



(51) International Patent Classification:

A47C 1/00 (2006.01) A47C 3/30 (2006.01)

A47C 3/02 (2006.01) A47C 7/00 (2006.01)

A47C 3/026 (2006.01) A47C 9/00 (2006.01)

(21) International Application Number:

PCT/IB2020/055459

(22) International Filing Date:

10 June 2020 (10.06.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/859,314 10 June 2019 (10.06.2019) US

(71) Applicant: INVENTOR GROUP GMBH [CH/CH]; Sihleggstrasse 23, 8832 Wollerau (CH).

(71) Applicant (for KN only): SMARTPAT PLC [US/US]; 400 Renaissance Center, Suite 2600, Detroit, Michigan 48243 (US).

(72) Inventor: WALSER, Thomas; Schulstrasse 7, 8280 Kreuzlingen (CH).

(74) Agent: NIX, Bernd Axel; 400 Renaissance Center, Suite 2600, Detroit, Michigan 48243 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: TILTABLE STOOL

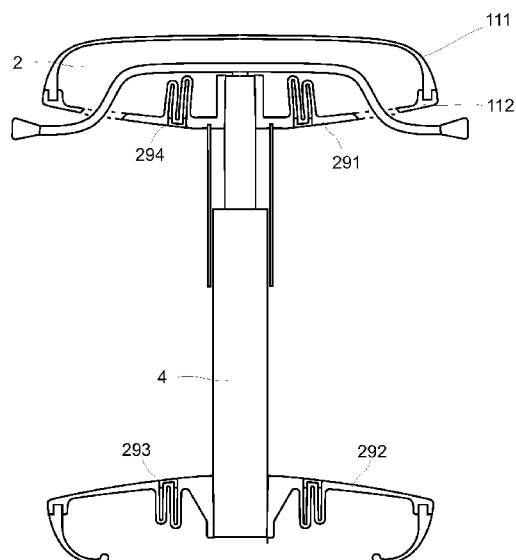


FIG. 29

(57) Abstract: A tiltable stool includes a seat which is connected to a base by an elongated body structure. The base has an upper base element and a lower base element. The upper base element is resiliently deformable. The resiliently deformable upper base element allows the stool to pivot in any direction. The lower base element is a rotationally symmetrical outwardly convex and inwardly concave body. The upper base element may include one or more annular grooves.

Published:

- *with international search report (Art. 21(3))*
- *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

TILTABLE STOOL

TECHNICAL FIELD

[0001] The present disclosure generally relates to an article of furniture, and more particularly, to a tiltable stool or chair.

BACKGROUND

[0002] Articles of furniture such as stools or chairs which allow a user to rock forward, backward and sideways are generally known. A tiltable stool is typically configured to be used on a generally horizontal surface such as a floor. The stool comprises a top portion providing a seat and a base portion comprising a bottom surface configured to support the stool on the floor.

[0003] An example of a tiltable stool is disclosed in the applicant's U.S. Patent No. 9,894,998 which is hereby incorporated by reference thereto in its entirety.

SUMMARY

[0004] A tiltable stool includes a seat, a base, and a body structure extending between the seat and the base. The base includes at least an inner base element and an outer base element. The outer base element extends outwardly around the inner base element. The body structure is firmly connected to a central portion of the inner base element. The outer base element has an annular upper end extending outwardly around the inner base element and a rotationally symmetrical outwardly convex and inwardly concave body extending from the annular upper end to an annular lower end. The outer base element or the inner base element is resiliently deformable, thereby allowing the body structure to pivot in any direction.

[0005] The inner base element and the outer base element may be connected to each other with a tongue and groove joint. In particular, the outer base element may have an inwardly facing tongue which engaged an outwardly open groove in the inner base element.

[0006] An upper surface of the inner base element and an upper surface of the outer base element may be arranged in a common plane. The upper surface of the inner base element and the upper surface of the outer base element may transition seamlessly into one another.

[0007] The inner base element may have an outwardly facing cylindrical support surface which abuts a corresponding inwardly facing cylindrical support surface of the outer base element. The outer base element may have an inwardly facing tongue which engages an outwardly open groove in the inner base element. In this configuration the outwardly facing cylindrical support surface of the inner base element may be arranged above the groove and the inwardly facing cylindrical support surface of the outer base element may be arranged above the tongue.

[0008] The inner base element may be made of an inelastic material and the outer base element may be made of a resiliently deformable material. Alternatively, the inner base element may be made of a resiliently deformable material and the outer base element may be made of an inelastic material. In yet another alternative both the inner base element and the outer base element may be made of resiliently deformable material.

[0009] An adjustment disk may be arranged at a variable height below the inner base element. A maximum tilt angle of the body structure may then be limited by selecting the variable height of the adjustment disk below the inner base element. The body structure may extend through the inner base element and the adjustment disk may comprise an inner thread which engages a corresponding outer thread arranged at a lower end of the body structure. The adjustment disk may be configured to push against the outer base element when a maximum tilt angle of the body structure has been reached.

[0010] The outer base element may have a generally C-shaped cross section. The inner base element may be generally disk-shaped. The inner base element may be made of spring steel and include a plurality of circumferentially distributed slots extending outward away from its central portion.

[0011] The seat of the stool may be pivotally mounted to an upper end of the body structure.

[0012] In another example, a tiltable stool includes a seat, a resiliently deformable inner base element, and a resiliently deformable outer base element extending outwardly around the inner base element. A body structure extends between the seat and the inner base element. The body structure is firmly connected to a central portion of the inner base element. The inner base element and the outer base element each form a spring damper system, allowing the body structure to pivot in any direction by

deforming the inner base element and the outer base element. A damping factor of the outer base element is larger than a damping factor of the inner base element.

[0013] In a different configuration, a tiltable stool has a seat, an upper base element, a lower base element, and a body structure extending between the seat and the upper base element. The body structure is firmly connected to a central portion of the upper base element. The lower base element has an annular upper end firmly connected to an annular outer portion of the upper base element. The upper base element is resiliently deformable.

[0014] The lower base element may be a rotationally symmetrical outwardly convex and inwardly concave body extending from the annular upper end to an annular lower end.

[0015] The lower base element and the upper base element may be connected to each other with a tongue and groove joint. In particular, the lower base element may comprise an upwardly facing tongue which engages a downwardly open groove in the upper base element.

[0016] An outer surface of the upper base element and an outer surface of the lower base element may seamlessly transition into one another.

[0017] The upper base element may be made of a resiliently deformable material and the lower base element may be made of an inelastic material. Alternatively, both the upper base element and the lower base element may be made of resiliently deformable material.

[0018] The upper base element may comprise an annular groove. The annular groove may be deeper than it is wide. The annular groove may have an inner side wall and an outer side wall. The inner side wall and the outer side wall may be arranged at an angle towards one another when the tiltable stool is in an upright position. The annular groove may be arranged concentrically around and proximal to the central portion.

[0019] The annular groove may have a generally V-shaped cross-sectional profile with a flat bottom.

[0020] The annular groove may have an inner side wall and an outer side wall. Upper portions of the inner side wall and the outer side wall may be arranged at a distance from one another when the tiltable stool is in an upright position. The upper portions of the inner side wall and the outer side wall may touch when the tiltable stool is deflected and reaches a maximum tilt angle.

[0021] The tiltable stool may include a tilt angle adjustment ring which is axially displaceable along a longitudinal axis of the body structure. The tilt angle adjustment ring may have a lower portion which engages the annular groove at a selectable depth. A maximum tilt angle of the body structure may be limited by selecting the selectable depth of the lower portion of the tilt angle adjustment ring in the annular groove.

[0022] The upper base element of the tiltable stool may include a plurality of concentric and radially spaced annular grooves. The annular grooves have a generally U-shaped cross-sectional profile. The annular grooves may be filled with a compressible compound.

[0023] The annular grooves may be wider than they are deep.

[0024] The upper base element may be generally disk-shaped.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] FIG. 1 shows a cross section of a first example of a base of a tiltable stool.

[0026] FIG. 2 shows a cross section of a second example of a base of a tiltable stool.

[0027] FIG. 3 shows a cross section of a third example of a base of a tiltable stool.

[0028] FIG. 4 shows a perspective cross section of a fourth example of a base of a tiltable stool.

[0029] FIG. 5 shows a cross section of a fifth example of a base of a tiltable stool.

[0030] FIG. 6 shows a cross section of a sixth example of a base of a tiltable stool.

[0031] FIG. 7 shows a cross section of a seventh example of a base of a tiltable stool in a normal state.

[0032] FIG. 8 shows the base of FIG. 7 in a deflected state.

[0033] FIG. 9 shows a cross section of an eighth example of a base of a tiltable stool in a normal state.

[0034] FIG. 10 shows the base of FIG. 9 in a deflected state.

[0035] FIG. 11 shows a cross section of a stool.

[0036] FIG. 12 is a diagram showing a mechanical spring and damper configuration.

[0037] FIG. 13 is a cross sectional view of a stool base showing an inner base member with conical lower surface.

[0038] FIG. 14 is a cross sectional view of a stool base showing an inner base member with conical upper surface.

- [0039] FIGs. 15-17 show a cross sectional profile of a stool base with an annular groove.
- [0040] FIGs. 18-20 show a cross sectional profile of a stool base with a plurality of annular grooves.
- [0041] FIGs. 21 and 22 show a cross sectional profile of a stool base with a corrugated upper base element.
- [0042] FIG. 23 is a partially cut perspective view of the stool base as in FIG. 22.
- [0043] FIG. 24 is a partially cut perspective view of the stool base as in FIG. 19.
- [0044] FIG. 25 is a cross sectional profile of a stool base with annular grooves and a cover.
- [0045] FIG. 26 is a cross sectional profile of a stool base with annular grooves formed in an intermediate part.
- [0046] FIG. 27 is a cross sectional profile of a stool base with annular grooves formed in an intermediate part.
- [0047] FIG. 28 is a cross sectional profile of a stool base with annular grooves and rollers.
- [0048] FIG. 29 is a cross sectional profile of a stool.

DETAILED DESCRIPTION

- [0049] Referring to FIGS. 1 and 11, a tiltable stool **1** has a seat **2**, a base **3**, and an elongated body structure **4** between the base **3** and the seat **2**. The stool **1** may comprise a height adjustment mechanism including an adjustment lever **7** to adjust the length of the body structure **4**. The body structure **4** may comprise a pillar assembly and defines a vertical axis **5** of the stool **1**.
- [0050] The base **3** may include an inner base element **20** which is connected to an outer base element **10**. The body structure **4** is firmly connected to a central portion **29** of the inner base element **20**. The central portion **29** may include a receiving opening for a lower portion of the body structure **4**. The outer base element **10** is configured to rest on a floor.
- [0051] The outer base element **10** or the inner base element **20** is resiliently deformable. This allows the body structure **4** to pivot in any direction by deforming the resilient element of the base **3**. Throughout this specification and the following claims, the coordinating conjunction "or" is not used to express exclusivity. That is, the outer base element or the inner base element being resiliently deformable means

that either the outer base element alone is resiliently deformable, that the inner base element alone is resiliently deformable, or that both the outer base element and the inner base element are resiliently deformable.

[0052] When a tilting force is applied to the seat, the seat is moved from a normal position into a dynamic seating position. Typically, the normal position is upright. In the upright position, the vertical axis **5** of the stool **1** is perpendicular to the floor. In response to a tilting force, the resilient element of the base **3** is deformed, and the vertical axis **5** of the stool **1** is tilted by a tilt angle α out of the normal position.

[0053] The outer base element **10** surrounds and is firmly connected to the inner base element **20**. In particular, an upper annular end of the outer base element is connected to an outer rim of the inner base element. The inner base element **20** may be connected to the outer base element **10** by a tongue and groove joint. As shown in FIG. 1, the outer base element **10** may include an inwardly facing tongue **11** which engages an outwardly open groove **21** in the rim of the inner base element **20**. The tongue-and-groove connection may also use an outwardly facing tongue arranged on the inner base element **20** and an inwardly open groove at the outer base element **10**.

[0054] The inner base element **20** and the outer base element **10** preferably transition seamlessly, i.e. smoothly and without gaps, into one another. An upper surface **26** of the inner base element and an upper surface **16** of the outer base element may be arranged in a common plane. The upper surface **26** of the inner base element and the upper surface **16** of the outer base element thereby transition seamlessly into one another.

[0055] The inner base element may have an outwardly facing cylindrical support surface **27** at its outer rim. This outwardly facing cylindrical support surface **27** abuts a corresponding inwardly facing cylindrical support surface **17** of the outer base element. In combination with a tongue and groove joint the outwardly facing cylindrical support surface **27** of the inner base element **20** and the inwardly facing cylindrical support surface **17** of the outer base element **10** are arranged in a plane axially spaced above the tongue **11** and groove **21**. The support surfaces **17**, **27** are generally vertically oriented.

[0056] The inner base element **20** may be generally disc-shaped having a generally vertically oriented, i.e. cylindrical, outer rim. The outer rim may alternatively have a frustoconical shape, in which case the support surfaces between the inner base element and the outer base element may also be frustoconical.

[0057] The desired tiltability of the stool can be achieved in that the inner base element is made of an inelastic material and the outer base element is made of a resiliently deformable material. Within the scope of this specification and the following claims, a material will be considered inelastic if a part made thereof, when the same is subjected to typical forces occurring in a stool, do not lead to a noticeable deformation of the part. An inelastic material may also be referred to as rigid. A material will be considered resiliently deformable, or simply resilient, if a part made thereof, when the same is subjected to typical forces occurring in a stool, does elastically deform and resume its original shape when no longer subjected to the typical forces. Within a stool forces up to 2500 N are typical.

[0058] The desired tiltability can also be achieved by making the inner base element from a resiliently deformable material and the outer base element from an inelastic material. In yet another variation both the inner base element and the outer base element may be made of resiliently deformable material. In that case, the inner base element and the outer base element are preferably made of different materials, and in particular of materials having different hardness.

[0059] The resilient element of the base **3** may be made of thermoplastic polyurethane (TPU), rubber, thermoplastic polyolefin (TPO), fiberglass enforced polyamide (PA) or fiberglass enforced polyurethane (PU). The selection of material requires a trade-off decision between cost and functionality. Experiments including durability tests have shown, that a thermoplastic polyurethane with 90A Shore hardness provides the required robustness at an affordable price. An outer base element **10** made of softer TPU with 75A Shore hardness would require about twice the amount of material as one made of TPU with 90A Shore hardness.

[0060] The inelastic element of the base **3** may be made of metal, e.g. aluminum, or steel, or be made of a hard plastic, e.g. a plastic with greater than 100A Shore hardness.

[0061] Shown in FIG. 1 and 2 is a configuration in which the inner base element **20** is made of a rigid material and the outer base element **10** is made of a resilient material. In this configuration, the shape of the outer base element **10** primarily determines how sitting on the stool feels to a user. The user primarily observes how the stool moves downwardly in response to vertical forces. This characteristic may be expressed as a vertical spring constant of the stool. The user will also observe how

easily the stool pivots, i.e. how strongly the stool pushes back against horizontal forces applied to the seat.

[0062] The shape of the outer base element **10** can be defined by several characteristic metrics as illustrated in FIG. 2. Among those characteristic metrics are the height **h** of the outer base element **10**, its thickness **t**, the diameter **D_u** of its circular upper end, the diameter **D_b** of its circular lower end, and its maximum diameter **D_{max}** between the upper end and the lower end.

[0063] While experiments have been conducted with parts of certain dimensions, the absolute size of those parts may be scaled, leaving characteristic proportions that have been found to be beneficial:

- $D_{\max}/D_u: > 1.2$
- $D_{\max}/h: 3 - 10$
- $D_{\max}/D_b: 1.05 - 2$
- $t/h: 0.05 - 0.35$

[0064] Generally, use of a thicker and stiffer material (e.g. between 75-85A Shore) for the outer base element should be considered for high-end products where comfort and service life of the product are critical. For lower cost models it is desirable to reduce the mass of the outer base member to ideally less than 1 kg, which can be accomplished by using thinner and harder material (e.g. above 90A Shore).

[0065] The outer base element **10** may have a generally C-shaped cross section. As illustrated in FIG. 1, the outer base element **10** may be formed as one piece, but functionally divided into an upper section **12**, a center section **13**, and a lower section **14**. As indicated by dotted lines the upper section **12** may extend from the upper end to a virtual line which cuts the outer surface of the outer base element perpendicularly at a 45° upward angle. The lower section **14** may extend from the lower end to a virtual line which cuts the outer surface of the outer base element perpendicularly at a 45° downward angle.

[0066] A differently shaped outer base element is illustrated in FIG. 5. Here, the lower section **54** of the outer base element is shaped as a generally flat ring. The center section **53** is generally cylindrical having vertical walls. The upper section **52** has a generally rounded circular cross section.

[0067] While the outer base element **10** will preferably be formed as one piece, it may also be formed in two pieces as shown in FIG. 3. For example, the outer base

element may consist of an upper outer base element **32** that is joined to a lower outer base element **34** by a joint **35**. The upper outer base element **32** and the lower outer base element **34** may be made of different hard materials.

[0068] FIG. 7 and 8 show a configuration in which the outer base element **72** is made of a rigid material which the inner base element **71** is made of a resilient material.

[0069] FIG. 4 shows a configuration in which both the outer base element and the inner base element **40** are made of resilient material. To improve its elasticity the inner base element **40** includes a plurality of circumferentially distributed slots **41** which extend outward away from the central portion. The slots **41** extend diagonally, i.e. with a radial and a circumferential component, from the central portion towards the rim of the inner base element. While diagonal slots have proven to be beneficial, in particular, if the inner base element is not completely flat, radially extending slots without a circumferential component can be used in flat parts.

[0070] It may be desirable to limit the tilt of the stool to a maximum tilt angle and to allow a user to adjust this maximum tilt angle. This can be accomplished by providing an adjustment disk **61** as shown in FIG. 6. The adjustment disk **61** is connected to the lower end of the body structure **4**. A central axis of the adjustment disk **61** is concentric with the vertical axis **5** of the stool **1**. As the stool **1** tilts, so does the adjustment disk **61**.

[0071] The adjustment disk **61** is wide, such that an outer rim of the adjustment disk, upon reaching the maximum tilt angle, pushes against an inner surface of the outer base element. The stool **1** can tilt no further than permitted by the height between the outer rim of the adjustment disk **61** and the inner surface of the outer base element underneath.

[0072] The position of the adjustment disk **61** within the base may be adjustable. For example, a lower portion of the body structure **4** may extend through the inner base element with a threaded end. The threaded end of the body structure may be connected with a threaded central opening of the adjustment disk **61**. By rotating the threaded adjustment disk **61** within the base it can thus move up and down as indicated by a lower position **61'** in dotted line and an upper position of the adjustment disk **61** shown in solid line in FIG. 6. In the lower position **61'**, tilt of the stool is significantly limited. Here, the adjustment disk **61'** leaves very little space for the stool to tilt until the adjustment disk pushes against the outer base element.

[0073] The concept of limiting the maximum tilt angle of the stool by an adjustment disk can also be applied to the configuration with a resilient inner base element **71** and rigid outer base element **72** shown in FIGS. 7 and 8. Such a configuration is shown in FIGS. 9 and 10. Here, the adjustment disk **91** is also provided in a height-adjustable arrangement within the base. However, the maximum tilt of the stool is limited when the adjustment disk **91** pushes against an upper portion of the outer base element. As shown, the maximum tilt of the stool is very limited when the adjustment disk **91** is in an upper position **90**, while the maximum pivot angle of the stool is larger when the adjustment disk is in a lower position **92**.

[0074] In either configuration, the adjustment disk is arranged within the base at a variable height below the inner base element. A maximum tilt angle of the body structure is limited by selecting the variable height of the adjustment disk below the inner base element.

[0075] The stool shown in FIG. 11 uses the same general structure of an inner base element **20** and an outer base element **10**. In this configuration both the inner base element **20** and the outer base element **10** are made of resilient material. The outer base element **10** may be made of a thermoplastic material having a hardness of about 80A-90A Shore. The inner base element **20** is preferably made of spring steel. As shown, the outer base element **10** overlaps the inner base element **20**. The inner base element **20** is connected to the outer base element **10** in that the inner base element **20** engages an undercut of the outer base element **10**. The relative softness of the outer base element **10**, in particular if still warm after molding or if heated, allows sliding the outer base element **10** onto the inner base element **20** by stretching the outer base element **10** and allowing the inner base element **20** to engage the undercut of the outer base element.

[0076] While a force fit connection between the inner base element and the outer base element is preferred for recyclability, the inner base element may also be welded (e.g. by ultrasonic welding) or glued to the outer base element. The outer base element may also be overmolded onto the inner base element. The inner base element and the outer base element may also be produced by multi-material injection molding.

[0077] Since both the inner base element **20** and the outer base element **10** are resiliently deformable, both deform when the stool is tilted. Surprisingly though, the dynamic response of the inner base element **20** and the outer base element **10** to a sudden lateral movement of the seat **2** can be quite different. Both the inner base

element **20** and the outer base element **10** can be considered damped spring systems. The damping factor of the outer base element **10** is significantly larger than the damping factor of the inner base element **20**. The different damping factors are attributed to the choice of materials (spring steel vs. thermoplastic) and their relative sizes.

[0078] The different damping characteristics of the inner base element and the outer base element support a desirable use of the stool: The inner base element allows small, high-frequency movements of a user, which stimulates the user's muscular system. The user may constantly make micro-adjustments to her position on the stool while maintain balance, and thereby exercising her muscles. Intentional larger movements of the stool, i.e. larger pivot angles when reaching for a distant object, are possible and supported by deformation of the outer base element. However, such larger movements are significantly more dampened than small and fast movements. This provides a sense of stability to the user and avoids a risk of accidental fall.

[0079] FIG. 11 illustrates this general concept of the base **3** schematically. The body structure **4** can pivot relative to the floor in response to a lateral force **F** by resiliently deforming the inner base element **20** or the outer base element **10**. Each of the base elements is a mechanical spring damper system. The inner base element is preferably underdamped, i.e. its damping ratio is smaller than one. The outer base element is preferably overdamped, i.e. its damping ratio is greater than one. The stool **1** so achieves a dynamic behavior that previously could only be accomplished with pressurized components, but without using any such pressurized components.

[0080] As shown in FIG. 11, the seat **2** may be pivotably mounted to an upper end of the body structure **4**. The seat **2** may include an upper seat member **111** which is firmly attached to a lower seat member **112**. The connection between the upper seat member **111** and the lower seat member **112** resembles the connection between the inner base element **20** and the outer base element **10**. The lower seat member **112** may be made of a resiliently deformable material. The lower seat member **112** may be a radially or diagonally slotted spring steel disk, which may be identical to the inner base element **20**. When in use, the seat **2** may move horizontally in any direction while staying in a generally horizontal orientation. That is, while the body structure **4** pivots about the base **3**, the seat **2** can pivot in opposite direction relative to the body structure and thereby maintain a generally horizontal orientation.

[0081] FIG. 13 shows a configuration of a resiliently deformable inner base element **20** having a frustoconical lower surface **131** which faces a correspondingly shaped conical surface of an adjustment member **132**. The adjustment member **132** is height-adjustably attached to the body structure **4**. The adjustment member **132** limits how far the inner base element **20** can deform downwardly. Deformation of the inner base element **20** is limited to an adjustment space **133** between the inner base element **20** and the adjustment member **132**. The adjustment member is arranged within the outer base element **10** and below the inner base element **20**.

[0082] An alternative configuration of an adjustment member **142** is shown in FIG. 14. Here, the resiliently deformable inner base element **20** has a frustoconical upper surface **141** which faces a correspondingly shaped conical surface of an adjustment member **142**. In this configuration the upward movement of the inner base element **20** is upwardly limited to a space **143** above the inner base element **20** and below the adjustment member **142**. As indicated by dotted lines the position of the adjustment member **142** can be adjusted.

[0083] A differently configured stool is shown in FIG. 15-17. The tiltable stool **1** has a base **3** and an elongated body structure **4** between the base **3** and a seat **2**. The base **3** includes an upper base element **150** which is firmly connected to a lower base element **160**. The body structure **4** is firmly connected to a central portion **29** of the upper base element **150**. The central portion **29** includes a receiving opening for a lower portion of the body structure **4**. The lower base element **160** is configured to rest on a floor.

[0084] The upper base element **150** is resiliently deformable. The lower base element **160** may be resiliently deformable and may in particular be the annular elastic base disclosed in the applicant's U.S. Pat. No. 9,894,998. The lower base element **160** may however be inelastic and may e.g. include roller wheels **281** attached to a rigid support structure **282** as shown in FIG. 28. At least the resiliently deformable upper base element **150** allows the body structure **4** to pivot in any direction. Even more preferably, both the upper base element **150** and the lower base element **160** are resiliently deformable and complement each other with different frequency responses to a deflective force.

[0085] When a tilting force is applied to the seat, the seat is moved from a normal position as illustrated in FIG. 16 into a dynamic seating position as shown in FIG. 15. Tiltability of the upper base element is enhanced by an annular groove **151** which is

arranged concentrically around and proximal to the central portion **29**. The annular groove may have a generally V-shaped profile with an inner side wall **153** and an outer side wall **152**. Both side walls **152**, **153** extend from an upper end of the groove to a bottom **154** of the groove **151**. The inner side wall **153** and the outer side wall **152** may be slanted at an angle towards one another. This causes a downwardly diminishing width of the groove. The bottom **154** of the groove may be generally flat.

[0086] The annular groove **151** is relatively deep, i.e. a depth of the groove is greater than a width of the groove. As illustrated, the groove is about three times deeper than it is wide.

[0087] The annular groove **151** allows use of relatively hard materials having a hardness greater than 90 Shore. Elasticity is primarily achieved through the shape of the groove, not the softness of the material used. Use of a relatively hard material is desirable, especially when using TPU which tends to become harder and brittle over time. This is true especially in areas where the TPU is frequently deformed. The structural elasticity afforded by the annular groove provides a longer life than elasticity obtained from use of softer material.

[0088] A tilt angle adjustment ring **170** may be provided. The tilt angle adjustment ring **170** as shown in FIG. 17 is axially displaceable along the longitudinal axis of the body structure **4**. For example, a lower portion of the body structure **4** may have an outer thread **171** which meshes with an inner thread **172** of the adjustment ring. The axial position of the adjustment ring **170** can then be selected by rotating the adjustment ring relative to the body structure **4**.

[0089] A lower portion **173** of the adjustment ring is configured to engage the annular groove **151** at a selectable depth. In a lowermost position of the adjustment ring **170** the lower portion **173** protrudes completely into and fills the space within the groove **151**. Thereby, the deformability of the upper base member **150** in the area of the groove **151** is substantially reduced.

[0090] By raising the adjustment ring, a maximum tilt angle α of the stool can be controlled. The stool can tilt only until the upper end of the outer wall **152** touches the lower portion **173** of the adjustment ring **170**.

[0091] The lower base element **160** is arranged entirely below and firmly connected to the upper base element **150**. In particular, an upper annular end of the lower base element is connected to an outer end of the upper base element. The upper base element **150** may be connected to the lower base element **160** by a tongue and groove

joint. As shown in FIGs. 15-17, the lower base element **160** may include an upwardly facing tongue **161** which engages a downwardly open groove **155** in the outer end of the upper base element **150**.

[0092] The upper base element **150** and the lower base element **160** preferably transition seamlessly, i.e. smoothly and without gaps, into one another.

[0093] An alternative configuration of an upper base element **180** is shown in FIGs. 18-20 and FIG. 24. The upper base element **180** has two radially spaced concentric grooves **181,182**. This includes an outer groove **181** and an inner groove **182**. In the illustrated configuration the grooves **181,182** have a generally U-shaped profile with parallel side walls. The side walls include an outer side wall **183** and a parallel inner side wall **184**. The U-shaped profile of the grooves **181,182** allows the body structure **4** to pivot in any direction about a pivot point **P**. The pivot point **P** is arranged along a central axis of the upper base element **180** within the base.

[0094] A total width of upper ends of the inner groove **182** and the outer groove **181** determines a maximum tilt angle α of the body structure **4** relative to the base **3**. As shown in FIGs. 18 and 19, the maximum tilt angle α is reached when the grooves **181,182** have been fully deformed such that upper ends of their respective inner side walls **184** and outer side walls **183** touch. The maximum tilt angle α is preferably about 10 degrees.

[0095] The width of the grooves **181,182** should be selected to meet pinch test standards and is preferably less than 8 mm or wider than 23 mm. The grooves **181, 182** may be filled with a compressible material **185**, for example a rubber compound.

[0096] Alternatively, the grooves **181, 182** may be covered with an annular cover **251** as shown in FIG. 25. The annular cover **251** is made of a compressible material such as a rubber compound or a resiliently deformable foam. The annular cover may have a ring-shaped body **254** which extends from the inner wall of the innermost groove to the outer wall of the outermost groove. Thereby, the ring-shaped body **254** covers upper ends of the grooves **181, 182**. Extending downwardly from the ring-shaped body **254** are legs **252, 253** which extend into the grooves **181, 182**. The legs **252, 253** may be held in the grooves **181, 182** by a form-fit connection.

[0097] Stiffening ribs **186, 187** may be formed in the upper base element **180** radially outwardly of the grooves **181,182**. Thereby, resilient deformation of the upper base element **180** is substantially limited to the area of the grooves **181,182**.

[0098] Another alternative configuration of an upper base element **210** is shown in FIGs. 21-23. In this configuration, five radially spaced grooves **211-215** are used. The grooves **211-215** are relatively shallow and resemble corrugations. The grooves **211-215** have a generally sinusoidal profile of alternating ridges and valleys. Relatively shallow here refers to a depth of the grooves being smaller than a width of the grooves. The corrugated profile of the upper base element **210** extends substantially along its entire surface from its center **216** to its radially outer end **217**.

[0099] Irrespective of a particular embodiment, the upper base element **150,180,210** is preferably an integrally molded single piece. In combination with a single-piece molded lower base element **160** the base **3** may thus consist essentially of only two parts. This allows for very cost effective manufacturing yet provides a desirable dynamic deformation. The utilization of grooves has proven beneficial to extend the useful life of the base.

[0100] In some configurations, it may be desirable not form the upper base element as a single part, but rather as an assembly of several pieces. One example of such a modular design is shown in FIG. 26. As shown, the body structure **4** of the stool is held in an inner base body **261**. The inner base body is connected to an intermediate upper base body **260**. The intermediate upper base body **260** is a resiliently deformable molded component. The intermediate upper base body **260** includes annular grooves **181, 182** which allows the body structure **4** to pivot in any direction. The intermediate upper base body **260** may overlap the inner base body **261** and extend to the body structure **4**. That is, the inner base body **261** may be covered entirely by the intermediate upper base body **260**. The intermediate upper base body **260** may be connected to the inner base body **261** with fasteners **265**. An outer upper base body **262** may be arranged around the intermediate upper base body **260**. The outer upper base body **262** may be generally disk-shaped and extend radially from the intermediate upper base body **260** at its inner end to a lower base body **263** at its outer end.

[0101] FIG. 27 shows an alternative configuration of an intermediate upper base body **270**. As shown, the intermediate upper base body **270** is connected to the inner base body by an inner tongue-and-groove joint **272**. The intermediate upper base body **270** is connected to the outer upper base body **275** by an outer tongue-and-groove joint **273**. The intermediate upper base body **270** is covered by a cover **271** which reaches above the annular grooves formed in the intermediate upper base body **270**.

The cover **271** extends from the inner base body **261** to the outer upper base body **275**. The cover **271** provides a seamlessly surface which hides the intermediate upper base body **270**.

[0102] FIG. 29 shows a stool with a resiliently deformable base having an upper base member **292** which includes a plurality of two or more annular grooves **293**. The grooves **293** are configured to deform under lateral load which allows the body structure **4** to pivot relative to the floor. The seat **2** is pivotably mounted to an upper end of the body structure **4**. The seat **2** includes an upper seat member **111** which is firmly attached to a lower seat member **112**. The lower seat member **112** mirrors the design of the upper base member **292** in that it has a plurality of two or more grooves **294**. This allows the seat **2** to pivot relative to the body structure **4**. The lower seat member **112** and the upper base member **292** may be so similar that they can be molded from a common tool.

[0103] Desirable configurations of a tiltable stool include: A tiltable stool, comprising: a seat; an inner base element; a body structure extending between the seat and the inner base element, the body structure being firmly connected to a central portion of the inner base element; and an outer base element, the outer base element having an annular upper end extending outwardly around the inner base element and a rotationally symmetrical outwardly convex and inwardly concave body extending from the annular upper end to an annular lower end, wherein the outer base element or the inner base element is resiliently deformable, thereby allowing the body structure to pivot in any direction.

[0104] The tiltable stool as described above, wherein the outer base element and the inner base element are connected to each other with a tongue and groove joint.

[0105] The tiltable stool as described above, wherein the outer base element comprises an inwardly facing tongue which engaged an outwardly open groove in the inner base element.

[0106] The tiltable stool as described above, wherein an upper surface of the inner base element and an upper surface of the outer base element are arranged in a common plane.

[0107] The tiltable stool as described above, wherein an upper surface of the inner base element and an upper surface of the outer base element transition seamlessly into one another.

[0108] The tiltable stool as described above, wherein the inner base element comprises an outwardly facing cylindrical support surface which abuts a corresponding inwardly facing cylindrical support surface of the outer base element.

[0109] The tiltable stool as described above, wherein the outer base element comprises an inwardly facing tongue which engaged an outwardly open groove in the inner base element, and wherein the outwardly facing cylindrical support surface of the inner base element is arranged above the groove and the inwardly facing cylindrical support surface of the outer base element is arranged above the tongue.

[0110] The tiltable stool as described above, wherein the inner base element is made of an inelastic material and the outer base element is made of a resiliently deformable material.

[0111] The tiltable stool as described above, wherein the inner base element is made of a resiliently deformable material and the outer base element is made of an inelastic material.

[0112] The tiltable stool as described above, wherein both the inner base element and the outer base element are made of resiliently deformable material.

[0113] The tiltable stool as described above, further comprising an adjustment disk which is arranged at a variable height below the inner base element.

[0114] The tiltable stool as described above, wherein a maximum tilt angle of the body structure is limited by selecting the variable height of the adjustment disk below the inner base element.

[0115] The tiltable stool as described above, wherein the body structure extends through the inner base element and wherein the adjustment disk comprises an inner thread which engages a corresponding outer thread arranged at a lower end of the body structure.

[0116] The tiltable stool as described above, the adjustment disk is configured to push against the outer base element when a maximum tilt angle of the body structure has been reached.

[0117] The tiltable stool as described above, wherein the outer base element has a generally C-shaped cross section.

[0118] The tiltable stool as described above, wherein the inner base element is generally disk-shaped.

[0119] The tiltable stool as described above, wherein the inner base element comprises a plurality of circumferentially distributed slots extending outward away from the central portion.

[0120] The tiltable stool as described above, wherein the seat is pivotally mounted to an upper end of the body structure.

[0121] A tiltable stool, comprising: a seat; a resiliently deformable inner base element; a body structure extending between the seat and the inner base element, the body structure being firmly connected to a central portion of the inner base element; and a resiliently deformable outer base element extending outwardly around the inner base element, wherein the inner base element and the outer base element each form a spring damper system, allowing the body structure to pivot in any direction by deforming the inner base element and the outer base element.

[0122] The tiltable stool as described above, wherein a damping factor of the outer base element is larger than a damping factor of the inner base element.

[0123] Various configurations of a tiltable stool are possible by combining any two or more of the following features: The structure of the lower base element being a rotationally symmetrical outwardly convex and inwardly concave body extending from the annular upper end to an annular lower end. The lower base element and the upper base element being connected to each other with a tongue and groove joint, in particular the lower base element having an upwardly facing tongue which engages a downwardly open groove in the upper base element. A seamless transition of an outer surface of the upper base element and an outer surface of the lower base element. A material selection of the upper base element being made of a resiliently deformable material and the lower base element being made of an inelastic material, or alternatively both the upper base element and the lower base element being made of resiliently deformable material. The upper base element having an annular groove, in particular an annular groove that is deeper than it is wide. The specific structure of the annular groove having an inner side wall and an outer side wall, the inner side wall and the outer side wall being arranged at an angle towards one another when the tiltable stool is in an upright position. The position of the annular groove being arranged concentrically around and proximal to the central portion. The shape of the annular groove having a generally V-shaped cross-sectional profile with a flat bottom. The limitation of a maximum tilt angle when the upper portions of an inner side wall and outer side wall of an annular groove touch. The use of a tilt angle adjustment ring

which is axially displaceable along a longitudinal axis of the body structure in which the tilt angle adjustment ring has a lower portion which engages the annular groove at a selectable depth. A maximum tilt angle of the body structure being limited by selecting the selectable depth of the lower portion of the tilt angle adjustment ring in the annular groove. The upper base element having a plurality of concentric and radially spaced annular grooves, in particular grooves having a generally U-shaped cross-sectional profile. Annular grooves being filled with a compressible compound or covered by a cover. The annular grooves being wider than they are deep. The upper base element being generally disk-shaped.

[0124] One skilled in the art will recognize that various additional configurations can be achieved by adding features not specifically listed above but generally described in this specification.

[0125] Within this specification the words “example” and “exemplary” are used herein to mean serving as an instance or illustration. Any embodiment or design described herein as “example” or “exemplary” is not necessarily to be construed as preferred or advantageous over other embodiments or designs. Rather, use of the word example or exemplary is intended to present concepts in a concrete fashion. As used in this application and the following claims the term “or” is an inclusive “or” rather than an exclusive “or”. That is, “or” means “and/or” unless specified otherwise or clear from context. The articles “a” and “an” as used in this application and the appended claims should generally be construed to mean “one or more” unless specified otherwise or clear from context to be directed to a singular form.

CLAIMS

What is claimed is:

1. A tiltable stool, comprising:
a seat;
an upper base element;
a body structure extending between the seat and the upper base element, the
body structure being firmly connected to a central portion of the upper
base element; and
a lower base element, the lower base element having an annular upper end
firmly connected to an annular outer portion of the upper base element,
wherein the upper base element is resiliently deformable.
2. The tiltable stool as in claim 1,
wherein the lower base element is a rotationally symmetrical outwardly
convex and inwardly concave body extending from the annular upper
end to an annular lower end.
3. The tiltable stool as in claim 1,
wherein the lower base element and the upper base element are connected to
each other with a tongue and groove joint.
4. The tiltable stool as in claim 1,
wherein the lower base element comprises an upwardly facing tongue which
engages a downwardly open groove in the upper base element.
5. The tiltable stool as in claim 1, wherein an outer surface of the upper base
element and an outer surface of the lower base element transition
seamlessly into one another.
6. The tiltable stool as in claim 1,
wherein the upper base element is made of a resiliently deformable material
and the lower base element is made of an inelastic material.

7. The tiltable stool as in claim 1,
wherein both the upper base element and the lower base element are made of resiliently deformable material.
8. The tiltable stool as in claim 1,
wherein the upper base element comprises an annular groove.
9. The tiltable stool as in claim 8,
wherein the annular groove is deeper than it is wide.
10. The tiltable stool as in claim 8,
wherein the annular groove an inner side wall and an outer side wall, the inner side wall and the outer side wall being arranged at an angle towards one another when the tiltable stool is in an upright position.
11. The tiltable stool as in claim 8,
wherein the annular groove is arranged concentrically around and proximal to the central portion.
12. The tiltable stool as in claim 8,
wherein the annular groove has a generally V-shaped cross-sectional profile with a flat bottom.
13. The tiltable stool as in claim 8,
wherein the annular groove has an inner side wall and an outer side wall,
wherein upper portions of the inner side wall and the outer side wall are arranged at a distance from one another when the tiltable stool is in an upright position, and
wherein the upper portions of the inner side wall and the outer side wall touch when the tiltable stool is deflected and reaches a maximum tilt angle.
14. The tiltable stool as in claim 8,

further comprising a tilt angle adjustment ring which is axially displaceable along a longitudinal axis of the body structure, the tilt angle adjustment ring having a lower portion which engages the annular groove at a selectable depth.

15. The tiltable stool as in claim 14,
wherein a maximum tilt angle of the body structure is limited by selecting the selectable depth of the lower portion of the tilt angle adjustment ring in the annular groove.
16. The tiltable stool as in claim 1,
wherein the upper base element comprises a plurality of concentric and radially spaced annular grooves.
17. The tiltable stool as in claim 16,
wherein the annular grooves have a generally U-shaped cross-sectional profile.
18. The tiltable stool as in claim 16,
wherein the annular grooves are filled with a compressible compound.
19. The tiltable stool as in claim 16,
wherein the annular grooves are wider than they are deep.
20. The tiltable stool as in claim 1,
wherein the upper base element is generally disk-shaped.
21. The tiltable stool as in any one of claims 1-20,
wherein the seat is pivotably mounted to an upper end of the body structure.
22. The tiltable stool as in any one of claims 1-20,
wherein the seat comprises
an upper seat member which is firmly attached to
a lower seat member, and

wherein the lower seat member includes an annular groove which is configured to deform and allow the seat to pivot relative to the body structure.

23. The tiltable stool as in claim 22,
wherein a width of the annular groove determines a maximum pivot angle of the seat relative to the body structure.
24. The tiltable stool as in any one of claims 1-20,
wherein the seat comprises
an upper seat member which is firmly attached to
a lower seat member, and
wherein the upper base element and the lower seat member each include an equal number of annular grooves that deform when a lateral load is applied to the seat.

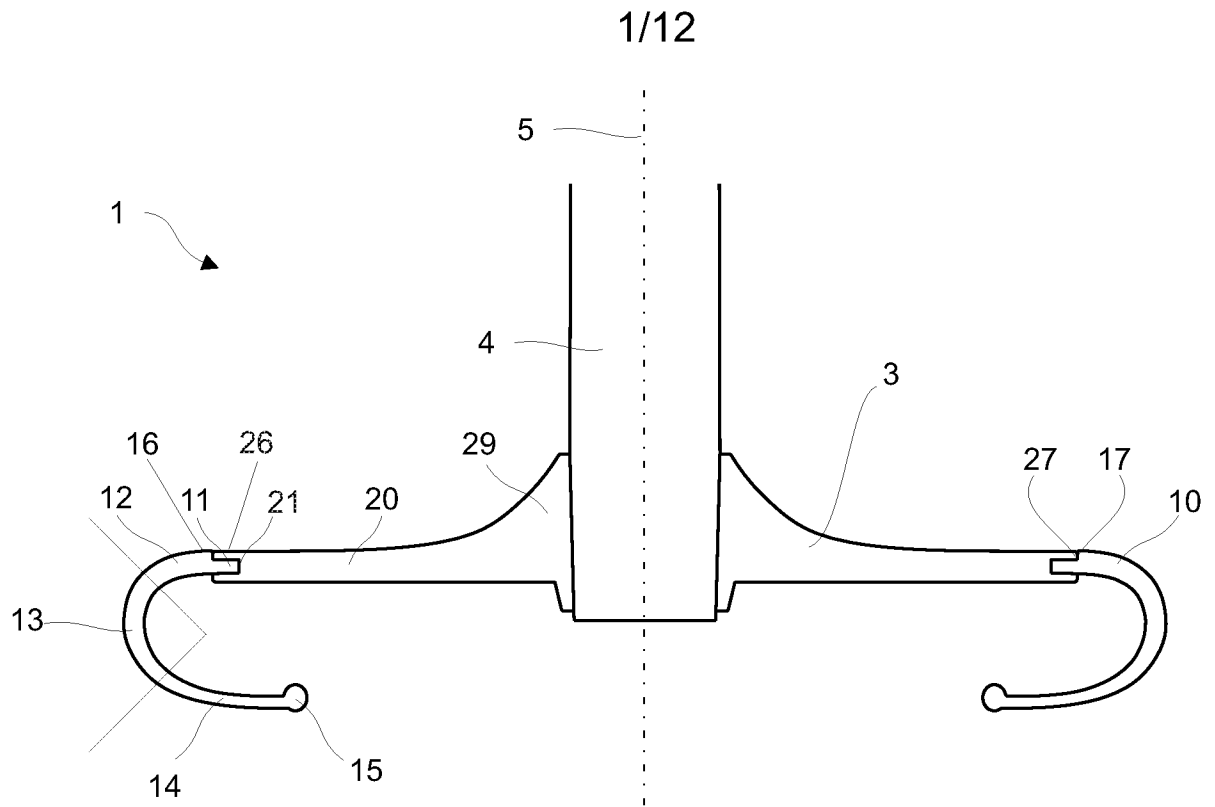


FIG. 1

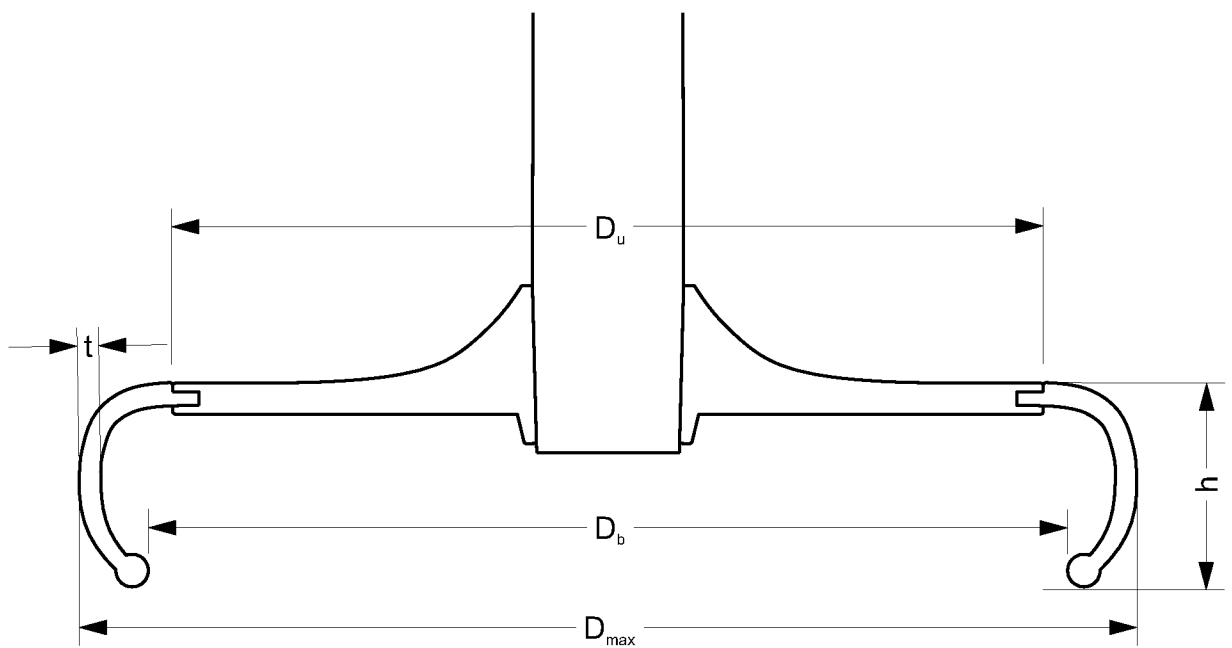


FIG. 2

2/12

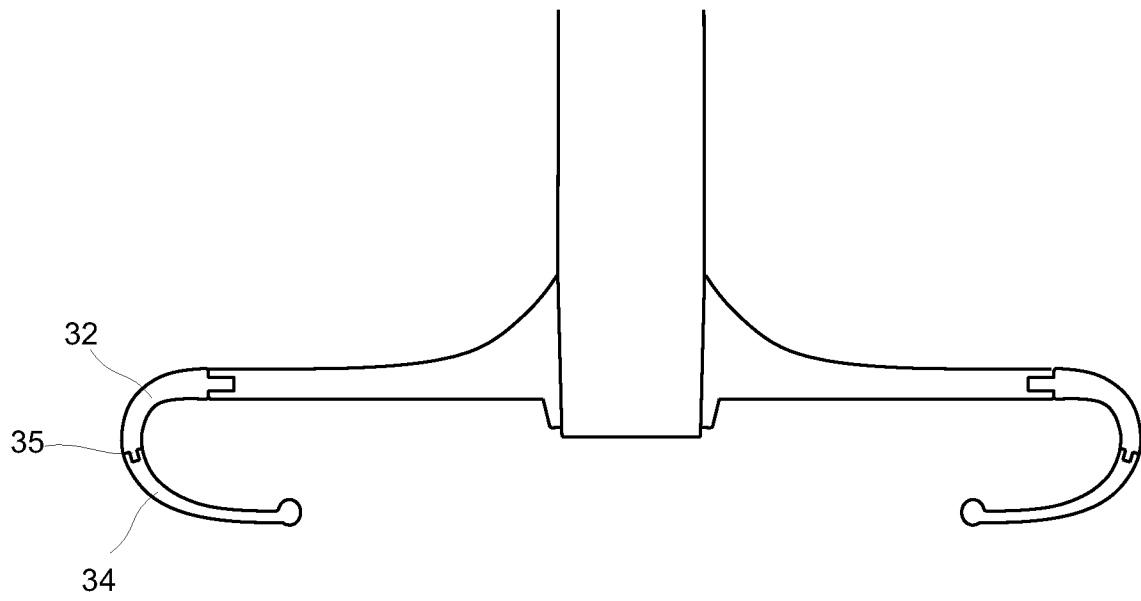


FIG. 3

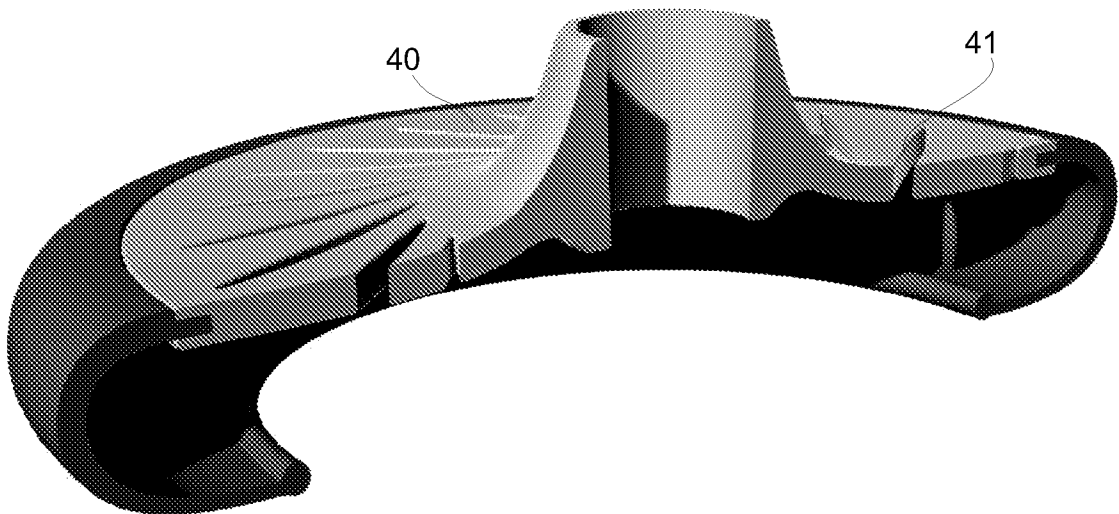


FIG. 4

3/12

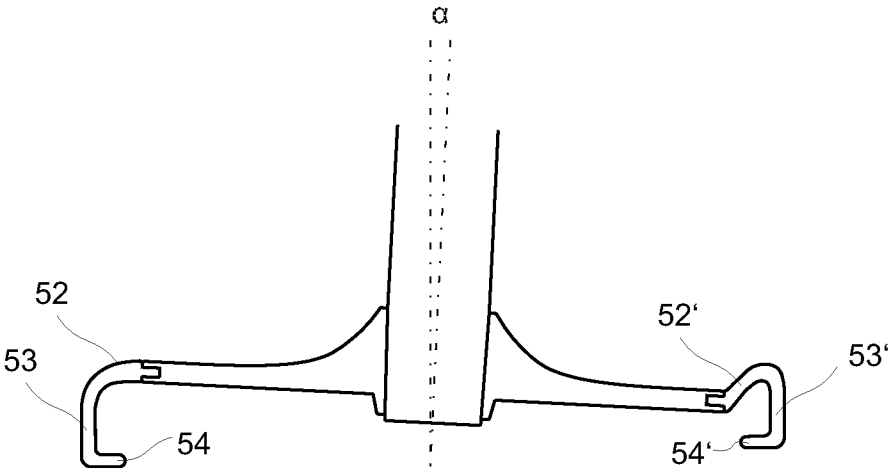


FIG. 5

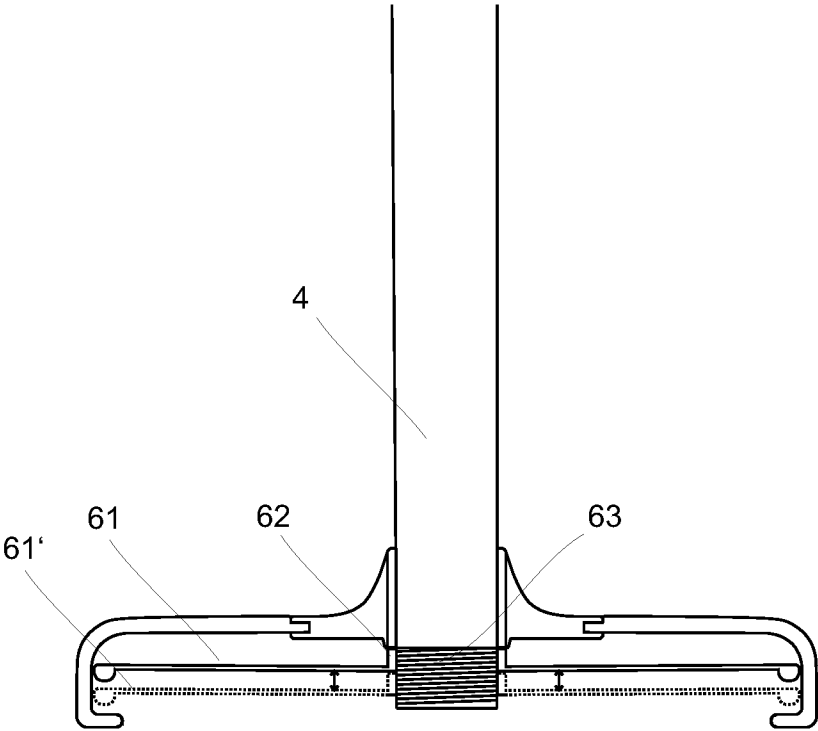


FIG. 6

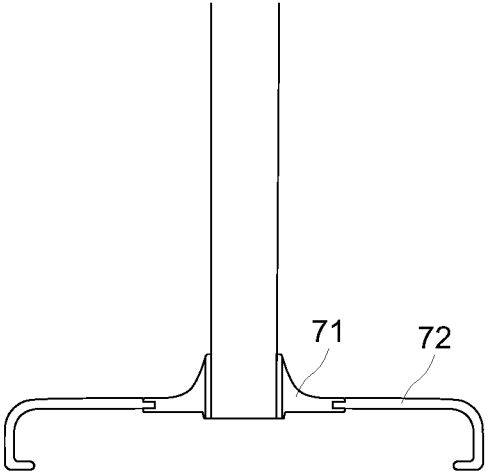


FIG. 7

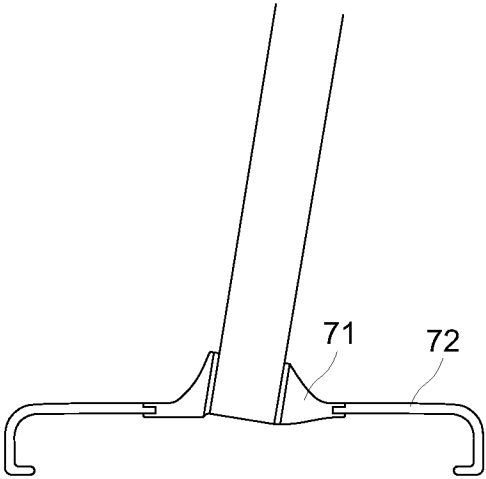


FIG. 8

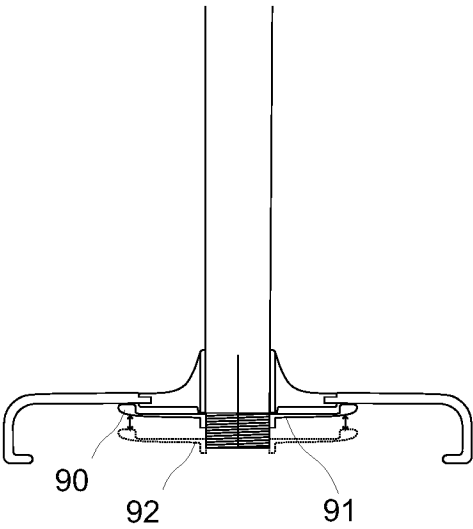


FIG. 9

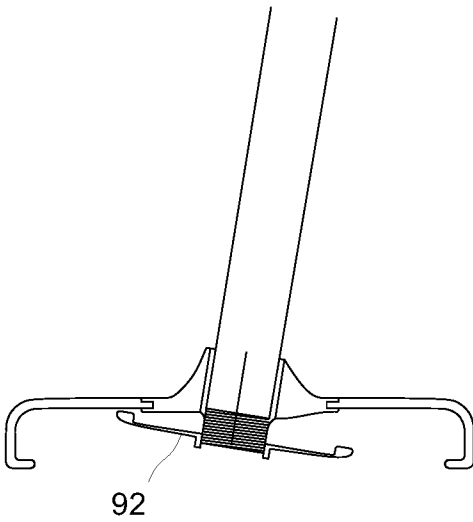


FIG. 10

5/12



FIG. 11

6/12

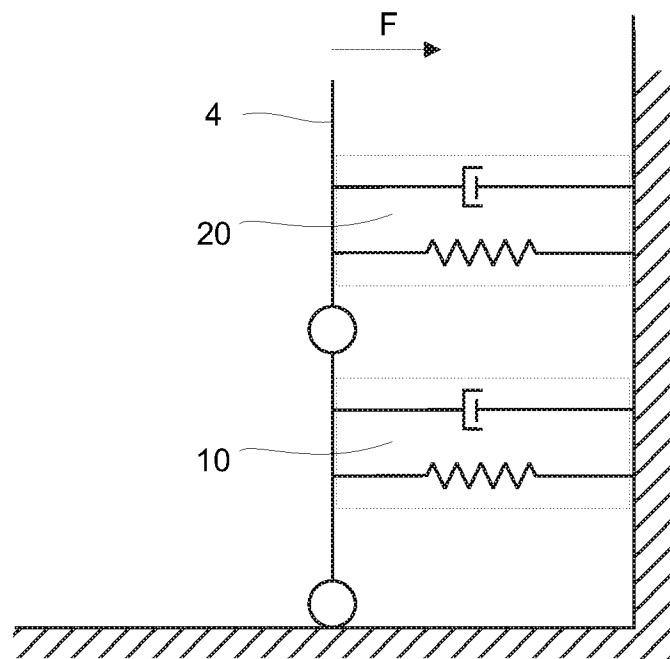


FIG. 12

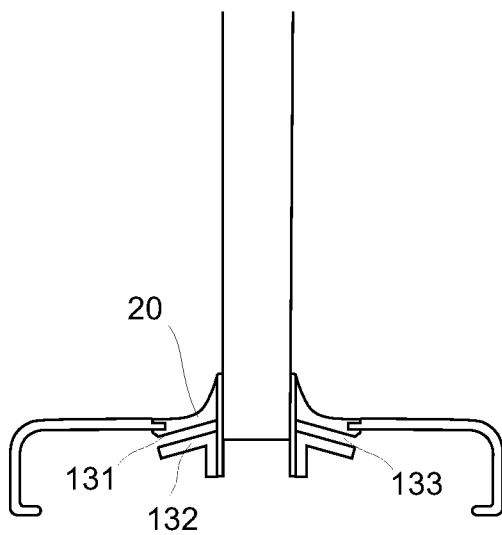


FIG. 13

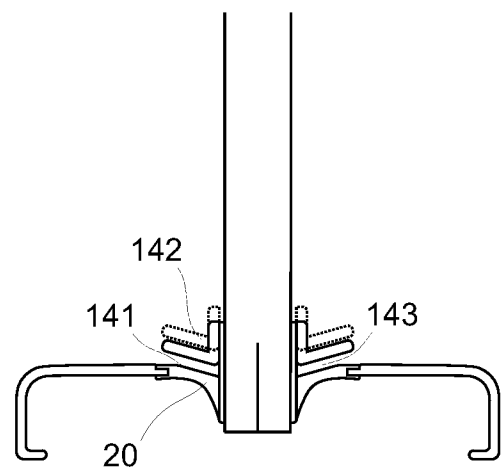


FIG. 14

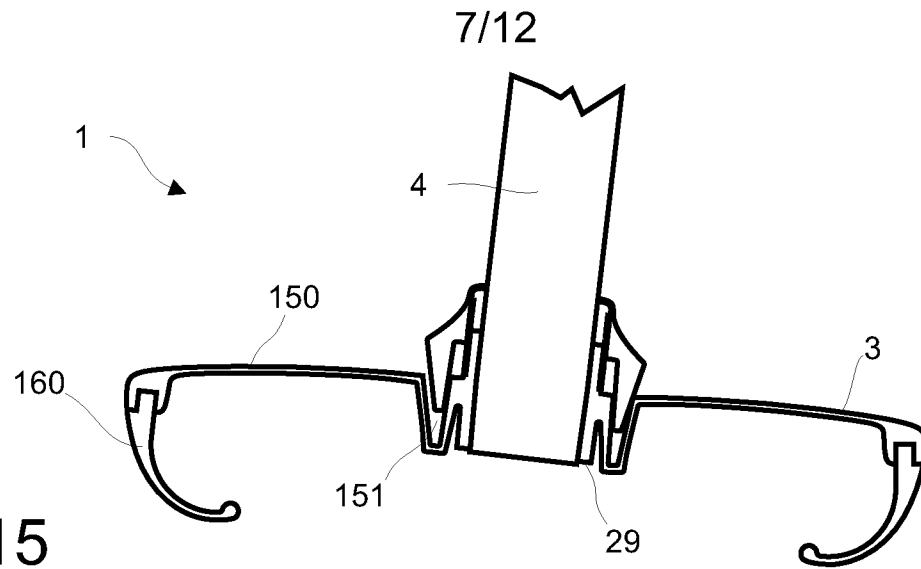


FIG. 15

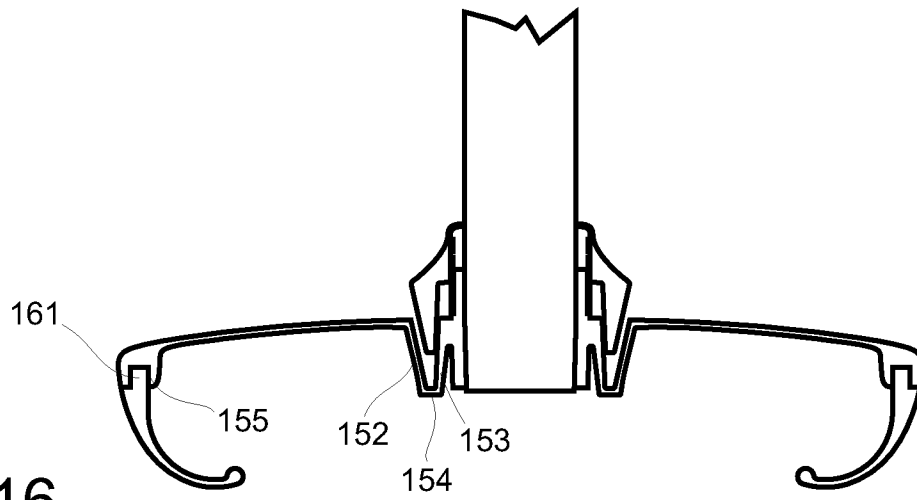


FIG. 16

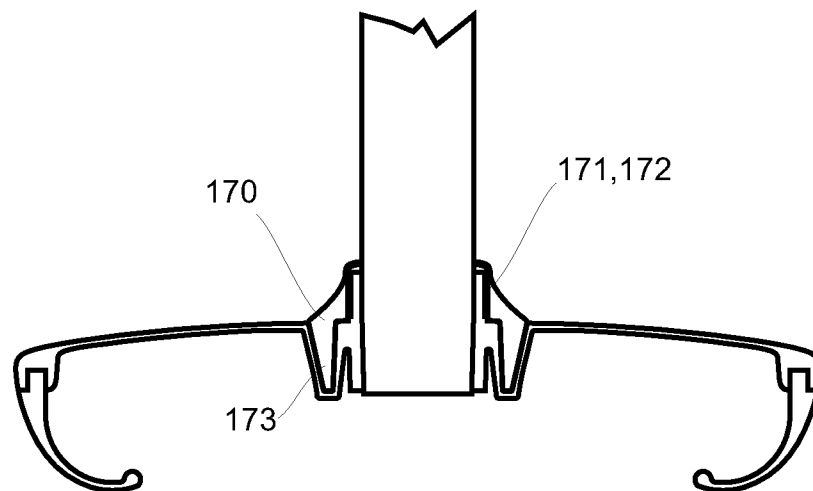


FIG. 17

8/12

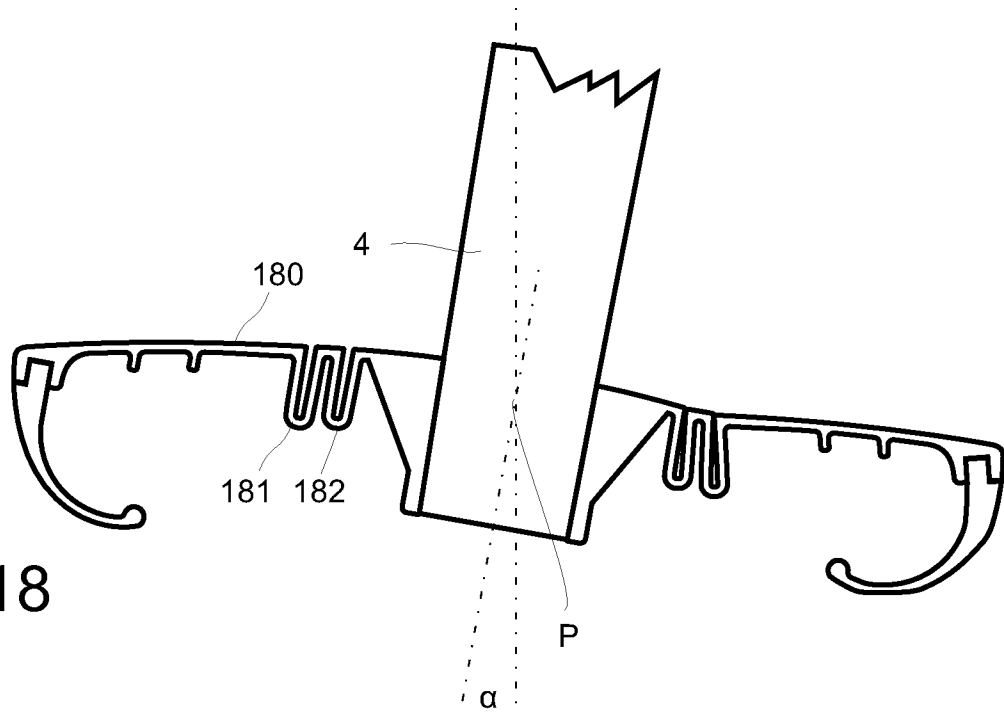


FIG. 18

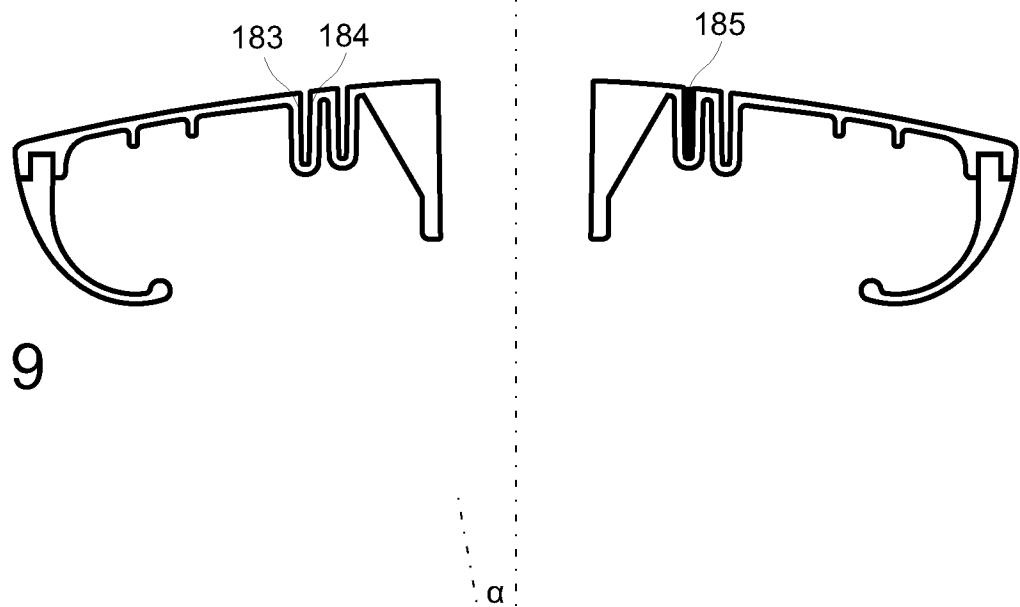


FIG. 19

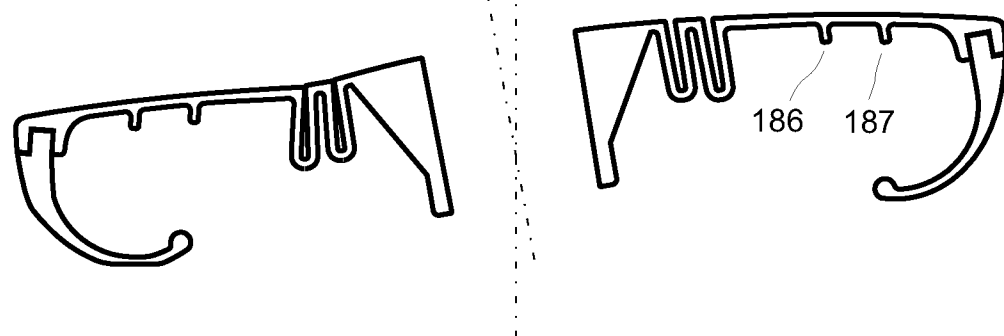


FIG. 20

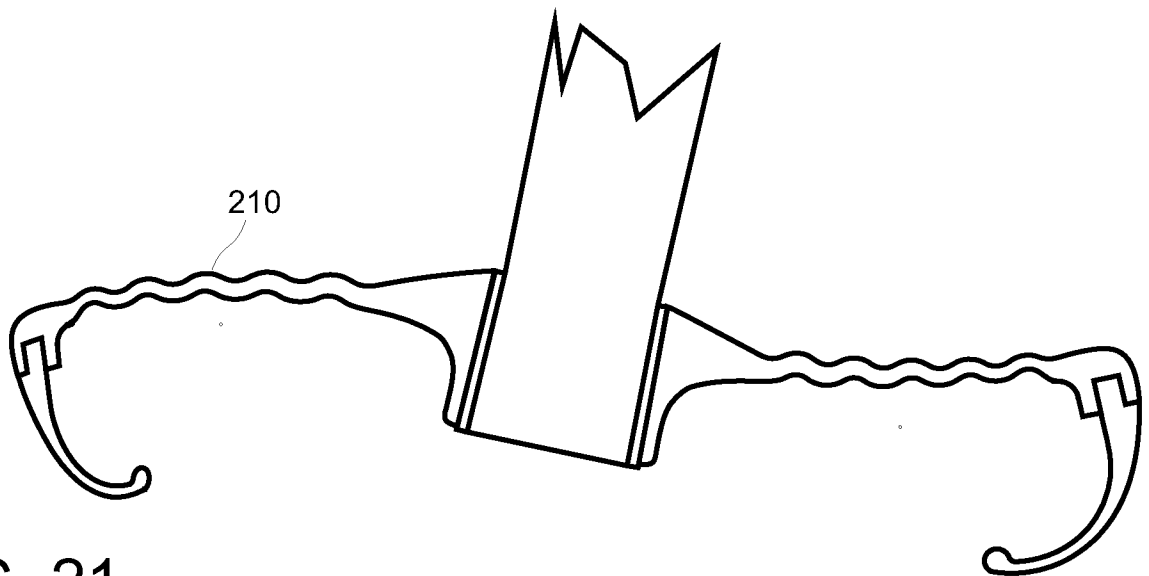


FIG. 21

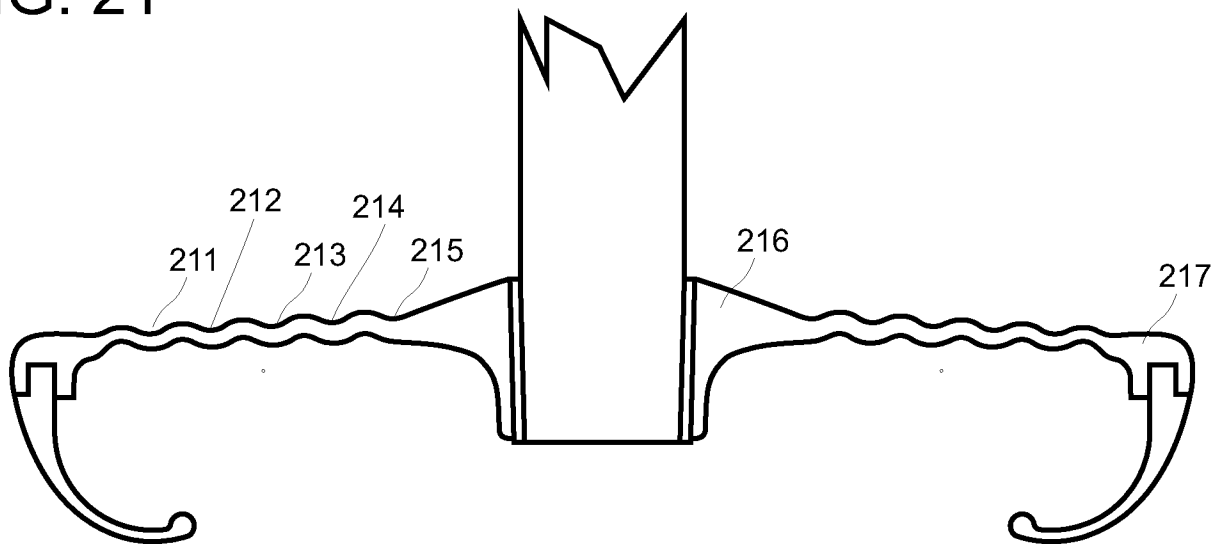


FIG. 22

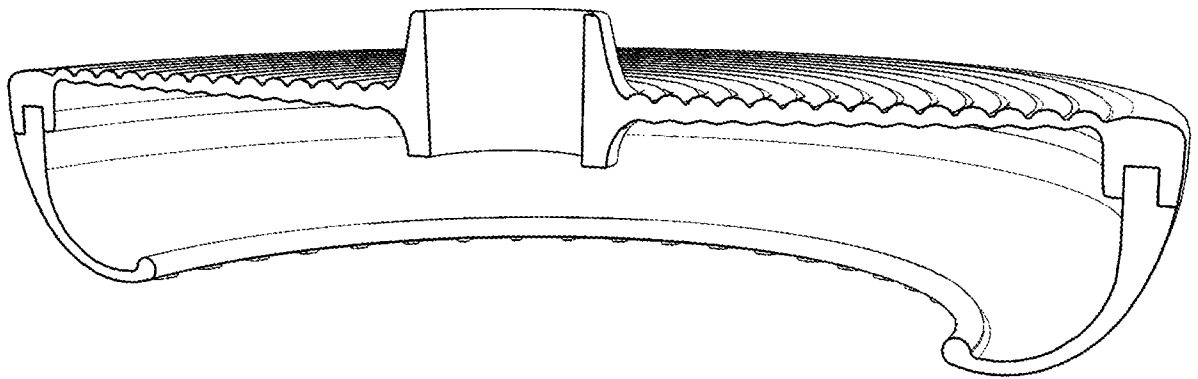


FIG. 23

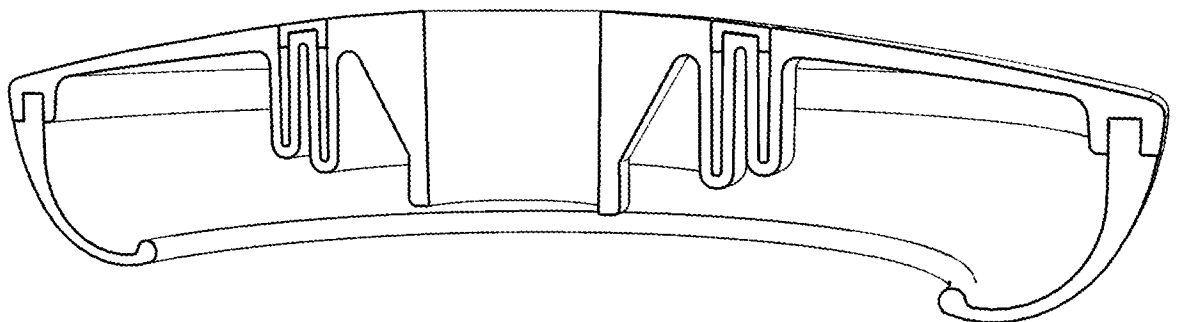


FIG. 24

11/12

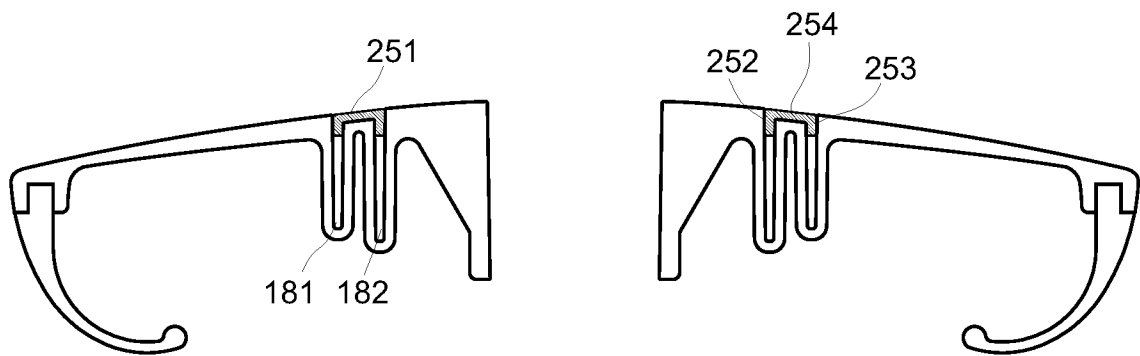


FIG. 25

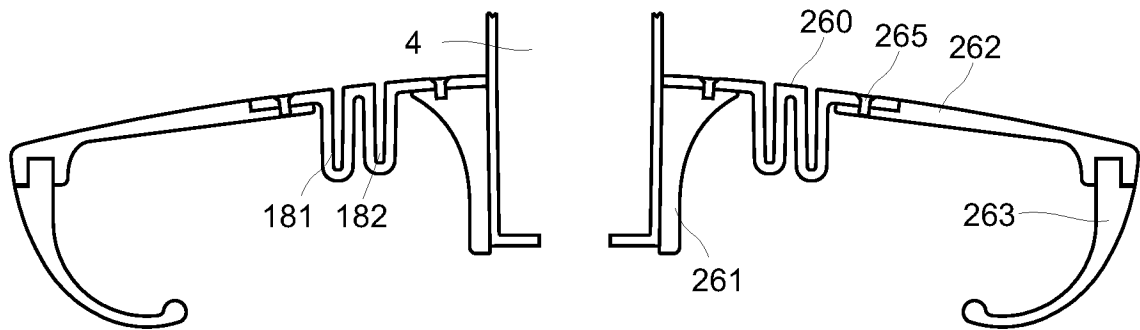


FIG. 26

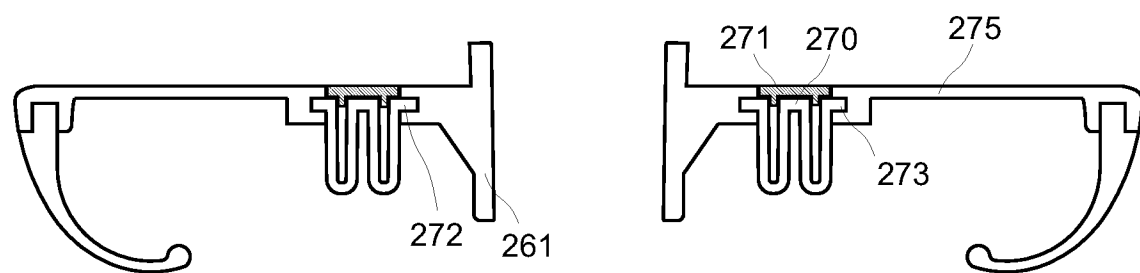
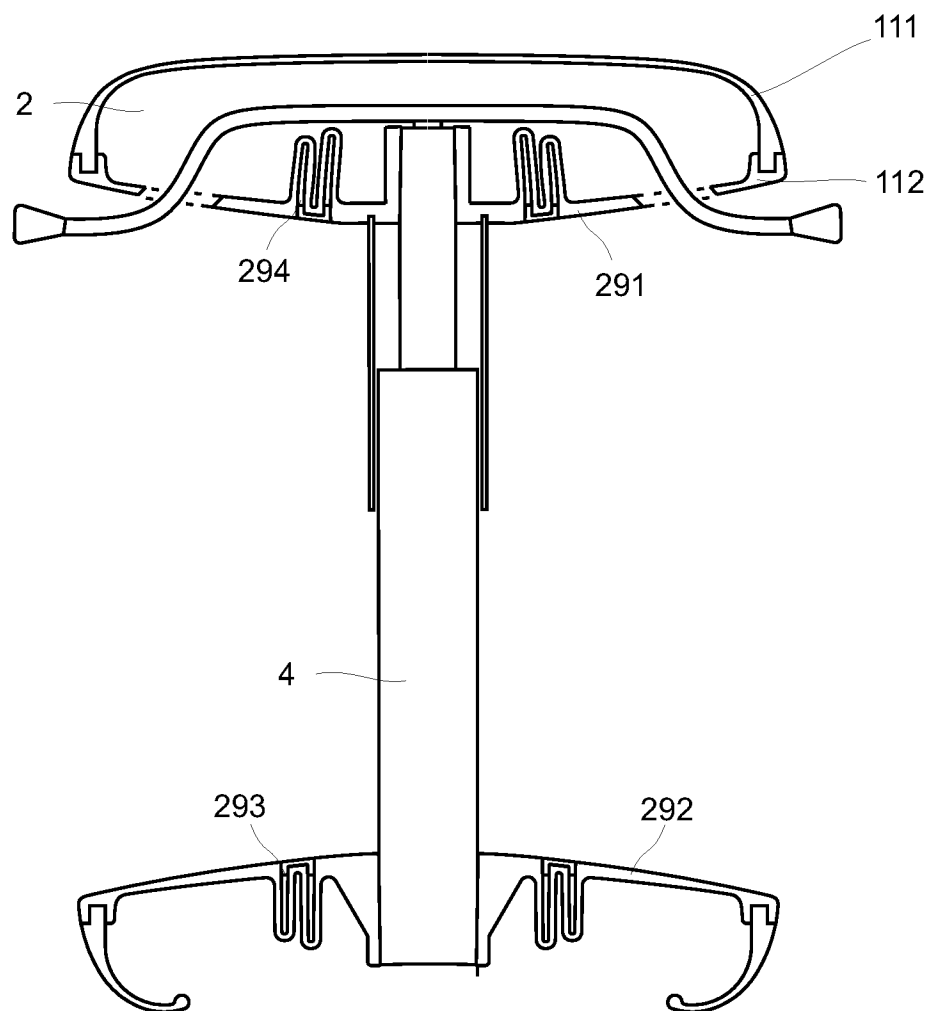
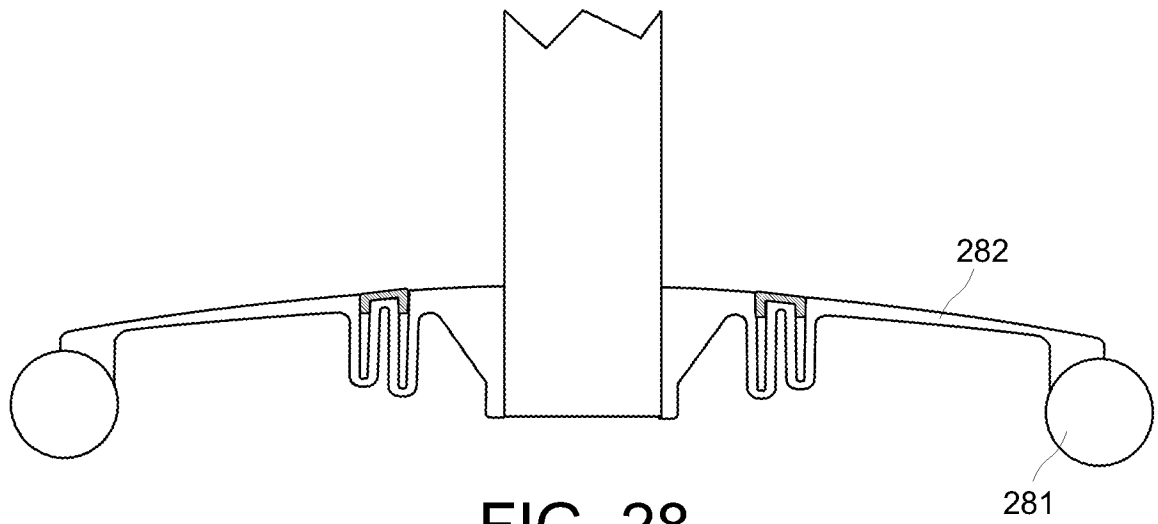


FIG. 27

12/12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB 20/55459

A. CLASSIFICATION OF SUBJECT MATTER

IPC - A47C 1/00, A47C 3/02, A47C 3/026, A47C 3/30, A47C 7/00, A47C 9/00 (2020.01)

CPC - A47C 3/026, A47C 3/30, A47C 7/004, A47C 3/02, A47C 9/002

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)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 6,644,742 B1 (WALSER) 11 November 2003 (11.11.2003), entire document	1-5, 7, 20 ----- (21-24)/(1-5, 7, 20)
X ----- Y ----- A	US 5,524,967 A (GLOECKL) 11 June 1996 (11.06.1996), entire document	1, 6, 8-11, 14-17, 19 ----- (21-24)/(1,6,8-11,14-17,19) ----- 18, (21-24)/18
X ----- Y ----- A	US 2008/0143162 A1 (GLOECKL) 19 June 2008 (19.06.2008), entire document	1, 8, 12-13, 16 ----- (21-24)/(1,8,12-13,16) ----- 18, (21-24)/18
Y	US 5,044,587 A (DEGEN) 3 September 1991 (03.09.1991), entire document	(21-24)/(1-20)

☒ Further documents are listed in the continuation of Box C.☐ 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

"D" document cited by the applicant in the international application

"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

11 AUGUST 2020

Date of mailing of the international search report

21 SEP 2020

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-8300

Authorized officer

Lee Young

Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB 20/55459

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2016/0088944 A1 (INVENTOR GROUP GMBH et al.) 31 March 2016 (31.03.2016), entire document	1-24
A	US 10,034,547 B1 (OASYSCHAIR CO., LTD et al.) 31 July 2018 (31.07.2018), entire document	1-24
A	US 3,309,137 A (WIEBE) 14 March 1967 (14.03.1967), entire document	1-24
A	US 2015/0250317 A1 (AERIS GMBH et al.) 10 September 2015 (10.09.2015), entire document	1-24