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(71) Applicant: **TE Connectivity Germany GmbH**
64625 Bensheim (DE)

(72) Inventors:
- **DUENKEL, Dirk**
  64625 Bensheim (DE)
- **WILL, Johannes**
  76646 Bruchsal (DE)
- **POLSAK, Zan**
  64658 Fuerth (DE)

(74) Representative: **Patentanwaltskanzlei WILHELM & BECK**
Prinzenstraße 13
80639 München (DE)

(54) **METHOD FOR PRODUCING A CONTACT DEVICE, CONTACT DEVICE AND CONTACT SYSTEM**

(57) The invention relates to a method for producing a contact device, to a contact device and to a contact system comprising such a contact device, wherein, to produce the contact device, a contact housing, a sealing element and a warm-caulking device comprising a pressing tool and a heating unit are provided, wherein a bar is arranged at the contact housing, wherein the sealing element is slid over the bar onto a sealing bearing surface of the contact housing, wherein to form a retaining means the bar is hot-caulked in such a way that by means of the heating unit at least a section of the bar is heated, wherein the pressing tool is pressed onto the section and the pressing tool moulds the retaining means from the heated section of the bar, wherein the heated section of the bar is cooled, wherein the retaining means secures a position of the sealing element at the contact housing.

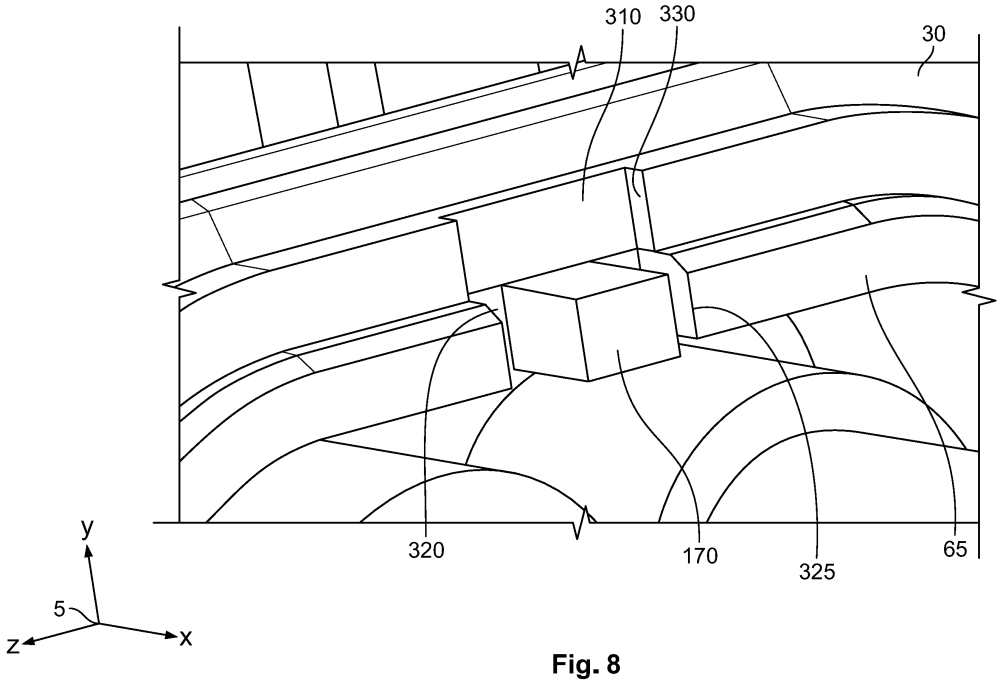

Fig. 8

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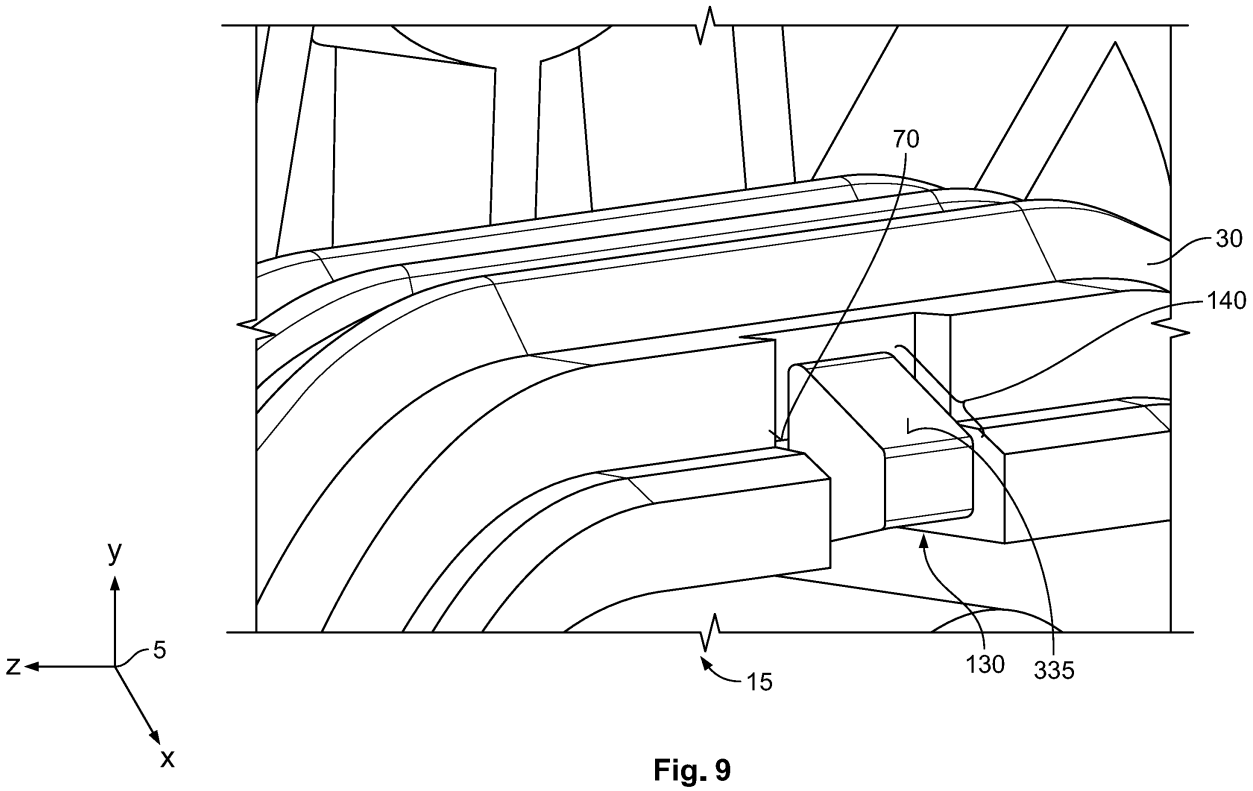

Fig. 9

Description

[0001] The invention relates to a method according to Claim 1, a contact device according to Claim 4 and a contact system according to Claim 14.

[0002] This patent application claims the priority of German patent application DE 10 2017 118 362.0 filed August 11, 2017, entitled, VERFAHREN ZUR HERSTELLUNG EINER KONTAKTEINRICHTUNG, KONTAKTEINRICHTUNG UND KONTAKTSYSTEM the disclosure content of which is hereby incorporated by reference in the entirety and for all purposes.

[0003] A contact device comprising a contact housing and a sealing element is known, wherein the sealing element is attached to the contact housing at the periphery. The sealing element can be retained on the contact housing by means of a securing ring, for example, so that the sealing element does not slip when a further contact device is put onto or removed from the contact device.

[0004] The problem of the invention is to provide an improved method for producing a contact device, an improved contact device and an improved contact system.

[0005] This problem is solved by means of a method according to Claim 1, by means of a contact device according to Claim 4 and by means of a contact system according to Claim 14. Advantageous embodiments are specified in the dependent claims.

[0006] It has been recognised that an improved method for producing a contact device can be provided wherein a contact housing, a sealing element and a warm-caulking device comprising a pressing tool and a heating unit are provided. A bar is arranged at the contact housing. The sealing element is slid over the bar onto a sealing bearing surface of the contact housing. To form a retaining means, the bar is hot-caulked in such a way that by means of the heating unit at least a section of the bar is heated, wherein the pressing tool is pressed onto the section and the pressing tool moulds the retaining means from the heated section of the bar, wherein the heated section of the bar is cooled. The retaining means secures a position of the sealing element at the contact housing.

[0007] This configuration has the advantage that the number of components of the contact device is reduced. Furthermore this method of production is also suitable for the production of large quantities in an automatic production process. Furthermore, an injection mould for producing the contact housing can be retained particularly simply and inexpensively.

[0008] In a further embodiment, the section is heated to a predefined temperature, wherein the predefined temperature is lower than a melting temperature of the material of the bar and of the contact housing. As a result, this prevents the material from liquefying and draining off.

[0009] In a further embodiment, a temperature of the contact housing is kept substantially constant during the heating of the section. As a result, possible damage to the contact housing while the pressing tool is being placed on is prevented and as a result the supporting of the pressing tool is reliably ensured via the contact housing by the forces introduced into the bar.

[0010] It has been recognised that a contact device able to be produced according to the method described above can be provided in that the contact device comprises a contact housing and a sealing element, wherein the contact housing has a sealing bearing surface arranged at the periphery, wherein the sealing element rests on the sealing bearing surface at the periphery. The contact housing furthermore has a retaining means, wherein the retaining means is configured to prevent the sealing element from being pulled off of the sealing bearing surface through a touching contact of the sealing element at the retaining means. The retaining means is connected at one side to the contact housing. The retaining means projects beyond the sealing bearing surface with a retaining section. The retaining means and the contact housing are configured in an integral and material-uniform manner. As a result, the number of components of the contact device can be kept particularly low.

[0011] In a further embodiment, the retaining means has a bar section, wherein the bar section is connected by a fixed end to the contact housing. A side surface of the bar section and the sealing bearing surface are arranged in alignment. The retaining section is arranged inclined, preferably perpendicular, relative to the bar section. The retaining section is hot-caulked.

[0012] In a further embodiment, the contact housing has a cavity with a cavity profile. The retaining means is arranged in the cavity, spaced apart from the cavity profile. The cavity profile is preferably configured corresponding to the pressing tool. As a result, in the production of the contact device, the pressing tool can dip into the cavity and the contact device can be configured particularly compactly.

[0013] In a further embodiment, the contact device has at least one contact element, wherein the contact housing has a contact section and a housing section. The contact element is arranged in the contact section at least in sections. The housing section is arranged at the periphery circumferentially around the contact section. The sealing bearing surface is arranged at the periphery at the housing section. The housing section is interrupted at the front end by the cavity and the retaining means. As a result, the required construction space for forming the contact housing can be kept particularly small.

[0014] In a further embodiment, the sealing element has a further cavity, wherein the further cavity is arranged on a front end of the sealing element, which front end faces the retaining means. The further cavity is open toward the retaining means, wherein the retaining section engages the further cavity. As a result, the required construction space can be further reduced.

[0015] In a further embodiment, the sealing element has a sealing section and an edge section which is connected to the sealing section, wherein the sealing section has at least one sealing lip at the periphery, wherein the edge section preferably has a rectangular cross-section.

The cavity is arranged in the edge section. Through this configuration, a play-free form-fitting connection of the sealing element at the contact housing is ensured and at the same time the required construction space is reduced once again.

[0016] In a further embodiment, the retaining means has a guide surface on a side facing away from the sealing element, wherein the guide surface is arranged obliquely inclined relative to the sealing bearing surface and/or a plugging direction of the contact device at a further contact device. The guide surface is preferably arranged at an angle to the sealing bearing surface and/or the plugging direction, wherein the angle has a value which is in a range from 25° to 75°, in particular in a range from 35° to 60°. As a result, squashing of the sealing element when the contact device and the further contact device are plugged into one another is reliably avoided because the guide surface guides a contact housing of the further contact device towards its correct orientation relative to the contact housing of the contact device.

[0017] In a further embodiment, the guide surface extends between a front end of the retaining means and a peripheral side arranged at the periphery of the retaining means. The peripheral side is arranged closer to the sealing element than the front end. The guide surface begins situated internally at the front end and ends situated externally at the peripheral side.

[0018] In a further embodiment, the retaining section has a trapeziform or rectangular or triangular cross-section.

[0019] In a further embodiment, the sealing bearing surface is arranged at an outer peripheral side of the contact housing, wherein the contact housing has a sealing supporting surface arranged at the front end. The sealing supporting surface is adjacent to the sealing bearing surface and is arranged inclined, preferably perpendicularly, to the sealing bearing surface. The sealing bearing surface is formed circumferentially at the periphery. The sealing element rests on the sealing bearing surface, on the outside. The sealing element is arranged between the retaining means and the sealing supporting surface, preferably without play. As a result, a position of the sealing element is fixed in a form-fitting manner.

[0020] It has been recognised that an improved contact system with a contact device and a further contact device can be provided by the contact device being formed as described above, wherein the further contact device has a further contact housing, wherein the further contact housing has a further sealing bearing surface, wherein the contact device and the further contact device are plugged into one another and delimit an inner space, wherein the sealing element is arranged between the sealing bearing surface and the further sealing bearing surface and seals the inner space off at least in sections from a surrounding area. The retaining means is formed to retain the sealing element in its position on the sealing bearing surface of the contact device when the contact device is pulled away from the further contact device.

[0021] In a further embodiment, when the contact device and the further contact device are plugged into one another, the further contact housing rests against the guide surface of the retaining means, wherein the guide surface is formed to guide the further contact housing transverse to the plugging movement toward the sealing element.

[0022] The invention will be explained in more detail hereafter with reference to figures. In the drawings:

Figure 1 shows a perspective depiction of a contact system with a first contact device according to a first embodiment;

Figure 2 shows a cut-out of a longitudinal section through the contact system shown in Figure 1;

Figure 3 shows a flow chart of a method for producing the first contact device which is shown in Figures 1 and 2;

Figure 4 shows a cut-out of a perspective depiction after a second method step;

Figure 5 shows a cut-out of a perspective depiction during a third method step;

Figure 6 shows a cut-out of a longitudinal section through a first contact device according to a second embodiment;

Figure 7 shows a cut-out of a longitudinal section through the first contact device which is shown in Figure 6, after a fourth method step;

Figure 8 shows a cut-out of a perspective depiction of the first contact device which is shown in Figure 6, after a second method step;

Figure 9 shows a cut-out of a longitudinal section through a first contact system according to a third embodiment;

Figure 10 shows a cut-out of a longitudinal section through a contact system with the first contact device shown in Figure 9;

[0023] In the following figures, reference is made to a coordinate system 5. The coordinate system 5 is configured as a right-handed system and has by way of example an x-axis (longitudinal direction), a y-axis (transverse direction) and a z-axis (vertical direction). The coordinate system 5 can also be configured differently.

[0024] Figure 1 shows a perspective depiction of a contact system 10 with a first contact device 15 (depicted using continuous lines) and a second contact device 20

(schematically indicated in Figure 1 by means of dashed lines).

[0025] The first contact device 15 has a first contact housing 25 with a contact section 26. The contact section 26 is depicted on the right in Figure 1 and has several contact receptacles 27 which are arranged in rows and configured like sleeves, wherein one first contact element 35 respectively of the first contact device 15 is arranged in each contact receptacle 27. The first contact element 35 is configured by way of example as a socket contact.

[0026] Towards the exterior, the contact section 26 is delimited by a first housing section 65. The first housing section 65 has a first sealing bearing surface 70, wherein a sealing element 30 of the first contact device 15 arranged on the first sealing bearing surface 70 on the outside. The sealing element 30 is configured circumferentially around the first sealing bearing surface 70. Here, the sealing element 30 has an approximately rectangular cross-section.

When the second contact device 20 is in the mounted state on the first contact device 15, the sealing element 30 seals an inner space 50, in which the contact section 26 is arranged, off from a surrounding area 55. In this case, the sealing element 30 is externally encompassed at the periphery side by a second contact housing 40 of the second contact device 20.

[0027] Figure 2 shows a cut-out of a longitudinal section through the contact system 10 shown in Figure 1.

[0028] The second contact device 20 has, alongside the second contact housing 40, at least one second contact element 45. The second contact element 45 is arranged in the second contact housing 40. In the embodiment, the second contact element 45 is configured by way of example as a pin contact which, when the first contact device 15 is in the mounted state on the second contact device 20, engages in the first contact element 35 and forms an electrical contact between the first contact element 35 and the second contact element 45. The second contact element 45 can also be configured differently. Therefore it is also conceivable, for example, for the second contact element 45 to be configured as a socket contact and the first contact element 35 to be configured as a plug contact.

[0029] Furthermore, on the rear side (not depicted in Figure 2), the contact housings 25, 40 are connected in a sealed manner to an undepicted connection lead, for example, so that the inner space 50 is fully sealed off from the surrounding area 55. The first contact element 35 and the second contact element 45 are oriented parallel to the x-axis. In order to plug the first contact device 15 and the second contact device 20 into one another, a plugging movement is carried out in the longitudinal direction (x-direction).

[0030] The first contact housing 25 has, at an outer periphery side 60, the circumferentially arranged first housing section 65, which extends in a straight line in the x-direction. The first housing section 65, with reference to the x-axis, is configured in a barrel-like manner circumferentially around the x-axis. At the outside, the first housing section 65 has the first sealing bearing surface 70. The first sealing bearing surface 70 extends parallel to the x-axis. The first contact housing has a second housing section 75. The second housing section is oriented perpendicular to the first housing section 65 and extends in the y-direction over the entire width of the first contact housing 25. The second housing section 75 is connected to the first housing section 65 and has a first sealing supporting surface 80 arranged on the front end. In the embodiment, the first sealing supporting surface 80 is arranged perpendicular to the first sealing bearing surface 70 and abuts the first sealing bearing surface 70 at the inside. Outside at the periphery, a first housing cavity 85 is arranged at the first sealing bearing surface 70, wherein a third housing section 90 of the second contact housing 40 engages in the first housing cavity 85.

[0031] The sealing element 30 has, at a first inner periphery side 95, at least one first sealing lip 100, preferably several first sealing lips 100 arranged spaced apart from one another in the x-direction. The first sealing lips 100 bear on the first sealing bearing surface 70. At an outer second periphery side 105 of the sealing element 30, the sealing element 30 has at least one second sealing lip 110, preferably several second sealing lips 110 spaced apart from one another in the x-direction.

[0032] The second contact housing 40 has a third housing section 90. The third housing section 90 is arranged on a side facing the first contact housing 25 and extends substantially in the x-direction. The third housing section 90 has a second sealing bearing surface 115 at the inside. The second sealing bearing surface 115 is arranged offset towards the outside relative to the first sealing bearing surface 70. The first sealing bearing surface 70 and the second sealing bearing surface 115 form a sealing gap 120, in which the sealing element 30 is arranged. The second sealing lip 110 bears at the outside on the second sealing bearing surface 115, so that the sealing element 30 reliably seals the inner space 50 off from the surrounding area 55. At the front end, the sealing element 30 lies against the first sealing supporting surface 80 with a first front end 125, so that, when the second contact device 20 is slid onto the first contact device 15, frictional forces, which are introduced into the sealing element 30 when the second contact housing 40 is slid on, are supported at the rear side via the first front end 125 at the first sealing supporting surface 80.

[0033] The first contact housing 25 further has a retaining means 130. The retaining means 130 has a bar section 135 and a retaining section 140. The bar section 135 is connected by a fixed end 145 to the first housing section 65. The bar section 135 and the first housing section 65 are aligned. The bar section 135 has a side surface 150 at the outer periphery side 60 of the first contact housing 25, wherein the side surface 150 of the bar section 135 and the first sealing bearing surface 70 are oriented in an aligned manner.

[0034] In the embodiment, the bar section 135 has, by

way of example, a rectangular cross-section and in the embodiment has the same width as the first housing section 65. In addition, at the inside relative to the first housing section 65 and the bar section 135, there can be provided a second housing cavity 136, wherein the second contact housing 40, in the mounted state on the first contact device 15, can engage in the second housing cavity 136.

[0035] The retaining section 140 is arranged on a side facing away from the first housing section 65 (and thus on a side facing the second contact device 20). In the embodiment, the retaining section 140 is, by way of example, arranged perpendicular to the first sealing bearing surface 70 and to the side surface 150 of the bar section 135.

In the embodiment, the retaining section 140 likewise has, by way of example, a rectangular cross-section. In this case, the retaining section 140 is arranged, at least in sections, on the outside relative to the bar section 135.

[0036] The retaining section 140 has a second bearing surface 155 on a side facing the sealing element 30. The second sealing supporting surface 155 is preferably oriented parallel to the first sealing supporting surface 80. Furthermore, the first sealing supporting surface 80 and the second sealing supporting surface 155 are arranged approximately on the same level in the y-direction.

[0037] In the embodiment, the sealing element 30 is arranged spaced apart from the second sealing supporting surface 155, so that a gap 165 is arranged between a second front end 160 of the sealing element 30, which second front end, in the x-direction, is arranged opposite the first front end 125 of the sealing element 30, and the second sealing supporting surface 155. The second front end 160 of the sealing element 30 may also lie against the second sealing supporting surface 155.

[0038] The retaining means 130 is configured in an integral and material-uniform manner with the first contact housing 25. The retaining means 130 is produced by means of hot-caulking, so that typical material alterations prevalent with hot-caulking can be detected compared to the first contact housing 25, particularly at the retaining section 140. The first contact housing 25 and the retaining means 130 preferably have a plastic, particularly a thermoplastic plastic, as the material. In addition, as a result of the hot-caulking, there can be provided on the inside of the bar section 135 a material excess 141 which projects into the second housing cavity 136.

[0039] Through the arrangement of the sealing element 30 between the retaining means 130 and the first sealing supporting surface 80, a position of the sealing element 30 at the first contact housing 25 is fixed. Here, the sealing element 30 strikes against the first sealing supporting surface 80 by the first front end 125 of the sealing element 30 when the two contact devices 15, 20 are plugged together. When the first contact device 15 is separated from the second contact device 20, the sealing element 30 can be carried along by the second contact housing 40, if the gap 165 is provided, through a friction lock between the second sealing lip 110 and the second sealing bearing surface 115, wherein the attachment of the sealing element 30 on the first contact housing 25 in the x-direction is ensured by the second front end 160 of the sealing element 30 striking against the second sealing supporting surface, and thus an undesired pulling of the sealing element 30 off of the first contact housing 25 is avoided.

[0040] Figure 3 shows a flow chart of a method for producing the first contact device 15. Figure 4 shows a cut-out of a perspective depiction of the first contact device 15 after a second method step 205. Figure 5 shows a cut-out of a perspective depiction of the first contact device 15 during a third method step 210.

[0041] In a first method step 200, the first contact housing 25 is injection-moulded together with a bar 170 arranged at the first housing section 65, by means of a first injection-moulding tool (not depicted). The bar 170 is configured as a rectangle and projects over the first housing section 65 at the front end in the x-direction. In the embodiment, several bars 170 (not depicted in Figure 4) are provided which are arranged at the front end offset at the first housing section 65. The geometric configuration of each bar 170 is selected identical to one another. A different configuration than shown in Figure 4 is conceivable for the bar 170. The side surface 150 of the bar 170 and the first sealing bearing surface 70 are aligned.

[0042] Furthermore, in the first method step 200, the sealing element 30 is injection-moulded in a second injection-moulding tool. A softer material, preferably an elastomer, is used to produce the sealing element 30 here.

[0043] After the materials of the first contact housing 25 and of the sealing element 30 have solidified, the first contact housing 25 and the sealing element 30 are each removed from the associated injection-moulding tool.

[0044] Alternatively, it is also conceivable for the sealing element 30 and the first contact housing 25 to be jointly produced in a two-component injection-moulding method.

[0045] In the second method step 205, the sealing element 30 is mounted on the first contact housing 25. Here, the first inner peripheral surface 95 of the sealing element 30 is slid both over the side surface 150 of the bar section 135 and over the first sealing bearing surface 70 in the x-direction in the direction of the first sealing supporting surface 80. It is particularly advantageous if the sealing element 30 is slid onto the first housing section 65 to such an extent that the first front end 125 of the sealing element 30 lies against the first sealing supporting surface 80.

[0046] In the following third to fifth method steps 210 to 220, the bar 170 is hot-caulked. For this purpose, a warm-caulking device 180 is provided in the third method step 210. The warm-caulking device 180 has a heating unit 185 and a pressing tool 190. The heating unit 185 can be a laser light source or an infrared light source, for example. The heating unit 185 can also be integrated in

a pressing tool 190.

[0047] In the third method step 210, a section 175 of the bar 170 is heated. The section 175 is arranged on a side of the bar 170 which faces away from the first housing section 65. It is also possible for the entire bar 170 to be heated.

[0048] During the heating of the section 175, a temperature of the first contact housing 25 and where applicable of at least part of the bar section 135 is kept substantially constant, for example at a room temperature. In this case, the section 175 is heated to a temperature within a temperature range of the material of the bar 170, in which the temperature is lower than a melting temperature of the material of the first contact housing 25 and of the bar 170. However, the temperature is significantly increased compared to room temperature, so that the material is deformable with a lower expenditure of force than at room temperature.

[0049] In a fourth method step 215, the pressing tool 190 is placed onto the bar 170. The pressing tool 190 presses against the section 175 of the bar 170 such that the section 175 is deformed corresponding to a profile of the pressing tool 190 and configures the retaining section 140. The pressing tool 190 can in this case be configured as, for example, a stamp that has on the inside a receptacle which is configured corresponding to a geometric configuration of the retaining section 140, for example as a rectangle as shown in Figure 2. In a fifth method step 220, a solidification or at least a partial solidification of the retaining section 140 is awaited.

[0050] In a sixth method step 225, the pressing tool 190 is removed from the first contact device 15. Through the formation of the retaining section 140, the sealing element 30 is secured in a form-fitting manner in its position at the first contact housing 25.

[0051] Figure 6 shows a cut-out of a longitudinal section through a first contact device 15 according to a second embodiment.

[0052] Unless otherwise indicated, the first contact device 15 shown in Figures 1 to 5 and the first contact device 15 described in Figure 6 are configured identically.

[0053] The sealing element 30 has a sealing section 300 and an edge section 305. The edge section 305 and the sealing section 300 are configured in an integral and material-uniform manner. The second sealing lip 110 is arranged at the periphery on the sealing section 300. The edge section 305 substantially has a rectangular cross-section and runs parallel to the first sealing bearing surface 70. The edge section 305 is arranged on a side facing away from the first sealing supporting surface 80. The sealing element 30 has a first cavity 310 in the edge section 305. The first cavity 310 is configured in the shape of a groove and extends in the y-direction over the entire width of the edge section 305. In the z-direction, the first cavity 310 is delimited on a portion of the edge section 305. In the embodiment, there are provided, by way of example, several first cavities 310 which are arranged offset and spaced apart relative to one another in the edge section 305.

[0054] The first cavity 310 is open towards the retaining means 130. The retaining section 140 of the retaining means 130 engages the first cavity 310. Through the engagement of the retaining section 140 in the first cavity 310, twisting of the sealing element 30 around the x-axis with respect to the first contact housing 25 is reliably avoided. Furthermore, in the x-direction, a required construction space for the fixing of the sealing element 30 is reduced compared to the configuration shown in Figures 1 and 2.

[0055] The first contact device 15 shown in Figure 6 is produced by means of the method described in Figure 3. In addition, the bar 170 has, however, been melted on and pressed with the pressing tool 190 such that no material excess 141 is formed on that side of the first housing section 65 which faces away from the sealing element 30. As a result, an engagement of the second contact housing 40 in the second cavity 320 is facilitated.

[0056] Figure 7 shows a perspective depiction of a cut-out of the first contact device 15 shown in Figure 6.

[0057] The first housing section 65 is circumferentially arranged at the periphery and is interrupted by a second cavity 320. The second cavity 320 has a rectangular shape. The second cavity 320 is aligned in the y-direction with the first cavity 310 of the sealing element 30. Here, a profile of the first housing section 65 is interrupted at the front end by the second cavity 320. The bar 170 is arranged in the second cavity 320.

[0058] The retaining section 140 engages the first cavity 310 of the sealing element 30 and the second cavity 320. In the embodiment, the retaining section 140 is arranged laterally spaced apart relative to the respective cavity profile 325, 330 of the cavity 310, 320. Obviously, the retaining section 140 can also rest against the cavity profile 325, 330 of the cavity 310, 320. The spaced-apart arrangement arises in that, when the pressing tool 190 is pressed on, the pressing tool 190 dips into the cavity 310, 320 and deforms the retaining section 140. The deformation can, however, also take place such that the cavity profile 325, 330 of the cavities 310, 320 serves as part of the form of the pressing tool 190.

[0059] By providing the cavity 310, 320, the required construction space for forming the retaining means 130 is particularly low.

[0060] Figure 8 shows a perspective depiction of the first contact device 15 shown in Figure 6 after the second method step 205.

[0061] According to the second method step 205, the bar 170 projects out of the second cavity 320, but with the bar 170 being arranged spaced apart relative to a cavity profile 325 of the second cavity 320.

[0062] Figure 9 shows a perspective depiction of a first contact device 15 according to a third embodiment.

[0063] Unless otherwise described, the first contact device 15 shown in Figures 9 and 10 is configured identically to the first contact device 15 shown in Figures 6 and 7.

[0064] In this embodiment, the retaining section 140 has a trapeziform cross-section. Alternatively, it would also be conceivable that the retaining section 140 is formed in cross-section as a circle segment or in a triangular shape.

[0065] The retaining means 130 has a guide surface 335 on a side facing away from the sealing element 30 in the x-direction. The guide surface 335 is arranged obliquely inclined relative to the first sealing bearing surface 70 and the x-axis of the first contact device 15, which corresponds to the plugging direction of the first contact device 15 on the second contact device 20.

[0066] Figure 10 shows a longitudinal section through the contact system 10 with the first contact device 15 shown in Figure 9.

[0067] The guide surface 335 begins at the front end on the side facing away from the sealing element 30, at a front end 340 of the retaining means 130. The front end 340 of the retaining means 130 is arranged perpendicular to the first sealing bearing surface 70. The guide surface 335 and the front end 340 of the retaining means 130 are adjacent to one another approximately in the y-direction at the first sealing bearing surface 70 on a side of the retaining means 130 which faces away from the first sealing bearing surface 70. The guide surface 335 extends towards the outside and is adjacent to a peripheral side 345 of the retaining means 130. The peripheral side 345 is arranged closer to the sealing element 30 than the front end 340 of the retaining means 130. The guide surface 335 is arranged at an angle α to the first sealing bearing surface 70 and/or to the x-axis or plugging direction. The angle α has a value which is in a range from 25° to 75°, in particular in a range from 35° to 60°.

[0068] The second contact housing 40 has a bevel 350 at the front end. The bevel 350 is preferably arranged at the same angle α to the second sealing bearing surface 115 as the guide surface 335. Through the corresponding arrangement of the bevel 350 and the guide surface 335, it can be assured that, when the first contact device 15 and the second contact device 20 are plugged into one another, the bevel 350 lies planarly against the guide surface 335 and the guide surface 335 guides the first contact housing 25 outwards in the plugging movement in the direction of the sealing element 30, so that squashing of the sealing element 30 in the sealing gap 120 is avoided. As a result, a particularly reliable plugging of the first contact device 15 and the second contact device 20 onto one another can be ensured and at the same time a reliable sealing-off of the inner space 50 by the sealing element 30 can be ensured.

[0069] Through the above-described configurations of the contact system 10, the number of components of the contact system 10 can be reduced. Furthermore, the first contact device 15 can be produced particularly quickly, simply and inexpensively and at the same time it is possible to reliably avoid both positioning the sealing element 30 and damaging the sealing element 30. Furthermore, the injection mould for producing the first contact housing 25 is formed particularly simply so that it is possible in particular to dispense with undercuts for fixing the sealing elements 30 in the injection mould, meaning that the production of the injection mould is particularly simple and inexpensive. Furthermore, the assembly is kept particularly simple through the guiding function of the guide surface 335.

Claims

1. A method for producing a contact device (15)

- wherein a contact housing (25), a sealing element (30) and a warm-caulking device (180) comprising a pressing tool (190) and a heating unit (185) are provided,
- wherein a bar (170) is arranged at the contact housing (25),
- wherein the sealing element (30) is slid over the bar (170) onto a sealing bearing surface (70) of the contact housing (25),

characterised in that

- to form a retaining means (130), the bar (170) is hot-caulked in such a way that by means of the heating unit (185) at least a section (175) of the bar (170) is heated,
- wherein the pressing tool (190) is pressed onto the section (175) and the pressing tool (190) moulds the retaining means (130) from the heated section (175) of the bar (170),
- wherein the heated section (175) of the bar is cooled,
- wherein the retaining means (130) secures a position of the sealing element (30) at the contact housing (25) .

2. The method according to Claim 1,

- wherein the section (175) is heated to a predefined temperature,
- wherein the predefined temperature is lower than a melting temperature of a material of the bar (170) and of the contact housing (25).

3. The method according to Claim 1 or 2,

- wherein a temperature of the contact housing (25) is kept substantially constant during the heating of the section (175).

4. A contact device (15), which is able to be produced according to a method according to any one of the preceding claims,

- wherein the contact device (15) comprises a

contact housing (25) and a sealing element (30),
- wherein the contact housing (25) has a sealing bearing surface (70) arranged at the periphery,
- wherein the sealing element (30) rests on the sealing bearing surface (70) at the periphery,
- wherein the contact housing (25) has a retaining means (130),
- wherein the retaining means (130) is configured to prevent the sealing element (30) from being pulled away from the sealing bearing surface (70) through a touching contact of the sealing element (30) at the retaining means (130),

characterised in that

- the retaining means (130) is connected at one side to the contact housing (25),
- wherein the retaining means (130) projects beyond the sealing bearing surface (70) with a retaining section (140),
- wherein the retaining means (130) and the contact housing (25) are configured in an integral and material-uniform manner.

5. The contact device (15) according to Claim 4,

- wherein the contact housing (130) has a bar section (135),
- wherein the bar section (135) is connected by a fixed end (145) to the contact housing (25),
- wherein the side surface (150) of the bar section (135) and the sealing bearing surface (70) are arranged in alignment,
- wherein the retaining section (140) is arranged inclined, preferably perpendicular, to the bar section (135),
- wherein the retaining section (140) is hot-caulked.

6. The contact device (15) according to Claim 4 or 5,

- wherein the contact housing (25) has a cavity (320) with a cavity profile (325),
- wherein the retaining means (130) is arranged in the cavity (320), spaced apart from the cavity profile (325),
- wherein the cavity profile (325) is preferably configured corresponding to the pressing tool (190).

7. The contact device (15) according to Claim 6,

- wherein the contact device (15) has at least one contact element (35),
- wherein the contact housing (25) has a contact section (26) and a housing section (65),
- wherein the contact element (35) is arranged in the contact section (26) at least in sections,
- wherein the housing section (65) is circumferentially arranged at the periphery around the contact section (26),
- wherein the sealing bearing surface (70) is arranged at the periphery at the housing section (65),
- wherein the housing section (65) is interrupted by the cavity (320) and the retaining means (130) at the front end.

8. The contact device (15) according to any one of Claims 4 to 7,

- wherein the second sealing element (30) has a further cavity (310),
- wherein the further cavity (310) is arranged on a front end (160) of the sealing element (30), which front end faces the retaining means (130),
- wherein the further cavity (310) is open towards the retaining means (130),
- wherein the retaining section (140) engages the further cavity (310).

9. The contact device (15) according to Claim 8,

- wherein the sealing element (30) has a sealing section (300) and an edge section (305) which is connected to the sealing section (300),
- wherein the sealing section (300) has at least one sealing lip (100, 110) at the periphery,
- wherein the edge section (305) preferably has a rectangular cross-section,
- wherein the cavity (310) is arranged in the edge section (305).

10. The contact device (15) according to any one of Claims 4 to 9,

- wherein the retaining means (130) has a guide surface (335) on a side facing away from the sealing element (30),
- wherein the guide surface (335) is arranged obliquely inclined relative to the sealing bearing surface (70) and/or a plugging direction of the contact device (15) at a further contact device (20),
- wherein the guide surface (335) is preferably arranged at an angle (α) to the sealing bearing surface (70) and/or to the plugging direction,
- wherein the angle (α) has a value which is in a range from 25° to 75°, in particular in a range from 35° to 60°.

11. The contact device (15) according to Claim 10,

- wherein the guide surface (335) extends between a front end (340) of the retaining means (130) and a peripheral side (345) arranged at

the periphery of the retaining means (130),
- wherein the periphery side (345) is arranged closer to the sealing element (30) than to the front side (340),
- wherein the guide surface (335) begins situated internally at the front end (340) and ends situated externally at the peripheral side (345).

12. The contact device (15) according to any one of Claims 4 to 11,

- wherein the retaining section (140) has a trapeziform or rectangular or triangular cross-section.

13. The contact device (15) according to any one of Claims 4 to 12,

- wherein the sealing bearing surface (70) is arranged at an outer peripheral side (60) of the contact housing (25),
- wherein the contact housing (25) has a sealing supporting surface (80) arranged at the front end,
- wherein the sealing supporting surface (80) is arranged adjacent to the sealing bearing surface (70) and inclined, preferably perpendicularly, to the sealing bearing surface (70),
- wherein the sealing bearing surface (70) is formed circumferentially at the periphery,
- wherein the sealing element (30) rests on the sealing supporting surface (70) at the outside,
- wherein the sealing element (30) is arranged between the retaining means (130) and the sealing bearing surface (80), preferably in a play-free manner.

14. A contact system (10) with a contact device (15) and a further contact device (20),

- wherein the contact device (15) is formed according to any one of Claims 4 to 13,
- wherein the further contact device (20) has a further contact housing (40),
- wherein the further contact housing (40) has a further sealing bearing surface (115),
- wherein the contact device (15) and the further contact device (20) are plugged into one another and delimit an inner space (50),
- wherein the sealing element (30) is arranged between the sealing bearing surface (70) and the further sealing bearing surface (115) and seals the inner space (50) off at least in sections from a surrounding area (55),
- wherein the retaining means (130) is formed to retain the sealing element (30) in its position on the sealing bearing surface (70) of the contact device (15) when the contact device (15) is pulled away from the further contact device (20).

15. The contact system (10) according to Claim 14,

- wherein, when the contact device (15) and the further contact device (20) are plugged into one another, the further contact housing (40) rests against the guide surface (335) of the retaining means (130),
- wherein the guide surface (335) is formed to guide the further contact housing (40) transverse to the plugging movement toward the sealing element (30).

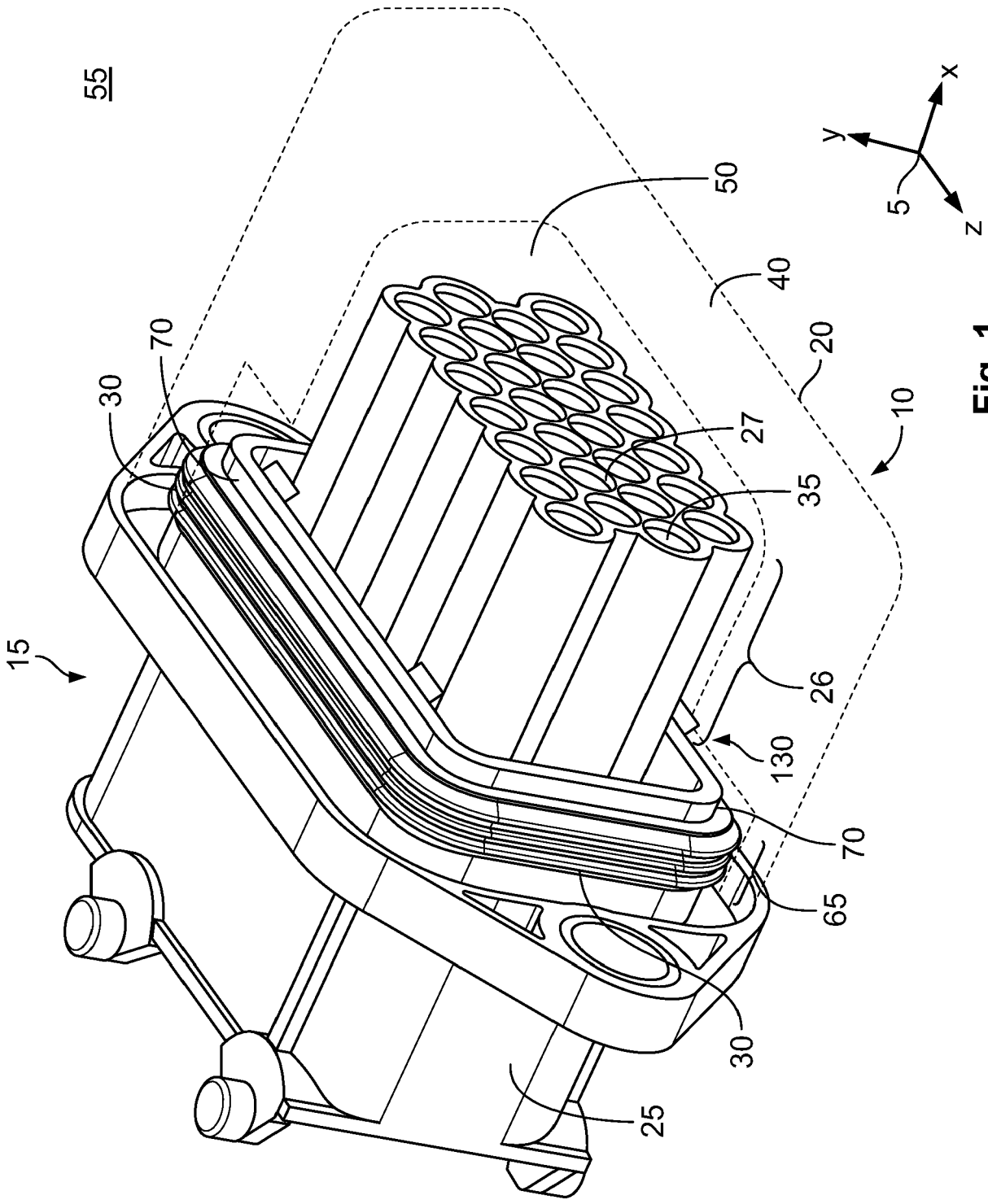

Fig. 1

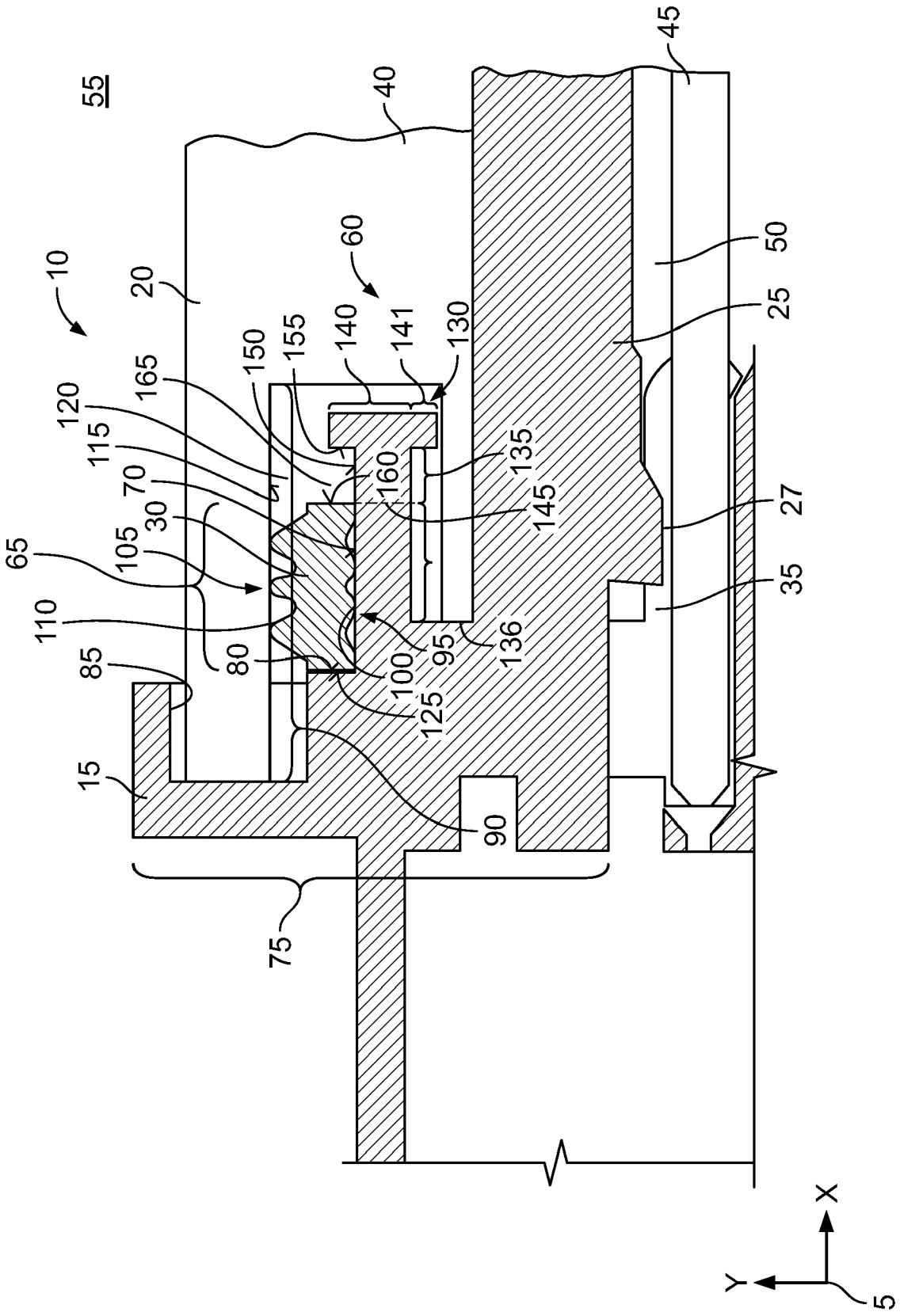
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Fig. 2

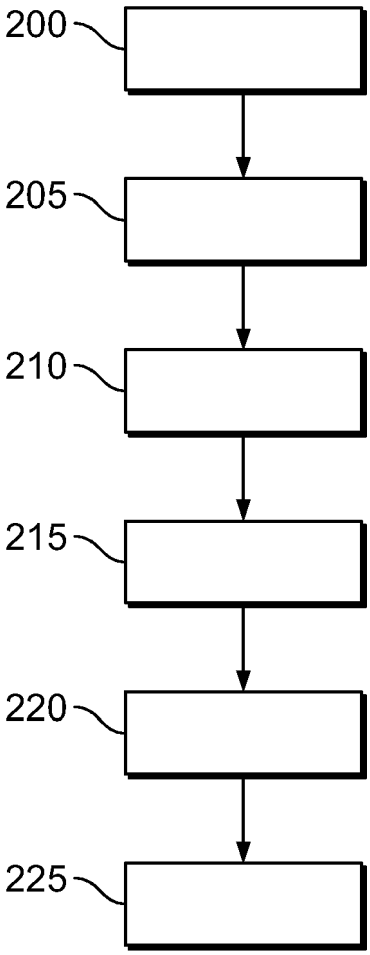

Fig. 3

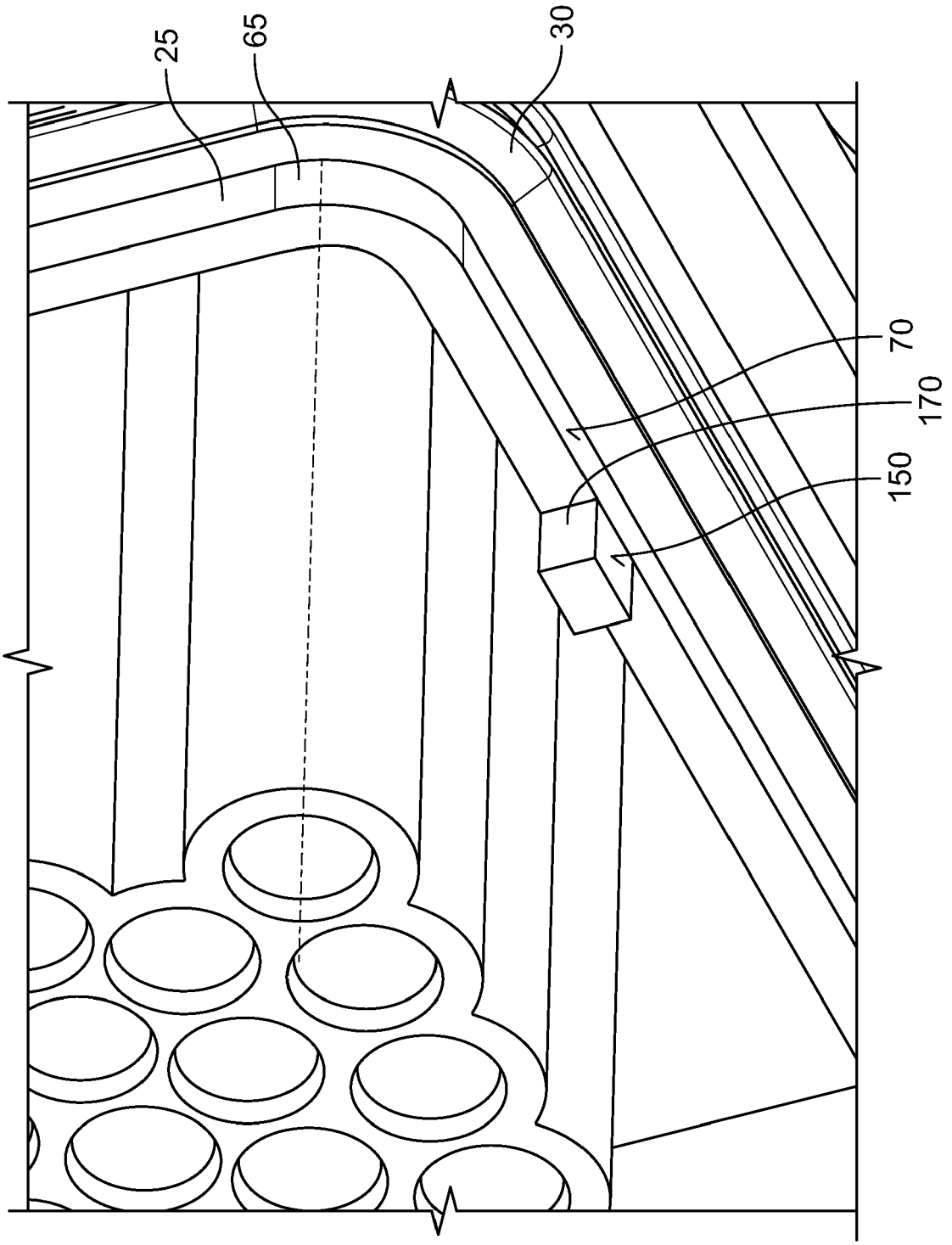

Fig. 4

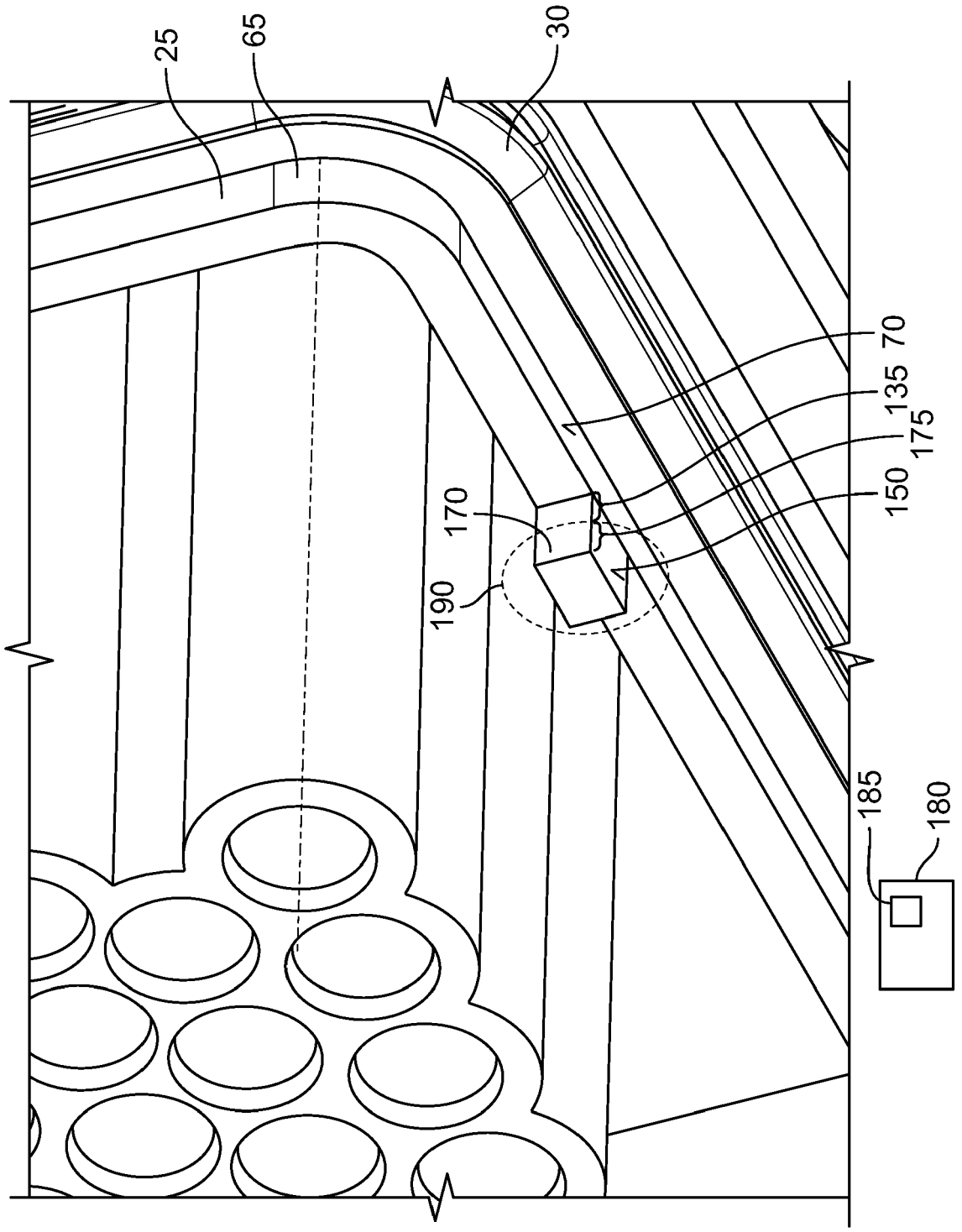

Fig. 5

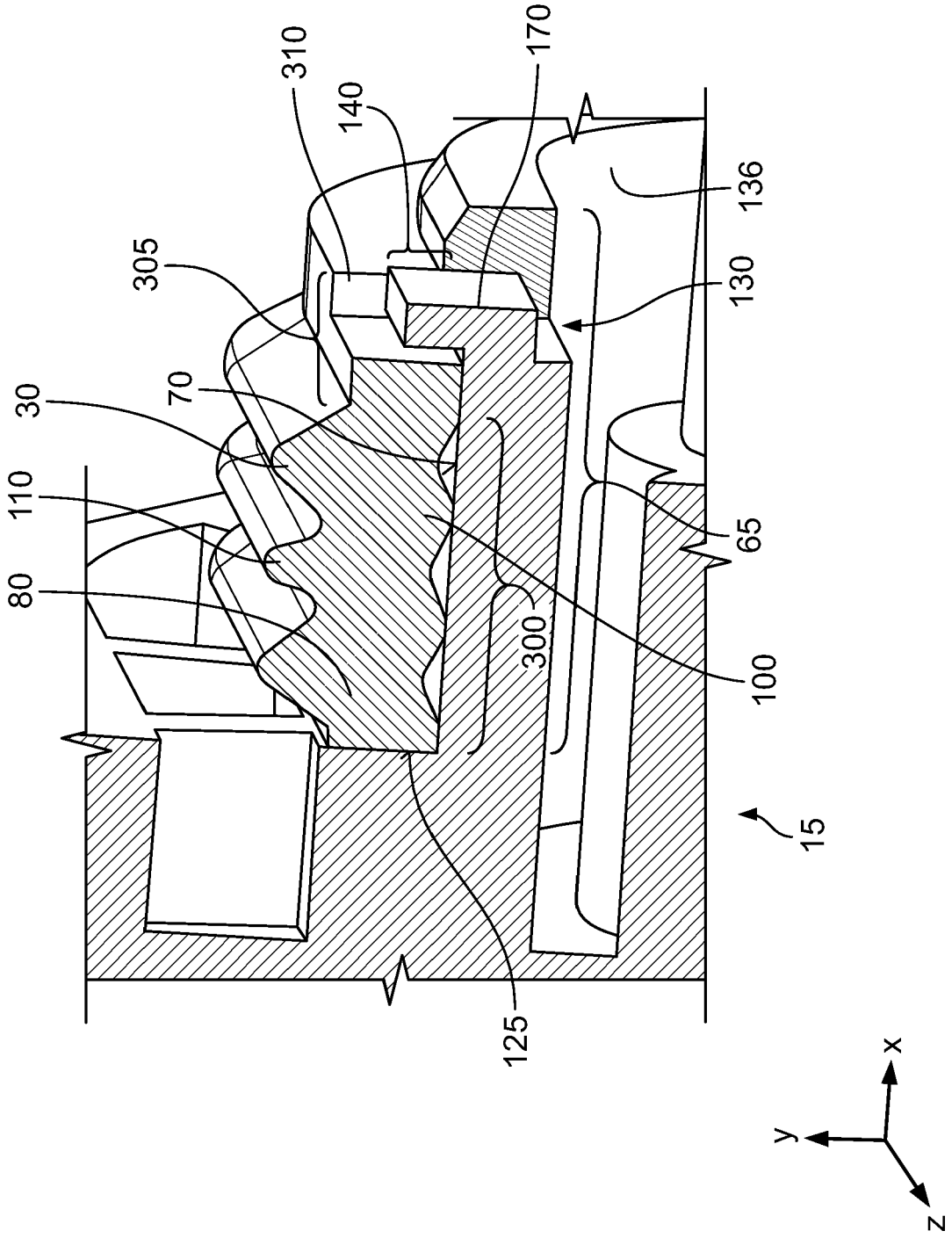

Fig. 6

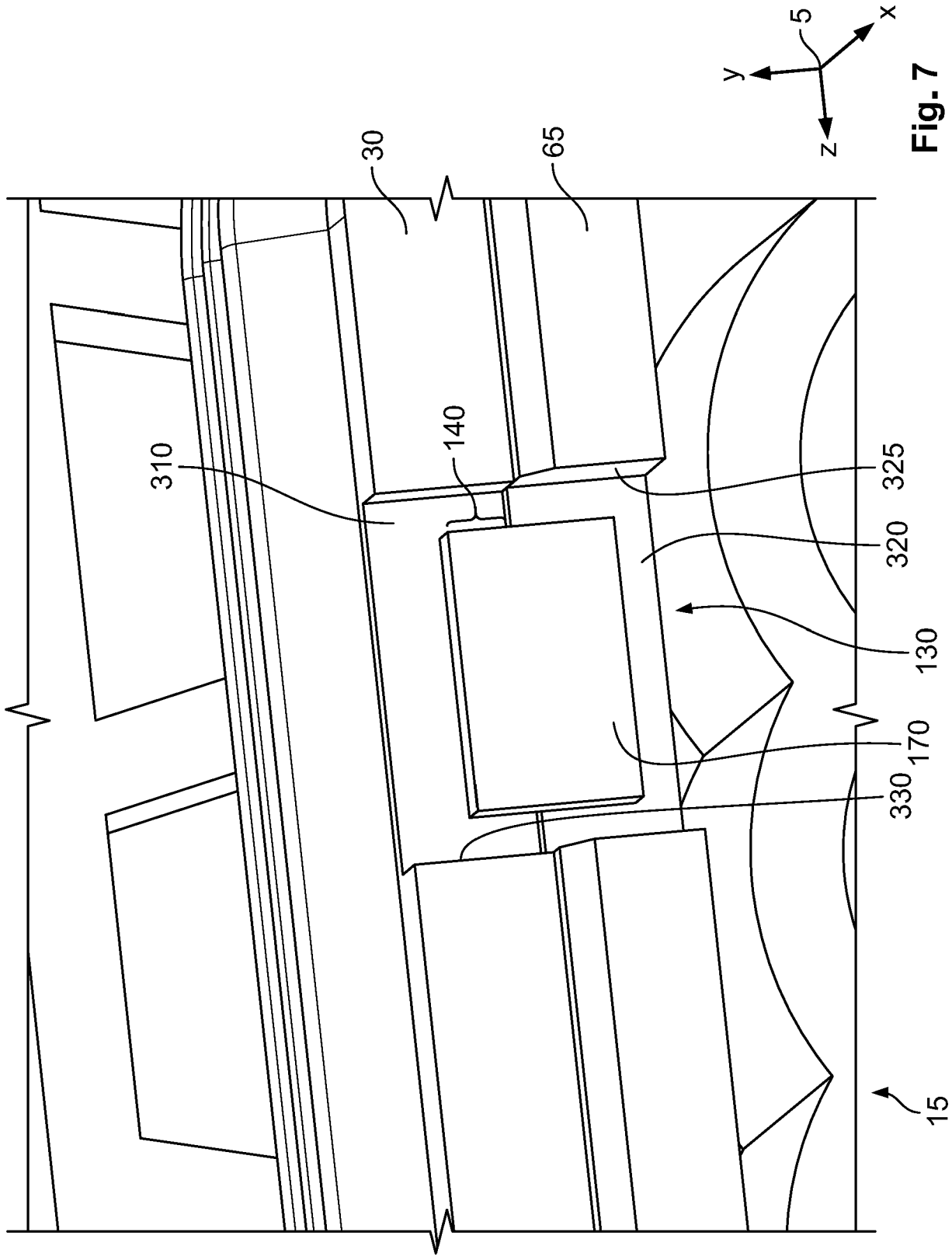

Fig. 7

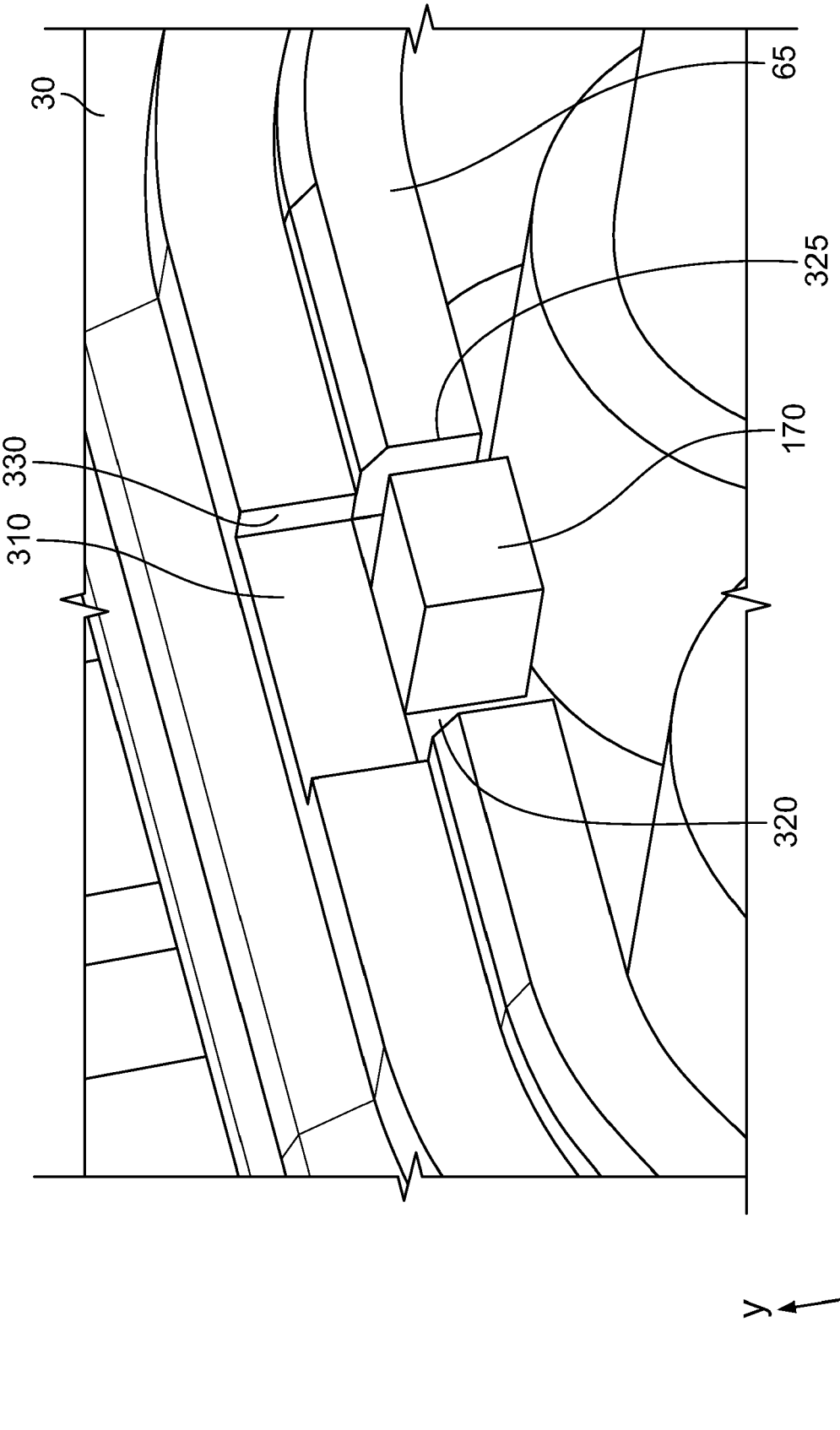

Fig. 8

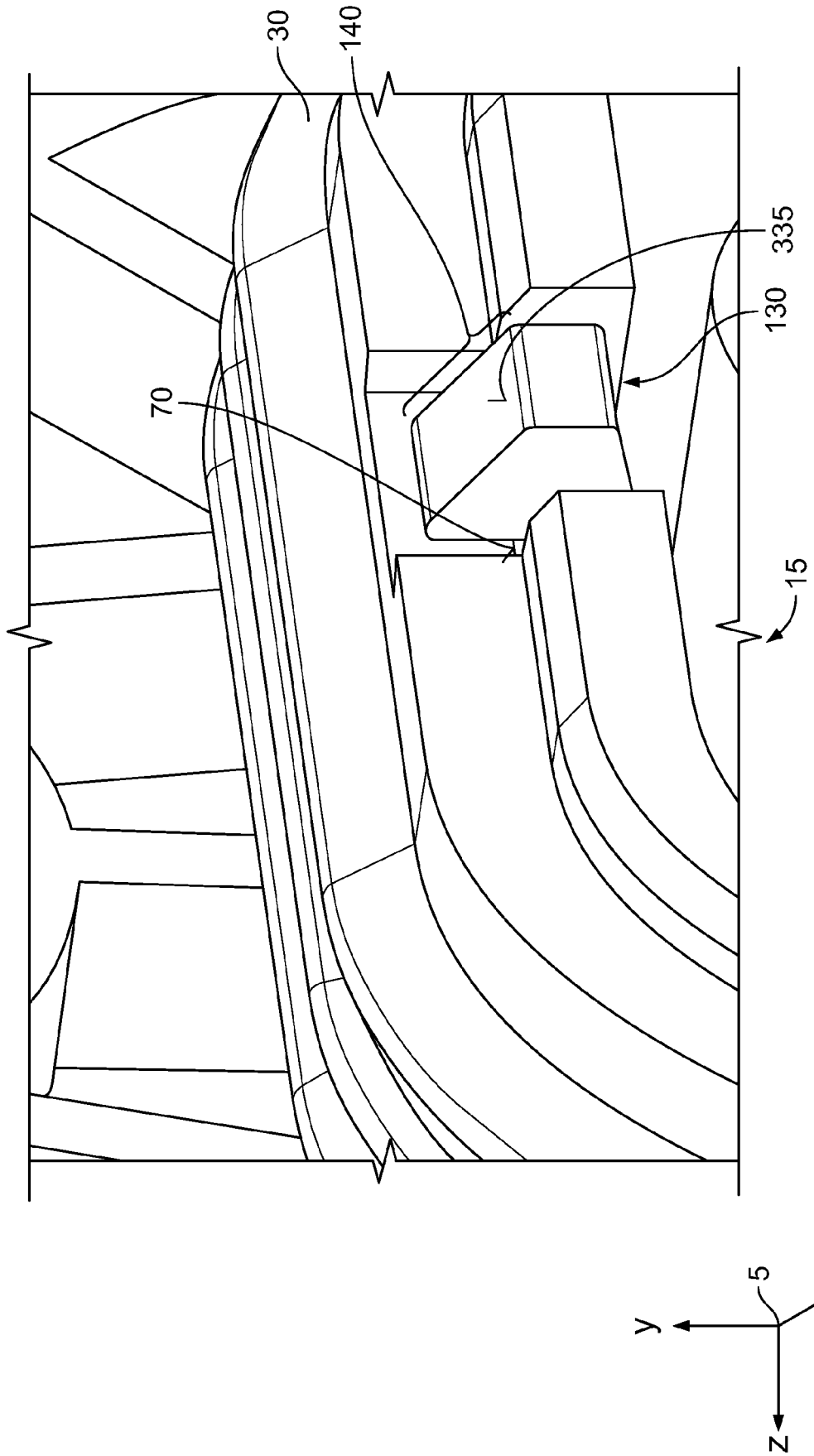

Fig. 9

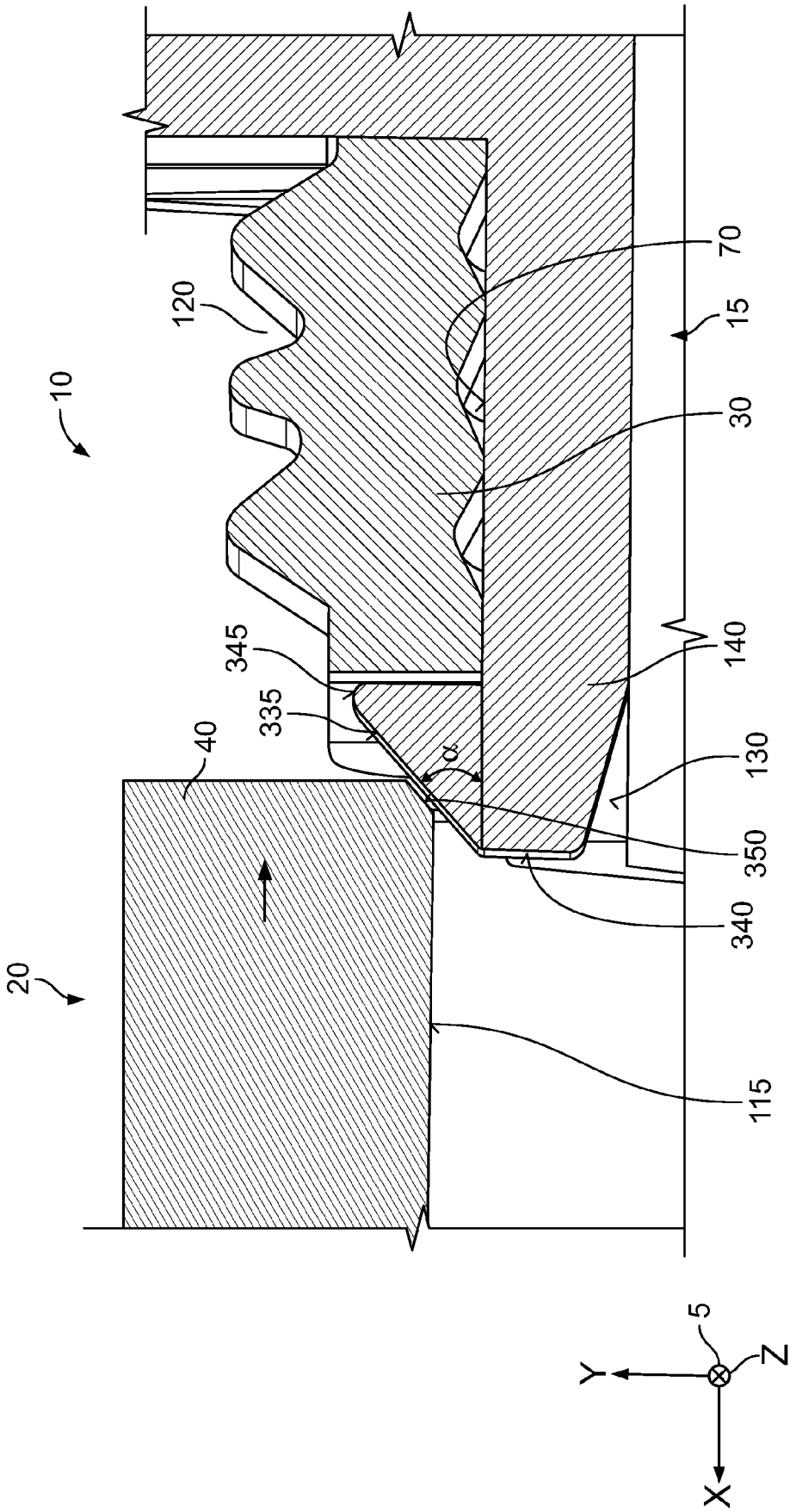

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 18 18 8528

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H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 December 2018	Gomes Sirenkov E M.

CATEGORY OF CITED DOCUMENTS

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