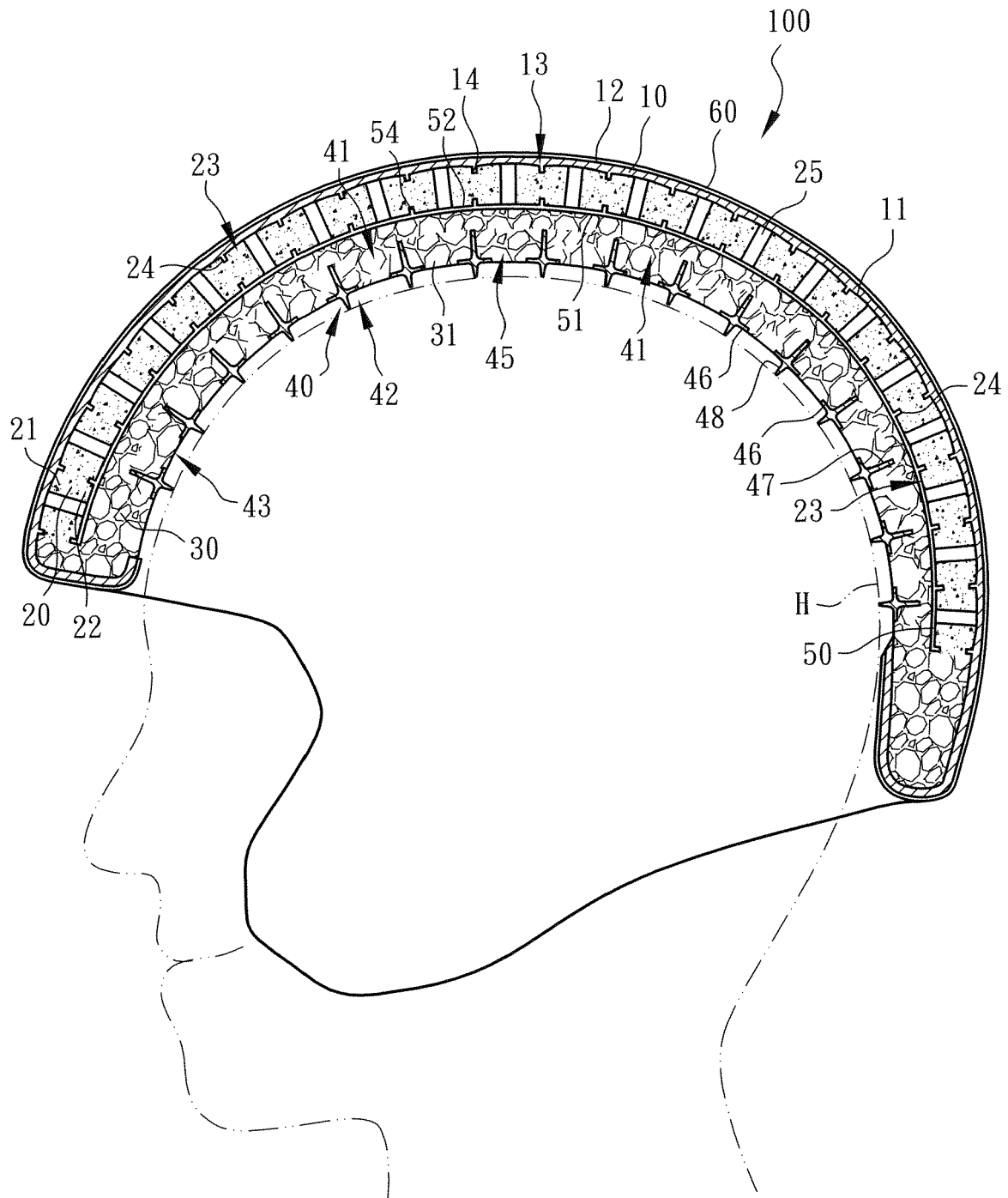


Fig. 4

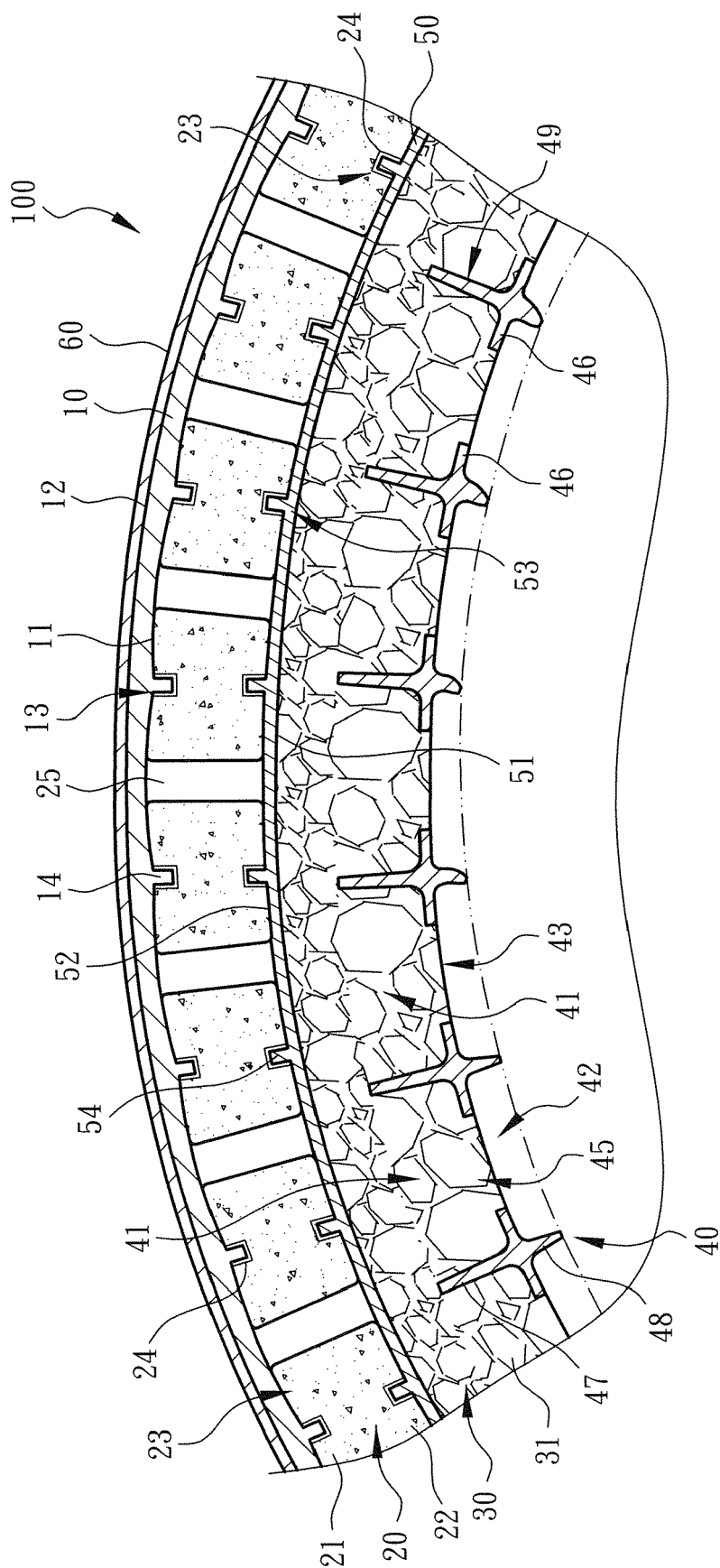


Fig. 5

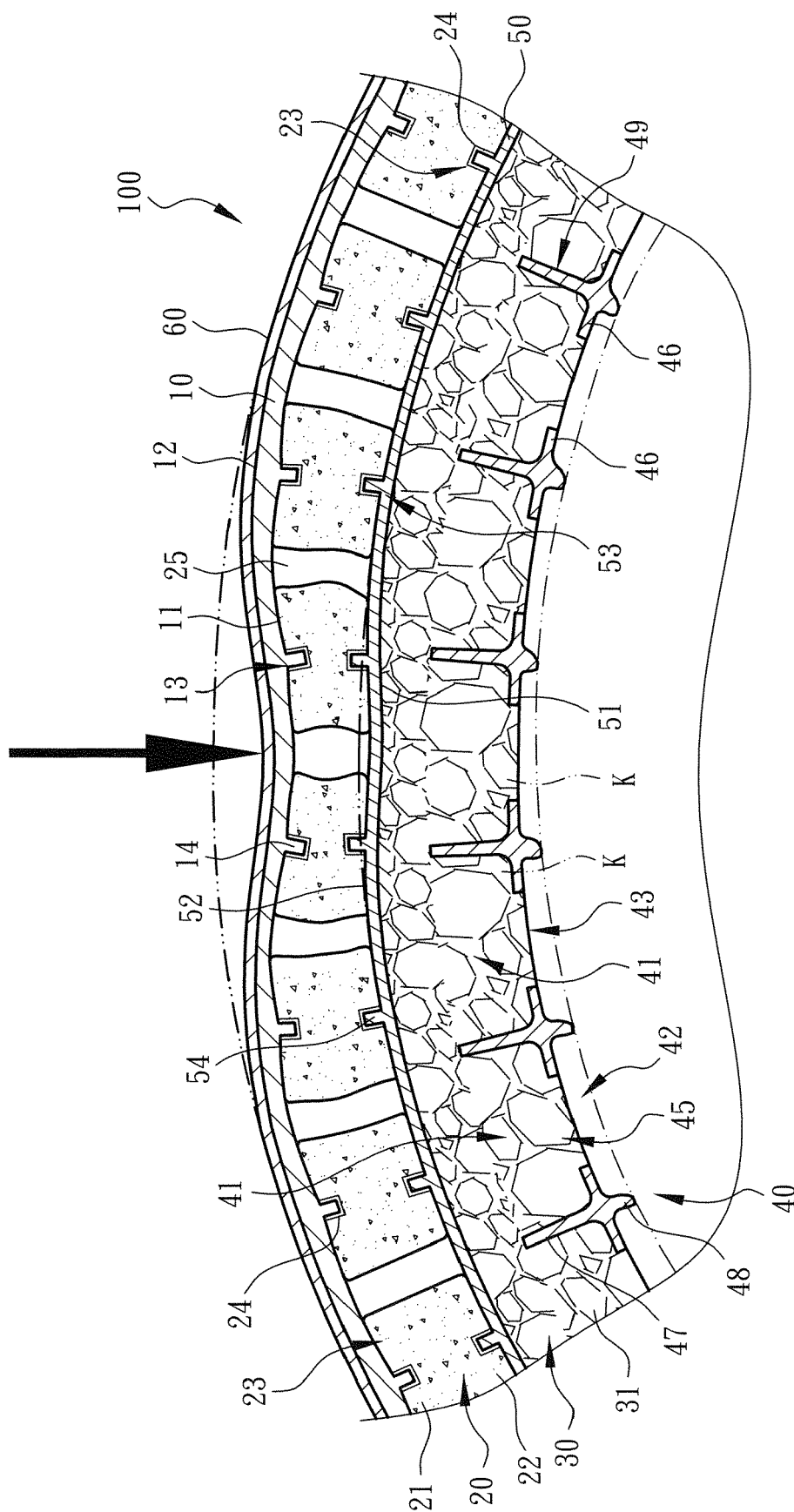


Fig. 6

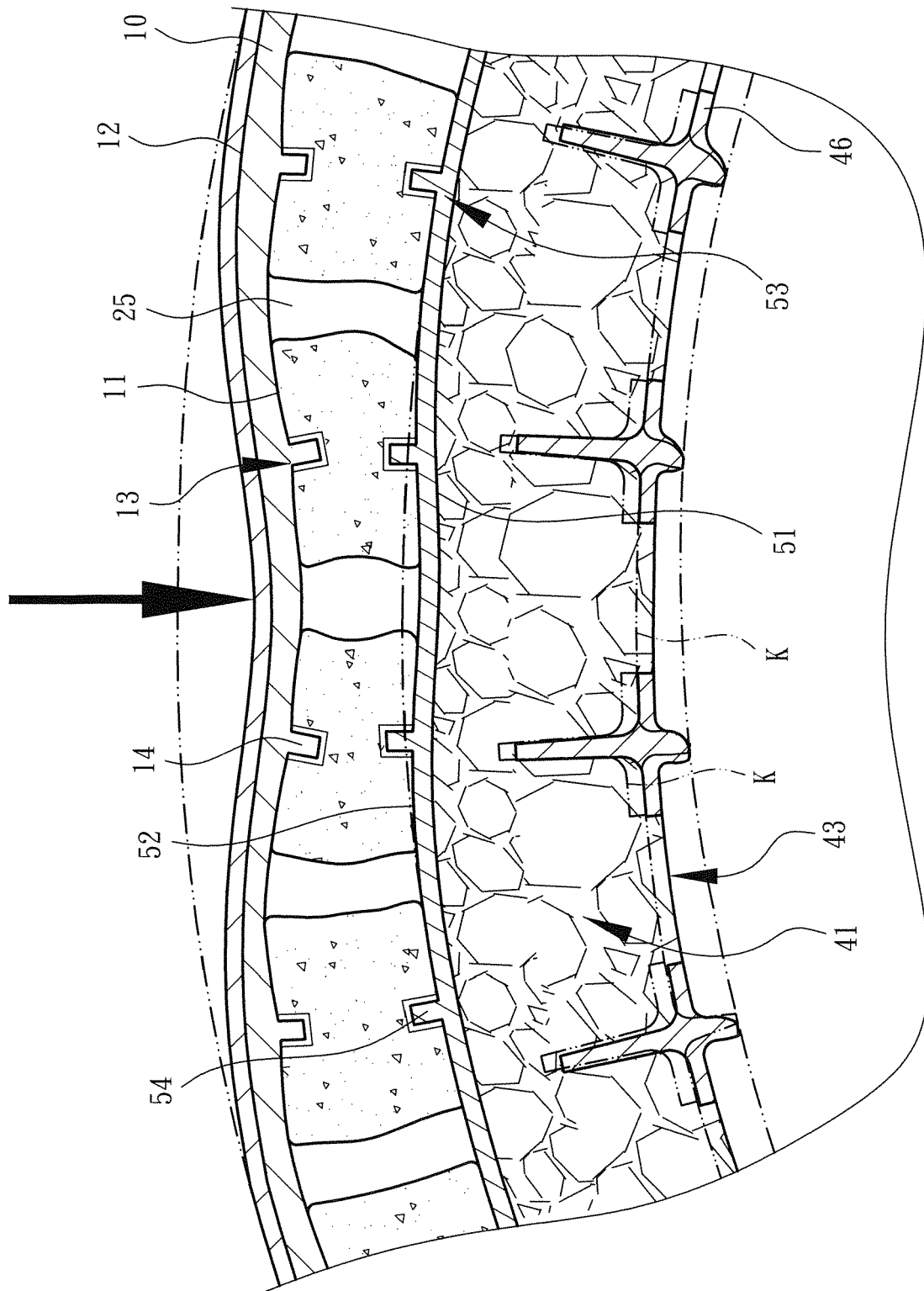


Fig. 6A

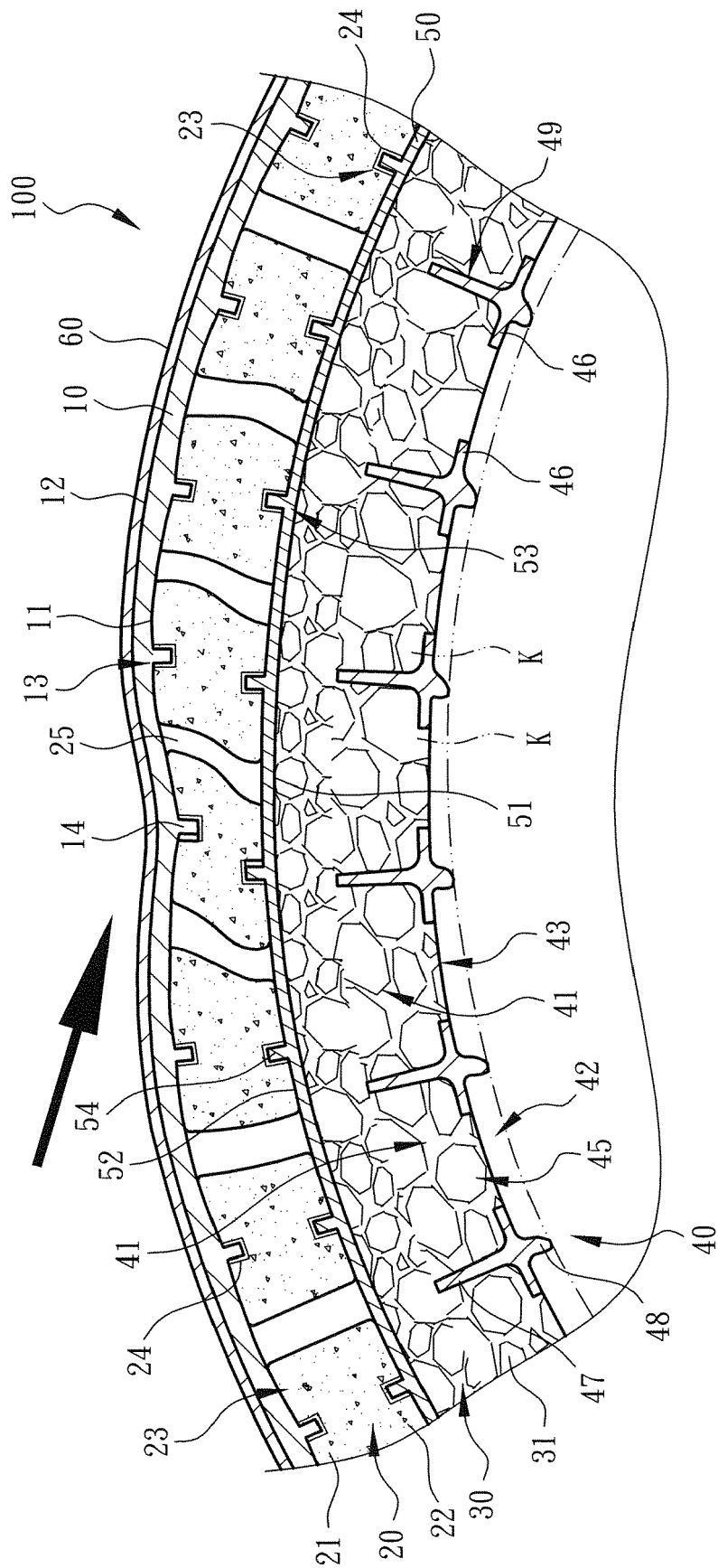


Fig. 7

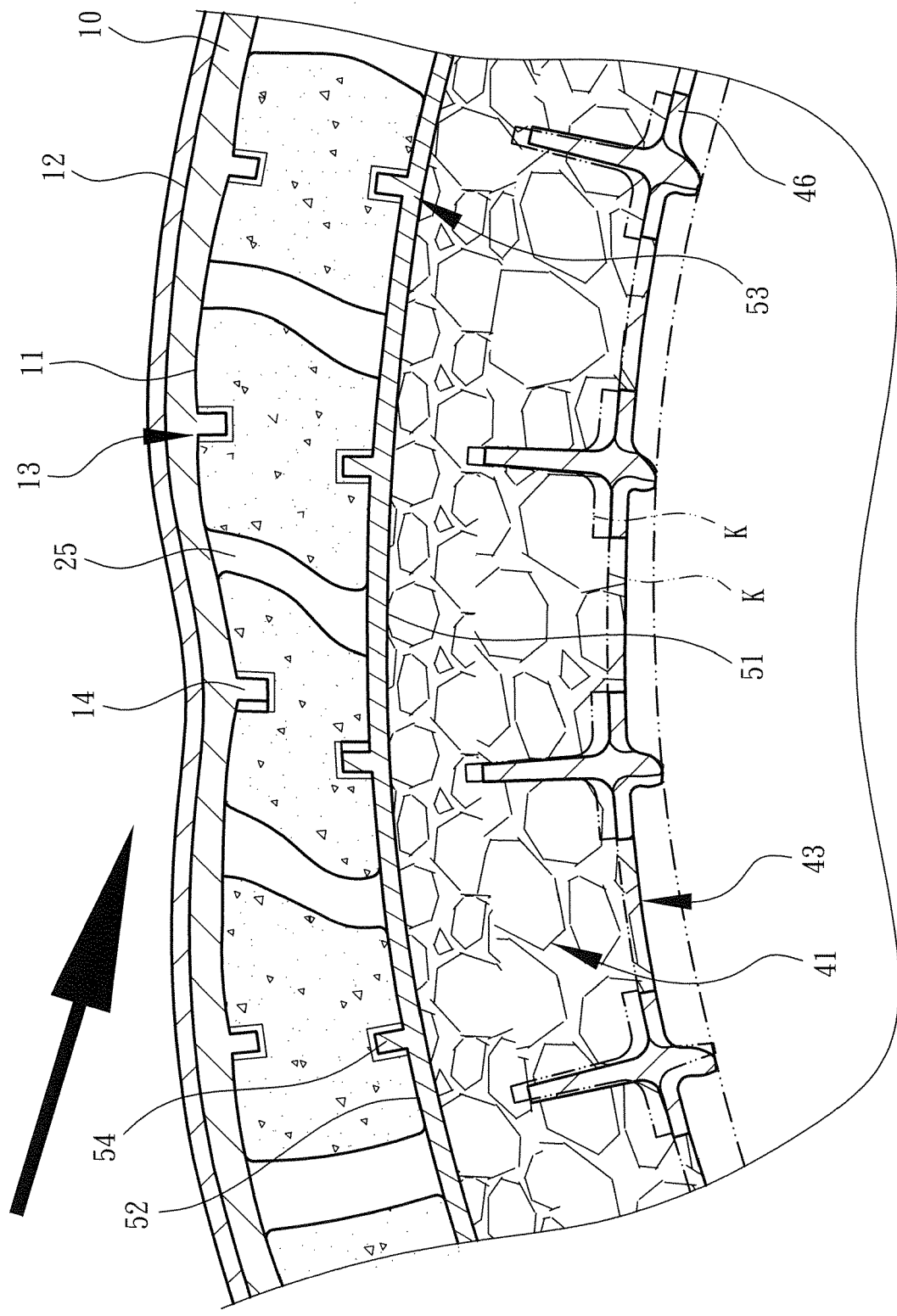


Fig. 7A

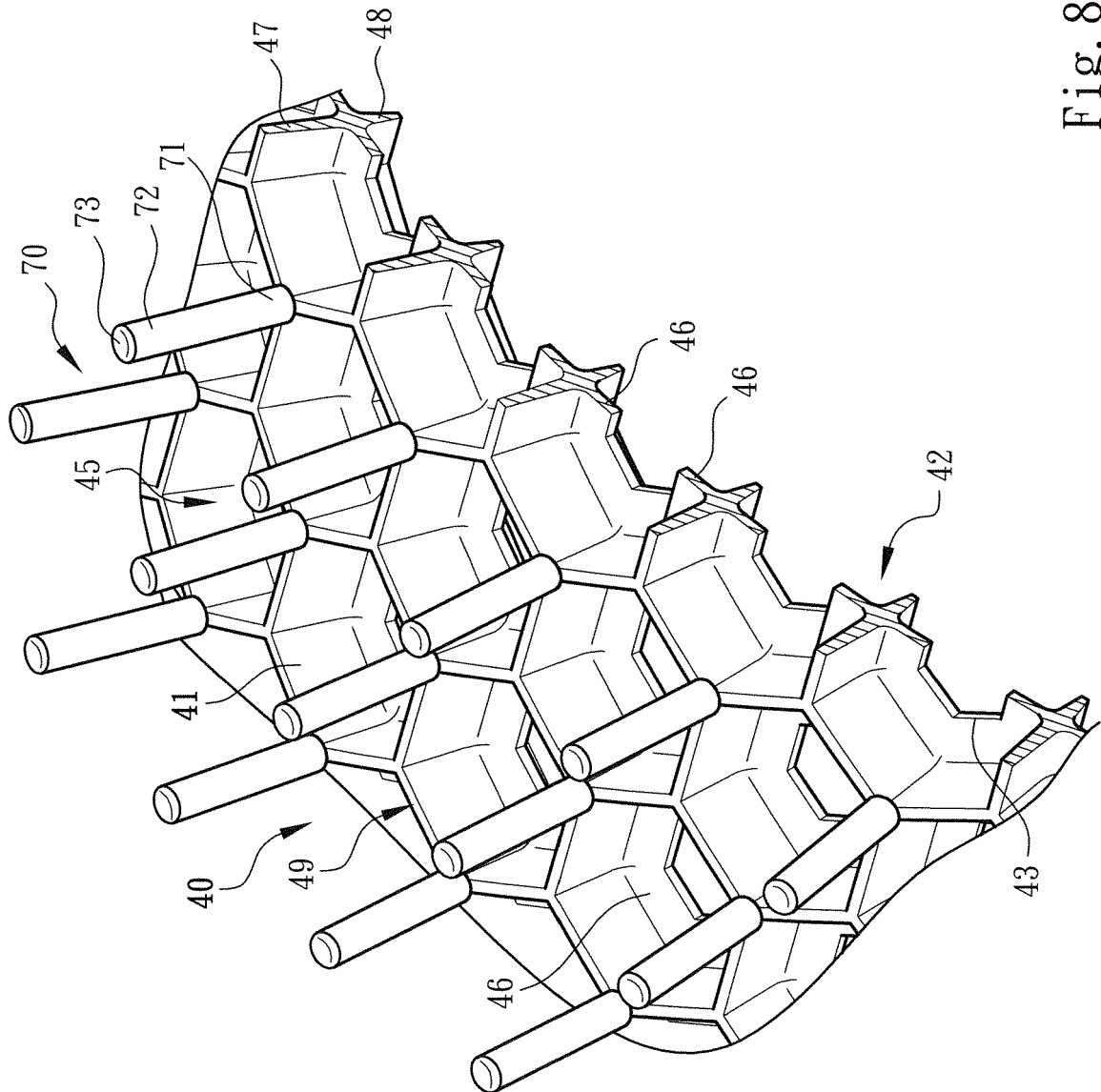


Fig. 8

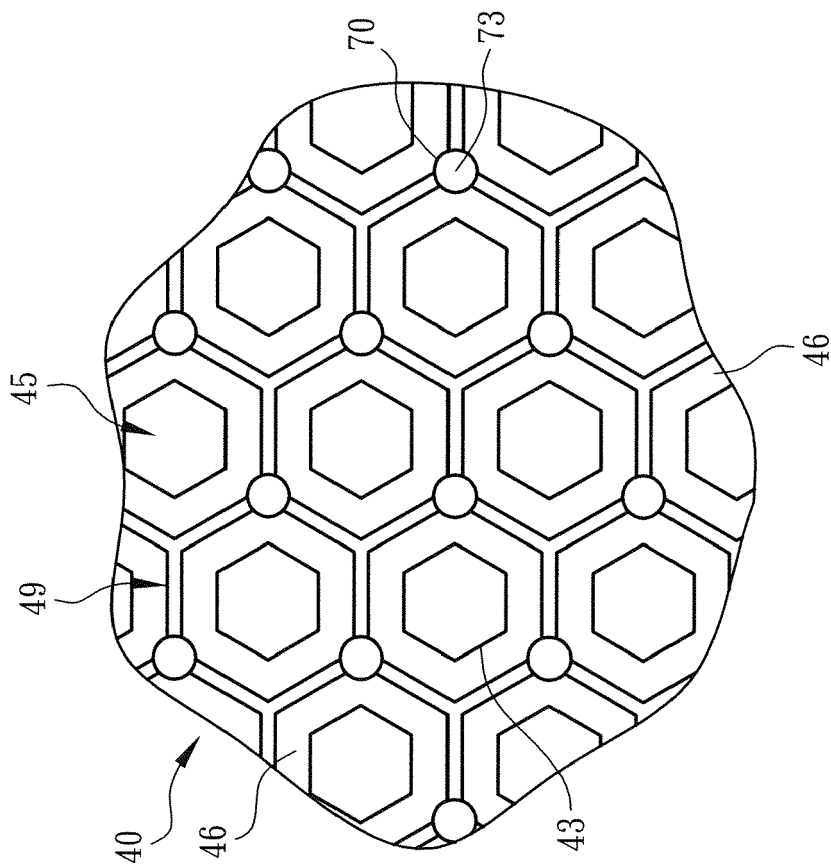


Fig. 9

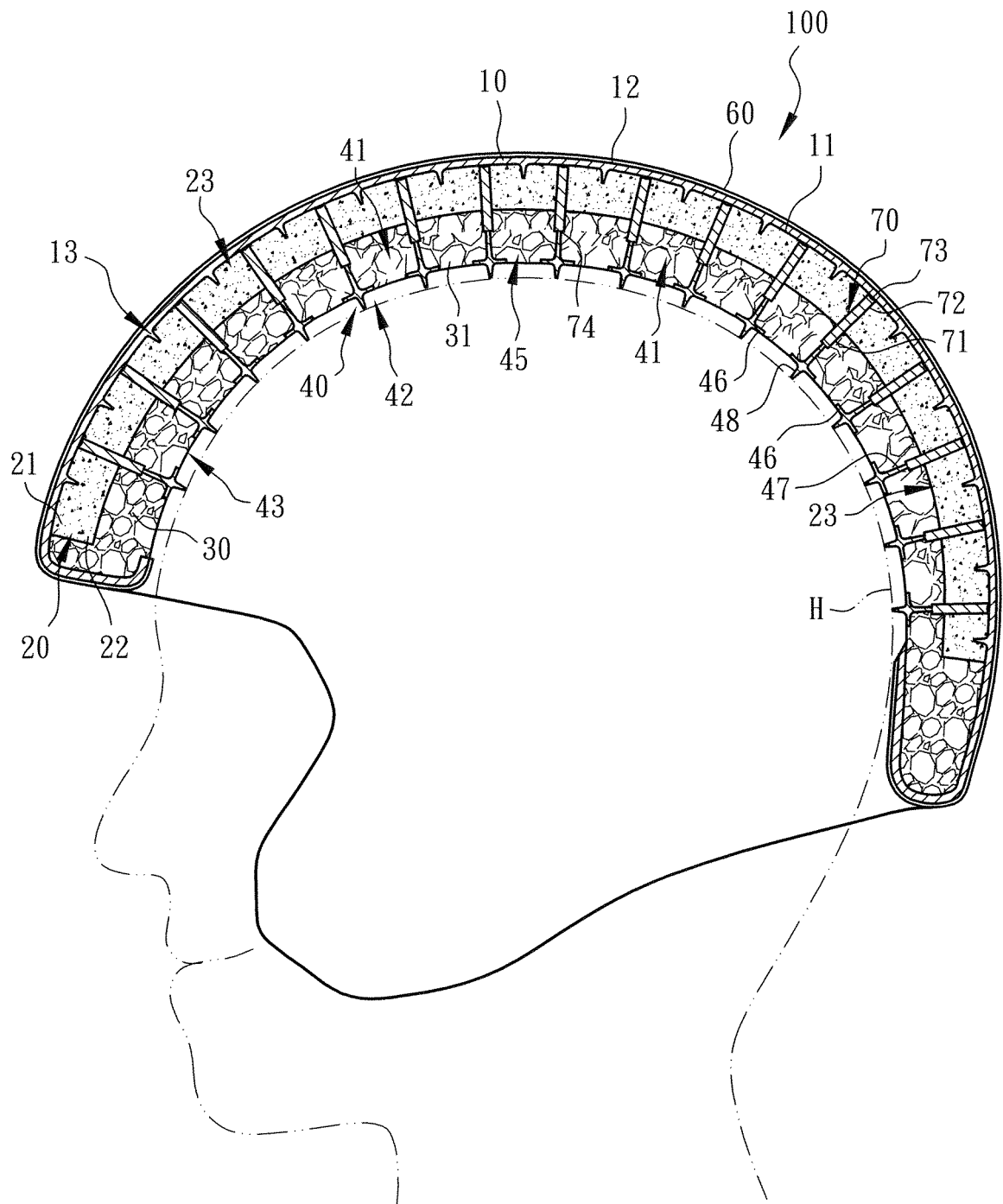


Fig. 10

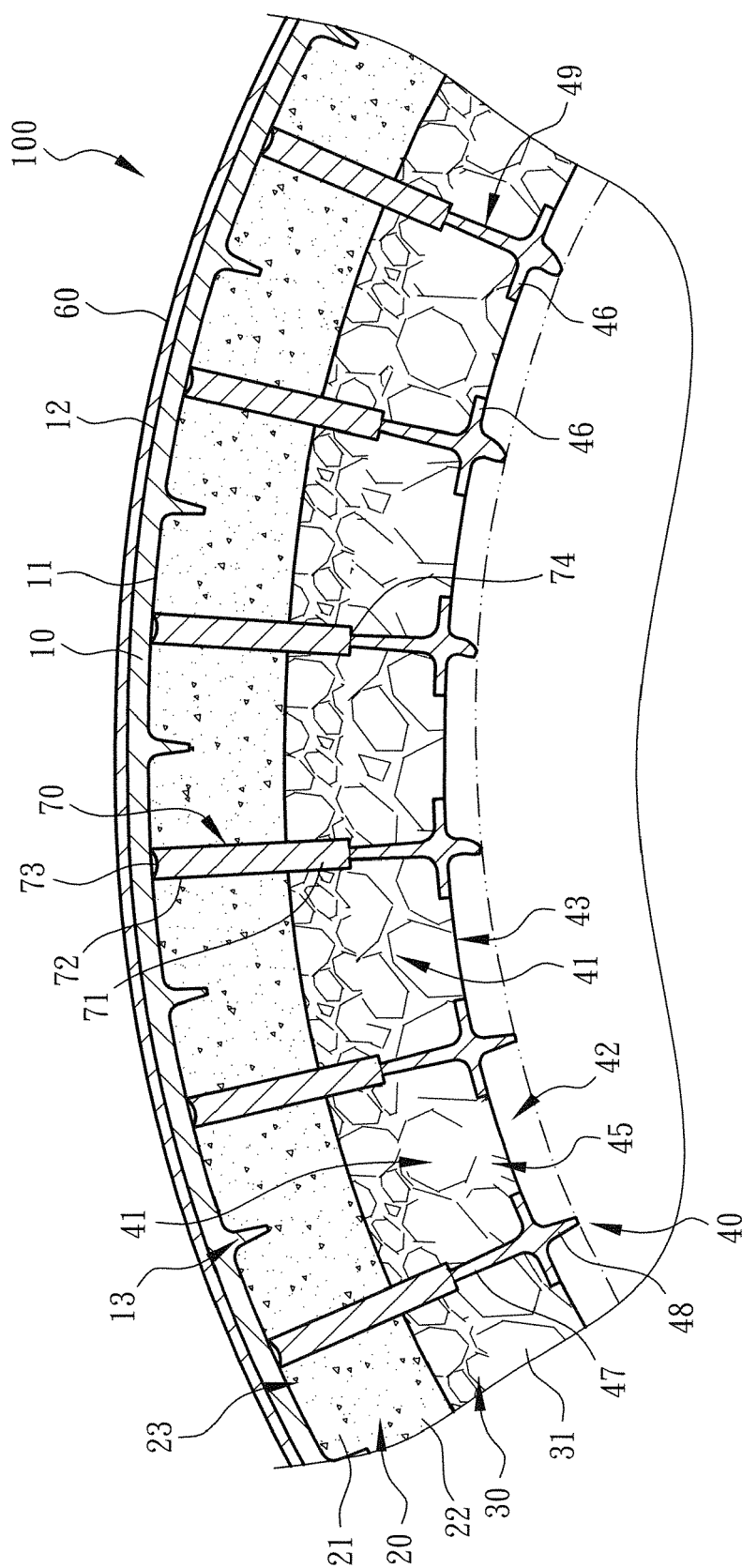


Fig. 11

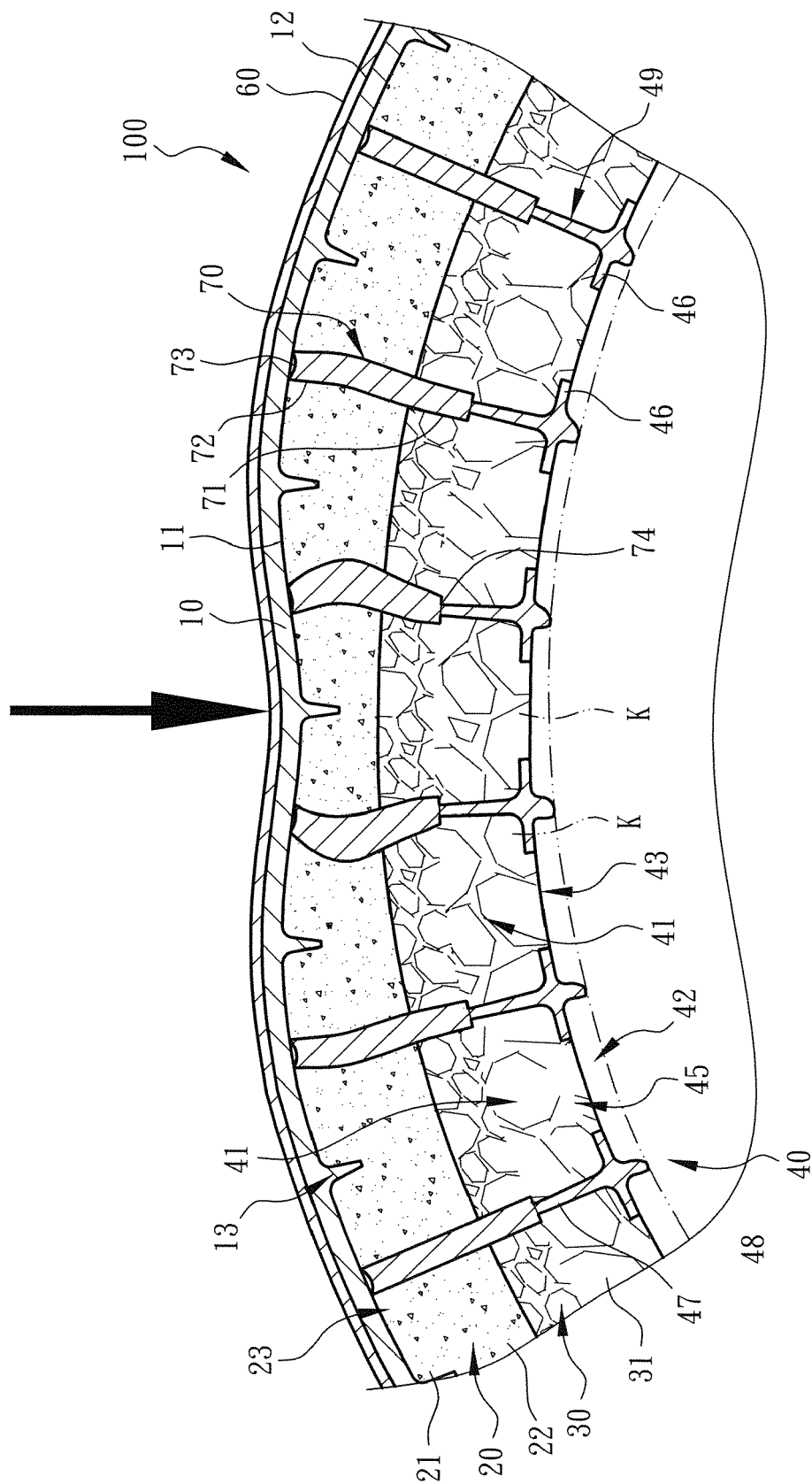


Fig. 12

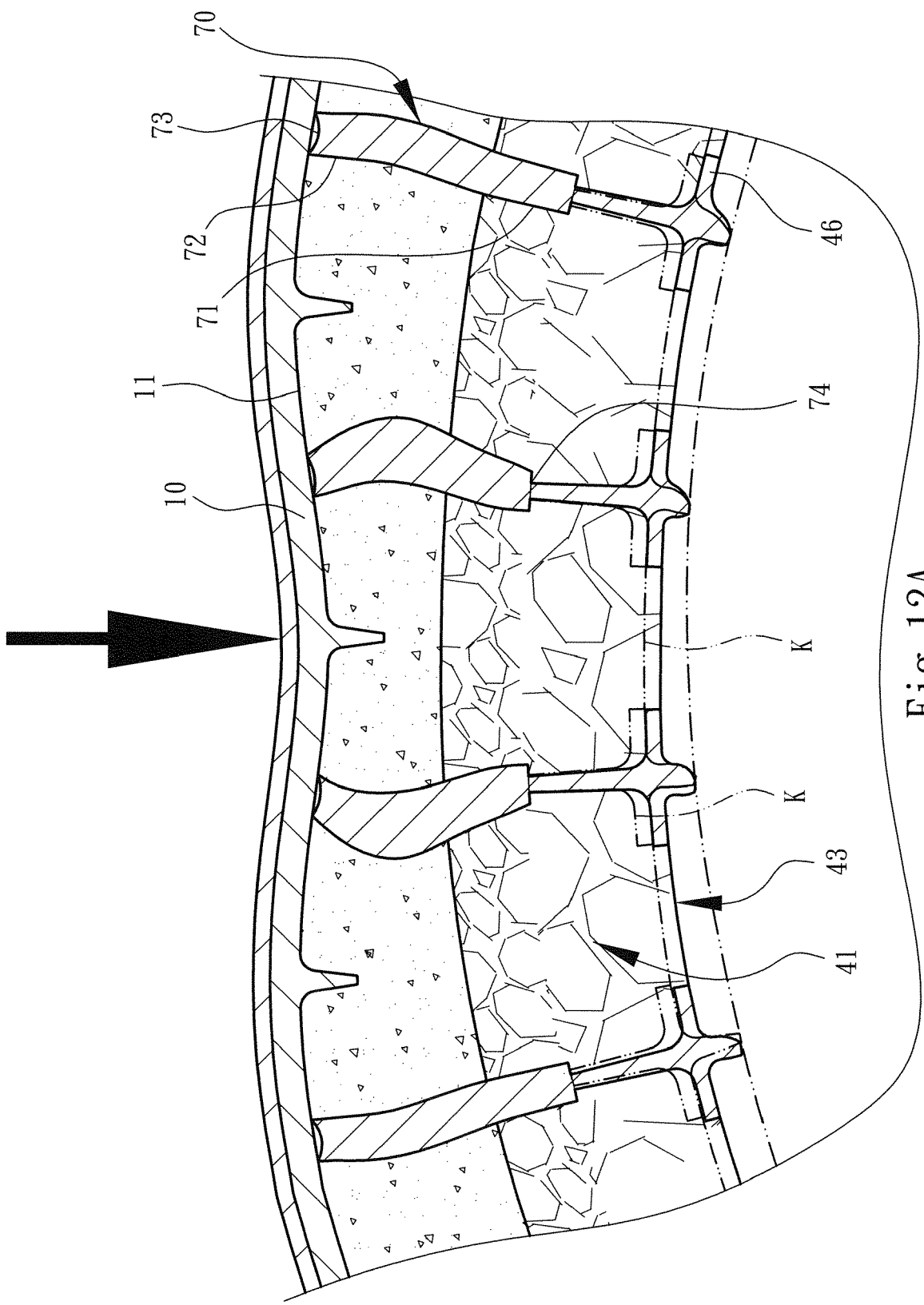


Fig. 12A

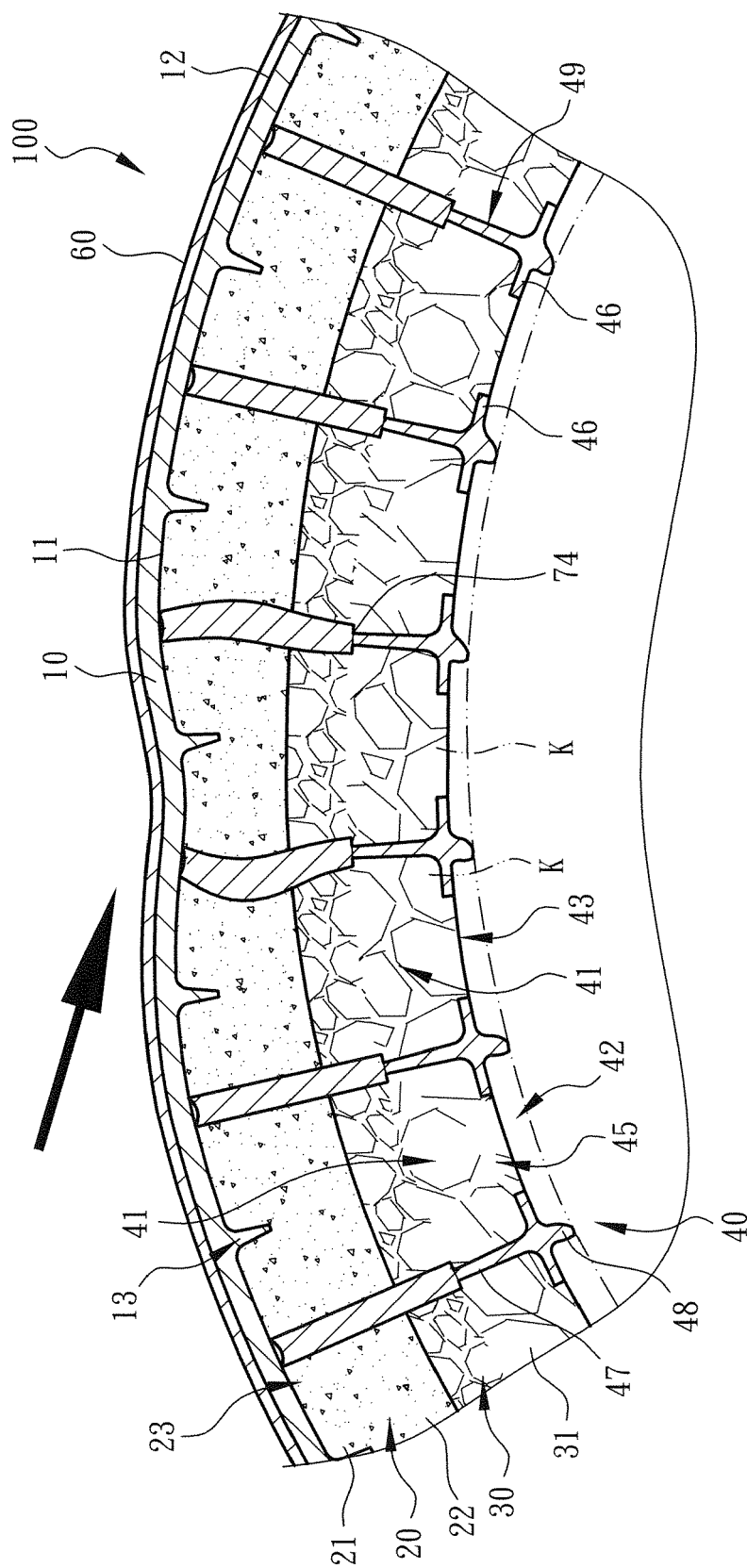


Fig. 13

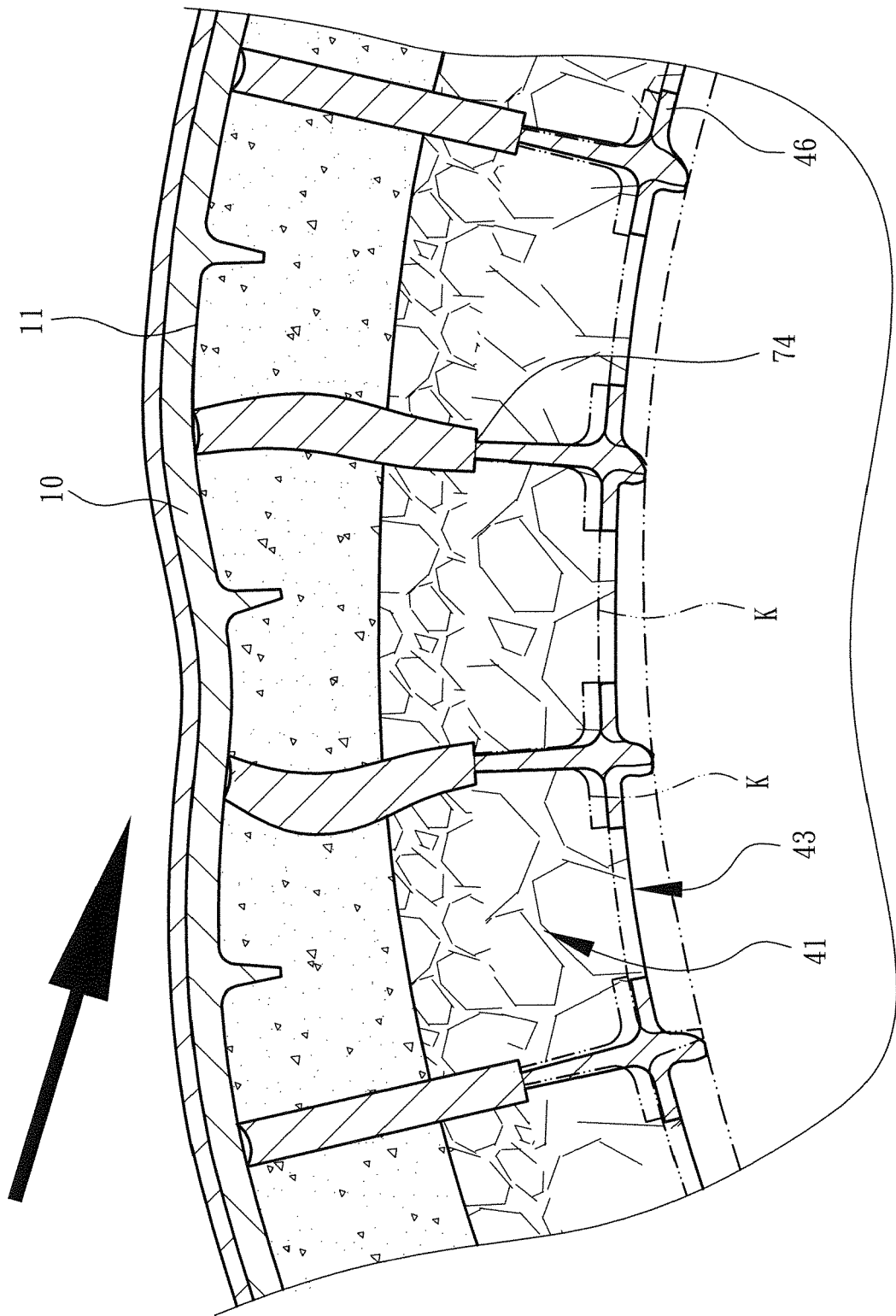


Fig. 13A

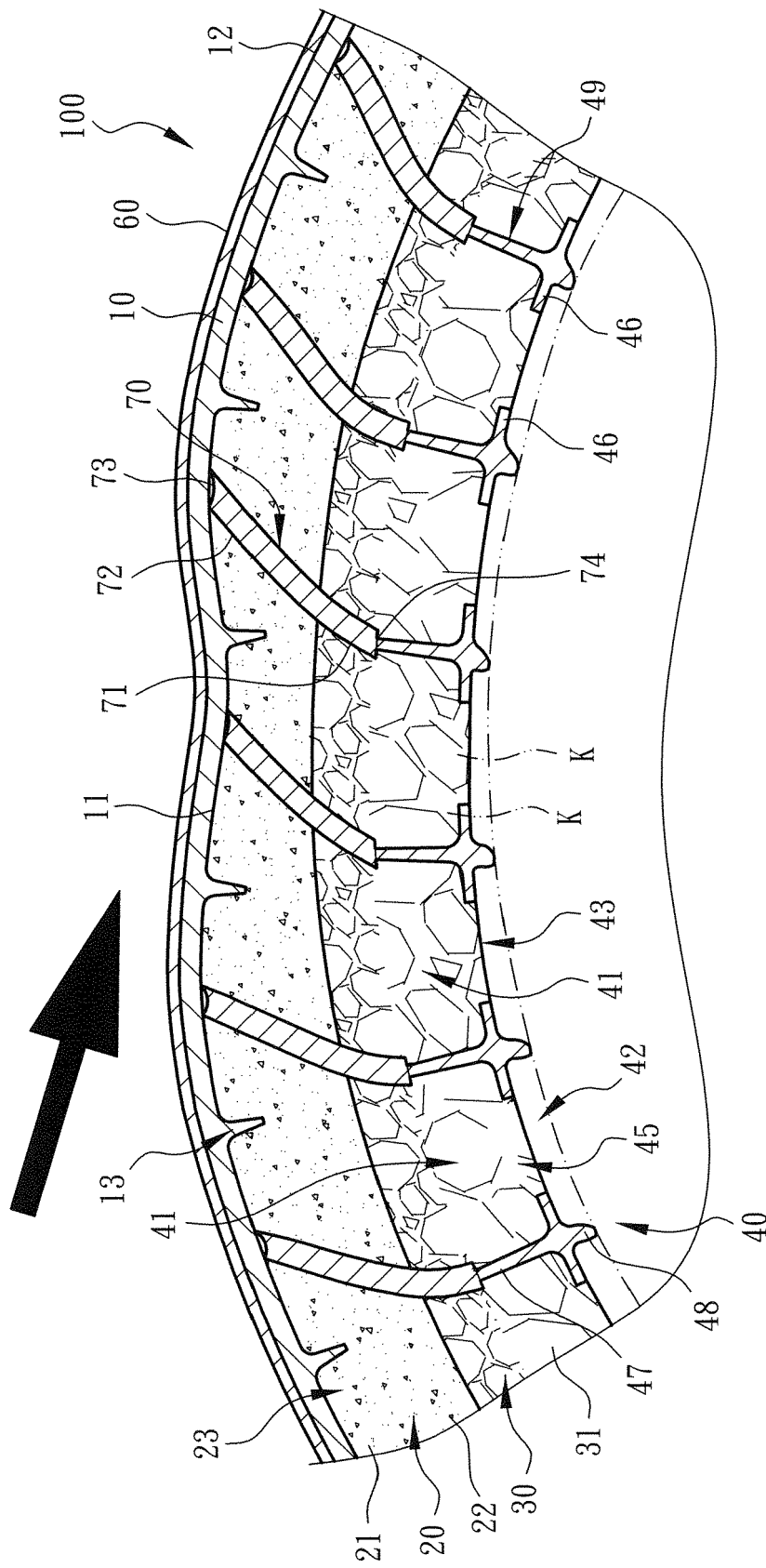


Fig. 14

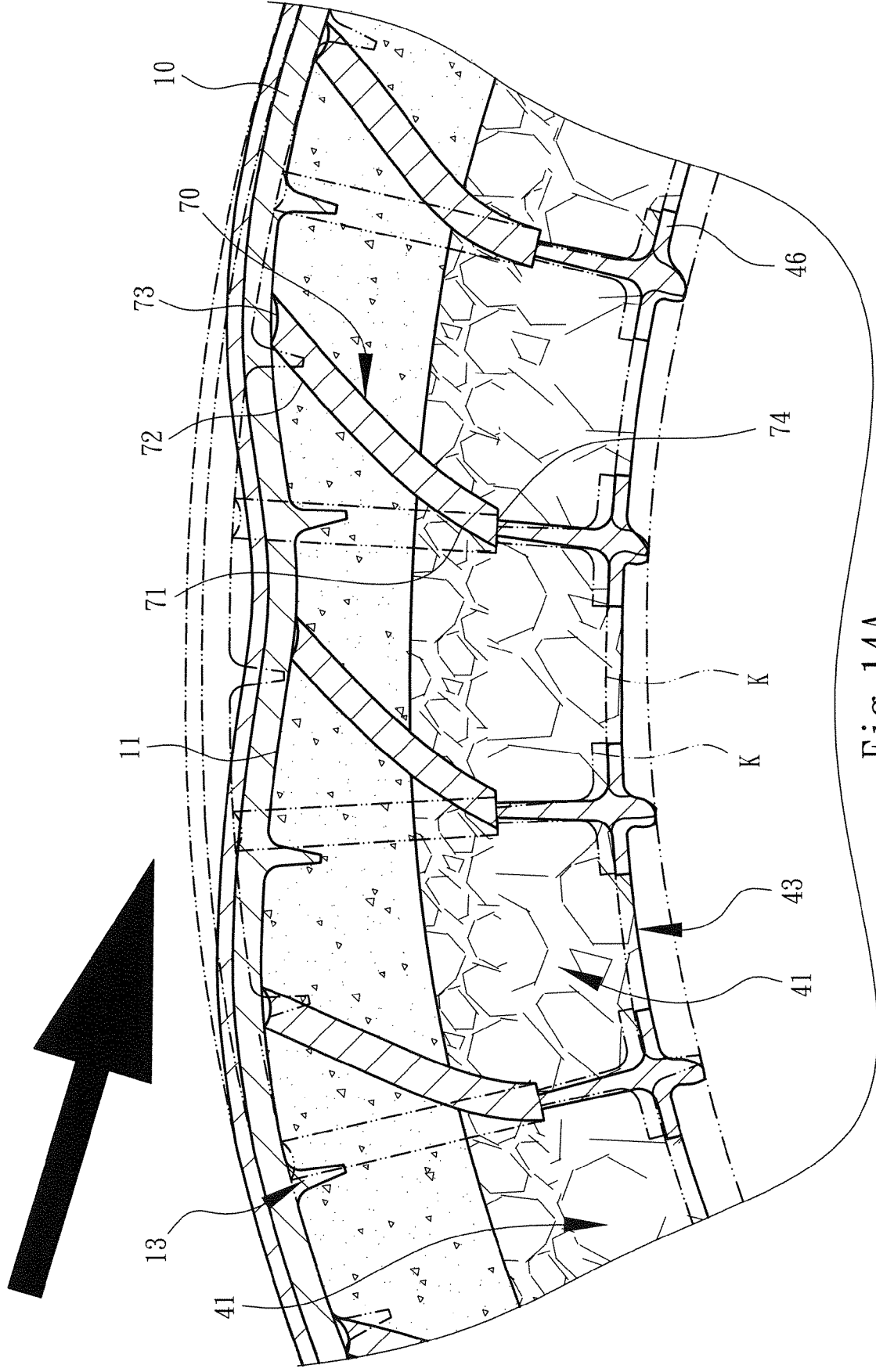


Fig. 14A



EUROPEAN SEARCH REPORT

 Application Number
 EP 17 17 6840

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A	US 9 173 445 B1 (WHITCOMB JOHN E [US]) 3 November 2015 (2015-11-03)	1-9	
	* column 4, lines 26-58; figure 1 *		

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 15 December 2017	Examiner D'Souza, Jennifer
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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The members are as contained in the European Patent Office EDP file on
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