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(54) Title: A SEAT SUPPORT STRUCTURE AND A SEAT STRUCTURE INCLUDING THE SEAT SUPPORT STRUCTURE

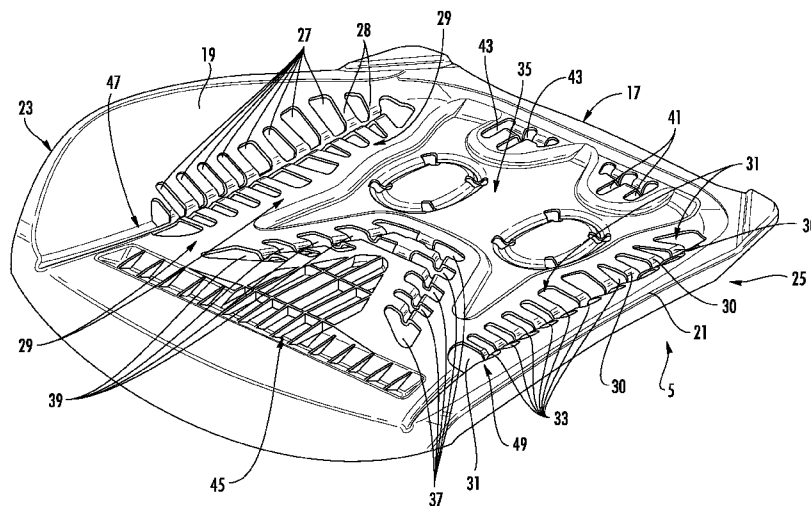


FIG. 3

(57) Abstract: A seat support structure including an elastomeric panel. The elastomeric panel positions and supports a seated occupant. The panel is constrained on a forward side and a rearward side.



A SEAT SUPPORT STRUCTURE AND A SEAT STRUCTURE INCLUDING THE SEAT SUPPORT STRUCTURE

FIELD OF THE INVENTION

[0001] The present invention relates to a seat support structure, and a seat structure that includes the seat support structure.

BACKGROUND OF THE INVENTION

5 **[0001]** Conventional seat support structures (seat cushions) for seats, particularly for seats in a motor vehicle, include foam. The foam used in conventional seat cushions provide for bulky seats that use an excessive amount of foam material, which increases manufacturing costs.

SUMMARY OF THE INVENTION

10 **[0002]** It is an object of the invention to provide a thin seat support structure (seat cushion) that conforms to a contour of an occupant.

[0003] According to the invention, a seat cushion comprises an elastomeric panel. The elastomeric panel positions and supports a seated occupant. The panel is constrained on a forward side and a rearward side of the seat cushion with respect to a traveling direction of a

vehicle.

[0004] The elastomeric panel may be further constrained from an inboard side of the seat cushion and an outboard side of the seat cushion.

[0005] The panel may be made of a thermoplastic elastomer.

5 **[0006]** The seat cushion may further comprise a foam pad.

[0007] The seat cushion may further comprise a trim cover.

[0008] The trim cover may comprise an attachment means for attachment to the elastomeric panel.

10 **[0009]** The elastomeric panel and the attachment means may be unitary (integrally connected to form a one piece elastomeric panel and attachment means structure). The elastomeric panel and the attachment means may be formed of the same material in a single forming operation.

15 **[0010]** The foam pad may comprise an opening and the trim cover attachment means may extend through the opening. The trim cover attachment means may be attached to the elastomeric panel.

[0011] The elastomeric panel may bend when loaded and then may be pulled in tension when a further load is applied.

20 **[0012]** According to the invention, a seat structure comprises an elastomeric panel for supporting a seated occupant, a first elastomeric panel support component and a second elastomeric panel support component. A forward side of the elastomeric panel is supported via the first elastomeric panel support component and a rearward side of the elastomeric panel is supported via the second elastomeric panel support component with respect to a traveling direction of a vehicle.

5 [0013] The seat structure may further comprise a third elastomeric panel support component and a fourth elastomeric panel support component. The elastomeric panel may be supported on a first lateral side via the third elastomeric panel support component and the elastomeric panel may be supported on a second lateral side via the fourth elastomeric panel support component. The first lateral side and the second lateral side may extend parallel to the traveling direction. The rearward side and the forward side may extend perpendicular to the traveling direction. The first elastomeric panel support component and the second elastomeric panel support component may define a longitudinal support structure. The third elastomeric panel support component and the fourth elastomeric panel support component may define a lateral support structure.

15 [0014] The seat structure may further comprise an interconnecting means between the longitudinal support structure and the lateral support structure for allowing movement of the longitudinal support structure with a degree of freedom relative to the lateral support structure. The elastomeric panel may have lateral portions that work in a manner to provide support to an occupant during ingress and egress. One or more of the lateral portions may deflect in a torsional manner about a respective lateral support component and provide support to the occupant. The lateral portions also may provide lateral support to the occupant when the occupant is a seated position.

20 [0015] The elastomeric panel may manage occupant loads based on a principle of a distributed beam. Once the loads exceed that of the occupant the panel may go into tension to limit deflection.

[0016] The elastomeric panel may be a one-piece elastomeric panel structure. The one-piece elastomeric panel structure may comprise a thermoplastic elastomer. The one-piece elastomeric panel structure may be formed entirely of the thermoplastic elastomer.

25 [0017] The seat structure may further comprise a foam pad. The elastomeric panel may comprise a plurality of members for supporting the foam pad. The elastomeric panel may bend when loaded. The elastomeric panel may be in tension when a further load is applied.

[0018] The members may bend when loaded. The members may be in tension when the further load is applied.

[0019] According to the invention, a seat support structure comprises a single, one-piece elastomeric panel for supporting a seated occupant. The single, one-piece elastomeric panel comprises a front region and a rear region. The front region is opposite the rear region with respect to a longitudinal axis of the single, one-piece elastomeric panel. The front region and the rear region define support areas for supporting the single, one-piece elastomeric panel such that the single, one-piece elastomeric panel is constrained in a direction parallel to the longitudinal axis.

[0020] The single, one-piece elastomeric panel may comprise a first lateral portion and a second lateral portion. The first lateral portion and the second lateral portion may extend parallel to the longitudinal axis. The first lateral portion may define a first lateral support region and the second lateral portion may define a second lateral support region. The single, one-piece elastomeric panel may be supported in the first lateral support region and the second lateral support region such that the single, one-piece elastomeric panel is constrained in a direction perpendicular to the longitudinal axis.

[0021] The seat support structure may further comprise a first panel support structure, a second panel support structure, a third panel support structure and a fourth panel support structure. The first panel support structure may be connected to the elastomeric panel in the front region. The front region of the single, one-piece elastomeric panel may be supported via the first panel support structure. The second panel support structure may be connected to the elastomeric panel in the rear region. The rear region of the single, one-piece elastomeric panel may be supported via the second panel support structure. The third panel support structure may be connected to the elastomeric panel in the first lateral support region. The first lateral support region of the single, one-piece elastomeric panel may be supported via the third panel support structure. The fourth panel support structure may be connected to the elastomeric panel in the second lateral support region. The second lateral portion of the single, one-piece elastomeric panel may be supported via the fourth panel support structure.

[0022] The present invention is directed toward a seat support structure. The seat support structure is formed of thermoplastic elastomer (TPE). A total targeted penetration of the seat support structure is greater than 20 mm.

[0023] The present invention provides a unitary single process and material panel that is flexible and is no thicker than 5mm and provides any and all features for suspension, bolster support, pressure distribution (the panel conforms to the shape of the occupant), trim attachment and structure affixment. This allows for a thinner seat that uses little or no foam and allows the packaging of the occupant closer to the structure due to managed pressure distribution. This in turn makes for a thin seat cushion system.

[0024] The panel includes bolsters that are unitarily constructed and the panel provides pressure distribution. Affixment to a structure provides torsional support/compliance as an occupant slides across for ingress and egress.

[0025] A center portion of the panel provides a sink in feel. The panel allows penetration of the occupant via geometry and material properties, which also allows the panel to distribute around and conform to the occupant, which can be done with a distributed beam. The center portion of the panel provides major support under the occupant, and a controlled lateral support/distribution, which may be done with cantilevered beams with a lateral sinusoidal step to allow movement of the insert section. The sinusoidal step may also accommodate a trim seam, which also allows the trim to deflect as the occupant penetrates the seat.

[0026] A front portion of the panel may provide a surface that allows forces from frontal impact to transfer into a lower structure in a compressive manner.

[0027] A cantilevered beam may be provided to prevent hammocking between the legs of the occupant.

[0028] The panel allows for side to side deflection and the ability to penetrate the panel. Cantilevered beams may be used to allow sink with low side pressure.

[0029] The present invention provides a thinner seat support structure because hugging of the occupant with the seat support structure comes from the panel and not deflection of foam as featured in conventional seat cushions.

[0030] The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference is made to the accompanying drawings and descriptive matter in which preferred embodiments of the invention are illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] In the drawings:

[0032] Figure 1 is a side view of a seat;

[0033] Figure 2 is a side view of the seat of Figure 1 with the seat supporting an occupant;

[0034] Figure 3 is a top perspective view of a seat support structure of Figure 1;

[0035] Figure 4 is a bottom perspective view of the seat support structure of Figure 1;

[0036] Figure 5 is another top perspective view of the seat support structure of Figure 1;

[0037] Figure 6 is a cross sectional view of the seat support structure of Figure 5 prior to the seat support structure being subjected to a load;

[0038] Figure 7 is a cross-sectional view of the support structure of Figure 5 after the support structure is subjected to a load;

[0039] Figure 8 is another perspective view of the seat support structure of Figure 5;

[0040] Figure 9 is a perspective view of the seat of Figure 1 showing a pressure distribution of the seat support structure when an occupant is seated in the seat;

[0041] Figure 10 is a side view of the seat of Figure 1 with the occupant applying a first load on the seat;

[0042] Figure 11 is a side view of the seat of Figure 1 with the occupant applying a second load on the seat;

[0043] Figure 12 is a perspective view of the seat of Figure 1 showing a displacement of the seat support structure;

[0044] Figure 13 is a perspective view of the seat of Figure 1 showing pressures applied to the seat when an occupant is seated in the seat;

[0045] Figure 14 is a perspective view of the seat of Figure 1 showing a Von-Mises stress distribution;

[0046] Figure 15 is a bottom view of another embodiment of a seat support structure;

[0047] Figure 16 is a partial top view of the seat support structure of Figure 3;

[0048] Figure 17 is a partial perspective view of the seat support structure of Figure 3; and

[0049] Figure 18 is bottom perspective view of yet another embodiment of a seat support structure.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0050] Referring to the drawings in particular, Figure 1 is a side view of a seat 1, particularly a seat for a motor vehicle. The seat 1 includes a seat back structure 3 and a seat support structure (seat cushion) 5. The seat support structure 5 is connected to a seat base structure 7. The seat back structure 3 may be movable relative to the seat support structure 5.

[0051] Figure 2 is a side view of the seat 1 of Figure 1 with the seat 1 supporting an occupant 9. The seat back structure 3 supports a back region 11 of the occupant 9. The seat support structure 5 supports a buttock portion 13 and a leg portion 15 of the occupant 9. A total targeted penetration of the seat support structure 5 is greater than 20 millimeters.

[0052] Figure 3 is a perspective view of the seat support structure 5 of Figure 1. The seat support structure 5 includes a single, one-piece elastomeric panel 17. The elastomeric panel 17 is no thicker than 5 millimeters. The elastomeric panel 17 is formed of TPE. The elastomeric panel 17 includes a first side bolster 19 and a second side bolster 21. The first side bolster 19 is located on a first side 23 of the elastomeric panel 17. The first side bolster 19 includes openings 27. The second side bolster 21 is located on a second side 25 of the elastomeric panel 17. The second side bolster 21 includes openings 33. The elastomeric panel 17 includes an elastomeric portion (supporting section, insert region) 35 that is provided between the first side bolster 19 and the second side bolster 21. The elastomeric portion 35 may be provided in a central section of the elastomeric panel 17. The first side bolster 19 and the second side bolster 21 may be arranged at an angle greater than zero relative to the elastomeric portion 35. The elastomeric panel 17 includes a plurality of connecting portions 28, 30. The elastomeric portion 35 is connected to the first side bolster 19 by at least the connecting portions 28. The elastomeric portion 35 is connected to the second side bolster 21 by at least the connecting portions 30. The elastomeric portion 35 is connected to the first side bolster 19 and the second side bolster 21 by at least the connecting portions 28 and the connecting portions 30 such that the elastomeric portion 35 is able to move relative to the first side bolster 19 and the second side bolster 21 when a load is applied to the elastomeric panel 17 by the occupant 9. The elastomeric portion 35 may deflect more quickly than the first side bolster 19 and the second side bolster 21 when a load is applied to the elastomeric panel 17 by the occupant 9. The first side bolster 19 and the second side bolster 21 may deflect at a different rate than a rate of deflection of the elastomeric portion 35 when a load is applied to the elastomeric panel 17 by the occupant 9. The elastomeric portion 35 includes openings 29, openings 31, openings 37, openings 39, openings 41 and openings 43. Each opening 29 is located opposite one of the openings 27 of the first side bolster 19. The openings 29 may or may not be in communication with the openings 27. Each opening 31 is located opposite one of the openings 33 of the second side bolster 21. The openings 31 may or may not be in

communication with the openings 33. The elastomeric portion 35 includes members 45 and connecting structures 47, 49. The members 45 may extend along the entire length of the elastomeric portion or only a part of the length of the elastomeric portion 35. The connecting structure 47 extends between the openings 27 and openings 29. The connecting structure 47 may be a large rib. The connecting structure 49 extends between the openings 31 and the openings 33. The connecting structure 49 may be a large rib.

[0053] Figure 4 is a bottom perspective view of the seat support structure (seat cushion) 5.

[0054] Figure 5 is another perspective view of the seat support structure 5.

[0055] Figure 6 is a cross sectional view of the seat support structure 5 of Figure 5 prior to the seat support structure 5 being subjected to a load. The elastomeric panel 17 includes a front region 55 and a rear region 57. The front region 55 is located opposite the rear region 57 with respect to a traveling direction 59 of a vehicle (not shown). The front region 55 of the elastomeric panel 17 is supported by a first support structure 51. The rear region 57 of the elastomeric panel 17 is supported by a second support structure 53. The elastomeric panel 17 includes projecting portions 61, 63. The first support structure 51 includes an opening 65. The opening 65 receives the projecting portion 61 to fix the projecting portion 61 to the first support structure 51. The second support structure 53 includes an opening 67. The opening 67 receives the projecting portion 63 to fix the projecting portion 63 to the second support structure 53.

[0056] Figure 7 is a cross sectional view of the support structure 5 of Figure 5 after the support structure 5 is subjected to a load. The elastomeric panel 17 bends when loaded and then is pulled in tension when a further load is applied.

[0057] Figure 8 is another perspective view of the seat support structure 5 of Figure 5.

[0058] Figure 9 is a perspective view of the seat 1 of Figure 1 showing a pressure distribution of the seat support structure 5 when an occupant is seated in the seat 1. Pressure is

applied in regions or areas 69, 71, 73 of the seat support structure 5. The pressure applied in the area 69 is greater than the pressure applied in the area 71 and the area 73 of the seat support structure 5. The pressure applied to the area 73 of the seat support structure 5 is less than the pressure applied to the area 71. The structure of the seat support structure 5 is such that side to side deflection is allowed and hammocking of the seat support structure between an occupant's legs is prevented. The seat support structure 5 is such that lateral hammocking is not attained. This is done to control the high lateral pressures on the occupant that could present themselves if not managed.

[0059] Figure 10 is a side view of the seat of Figure 1 with the occupant 9 applying a first load on the seat 1 before the occupant 9 has fully positioned himself or herself in the seat 1, such as when the occupant 9 first sits in the seat 1. Before the occupant 9 is fully positioned in the seat 1, the elastomeric panel 17 bends.

[0060] Figure 11 is a side view of the seat 1 of Figure 1 with the occupant 9 applying a second load on the seat 1. Figure 11 shows the situation in which the occupant 9 has fully positioned himself or herself in the seat 1. After the occupant 9 is fully positioned in the seat 1 as shown in Figure 11, the elastomeric panel 17 has conformed to the occupant.

[0061] Figure 12 is a perspective view of the seat 1 of Figure 1 showing a displacement of the seat support structure 5 in a z-direction when the occupant 9 is seated in the seat 1. The seat support structure 5 is displaced in regions or areas 75, 77, 79. An amount of displacement in the area 75 is greater than the amount of displacement that occurs in the area 77 and the area 79 of the seat support structure 5. The amount of displacement that occurs in the area 79 of the seat support structure 5 is less than the amount of displacement that occurs in area 75 and area 77. The area 77 is displaced by an amount that is greater than the amount of displacement that occurs in area 79, but less than the amount of displacement that occurs in the area 75.

[0062] Figure 13 is a perspective view of the seat 1 of Figure 1 showing pressures applied to the seat 1 when an occupant is seated in the seat 1. Pressure is applied by an occupant in areas 81, 83 of the seat support structure 5 that is greater than other areas of the

seat support structure 5.

[0063] Figure 14 is a perspective view of the seat 1 of Figure 1 showing a Von-Mises stress distribution of the seat back structure 3 and the seat support structure 5. The seat support structure 5 is subjected to the greatest amount of stress in areas 85, 87, 89, 91. This high stress is typical for attachment points in an area where the design is focused in the elastomeric portion (supporting center section) 35 where it is designed to work like a distributed beam. Openings (holes) 27, 33 flaring off to a respective side 32, 34 of the seat support structure 5 are created to support the occupant and connecting structures (large ribs) 47, 49 allow deflection of the elastomeric portion 35.

[0064] Figure 15 is a bottom view of another embodiment of a seat support structure 5". The seat support structure 5" includes a single, one-piece elastomeric panel 17". The single, one-piece elastomeric panel 17" includes a first side bolster 19", a second side bolster 21" and connecting structures 27". Springs 23" are connected to the connecting structures 27" and a portion 25" of the elastomeric panel 17". Any number of springs 23" may be provided, but preferably at least four springs 23" are provided. An object of providing the elastomeric panel 17", which is thin, is to provide a deflectable three-dimensional supporting surface. In order to provide a deflectable three-dimensional supporting surface, springs 23 are provided in an array to make deflection follow contours of the occupant.

[0065] Figure 16 is a partial top view of the seat support structure 5 of Figure 3. A foam pad 95 and a trim cover 97 are connected to the seat support structure 5.

[0066] Figure 17 is a partial perspective view of the seat support structure 5 of Figure 3. The seat support structure 5 is connected to a component 101, such as a trim component, of a seat structure 103 by connectors 99. Each of the connectors 99 surrounds at least a portion of the connecting structure 49 and at least a portion of the component (trim component) 101 of the seat structure 103. The connectors may be of any type of connector, including rings, preferably hog rings.

[0067] Figure 18 is bottom perspective view of yet another embodiment of a seat

support structure 5". The seat support structure 5" includes a single, one-piece elastomeric panel 17". The single, one-piece elastomeric panel 17" is identical to the single, one-piece elastomeric panel 17 shown in Figures 1-14 except the one-piece elastomeric panel 17" includes connecting elements 61", 62", 63", 64" for connecting the one-piece elastomeric panel 17" to a seat support structure 50". The connecting elements 61", 62", 63", 64" may be integrally connected to the one-piece elastomeric panel 17". Although four connecting elements 61", 62", 63", 64" are shown in Figure 18, it is understood that any number of connecting elements may be used. The seat support structure 50" includes a seat support structure element 51" and a seat support structure element 53". The connecting elements 61", 62" engage the seat support structure element 51" and the connecting elements 63", 64" engage the seat support structure element 53". The connecting element 61" has a surface 65" for contacting the seat support structure element 51". The connecting element 62" has a surface 66" for contacting the seat support structure element 51". The connecting element 63" has a surface 67" for contacting the seat support structure element 53". The connecting element 64" has a surface 68" for contacting the seat support structure element 53". The surface 65" and the surface 66" are shown in Figure 18 with an arcuate contour, but it is understood that the surface 65" and the surface 66" may have a different shape or contour, including a contour that is the same as the contour of the seat support structure element 51". The surface 67" and the surface 68" are shown in Figure 18 with an arcuate contour, but it is understood that the surface 67" and the surface 68" may have a different contour or shape, including a contour that is the same as the contour of the seat support structure element 53". The seat support structure 50", including the seat support structure 51" and the seat support structure 53", is shown as a tubular structure, but it is understood that the seat support structure 50" can have a different structure with a different shape or contour. As in previous embodiments, the connecting element 61" interacts with the surface 65" and connecting element 62" interacts with the surface 66" in a manner that allows a center longitudinal section to deflect as a distributed beam and then go into tension.

[0068] While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

WHAT IS CLAIMED IS:

1. A seat cushion comprising:
an elastomeric panel, wherein said elastomeric panel positions and supports a seated occupant, wherein said panel is constrained on a forward side and a rearward side of the seat cushion with respect to a traveling direction of a vehicle.
2. A seat cushion in accordance with claim 1, wherein said elastomeric panel is further constrained from an inboard side of the seat cushion and an outboard side of the seat cushion.
3. A seat cushion in accordance with at least claim 1, wherein said panel is made of a thermoplastic elastomer.
4. A seat cushion in accordance with at least claim 1, further comprising a foam pad.
5. A seat cushion in accordance with at least claim 4, further comprising a trim cover.
6. A seat cushion in accordance with at least claim 5, wherein said trim cover comprises an attachment means for attachment to said elastomeric panel.
7. A seat cushion in accordance with at least claim 6, wherein said elastomeric panel and said attachment means are unitary, formed of the same material in a single forming operation.
8. A seat cushion in accordance with at least claim 6, wherein said foam pad comprises an opening and said trim cover attachment means extend through said opening, wherein said trim cover attachment means is attached to said elastomeric panel.
9. A seat cushion in accordance with at least claim 1, wherein said elastomeric panel bends when loaded and then is pulled in tension when a further load is applied.
10. A seat cushion in accordance with at least claim 1, wherein said elastomeric panel comprises an attachment means for attachment to a seat structure.

11. A seat cushion in accordance with at least claim 10, where said elastomeric panel and said attachment means are unitary.

12. A seat cushion in accordance with at least claim 11, wherein said elastomeric panel and said attachment means are formed of the same material in a single forming operation.

13. A seat structure comprising:

an elastomeric panel for supporting a seated occupant;

a first elastomeric panel support component;

5 a second elastomeric panel support component, wherein said elastomeric panel is supported on a forward side thereof via said first elastomeric panel support component and said elastomeric panel is supported on a rearward side thereof via said second elastomeric panel support component with respect to a traveling direction of a vehicle.

14. A seat structure in accordance with claim 13, further comprising:

a third elastomeric panel support component;

5 a fourth elastomeric panel support component, wherein said elastomeric panel is supported on a first lateral side via said third elastomeric panel support component and said elastomeric panel is supported on a second lateral side via said fourth elastomeric panel support component, said first lateral side and said second lateral side extending parallel to the traveling direction, said rearward side and said forward side extending perpendicular to the traveling direction, said first elastomeric panel support component and said second elastomeric panel support component defining a longitudinal support structure, said third elastomeric panel support component and said fourth elastomeric panel support component defining a lateral support structure.

10 15. A seat structure in accordance with at least claim 14, further comprising an interconnecting means between the longitudinal support structure and the lateral support structure for allowing movement of the longitudinal support structure with a degree of freedom relative to the lateral support structure, said elastomeric panel comprising a lateral portion, said lateral portion providing support to the occupant during ingress and egress and said lateral portion deflecting in a torsional manner about one of said third elastomeric panel support

component and said fourth elastomeric panel support component to support the occupant, said lateral portion providing support to an occupant during a seated position.

16. A seat structure in accordance with at least claim 13, wherein said elastomeric panel manages occupant loads based on a principle of a distributed beam, wherein once the loads exceed that of the occupant the panel goes into tension to limit deflection.

17. A seat structure in accordance with at least claim 14, wherein said elastomeric panel is a one-piece elastomeric panel structure, said one-piece elastomeric panel structure comprising a thermoplastic elastomer.

18. A seat structure in accordance with at least claim 14, further comprising a foam pad, wherein said elastomeric panel comprises a plurality of members for supporting said foam pad, said elastomeric panel bending when loaded, said elastomeric panel being in tension when a further load is applied.

19. A seat structure in accordance with at least claim 18, wherein said members bend when loaded, said members being in tension when the further load is applied.

20. A seat support structure comprising:

a single, one-piece elastomeric panel for supporting a seated occupant, said single, one-piece elastomeric panel comprising a front region and a rear region, said front region being opposite said rear region with respect to a longitudinal axis of said single, one-piece elastomeric panel, said front region and said rear region defining support areas for supporting said single, one-piece elastomeric panel such that said single, one-piece elastomeric panel is constrained in a direction parallel to said longitudinal axis.

21. A seat support structure in accordance with claim 20, wherein said single, one-piece elastomeric panel comprises a first lateral portion and a second lateral portion, said first lateral portion and said second lateral portion extending parallel to said longitudinal axis, said first lateral portion defining a first lateral support region and said second lateral portion defining a second lateral support region, wherein said single, one-piece elastomeric panel is

supported in said first lateral support region and said second lateral support region such that said single, one-piece elastomeric panel is constrained in a direction perpendicular to said longitudinal axis.

22. A seat support structure in accordance with claim 21, further comprising:

a first panel support structure connected to said elastomeric panel in said front region, wherein said front region of said single, one-piece elastomeric panel is supported via said first panel support structure;

5 a second panel support structure connected to said elastomeric panel in said rear region, wherein said rear region of said single, one-piece elastomeric panel is supported via said second panel support structure;

10 a third panel support structure connected to said elastomeric panel in said first lateral support region, wherein said first lateral support region of said single, one-piece elastomeric panel is supported via said third panel support structure;

a fourth panel support structure connected to said elastomeric panel in said second lateral support region, wherein said second lateral portion of said single, one-piece elastomeric panel is supported via said fourth panel support structure.

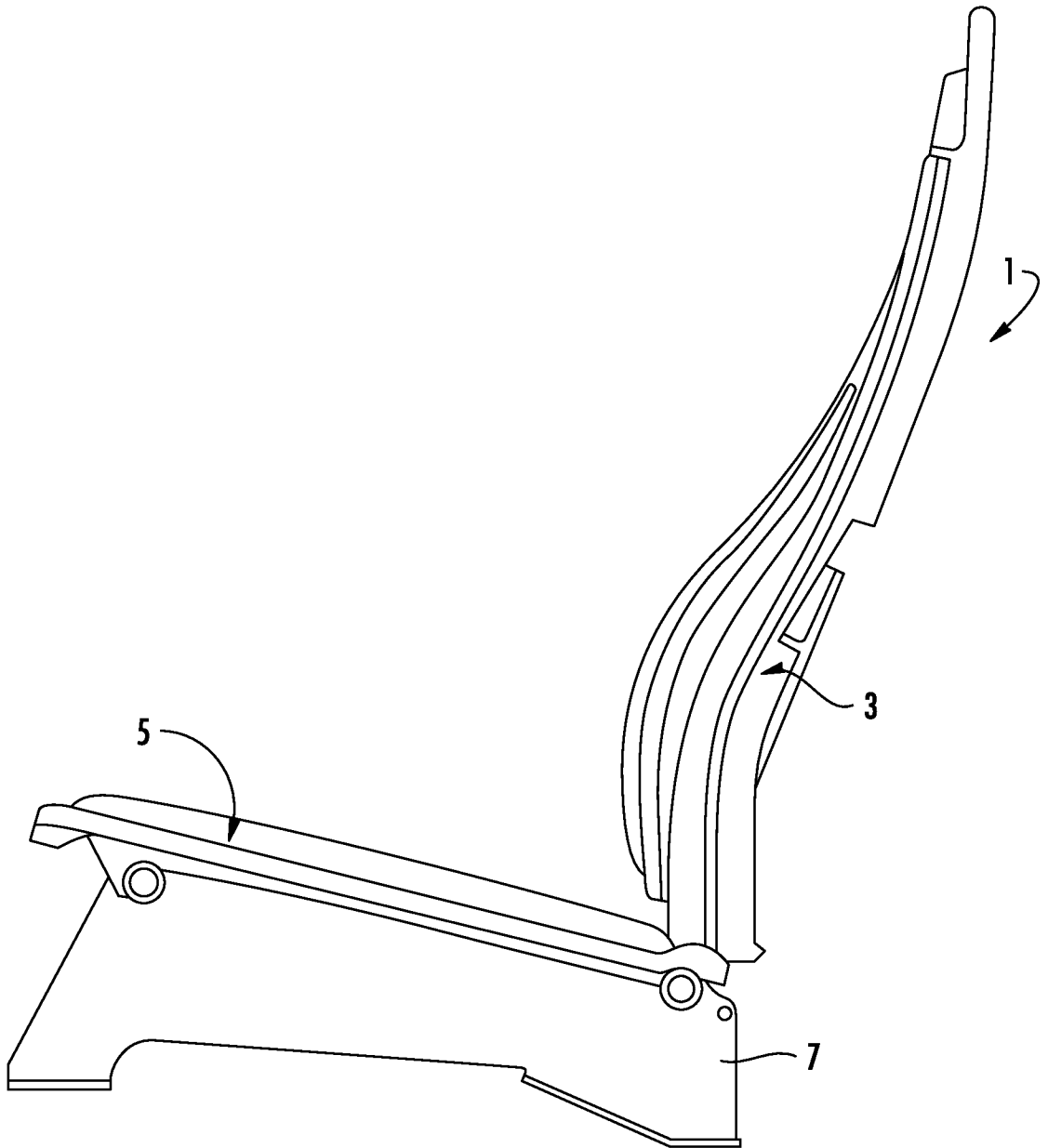


FIG. 1

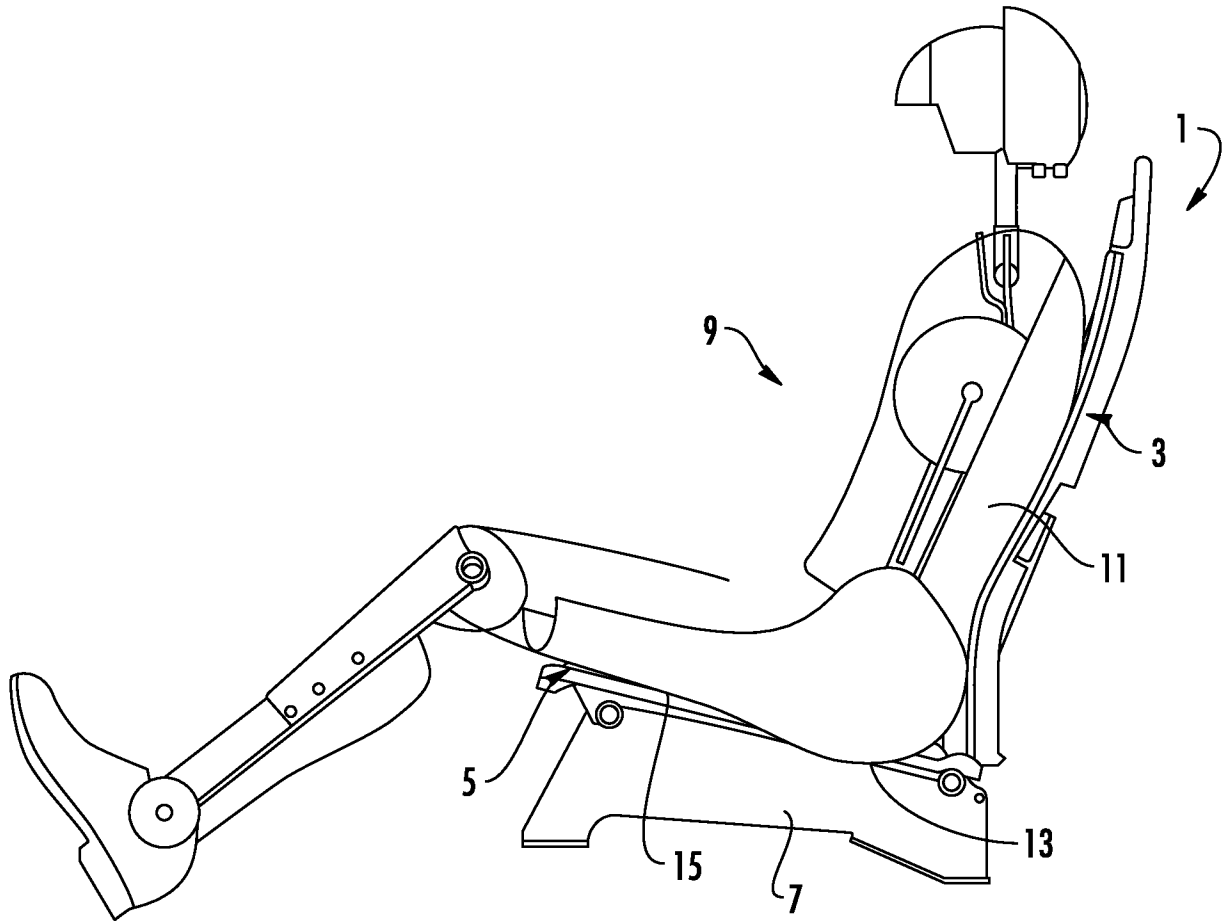


FIG. 2

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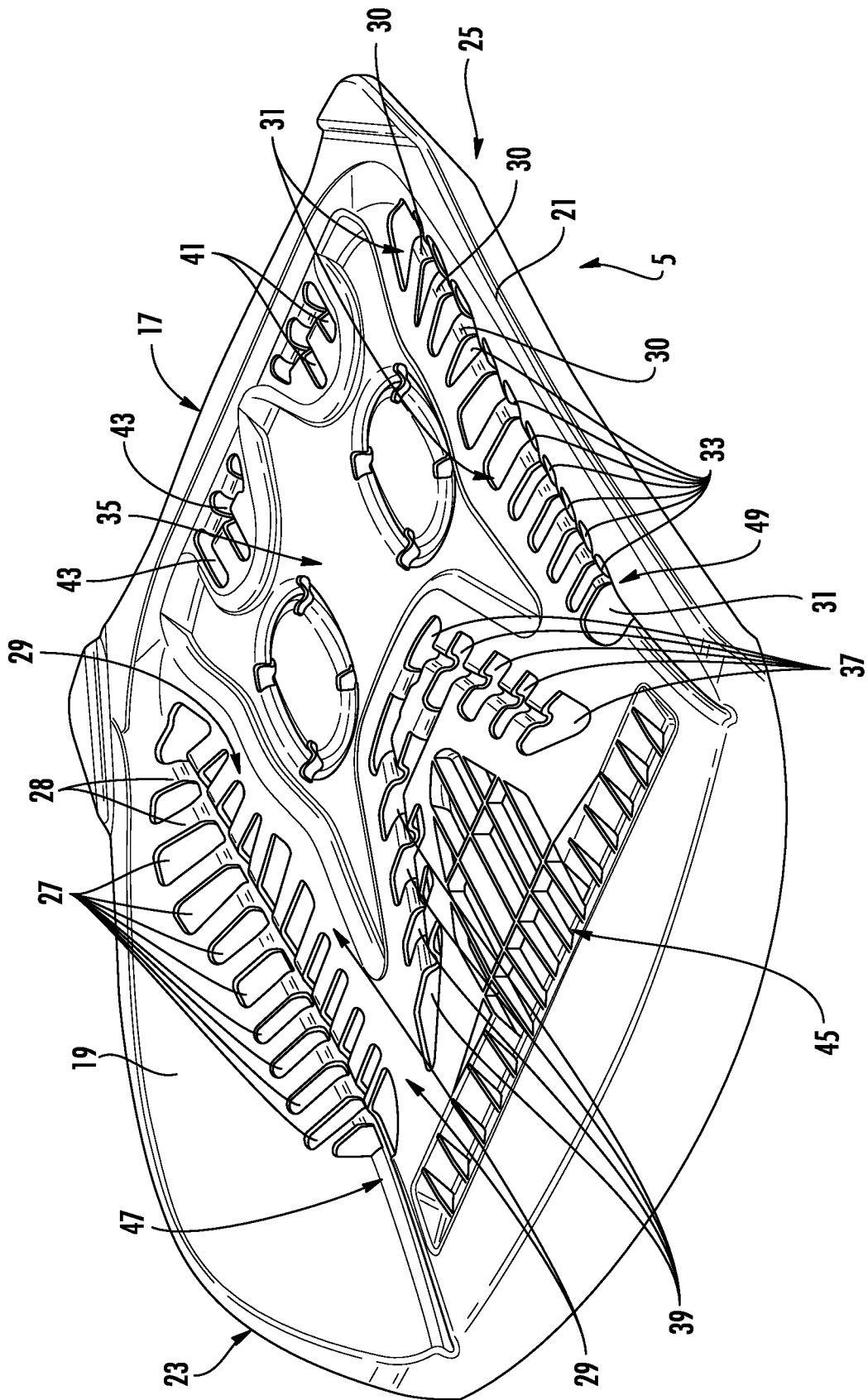


FIG. 3

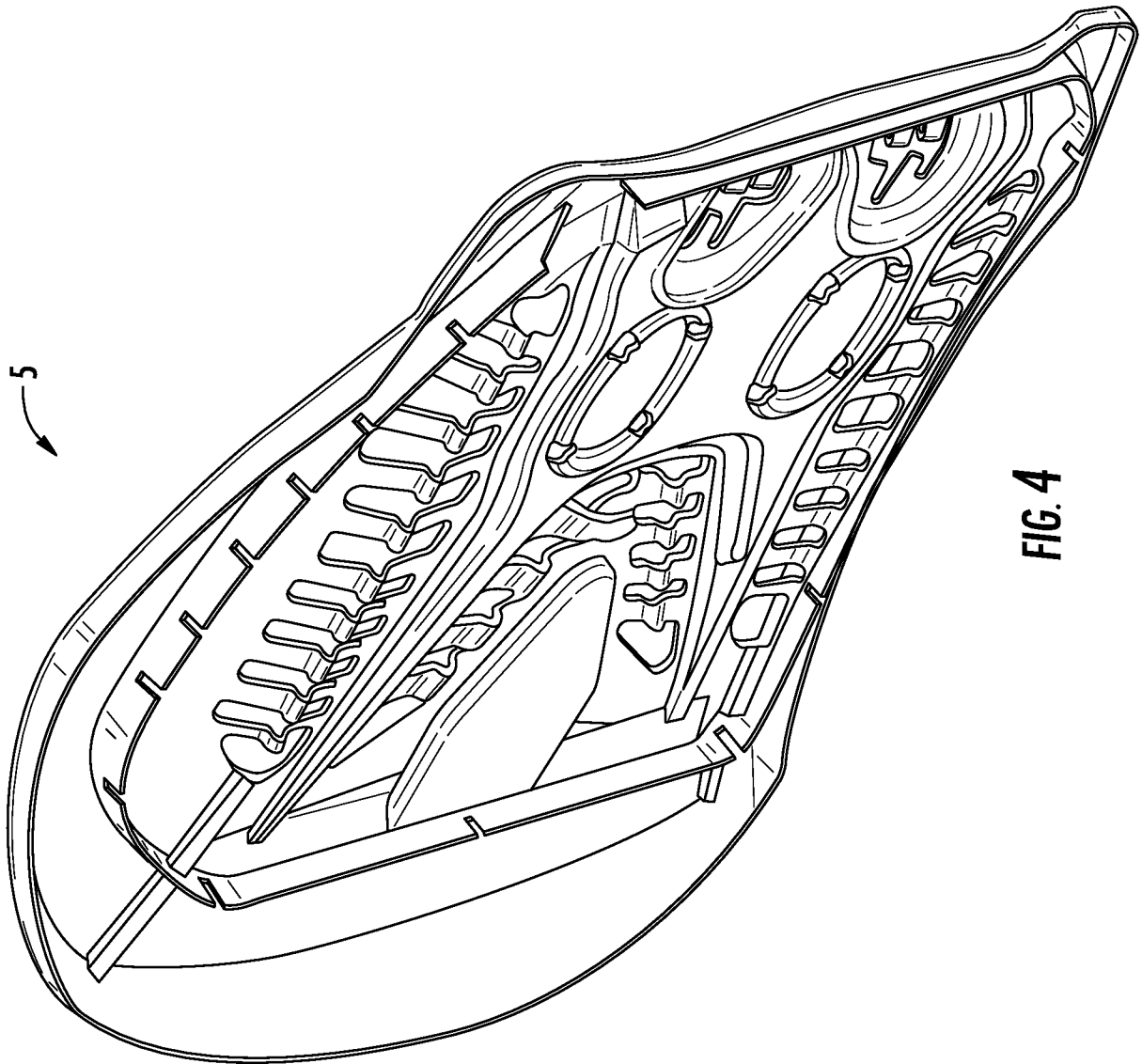


FIG. 4

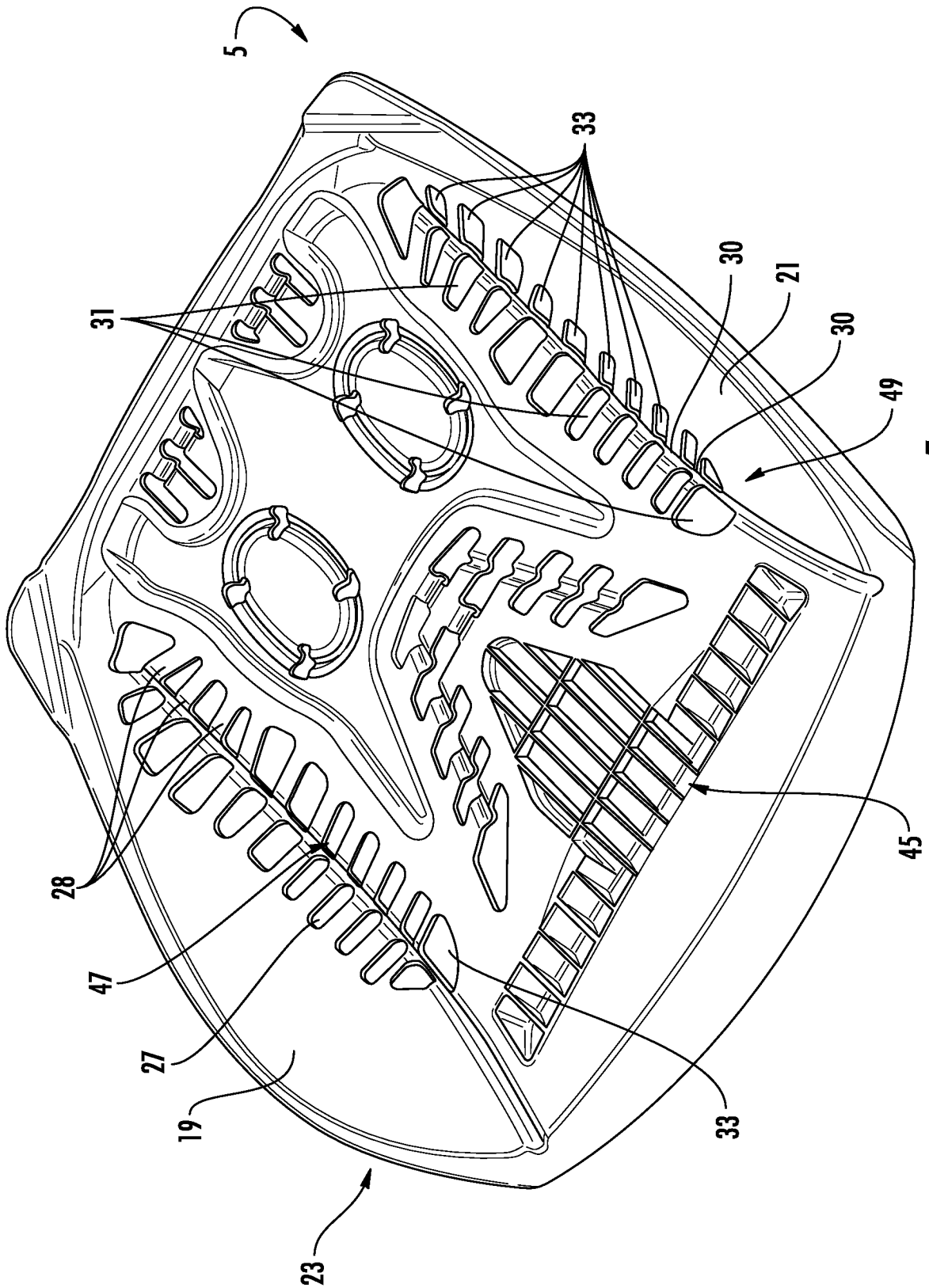


FIG. 5

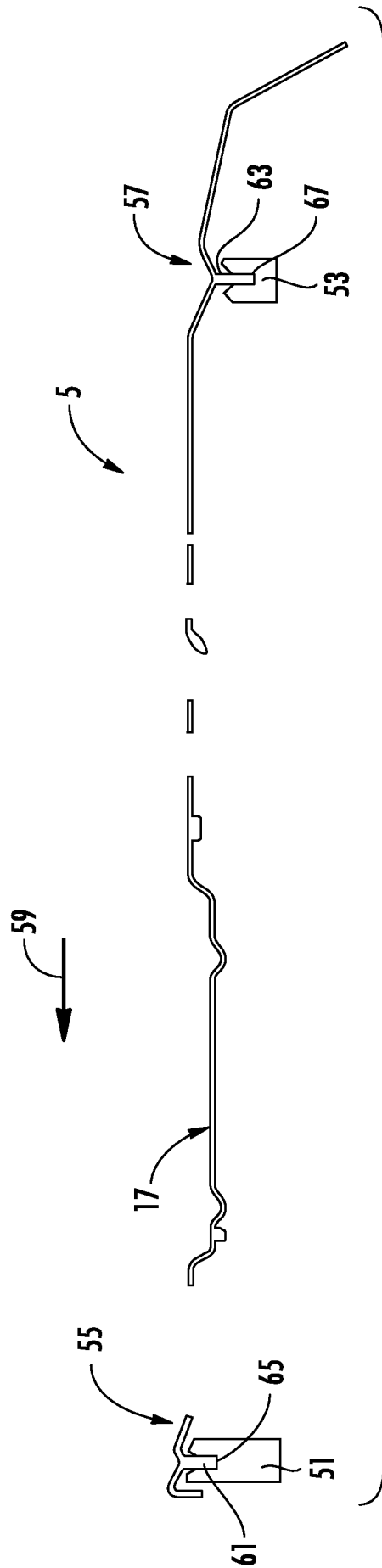


FIG. 6



FIG. 7

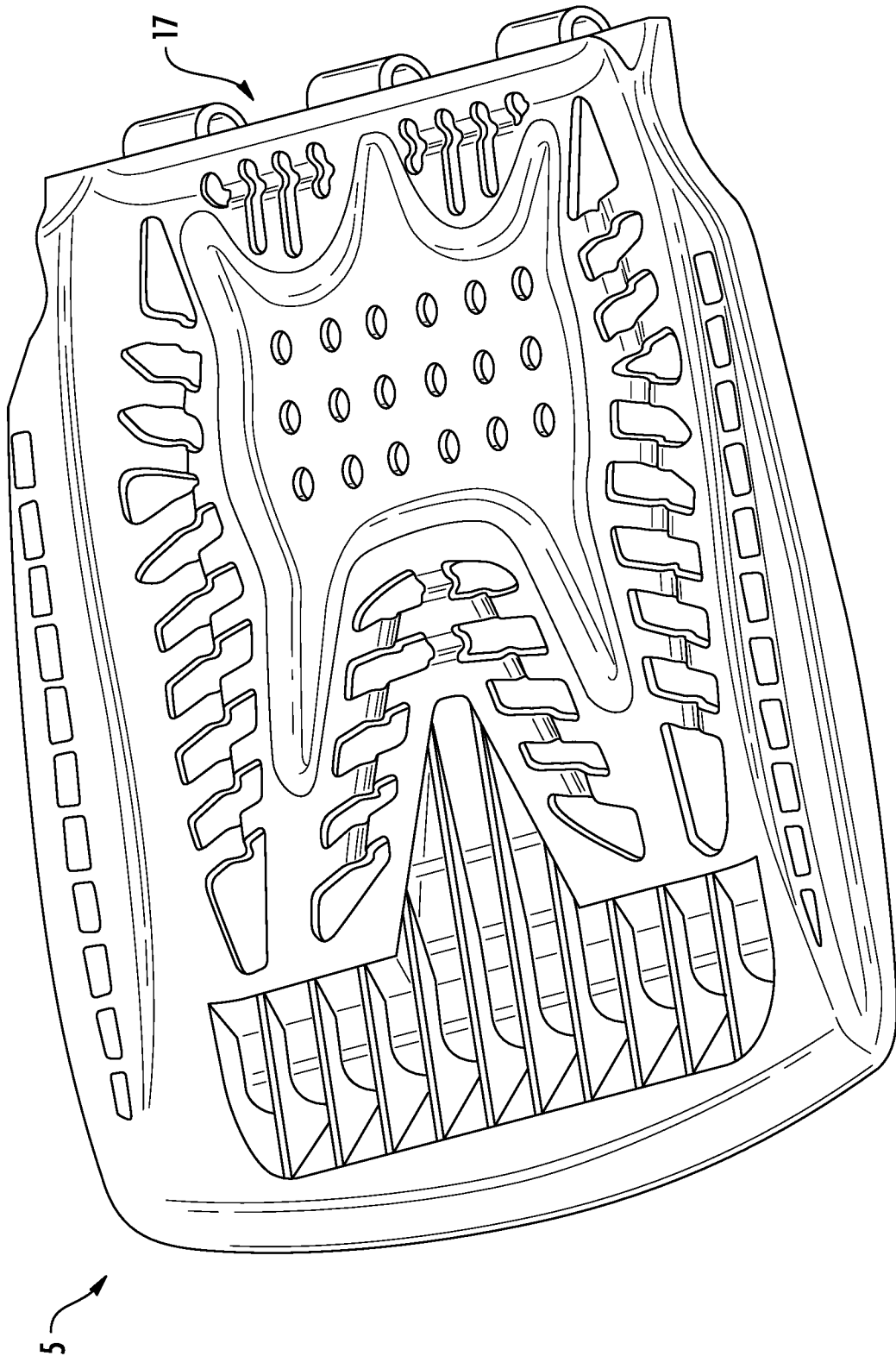


FIG. 8

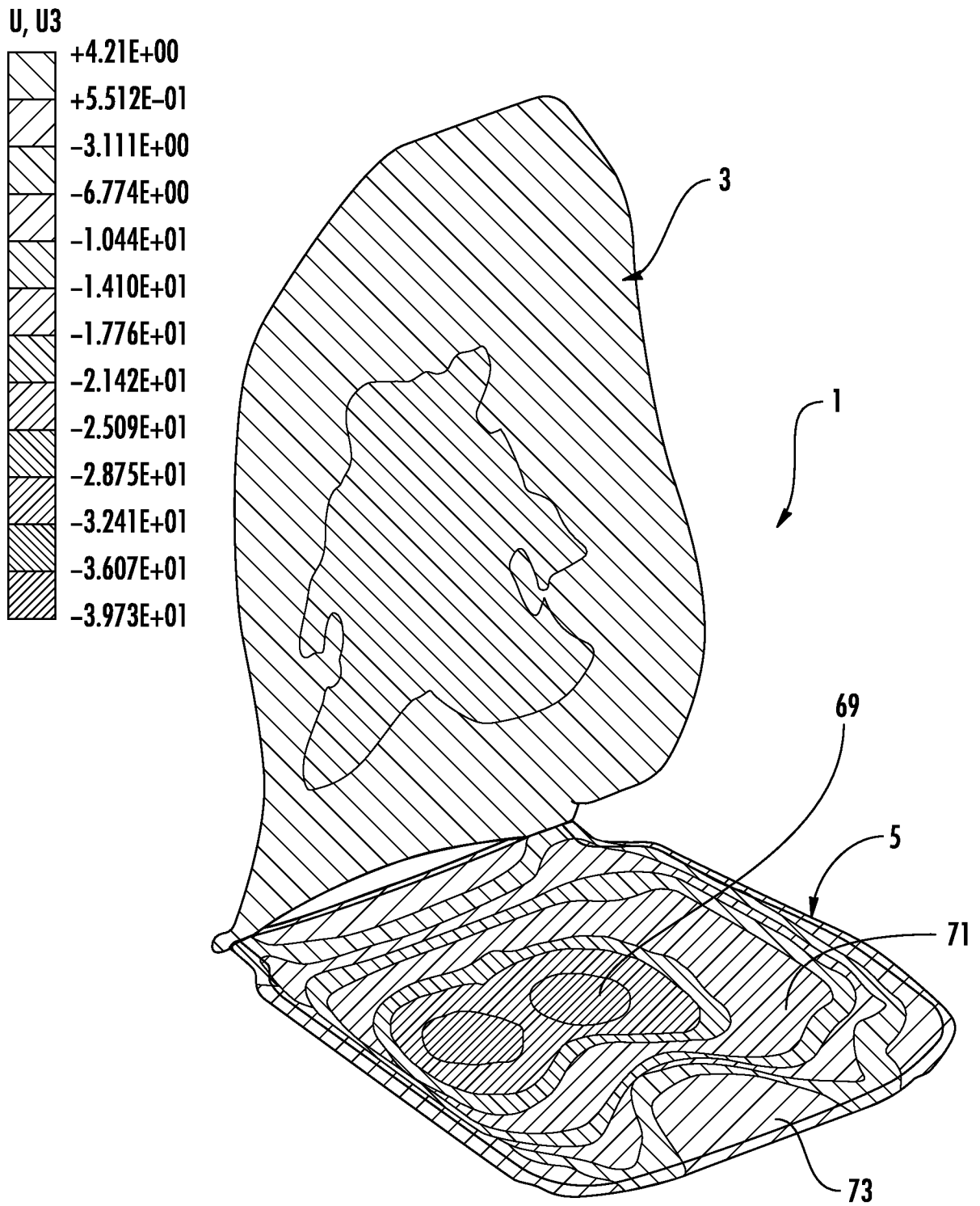


FIG. 9

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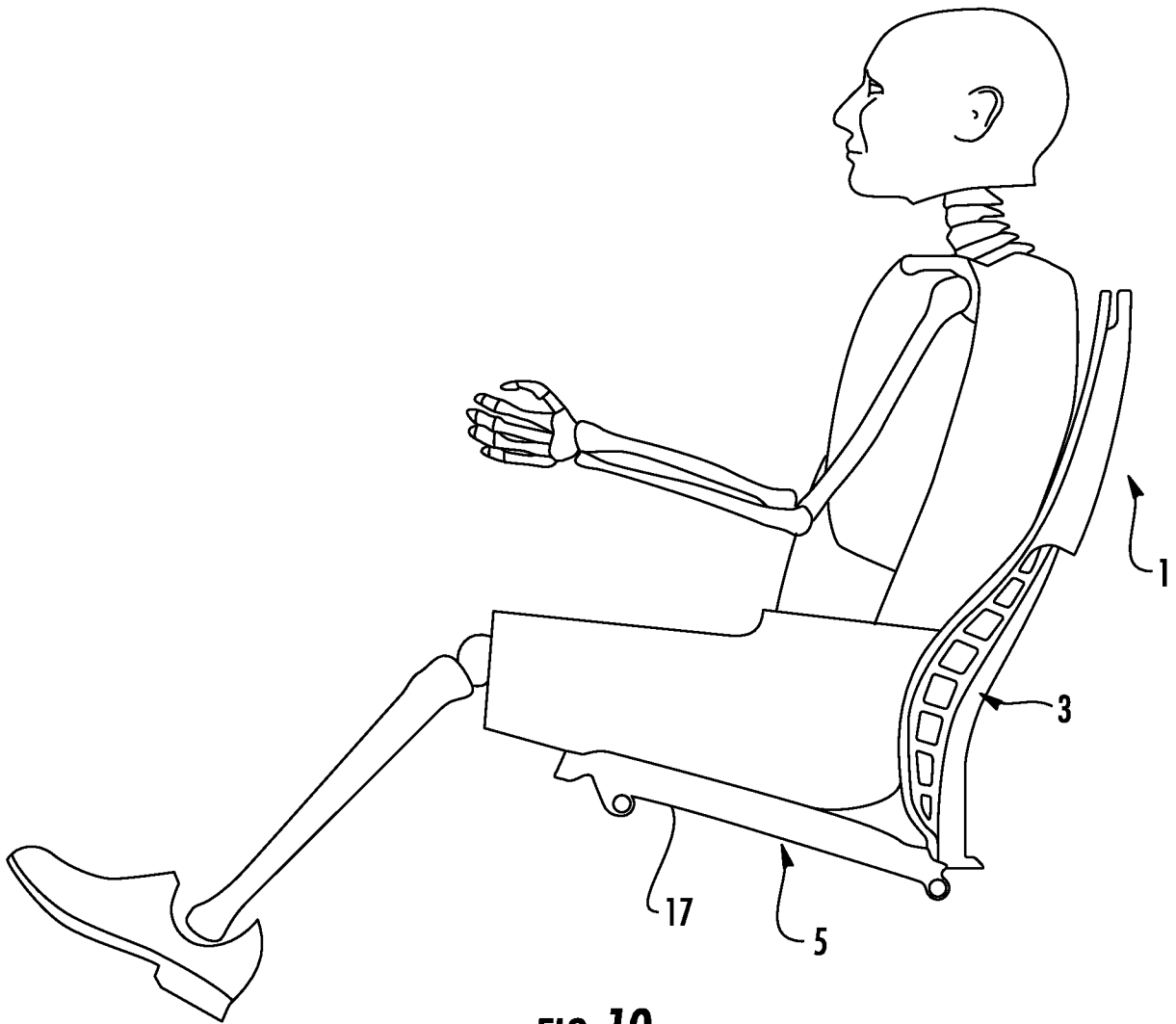


FIG. 10

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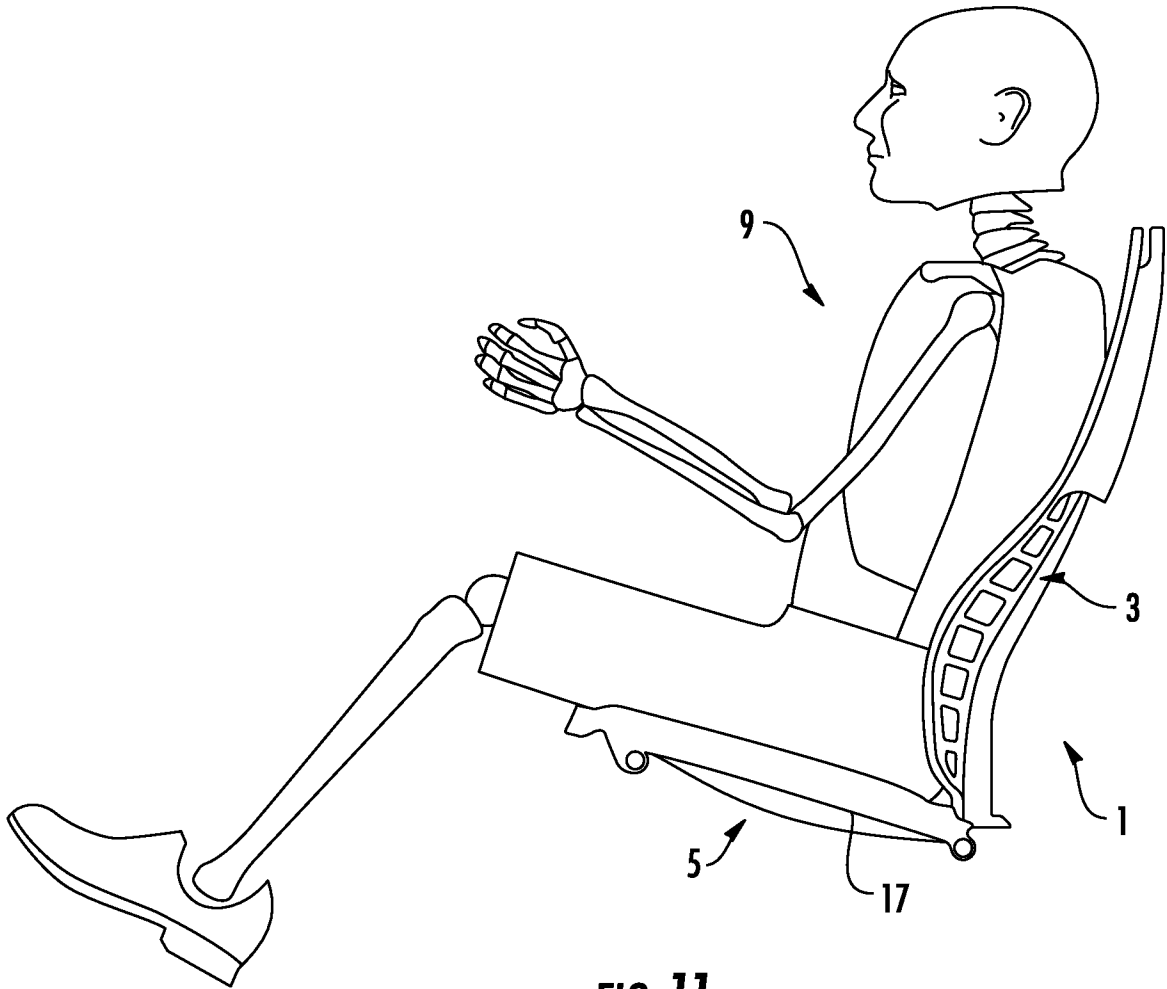
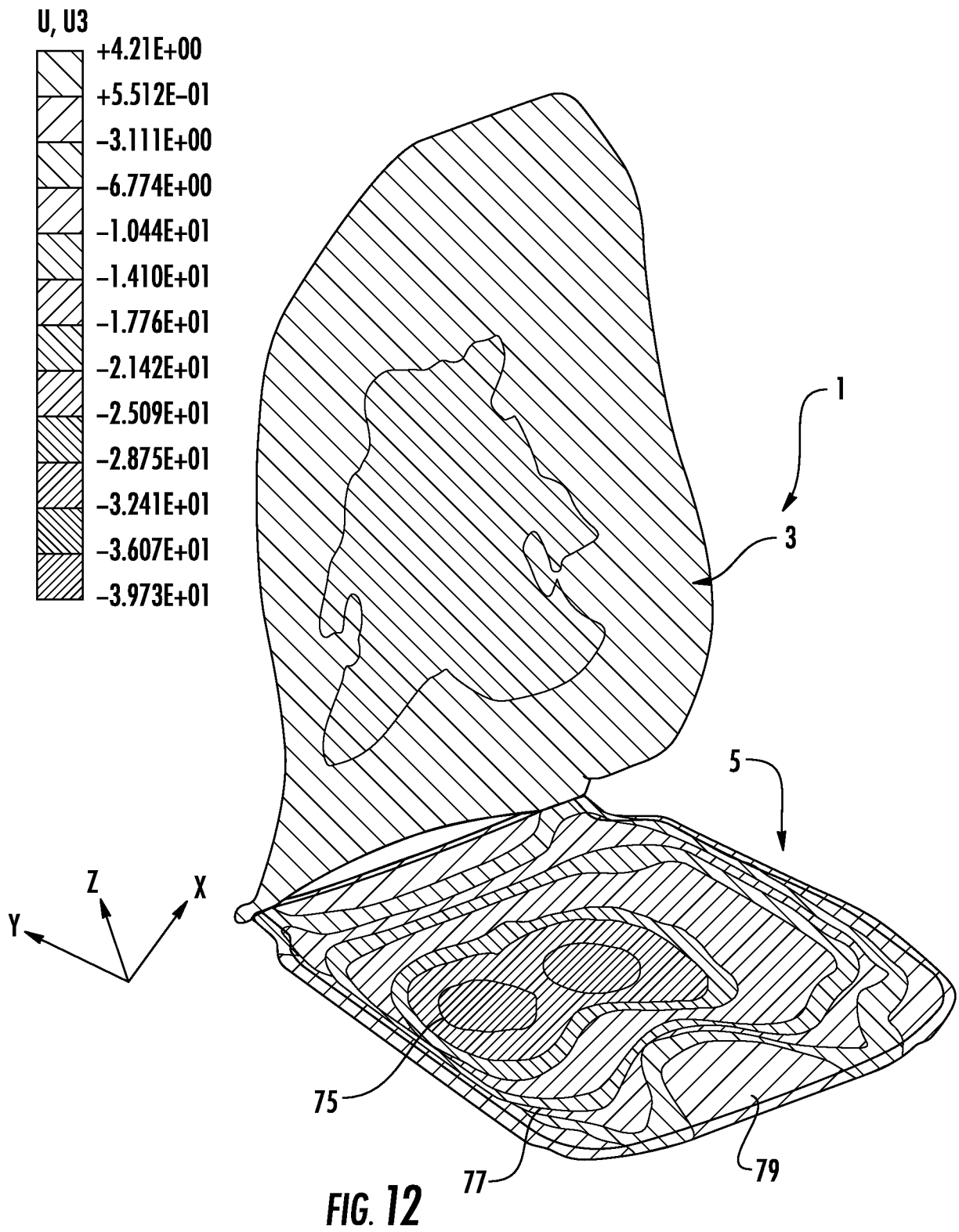


FIG. 11



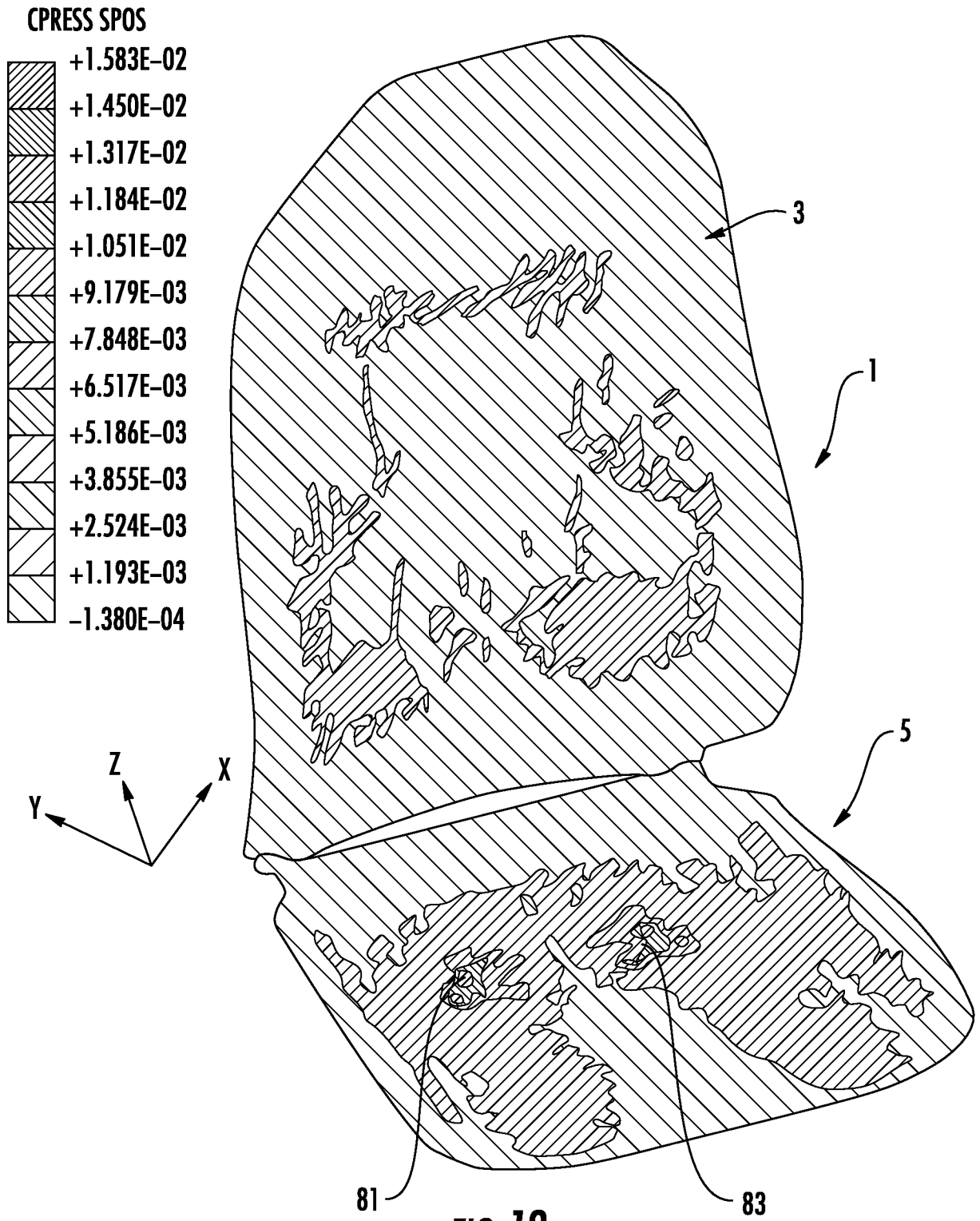
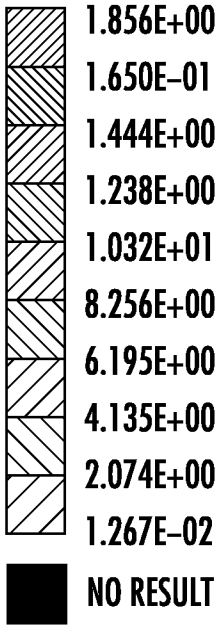


FIG. 13

CONTOUR PLOT
S-GLOBAL-STRESS COMPONTS (VONMISES, MAX)
ELEMENTAL SYSTEM
SIMPLE AVERAGE



MAX= 1.478E+01
PART-1- 207647

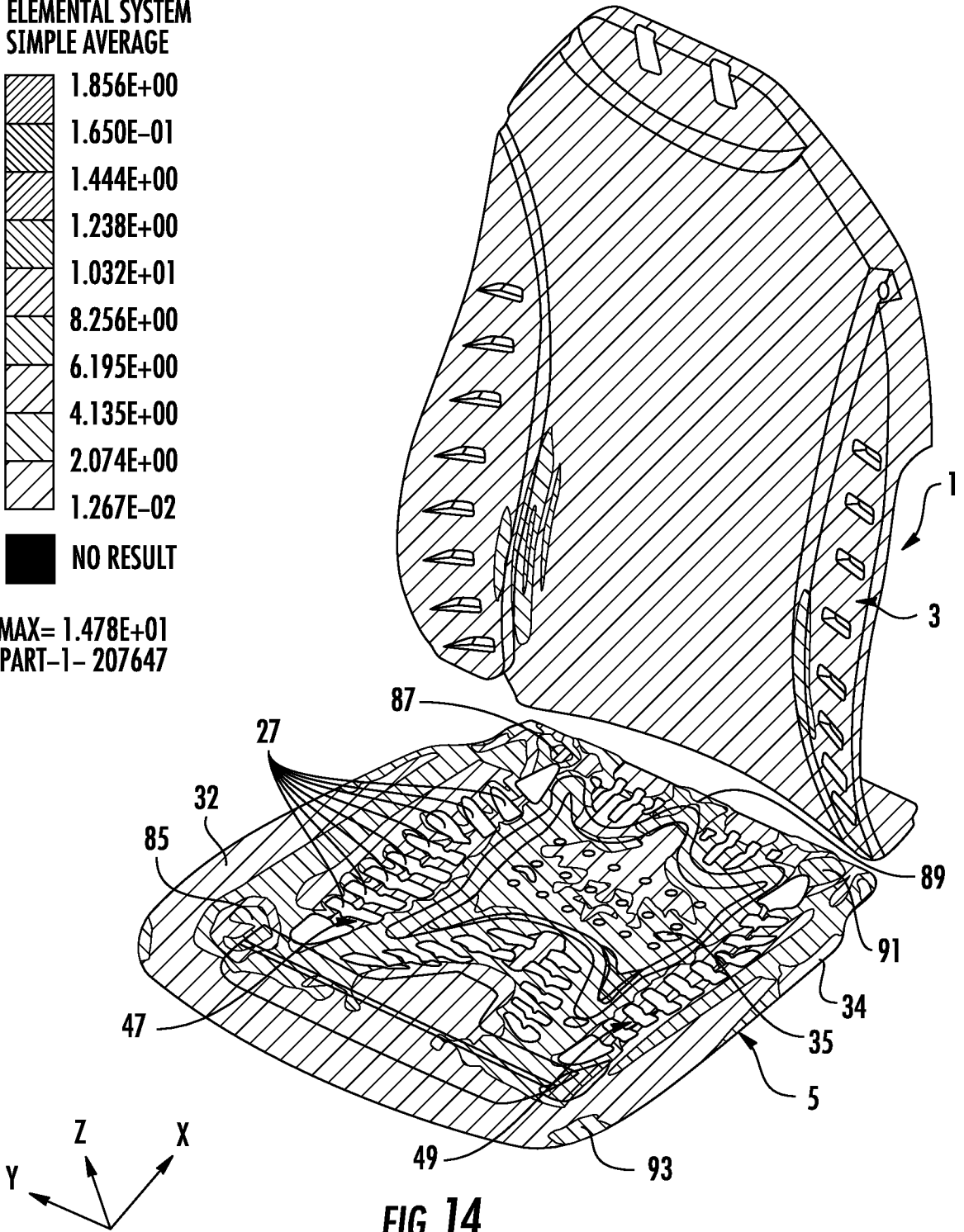
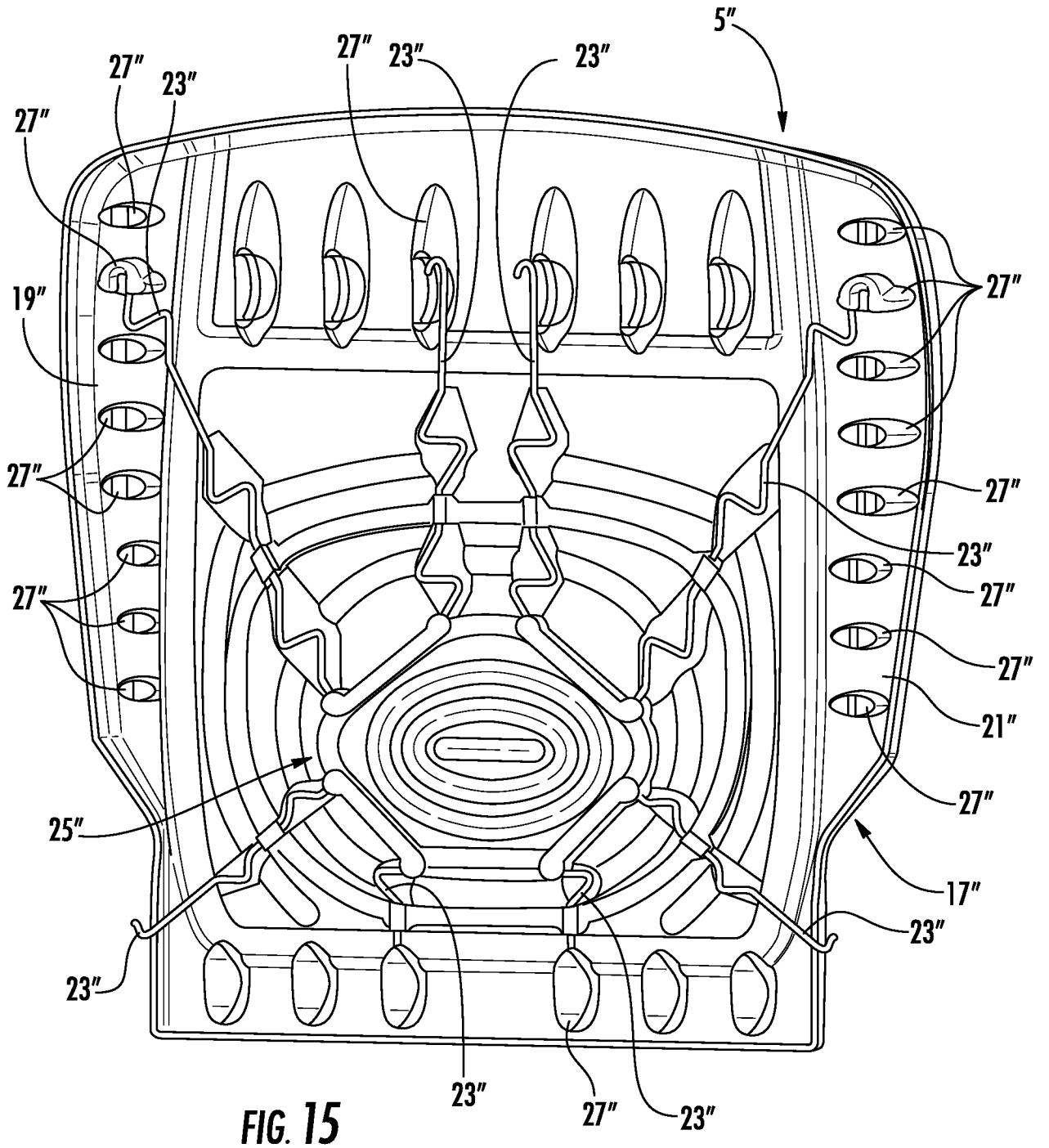
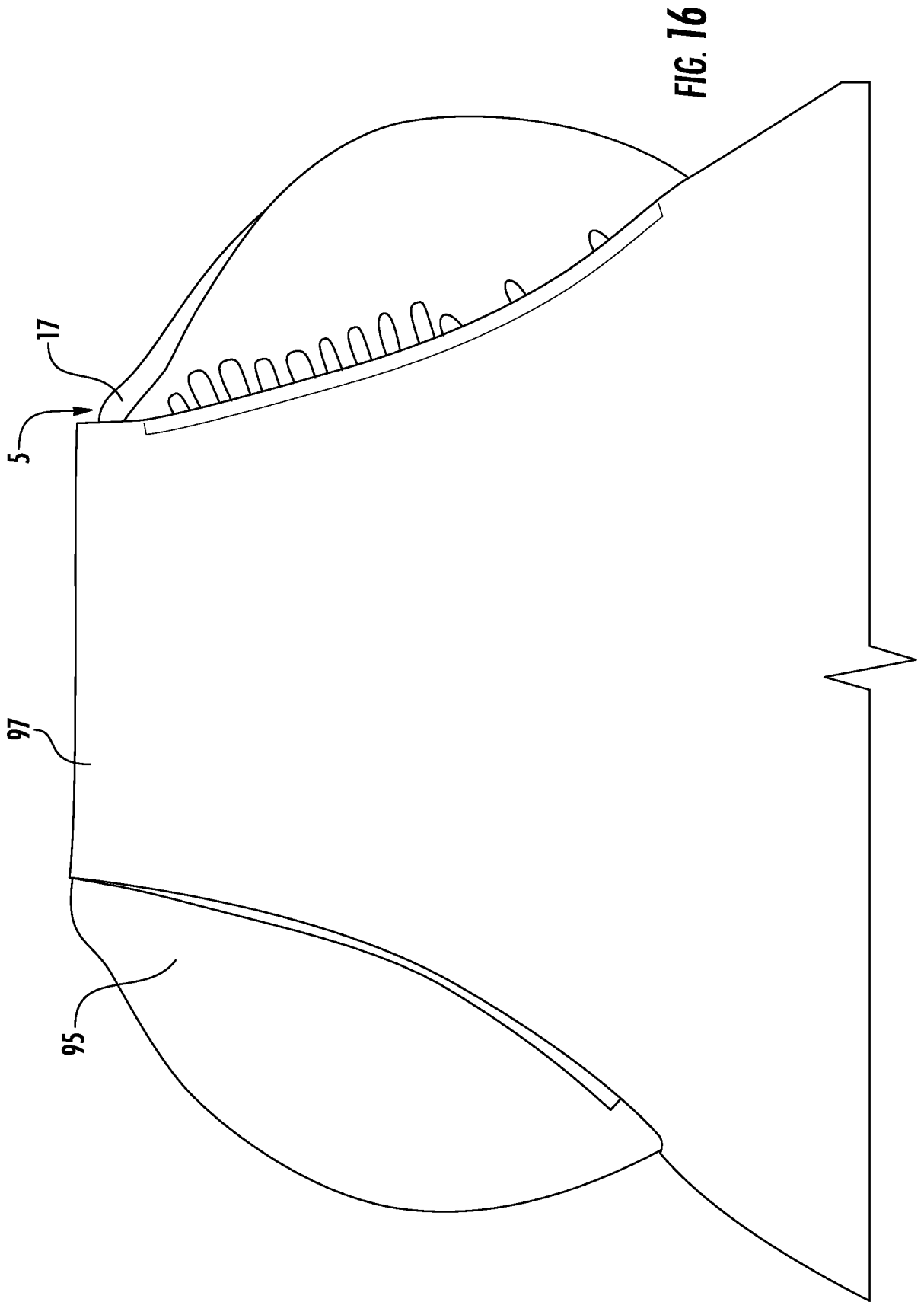
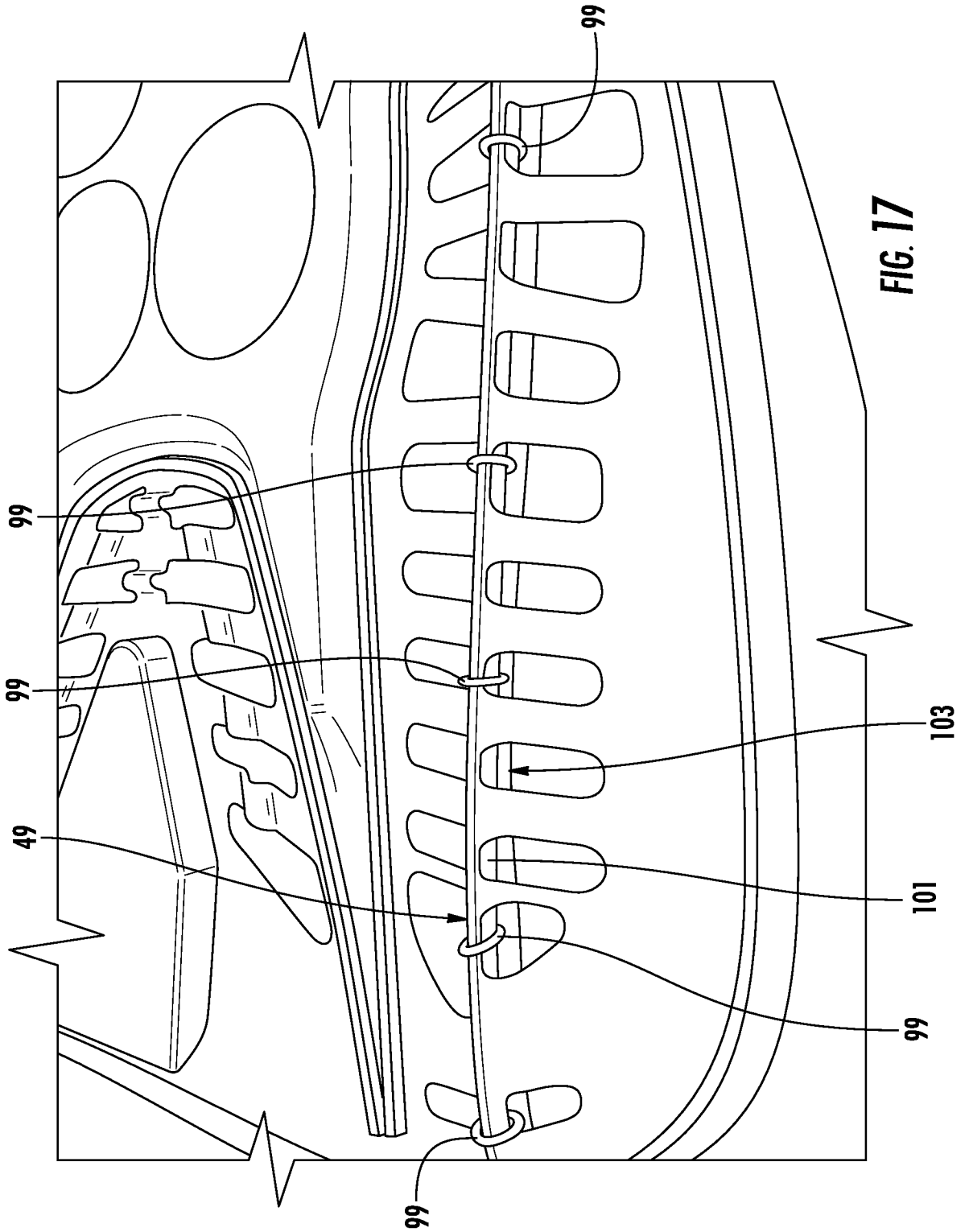


FIG. 14







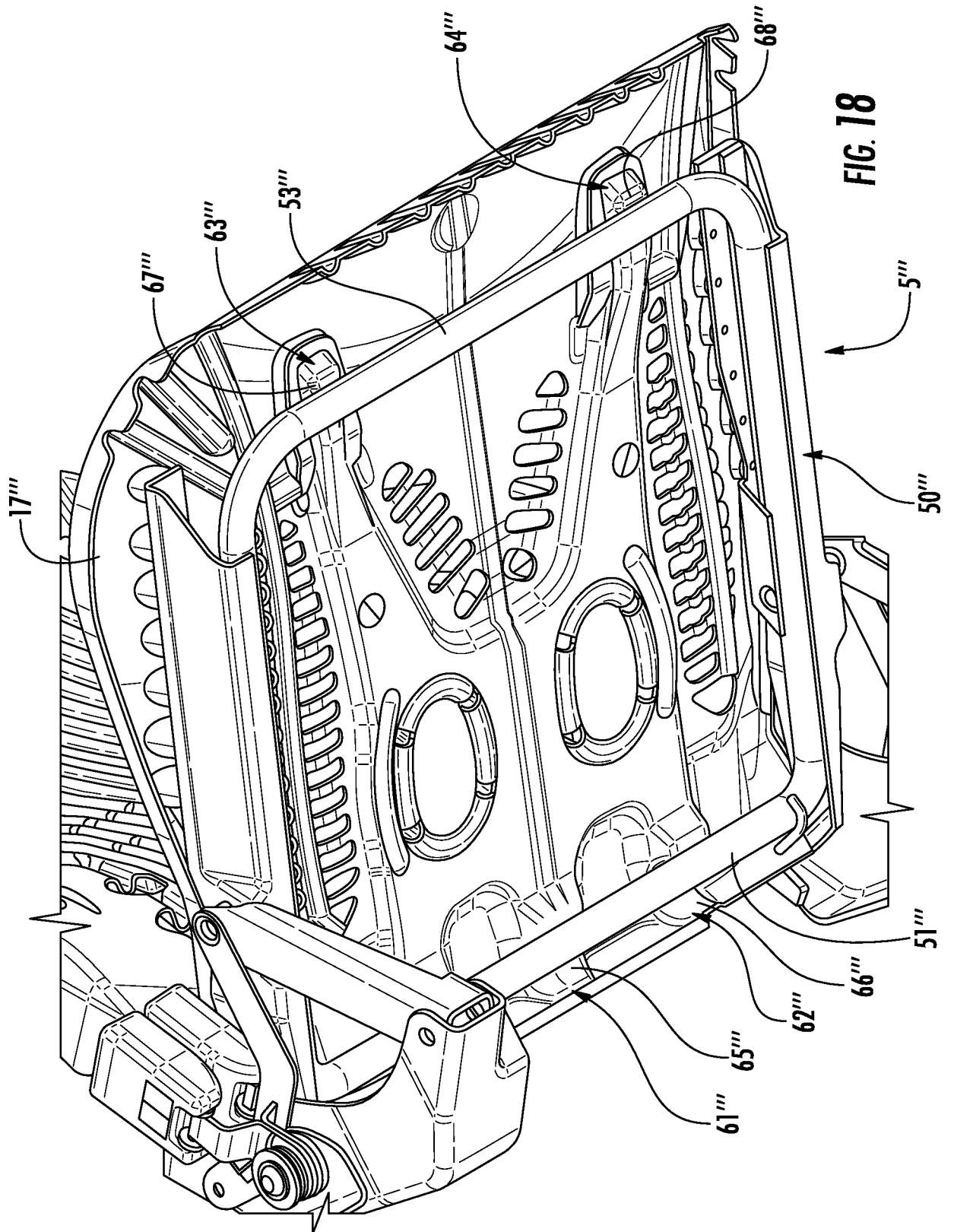


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US16/32293

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - B60N 2/16, 2/50, 2/58 (2016.01) CPC - B60N 2/502, 2/505, 2/508, 2/542, 2/544 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC(8) Classifications: B60N 2/16, 2/30, 2/44, 2/50, 2/54, 2/56, 2/58, 2/64, 2/70; B62J 1/00, 1/12 (2016.01) CPC Classifications: B60N 2/28, 2/2866, 2/2881, 2/3011, 2/305, 2/502, 2/505, 2/508, 2/542, 2/544; B62J 1/00, 1/12 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); seat, chair, cushion, pad, foam, elastomer, neoprene, TPE, thermoplastic elastomer, rubber, mold, mould, body, cover, membrane, web, mesh, automobile, vehicle, car, truck, boat, airplane, bike, bicycle, motorcycle, suspend, hammock		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/0089219 A1 (BLANCO E. E. et al.) July 11, 2002; abstract; figures 1, 2; paragraphs [0018]-[0023]	1-6, 8, 10, 13-15, 17-22
X	US 2014/0110980 A1 (ATTEY G. S.) April 24, 2014; abstract; figures 7, 9, 10; paragraphs [0009], [0057]	1, 3-7, 9-14, 16, 17, 20-22
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Y		4-7
X	US 2004/0004375 A1 (GARLAND T. et al.) January 8, 2004; abstract; figures 1, 3D, 3H; paragraphs [0041], [0111]	1, 4-7
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Y		4-7
X	US 5,013,089 A (ABU-ISA I. A. et al.) May 7, 1991; figures 1, 3, 4; abstract; column 5, line 40-column 6, line 30	1, 12
X	US 4,869,554 A (ABU-ISA I. A. et al.) September 26, 1989; abstract; figures 2-4	1, 12
A	US 4,826,249 A (BRADBURY J. W.) May 2, 1989; entire document	1-22
A	US 2012/0013165 A1 (DI GIUSTO N. et al.) January 19, 2012; entire document	1-22
A	US 2011/0049948 A1 (HOBL R. et al.) March 3, 2011; entire document	1-22
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
12 July 2016 (12.07.2016)		18 AUG 2016
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300		Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774