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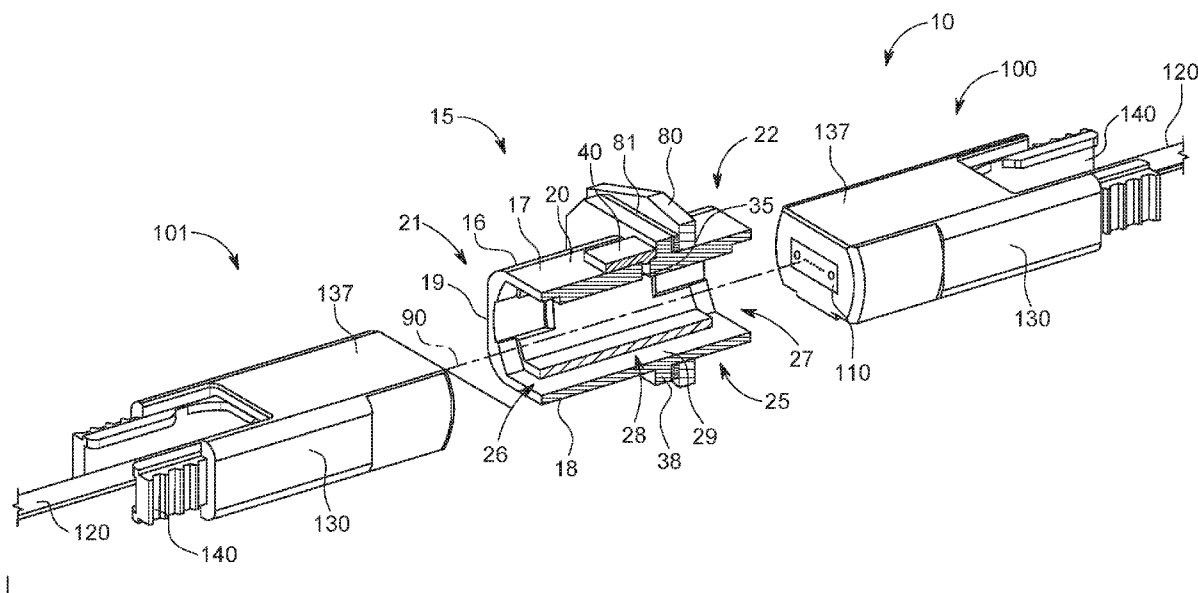


FIG. 2

(57) Abstract: An optical fiber adapter assembly includes a housing having a passage extending therethrough and including an outer surface spaced from the passage. The passage includes a longitudinal axis and a mating section along the longitudinal axis. An air vent extends between the mating section and the outer surface and a valve member is configured to selectively seal the air vent.

## OPTICAL FIBER ADAPTER ASSEMBLY

### Related Applications

[0001] This application claims priority to U.S. Provisional Application No. 62/471,046, filed March 14, 2017, which is incorporated herein by reference in its entirety.

### Technical Field

[0002] The present disclosure relates generally to optical fiber connector assemblies and, more particularly, to a self-cleaning adapter for supporting mating optical fiber connector assemblies.

### Background

[0003] Systems for interconnecting optical fibers typically utilize mating ferrules to facilitate handling and accurate positioning of the fibers. The optical fibers are secured within the ferrule with an end surface of each fiber being positioned generally flush with or slightly protruding from an end face of the ferrule. When complementary ferrules are mated, each optical fiber of one ferrule is coaxially positioned with a mating optical fiber of the other ferrule.

[0004] In some applications, the end faces of the mating optical fibers physically contact one another in order to effect signal transmission between the mating optical fiber pair. In such applications, dust or debris between the fibers at the mating interface may reduce the efficiency of the light transmission between the optical fiber pair. Due to the small optical path relative to the size of any foreign objects such as dust or debris, any such foreign objects will likely interfere with the transmission of light. In addition, debris on the mating face of one of the mating ferrules may prevent the desired contact between mating optical fibers.

[0005] The foregoing background discussion is intended solely to aid the reader. It is not intended to limit the innovations described herein, nor to limit or expand the prior art discussed. Thus, the foregoing discussion should not be taken to indicate that any particular element of a prior system is unsuitable for use with the innovations described herein, nor is it intended to indicate that any element is essential in implementing the innovations described

herein. The implementations and application of the innovations described herein are defined by the appended claims.

### Summary

[0006] In one aspect, an optical fiber adapter assembly includes a housing having a passage extending therethrough and including an outer surface spaced from the passage. The passage includes a longitudinal axis and a mating section along the longitudinal axis. An air vent extends between the mating section and the outer surface and a valve member is configured to selectively seal the air vent.

[0007] In another aspect, an optical fiber adapter assembly includes a housing having a passage extending therethrough and an outer surface spaced from the passage, with the passage including a first connector receiving section and a second connector receiving section aligned with the first connector receiving section. An air vent extends between the passage and the outer surface and a movable member is operative to selectively seal the air vent. The movable member is movable between a first position at which the air vent is sealed and a second position at which the air vent is open.

[0008] In still another aspect, an optical fiber adapter assembly includes a housing having a passage extending therethrough and an outer surface spaced from the passage. The passage including a first connector receiving section, a second connector receiving section spaced from the first connector receiving section, and a mating section disposed between the first connector receiving section and the second connector receiving section and along a longitudinal axis of the passage. An air vent extends between the mating section and the outer surface and a valve member is configured to selectively seal the air vent.

### Brief Description of the Drawings

[0009] Fig. 1 is a perspective view of an optical fiber assembly including first and second optical fiber connector assemblies inserted into an adapter assembly;

[0010] Fig. 2 is a perspective view of the optical fiber assembly of Fig. 1 with the first and second optical fiber connector assemblies exploded from the adapter assembly and with the adapter assembly in section;

[0011] Fig. 3 is an exploded perspective view of the optical fiber assembly of Fig. 1;

- [0012] Fig. 4 is an enlarged view of a portion of Fig. 3 depicting a portion of an optical fiber connector assembly;
- [0013] Fig. 5 is an enlarged view of a portion of Fig. 3 depicting a section of the adapter assembly;
- [0014] Fig. 6 is a schematic representation of an embodiment of an adapter assembly and ferrule;
- [0015] Fig. 7 is a schematic representation similar to Fig. 6 but with an alternate air vent structure;
- [0016] Fig. 8 is a schematic representation of another embodiment of an adapter assembly with a pair of mating ferrules and upper and lower air vent structures with a second ferrule initially inserted into the adapter assembly;
- [0017] Fig. 9 is a schematic representation similar to Fig. 8 but with the second ferrule further inserted into the adapter assembly;
- [0018] Fig. 10 is a schematic representation similar to Fig. 9 but with the second ferrule fully inserted into the adapter assembly;
- [0019] Fig. 11 is a perspective view of the optical fiber assembly of Fig. 2 with the first optical fiber connector assembly fully inserted into the adapter assembly and with the second optical fiber connector assembly initially inserted into the adapter assembly;
- [0020] Fig. 12 is a sectional view of the optical fiber assembly of Fig. 11;
- [0021] Fig. 13 is a perspective view similar to Fig. 11 but with the second optical fiber connector assembly further inserted into the adapter assembly;
- [0022] Fig. 14 is a sectional view of the optical fiber assembly of Fig. 13;
- [0023] Fig. 15 is a perspective view similar to Fig. 13 but with the second optical fiber connector assembly fully inserted into the adapter assembly;
- [0024] Fig. 16 is a sectional view of the optical fiber assembly of Fig. 15;
- [0025] Fig. 17 is a schematic perspective representation of another alternate embodiment of an adapter assembly and valve member;
- [0026] Fig. 18 is a schematic side elevational view of a ball valve for use with an adapter assembly with the ball valve in a closed position;

[0027] Fig. 19 is a schematic side elevational view of the ball valve of Fig. 18 but with the ball valve in an open position;

[0028] Fig. 20 is a schematic top plan view of the ball valve of Fig. 18;

[0029] Fig. 21 is a schematic side elevational view of the ball valve of Fig. 18 but with the sealing ball exploded for clarity;

[0030] Fig. 22 is a schematic top plan view of the ball valve of Fig. 21 but with the sealing ball exploded for clarity;

[0031] Fig. 23 is a schematic representation of a further embodiment of a pair of optical fiber connector assemblies aligned for insertion into a further embodiment of an adapter assembly with a second optical fiber connector assembly initially inserted into the adapter assembly;

[0032] Fig. 24 is a schematic representation similar to Fig. 23 but with the second optical fiber connector assembly further inserted into the adapter assembly; and

[0033] Fig. 25 is a schematic representation similar to Fig. 24 but with the second optical fiber connector assembly fully inserted into the adapter assembly.

#### Detailed Description

[0034] Referring to Figs. 1-3, an optical fiber assembly 10 includes a housing in the form of an adapter assembly 15, a first optical fiber connector assembly 100, and a second optical fiber connector assembly 101 optically connected to the first optical fiber connector assembly. The first and second optical fiber connector assemblies 100, 101 may have any configuration. For example, as depicted, the first and second optical fiber connector assemblies 100, 101 are identically configured.

[0035] Each of the depicted optical fiber connector assemblies 100, 101 includes an optical fiber and ferrule assembly or multi-fiber optical assembly 105, an inner housing component 140 configured to receive the optical fiber and ferrule assembly 105, and an outer housing component 130 configured to receive the inner housing component.

[0036] The optical fiber and ferrule assembly 105 comprises an optical fiber cable 120 and a ferrule 110 secured to at least one end of the cable. The optical fiber cable 120 is depicted as being generally planar or flat and may include any number and any type of optical

fibers 123. The optical fiber cable 120 may include a sheathing 122 surrounding the cable as well as other materials (not shown) that surround the optical fibers 123 within the cable such as a buffer. In an alternate embodiment that is not depicted, the cable may be round or may include a plurality of loose optical fibers. The optical fibers 123 may have any configuration or be any type such as a single-mode or multi-mode configuration.

**[0037]** Referring to Fig. 4, the ferrule 110 may have any configuration but is depicted as a generally rectangular cuboid configured to support and align an end of each of the optical fibers 123. The ferrule 110 has an upper surface 111, an opposite lower surface 112, and a pair of spaced apart side surfaces 113 that interconnect the upper surface and lower surface. The optical fibers 123 extend through a fiber receiving section of the ferrule 110 past the rear face 114 of the ferrule and terminate generally adjacent the front face 115 of the ferrule. A raised surface 116 may extend along each of the upper surface 111, lower surface 112, and side surfaces 113 generally adjacent the rear face 114 of the ferrule 110 and defines a front or forward edge 117 between the rear face 114 and the front face 115.

**[0038]** The fiber receiving section may be configured as a plurality of adjacent bores configured to receive the optical fibers 123. Although the ferrule 110 is depicted as being configured to receive twelve optical fibers 123, the ferrule may be configured to receive any number of optical fibers in one or more rows.

**[0039]** The end of each optical fiber 123 may extend slightly past the front face 115 of the ferrule 110. In some embodiments, the end of each optical fiber 123 may be formed and/or polished to be generally perpendicular to the axis of the optical fiber. In other embodiments, the end of each optical fiber 123 may be formed and/or polished to be at a slight angle relative to perpendicular to the axis of the optical fiber. In one embodiment, the angle may be approximately 8°. By configuring the ends of the optical fibers 123 to be at a slight angle to perpendicular to the optical axis, optical transmission is not significantly degraded while reducing the likelihood of reflection at the interface between mating optical fibers.

**[0040]** The outer housing component 130 may have any configuration and includes a central bore 131 into which the inner housing component 140 may be inserted. The front face 132 includes a rectangular bore 133 configured to permit a portion of the ferrule 110 to be inserted therethrough. In one configuration, the ferrule 110 may be inserted into the rectangular bore 133 so that the front face 115 of the ferrule is aligned with or projects

slightly beyond the front face 132 of the outer housing component 130. The outer housing component 130 and inner housing component 140 may include a locking structure to secure the inner housing component within the outer housing component. As depicted, the outer housing component 130 includes a locking aperture 135 generally adjacent a rear portion of the outer housing component that forms a portion of the locking structure.

**[0041]** The inner housing component 140 may have any configuration that permits it to be lockingly received within the central bore 131 of the outer housing component 130. The inner housing component 140 also includes a central bore 141 through which the ferrule 110 may pass. The inner housing component 140 may include ferrule securing structure at one end for securing the ferrule 110 within the inner housing component. More specifically, the inner housing component 140 may include a pair of spaced apart, inwardly extending lateral projections 142 that together define a gap or opening 143 through which the forward portion of the ferrule 110 may extend. The length of the opening 143 between the lateral projections 142 is greater than the lateral distance or width of the ferrule 110 adjacent the front face 115 but is less than the lateral distance or width of the ferrule at the raised surface 116 adjacent the rear face 114. As a result, the ferrule 110 may be inserted into the central bore 141 of inner housing component 140 until the forward edge 117 of each raised surface 116 along the side surfaces 113 contacts one of the lateral projections 142.

**[0042]** The inner housing component 140 further includes a pair of spaced apart, resilient arms 144 each having an inwardly extending lateral projection 145 that together define a gap or opening 146 through which a portion of the ferrule extends. More specifically, while in an undeflected state, the arms 144 define the length of the opening 146 to be less than the distance between the raised surface 116 along the upper surface 111 and the raised surface 116 along the lower surface 112 of the ferrule 110. However, the arms 144 may deflect upon insertion of the ferrule 110 into the central bore 141 to permit the ferrule including the raised surfaces 116 along the upper and lower surfaces 111, 112 to be inserted past the lateral projections 145 on the resilient arms 144.

**[0043]** The inner housing component 140 further includes portion of the locking structure for securing the inner housing component 140 to the outer housing component 130. More specifically, the inner housing component 140 includes a first rigid arm 147 and a second deflectable arm 148 spaced from the first rigid arm. The second deflectable arm 148 may include a locking projection (not shown) that lockingly engages the locking aperture 135 to

secure the inner housing component 140 to the outer housing component 130 when the inner housing component is inserted into the outer housing component.

[0044] Referring to Fig. 5, adapter assembly 15 has an adapter body 16 that is generally rectangular in cross-section and includes an upper wall 17, a lower wall 18 opposite the upper wall, and a pair of sidewalls 19 interconnecting the upper and lower walls. Body 16 further includes a first end 21 and an oppositely facing second end 22 with a passage 25 extending between the two ends. The passage 25 includes a first connector receiving section or end 26 extending inwardly from the first end 21 towards the second end 22, a second connector receiving section or end 27 extending inwardly from the second end towards the first end, and a third or mating section 28 between the first and second sections. The mating section 28 may be centrally located or offset between the first end 21 and second end 22 of the body 16 along passage 25. Each of the first connector receiving section 26 and the second connector receiving section 27 has a cross-section configured to receive the outer housing component 130 of the first and second optical fiber connector assemblies 100, 101, respectively.

[0045] The first connector receiving section 26 and the second connector receiving section 27 are generally aligned along a longitudinal or mating axis 90 of the passage 25. The mating section 28 is configured to tightly receive at least the end portions of the first optical fiber connector assembly 100 and the second optical fiber connector assembly 101. In doing so, the cross-section of the passage 25, at least at the mating section 28, and the cross-sections of the first and second optical fiber connector assemblies 100, 101 are configured to reduce, minimize, or potentially eliminate air passing between or along the outer surface 137 of outer housing component 130 of the optical fiber connector assemblies and the inner wall or surface 29 of the passage 25 as the optical fiber connector assemblies are inserted into the passage.

[0046] The adapter body 16 further includes an air vent or channel 35 that extends between the inner surface 29 of the passage 25 and the outer surface 20 of the adapter body. In one embodiment, the air vent 35 may be positioned to intersect with the mating section 28 of passage 25 along the mating plane 91 (Fig. 11) of the ends of the optical fibers 123 of each of the optical fiber connector assemblies 100, 101.

[0047] The air vent 35 may have any desired configuration. The air vent 35 may include one or more openings that extend upward or downward (to the upper wall 17 or lower wall 18, respectively) as depicted in Figs. 1-5 or may include one or more openings with some

extending upward and others extending downward as depicted in Figs. 8-10. As depicted in Fig. 6, in some embodiments, the air vent 35 may be a slot 36 extending laterally or perpendicularly relative to the mating axis 90. The path of air flow from mating section 28 through the air vent 35 is indicated schematically at arrow 85. The lateral dimension or width of the slot 36 may be set as desired and may be dependent upon its length parallel to the mating axis 90. As depicted, the slot 36 may be slightly wider than the distance between the optical fibers 123 closest to the opposite side surfaces 113 of the ferrule 110. In other words, as depicted, the slot 36 is slightly narrower than the width of the ferrule 110. In other embodiments, the slot 36 may have any other desired width such as approximately as wide as the distance between the outermost optical fibers 123 or a width narrower than the distance between the outermost optical fibers.

**[0048]** In another embodiment, the air vent 35 may comprise a plurality of laterally spaced apart openings or bores 37 (Fig. 7). In other words, rather than utilizing a relatively wide slot 36 as depicted in Fig. 6, the air vent 35 may comprise a plurality of smaller openings or bores 37 that extend laterally relative to the mating axis 90. The bores 37 may be dimensioned as desired and may be spaced apart to define a distance between the outermost bores equal to the width of the slots 36 described above.

**[0049]** In some embodiments, body 16 may include a mounting flange 38 (Figs. 1-3) to facilitate mounting the adapter assembly 15 to a panel 80. A gasket 81 provides a seal between the flange 38 and the panel 80. In other embodiments, the body 16 may not include a flange. Body 16 may be formed of any desired material such as a resin or polymer. In addition, body 16 may be formed as a single, unitary molded component or it may be formed from a plurality of components that are assembled together.

**[0050]** Referring back to Fig. 5, adapter assembly 15 may include a valve member 40 mounted on the adapter body 16 and configured to selectively seal the air vent 35. The valve member 40 is operative to permit air to escape from the passage 25 through the air vent 35 as the first and second optical fiber connector assemblies 100, 101 are mated within the adapter assembly 15. The flow of air from the passage 25 through the air vent 35 is operative to dislodge dust and debris on the ends of the optical fibers 123 as well as any other debris on the front face 115 of the ferrule that may otherwise affect the mating of the first and second optical fiber connector assemblies 100, 101. The valve member 40 may further be configured to seal the air vent 35 at all other times to prevent dust and debris from entering the passage 25 through the air vent.

**[0051]** In one embodiment, the valve member 40 may be an elastomeric sealing member 41 secured to the outer surface 20 of the adapter body 16 adjacent the air vent 35. When configured as an elastomeric member 41, the valve member 40 may include a first or mounting section 42 for securing the elastomeric member to the adapter body adjacent the air vent 35, a sealing section 43 for sealing the air vent, and a deflectable section 44 to permit movement of the sealing section. Referring to Figs. 8-10, The sealing section 43 is movable between a first or sealed position at which the sealing section engages the adapter body 16 to seal the air vent 35 (Figs. 8 and 10) and a second or open position at which air may pass through the air vent (Fig. 9).

**[0052]** The elastomeric sealing member 41 permits air within the mating section 28 of passage 25 between the ferrules 110 of the first and second optical fiber connector assemblies 100, 101 to exit the mating section 28 and pass outside of the adapter assembly 15 through the air vent 35. More specifically, upon moving the mating optical fiber connector assemblies 100, 101 relatively towards each other within the passage 25, the pressure of the air between the connector assemblies and within the air vent 35 will increase as a result of the relatively tight spacing between the mating section 28 of passage 25 and outer surface 137 of the outer housing components 130 of the first and second connector assemblies.

**[0053]** Once the air pressure between the connector assemblies 100, 101 and within the air vent 35 exceeds a predetermined threshold, the air pressure will force the deflection of the deflectable section 44 and cause the sealing section 43 to move from its first or sealed position (Fig. 8) to its second or open position (Fig. 9) permitting air within the mating section 28 and the air vent 35 to be expelled past the elastomeric sealing member 41. Continued relative movement of the first and second optical fiber connector assemblies 100, 101 towards each other will continue to cause air to escape through the air vent 35 past the sealing section 43. While the optical fiber connector assemblies 100, 101 are moving towards each other, air will flow from the passage 25 through the air vent 35 and expel or discharge dust and debris from within the passage and dislodge dust and debris 82 from the front face 115 of the ferrules 110. The path of air flow from mating section 28 through the air vent 35 is indicated schematically at arrow 86.

**[0054]** Once the first and second optical fiber connector assemblies 100, 101 are fully mated (i.e., relative movement between the connector assemblies ceases) as depicted in Fig. 10, the resilient nature of the deflectable section 44 will cause the sealing section 43 to move from the second or open position to the first or sealed position, thus sealing the air vent 35.

[0055] Upon unmating one of the first and second optical fiber connector assemblies 100, 101 from the adapter 15, a relative vacuum or reduction in air pressure may be created causing the sealing section 43 of the elastomeric sealing member 41 to deflect inward towards passage 25. However, a sufficient amount of air may pass along the interface between the inner wall 29 of passage 25 and the outer surface 137 of the outer housing components 130 of the first and second optical fiber connector assemblies 100, 101 to permit the removal of the first of the optical fiber connector assemblies.

[0056] In operation, the first optical fiber connector assembly 100 is fully inserted within the first end 26 of passage 25 as depicted in Figs. 11-12. In the fully inserted position, the front face 115 of the ferrule 110 of the first optical fiber connector assembly 100 is positioned or aligned with the mating plane 91. In addition, the outer surface 137 of the outer housing component 130 of the first optical fiber connector assembly 100 is positioned adjacent or in close proximity to the inner wall 29 of the mating section 28 of the passage 25 of adapter body 16 in a manner sufficient to somewhat seal or restrict the amount of air that may pass between the outer surface of the outer housing component and the inner surface of the mating section of the passage 25. The second optical fiber connector assembly 101 is aligned with the second end 27 of passage 25 and positioned along the mating axis 90.

[0057] As the second optical fiber connector assembly 101 is inserted into the passage 25 as depicted in Figs. 13-14, the front face 115 of the ferrule 110 of the second optical fiber connector assembly moves towards the mating section 28 of the passage 25 of adapter body 16. Upon reaching the mating section 28, the outer surface 137 of the outer housing component 130 of the second optical fiber connector assembly 101 is positioned adjacent or in close proximity to the inner surface 29 of the mating section 28 of the adapter body 16 in a manner sufficient to somewhat seal or restrict the amount of air that may pass between outer surface of the outer housing component and the inner surface of the mating section of the passage 25.

[0058] As a result of the airflow restriction between the outer housing components 130 of the first and second optical fiber connector assemblies 100, 101 and the passage 25, continued insertion of the second optical fiber connector assembly towards the first optical fiber connector assembly will increase the air pressure within the mating section 28 of passage 25 between the front face 115 of the ferrules 110 of the two connector assemblies. Air vent 35 is fluidly connected to the mating section 28 so that an increase in air pressure within the mating section also results in an increase in air pressure within the air vent. Once

the air pressure within the mating section 28 of passage 25 exceeds a predetermined threshold, the air pressure at the air vent 35 will cause movement of the sealing section 43 of the elastomeric seal member 41 to permit air to escape or be discharged from the mating section through the air vent and past the seal member. Movement of air within the mating section 28 of passage 25 may be operative to displace dust and debris from the front face 115 of the ferrules 110.

[0059] The second optical fiber connector assembly 101 may continue to be moved towards the first optical fiber connector assembly 100 until the front faces 115 of the ferrules 110 of the two connector assemblies are mated together with the front faces disposed adjacent or along the mating plane 91 as depicted in Figs. 15-16. Once the first and second optical fiber connector assemblies 100, 101 are fully mated, the resilient nature of the elastomeric sealing member 41 will cause the sealing section 43 to return to its sealed position, thus sealing the air vent 35. By resealing the air vent 35, upon unmating the first and second optical fiber connector assemblies 100, 101, dust and/or debris from outside of the adapter assembly 15 will not be drawn into the passage 25 through the air vent.

[0060] Various alternative embodiments are contemplated. For example, although the air vent 35 in the embodiment depicted in Figs. 1-5 is positioned along the mating plane 91, in another embodiment, the air vent may be offset from the mating plane. In still another embodiment, the air vent 35 may extend laterally or parallel to the major axis of the ferrule 110 (i.e., parallel to the rows of optical fibers 123) rather than extending to the upper and/or lower walls 17, 18 of the adapter body 16.

[0061] Further, although the embodiment described above includes mating ends of the optical fibers 123 being in contact along the mating plane 91, the concepts described herein may also be used with optical fiber connector assemblies in which the ends of the optical fibers of the mating connector assemblies are not in contact. For example, the optical fiber connector assemblies may include lens elements (not shown) aligned with the optical fibers that eliminate the need for the ends of mating optical fibers to be in contact with each other.

[0062] In some instances, the front face 115 of the ferrules 110 may extend or project past the front face of the outer and inner housing components 130, 140. The front face 115 may project past the front face of the outer and inner housing components 130, 140 a distance sufficient such that dust or debris that is dislodged from the front face 115 of the ferrules 110

that is not evacuated from the passage 25 and is disposed on one of the housings does not disrupt the mating of the first and second optical fiber connectors 100, 101.

**[0063]** In still another embodiment depicted in Figs. 8-10, the mating section 28 of passage 25 may be dimensioned to tightly receive the ferrules 170 without the outer and inner housing components 130, 140. In such case, it may be desirable to form each ferrule 170 with rounded corners 176 along its front face 175. Upon mating a pair of ferrules 170, the rounded corners 176 will form debris reservoirs 177 to accommodate dust or debris 82 that is not expelled from the passage 25 but rather is pushed to the edge of the ferrule.

**[0064]** As may be understood from this description, the mating function and its resulting debris expulsion action may be repeated one or more times, as desired, to effect the removal of perceived or suspected debris.

**[0065]** Various alternatives of the valve member 40 are contemplated. For example, referring to Fig. 17, the valve member 40 may be configured as continuous elastomeric member 45 that extends around the adapter body 16 and seals the air vent 35. In another alternate embodiment depicted in Figs. 18-22, the valve member 40 may be configured as a ball valve 50 positioned on adapter body 16 and aligned with air vent 35. The ball valve 50 may include a semi-spherical valve seat 51 within valve body 52. A sealing ball 53 is positioned or disposed adjacent the valve seat 51 and is retained in place with elastomeric member 54. The elastomeric member 54 may be secured to the valve body 52 by a mounting section 55 and engages the sealing ball 53 at the engagement section 56. The elastomeric nature of the engagement member 54 permits the sealing ball 53 to move between a first or sealed position (Fig. 18) and a second or open position (Fig. 19) when the air pressure within the mating section 28 of passage 25 exceeds a predetermined threshold. In Fig. 19, air escaping from the air vent 35 is depicted by arrow 87 and air escaping past the valve seat 52 and sealing ball 53 is depicted by arrow 88. Figs. 21-22 depict the ball valve 50 with the seal ball 52 exploded from the valve seat 51 for clarity. In an alternate embodiment, the elastomeric member 54 may be secured to the adapter body 16.

**[0066]** In another embodiment, one or both of the optical fiber connector assemblies 100, 101 or the adapter assembly 15 may include an element (not shown) to selectively permit air to flow into the mating section 28 of passage 25 during unmating of the optical fiber connector assemblies. For example, the connector assemblies 100, 101 or the adapter assembly 15 may include a member, such as a portion of a latch, that is configured to open a

passage (not shown) to permit air to flow to the mating section 28 only while unmating the connector assemblies. Such structure may be desirable when the airflow between the outer surface 137 of the outer housing component 130 and the inner surface 29 of the mating section 28 is so limited that removal of one of the optical fiber connector assemblies 100, 101 is restricted.

**[0067]** In some instances, it may be desirable to generate an impulse or blast of air to dislodge the dust and debris from the optical fiber connector assemblies. In one embodiment, a structure may be provided that creates some resistance to the insertion of the optical fiber connector assemblies. Upon overcoming the resistance, the optical fiber connector assembly being inserted will move rapidly towards the mating plane 91. If the one of the optical fiber connector assemblies is already inserted into the adapter assembly 15, the rapid insertion of the other optical fiber connector assembly resulting from overcoming the resistance will result in a rapid increase in air pressure within the mating section 28 and thus rapidly force air including dust and debris through the air vent 35.

**[0068]** In one embodiment depicted in Figs. 23-25, adapter body 216 may include a deflectable locking structure, such as latch arms 225, to provide the resistance to insertion of the optical fiber connector assemblies 200, 201. More specifically, the first and second optical fiber connector assemblies 200, 201 are depicted with adapter assembly 215. Each of the optical fiber connector assemblies 200, 201 may be similar to the optical fiber connector assemblies 100, 101 but further include a reduced cross-section portion 205, between the rear face 202 and the front face 203, which defines a pair of rearwardly facing locking edges or surfaces 206.

**[0069]** The adapter assembly 215 may be similar to adapter 15 but includes a pair of deflectable latch arms 225 associated with each end or opening 223 of the cavity 222. Each deflectable latch arm 225 includes a resilient cantilevered arm 226 and a locking projection 227 at the free end of the cantilevered arm. The locking projection 227 may include a first tapered or angled lead-in surface 228 and a second tapered or angled locking surface 229. The angled lead-in surface 228 is configured to engage the front face 203 of the optical fiber connector assemblies 200, 201 to cause the deflection of the latch arms 225 to permit the insertion of an optical fiber connector assembly. The angled locking surface 229 is configured to engage one of the locking surfaces 206 of the reduced cross-section portion 205 of the optical fiber connector assemblies 200, 201 to retain the optical fiber connector assemblies within the adapter assembly 215.

[0070] In addition, upon the latch arms 225 reaching the reduced cross-section portion 205, the resistance to insertion will be reduced and the angled locking surface 229 will assist in propelling the optical fiber connector assembly 200, 201 towards the mating plane 91 to create an impulse or blast of air through the air vent 35.

[0071] In operation and as depicted in Fig. 23, first optical fiber connector assembly 200 is positioned within adapter assembly 215.

[0072] The second optical fiber connector assembly 201 is aligned with the mating axis 90 of passage 25 of adapter assembly 215. Movement of the second optical fiber connector assembly 201 along the mating axis 90 in a mating direction causes the front face 203 of the optical fiber connector assembly 201 to engage the angled lead-in surfaces 228 of the latch arms 225 and deflect the latch arms.

[0073] As depicted in Fig. 24, continued insertion movement of the optical fiber and ferrule assembly 200 causes the tip 230 of the locking projection 227 to engage the outer surfaces 204 of the second optical fiber connector assembly 201 as the second optical fiber connector assembly is moved into the passage 25 towards the mating plane 91. Once the second optical fiber connector assembly 201 is inserted sufficiently into the passage 25, the locking projection 227 will be aligned with the reduced cross-section portion 205 of the second optical fiber connector assembly 201. The resilient nature of the cantilevered arms 226 of deflectable latch arms 225 will cause the locking projection 227 to enter the reduced cross-section portion 205 with the angled locking surface 229 engaging the locking surface 206 of the second optical fiber connector assembly 201 as depicted in Fig. 25.

[0074] Upon tips 230 of the locking projections 227 reaching the reduced cross-section portion 205, the speed of insertion of the second optical fiber connector assembly 201 may be increased to cause an impulse or blast of air through the air vent 35. More specifically, upon tips 230 of the locking projections 227 reaching the reduced cross-section portion 205, the resistance to insertion caused by the engagement of the projections with the outer surface of the second optical fiber connector assembly 201 will be eliminated. In addition, the angled locking surface 229 may engage the locking surface 206 of the second optical fiber connector assembly 201, further causing an increase in insertion speed of the second optical fiber connector assembly 201.

[0075] It will be appreciated that the foregoing description provides examples of the disclosed system and technique. However, it is contemplated that other implementations of

the disclosure may differ in detail from the foregoing examples. All references to the disclosure or examples thereof are intended to reference the particular example being discussed at that point and are not intended to imply any limitation as to the scope of the disclosure more generally. All language of distinction and disparagement with respect to certain features is intended to indicate a lack of preference for those features, but not to exclude such from the scope of the disclosure entirely unless otherwise indicated.

[0076] Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context.

[0077] Accordingly, this disclosure includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the disclosure unless otherwise indicated herein or otherwise clearly contradicted by context. Still further, the advantages described herein may not be applicable to all embodiments encompassed by the claims.

CLAIMS:

1. An optical fiber adapter assembly comprising:  
a housing having a passage extending therethrough, the passage having a longitudinal axis, the housing further including an outer surface spaced from the passage;  
the passage including a mating section along the longitudinal axis of the passage;  
an air vent extending between the mating section and the outer surface; and  
a valve member configured to selectively seal the air vent.
2. The optical fiber adapter assembly of claim 1, wherein the valve member is movable between a first position at which the air vent is sealed and a second position at which the air vent is open.
3. The optical fiber adapter assembly of claim 2, wherein the valve member comprises an elastomeric member.
4. The optical fiber adapter assembly of claim 1, wherein the valve member is disposed along the air passage.
5. The optical fiber adapter assembly of claim 1, wherein the mating section is configured to receive mating end surfaces of first and second optical fiber connectors inserted into the mating section, the mating end surfaces being aligned along a mating plane, and the air vent being adjacent the mating plane.
6. The optical fiber adapter assembly of claim 5, wherein the air vent is along the mating plane.
7. The optical fiber adapter assembly of claim 1, wherein the air vent is a first air vent and the valve member is a first valve member, and the housing further comprises a second air vent extending between the mating section and the outer surface of the housing and further comprising a second valve member configured to selectively seal the air vent.
8. The optical fiber adapter assembly of claim 7, wherein the first valve member and the second valve member are portions of a single elastomeric member.

9. The optical fiber adapter assembly of claim 1, wherein the mating section is dimensioned to snugly receive portions of first and second optical fiber connectors therein.

10. The optical fiber adapter assembly of claim 9, wherein upon positioning the portion of the first optical fiber connector at the mating section of the passage and inserting the portion of the second optical fiber connector into the mating section of the passage, air within the mating section will pass through the air vent.

11. The optical fiber adapter assembly of claim 10, wherein the valve member is configured to be moved from a closed position to an open position by the air passing through the air vent.

12. The optical fiber adapter assembly of claim 10, wherein the mating section has a mating cross-section and the portions of the first and second optical fiber connectors each have a connector cross-section, the mating cross-section and the connector cross-sections are configured so that the air passing through the air vent is caused by an increase in air pressure within the mating section.

13. The optical fiber adapter assembly of claim 1, wherein the air vent is generally perpendicular to the longitudinal axis of the passage.

14. An optical fiber adapter assembly comprising:  
a housing having a passage extending therethrough and an outer surface spaced from the passage;  
the passage including a first connector receiving section and a second connector receiving section aligned with the first connector receiving section;  
an air vent extending between the passage and the outer surface; and  
a movable member operative to selectively seal the air vent, the movable member being movable between a first position at which the air vent is sealed and a second position at which the air vent is open.

15. The optical fiber adapter assembly of claim 14, wherein the first connector receiving section is spaced from the second connector receiving section.

16. The optical fiber adapter assembly of claim 14, wherein the passage further comprises a mating section aligned with and between the first and second connector receiving sections, the mating section being configured to receive mating end surfaces of first and second optical fiber connectors inserted into the mating section, the mating end surfaces being aligned along a mating plane, and the air vent being adjacent the mating plane.

17. The optical fiber adapter assembly of claim 16, wherein the air vent is along the mating plane.

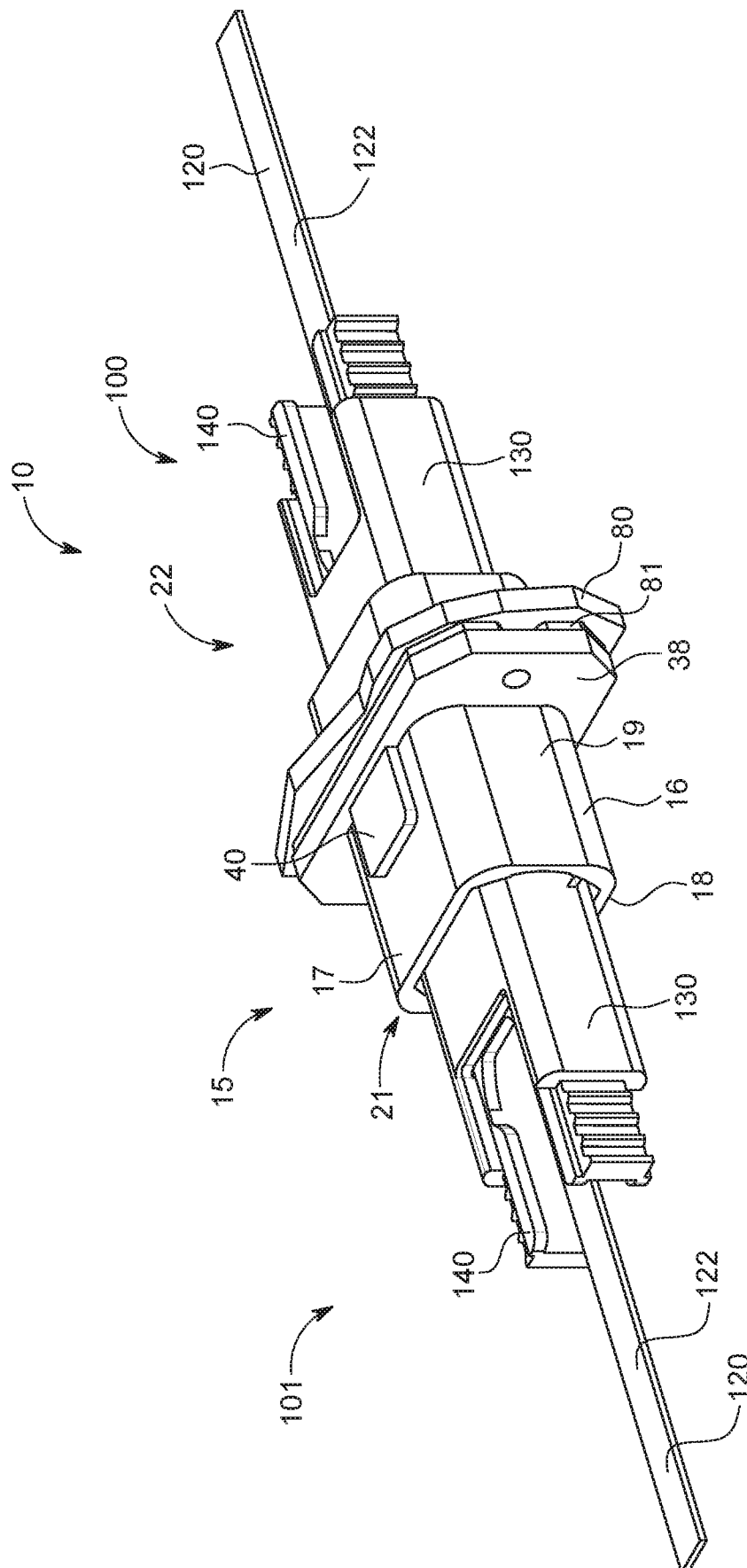
18. The optical fiber adapter assembly of claim 14, wherein the mating section is dimensioned to snugly receive portions of first and second optical fiber connectors therein, and upon positioning the portion of the first optical fiber connector at the mating section of the passage and inserting the portion of the second optical fiber connector into the mating section of the passage, air within the mating section will pass through the air vent.

19. The optical fiber adapter assembly of claim 18, wherein the valve member is configured to be moved from a closed position to an open position by the air passing through the air vent.

20. The optical fiber adapter assembly of claim 18, wherein the mating section has a mating cross-section and the portions of the first and second optical fiber connectors each have a connector cross-section, the mating cross-section and the connector cross-sections are configured so that the air passing through the air vent is caused by an increase in air pressure within the mating section.

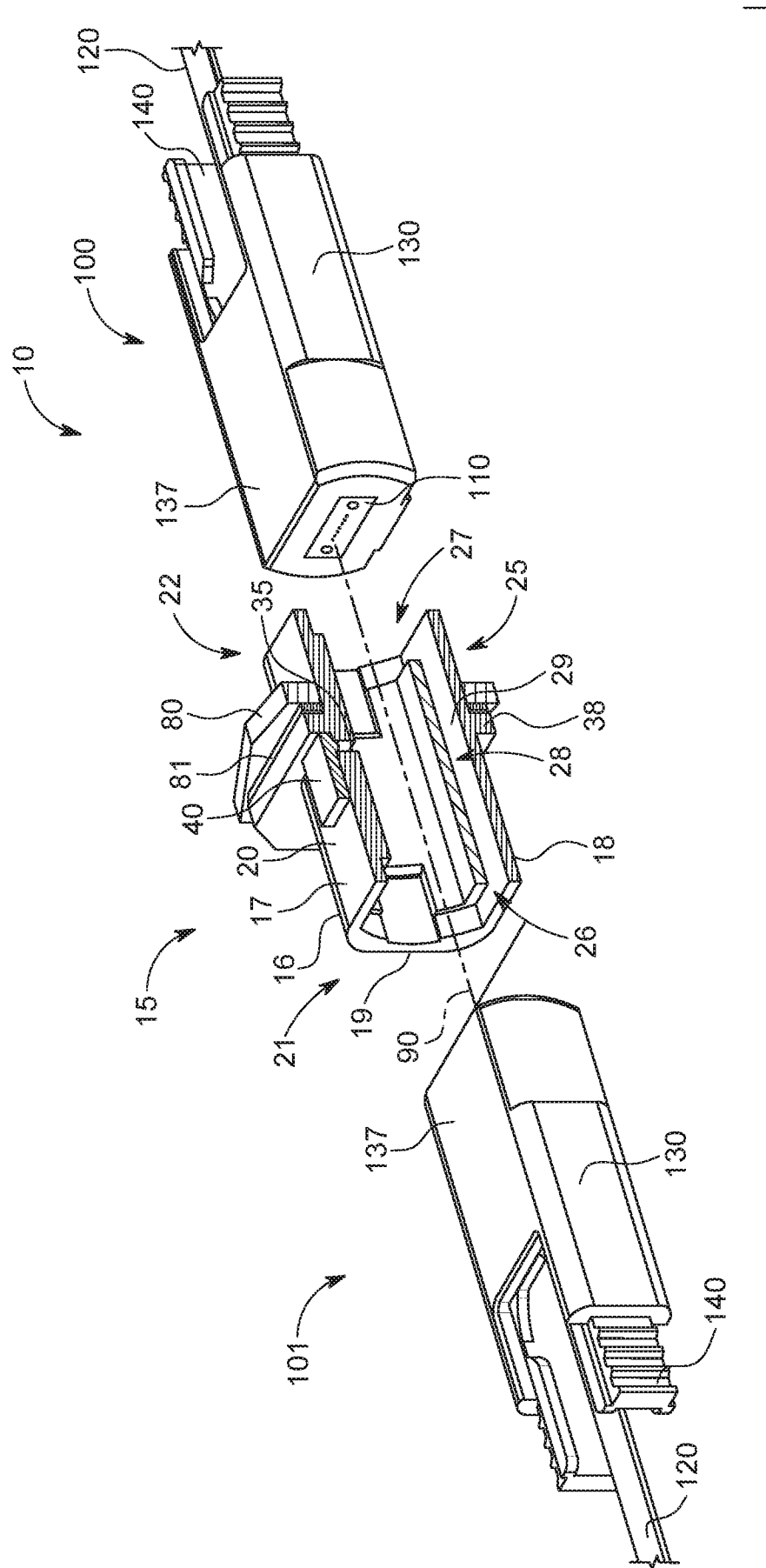
21. An optical fiber adapter assembly comprising:  
a housing having a passage extending therethrough, the passage having a longitudinal axis, the housing further including an outer surface spaced from the passage;  
the passage including a first connector receiving section, a second connector receiving section spaced from the first connector receiving section, and a mating section disposed between the first connector receiving section and the second connector receiving section and along the longitudinal axis of the passage;  
an air vent extending between the mating section and the outer surface; and  
a valve member configured to selectively seal the air vent.

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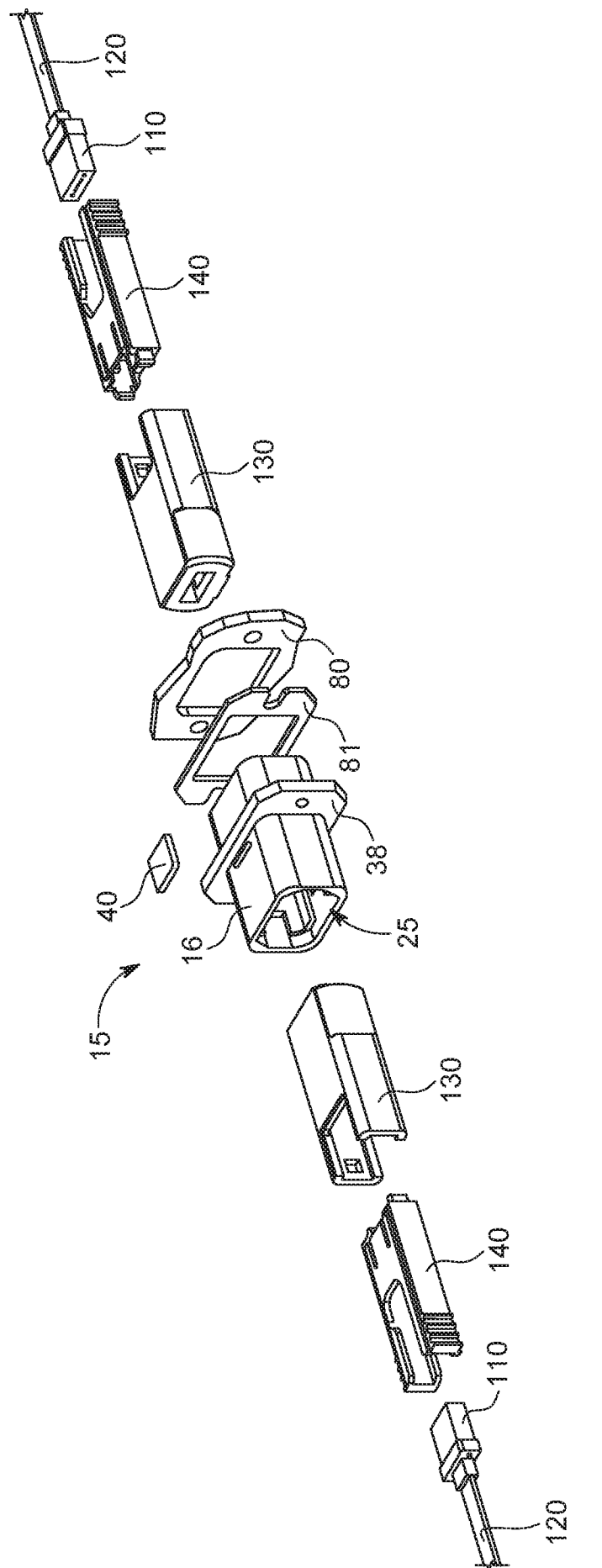
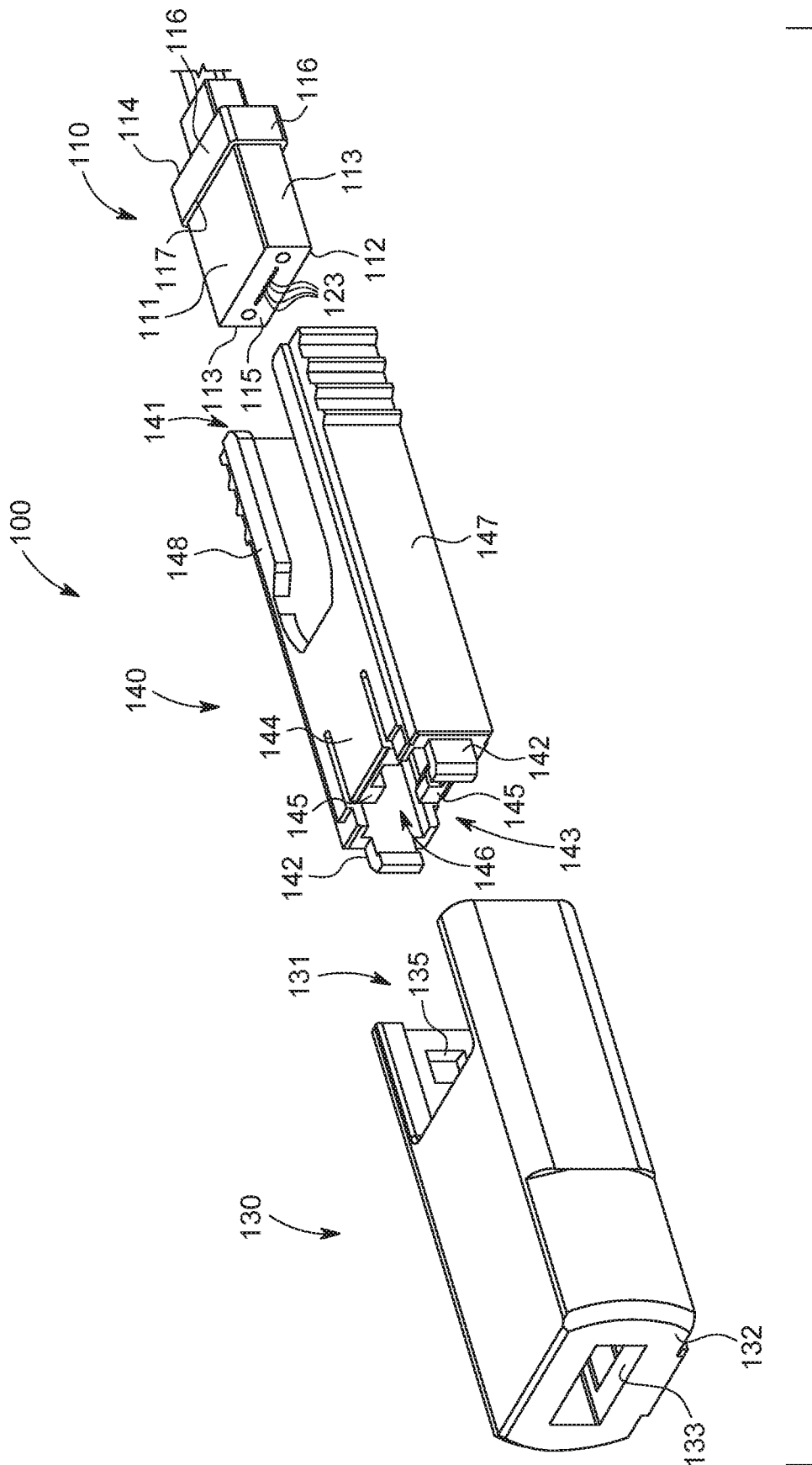
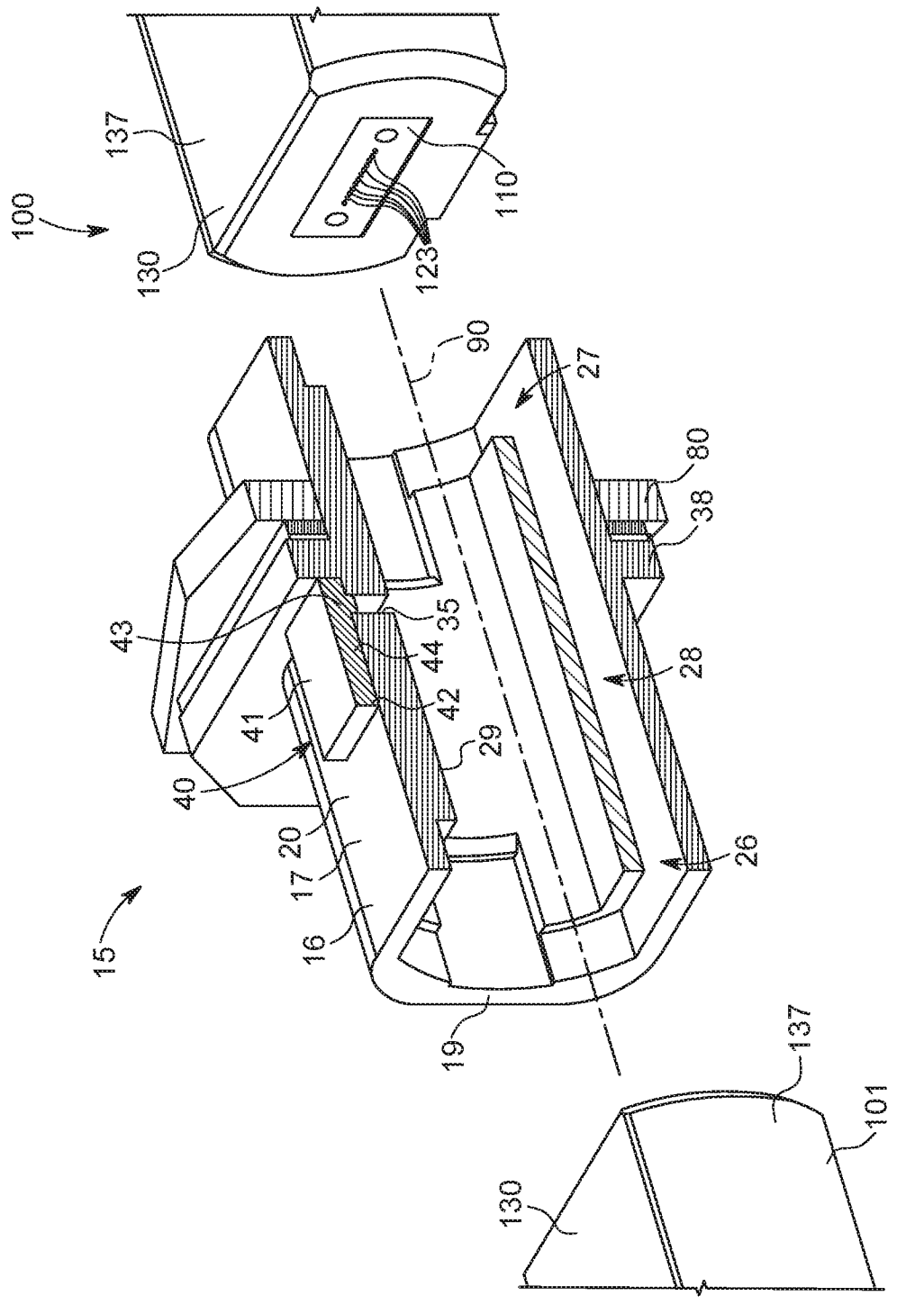


FIG. 3

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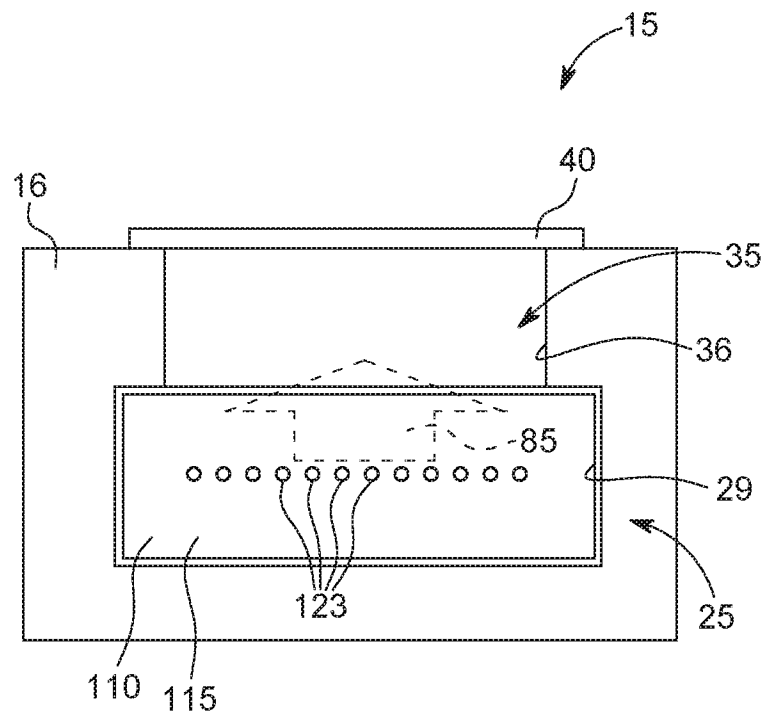


FIG. 6

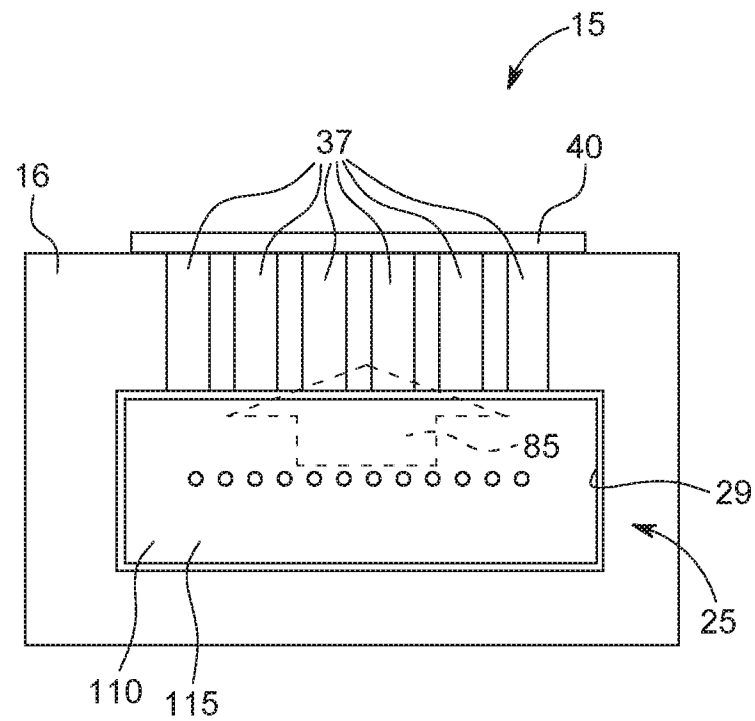


FIG. 7

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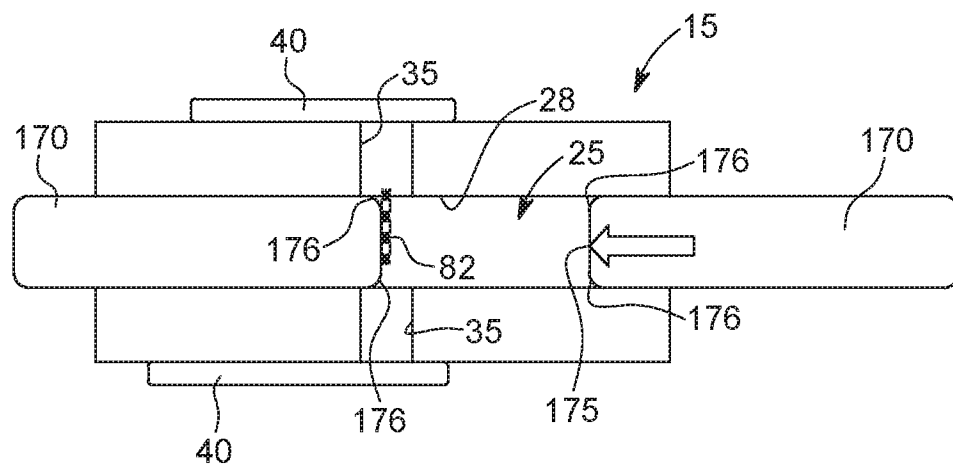


FIG. 8

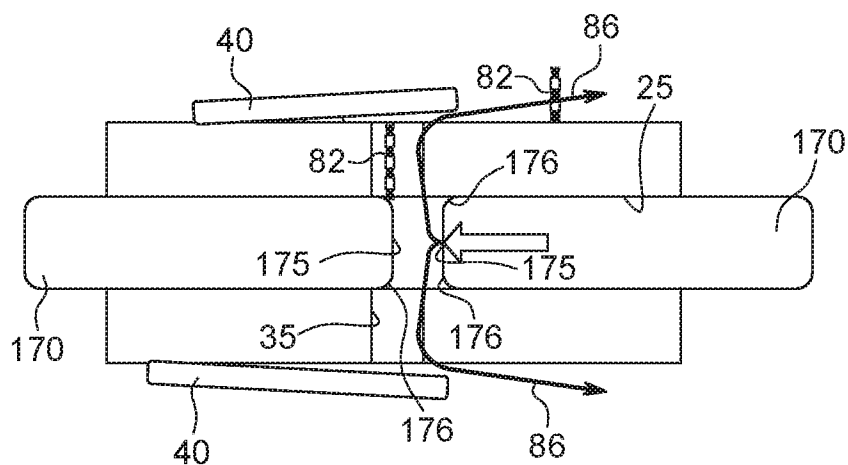


FIG. 9

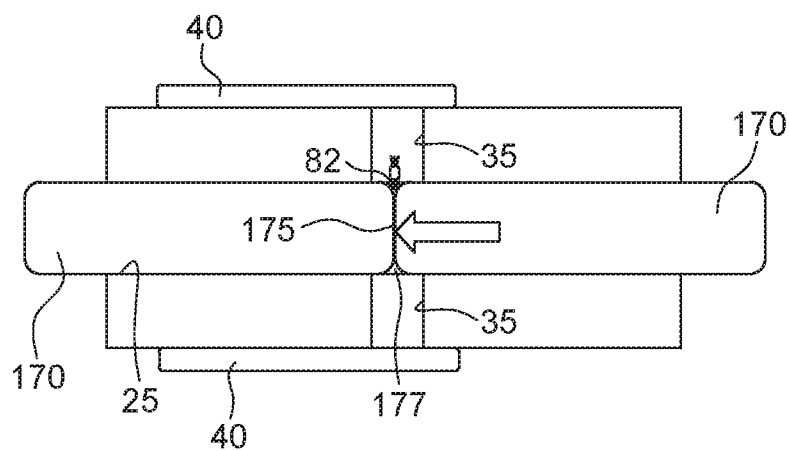
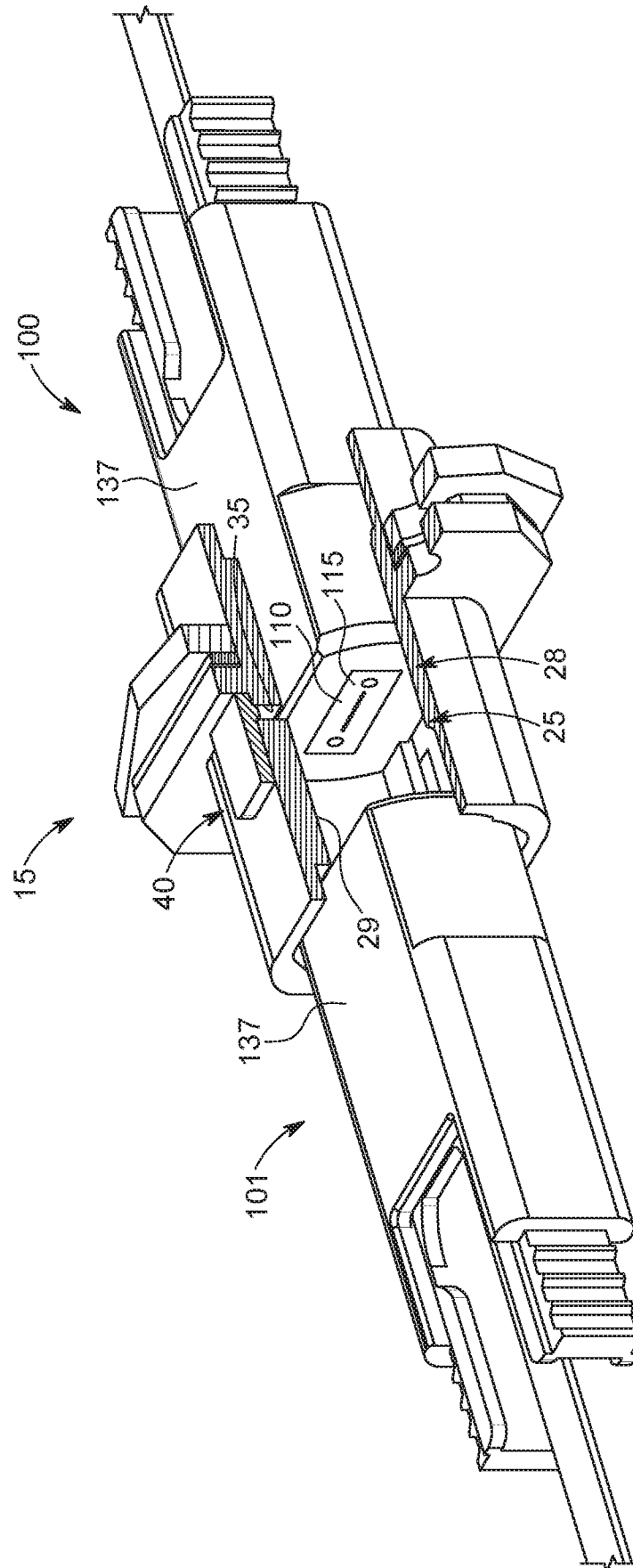


FIG. 10

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7  
 7  
 8  
 0  
 0  
 0

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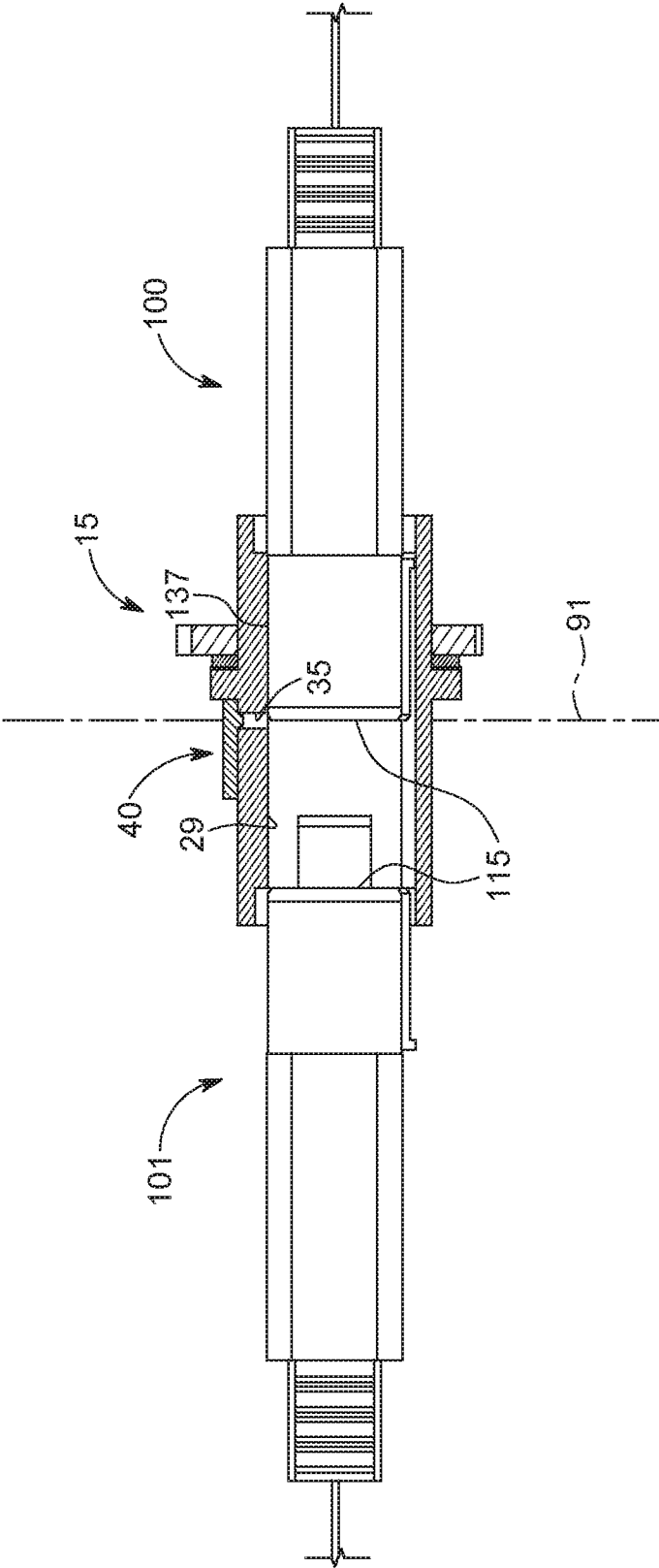


FIG. 12

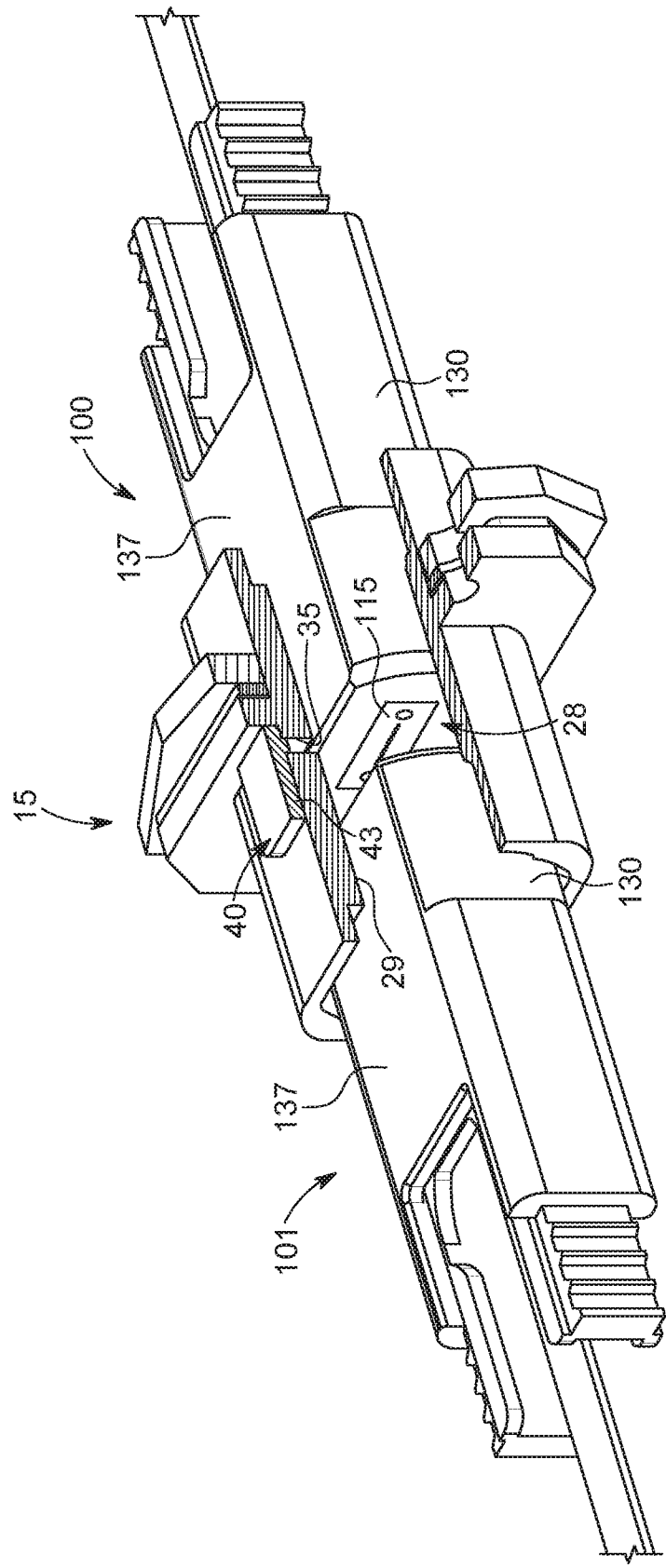


FIG. 13

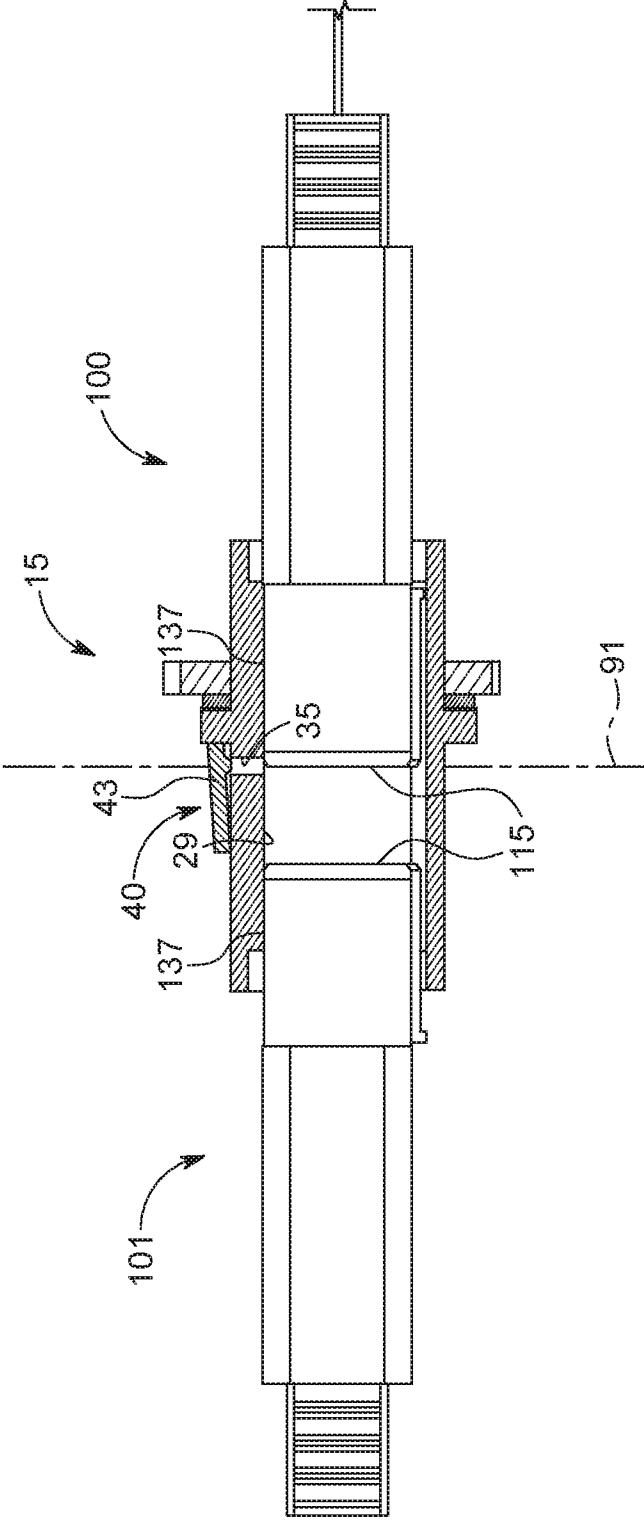


FIG. 14

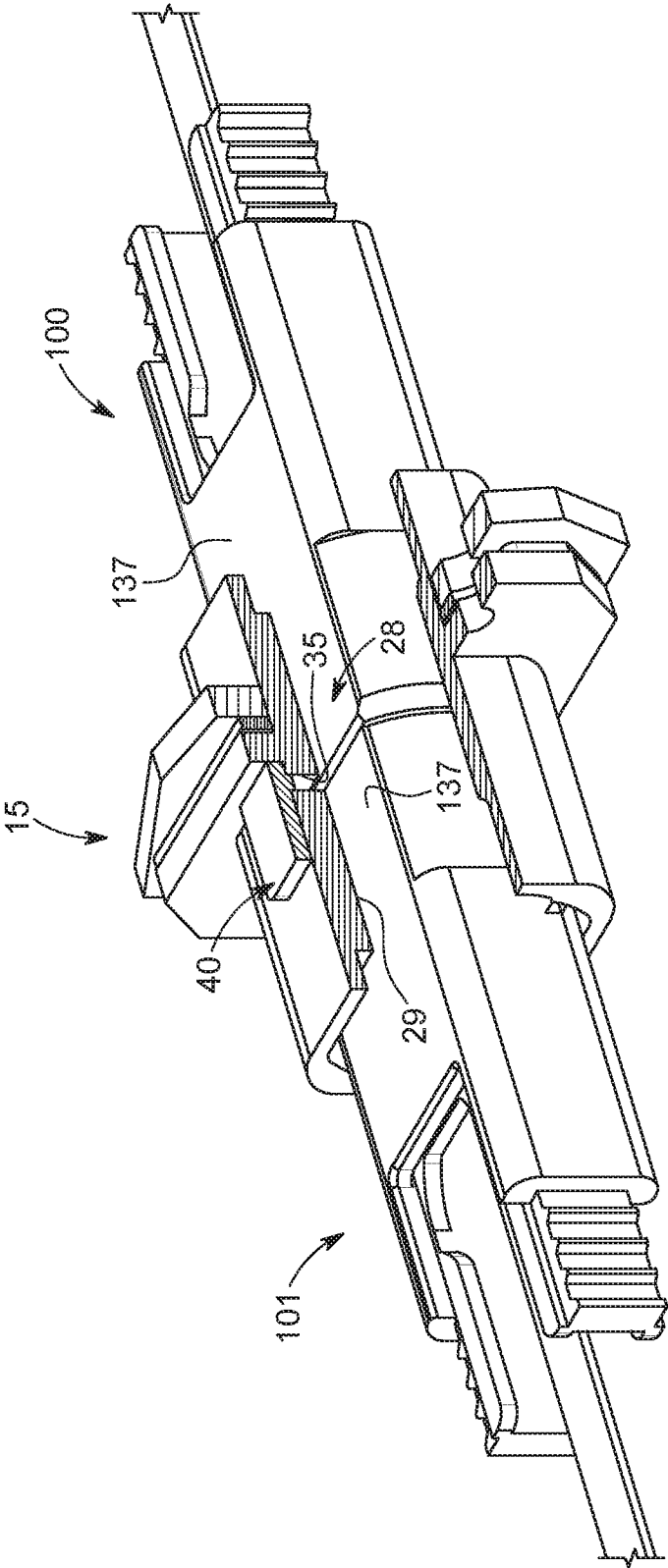
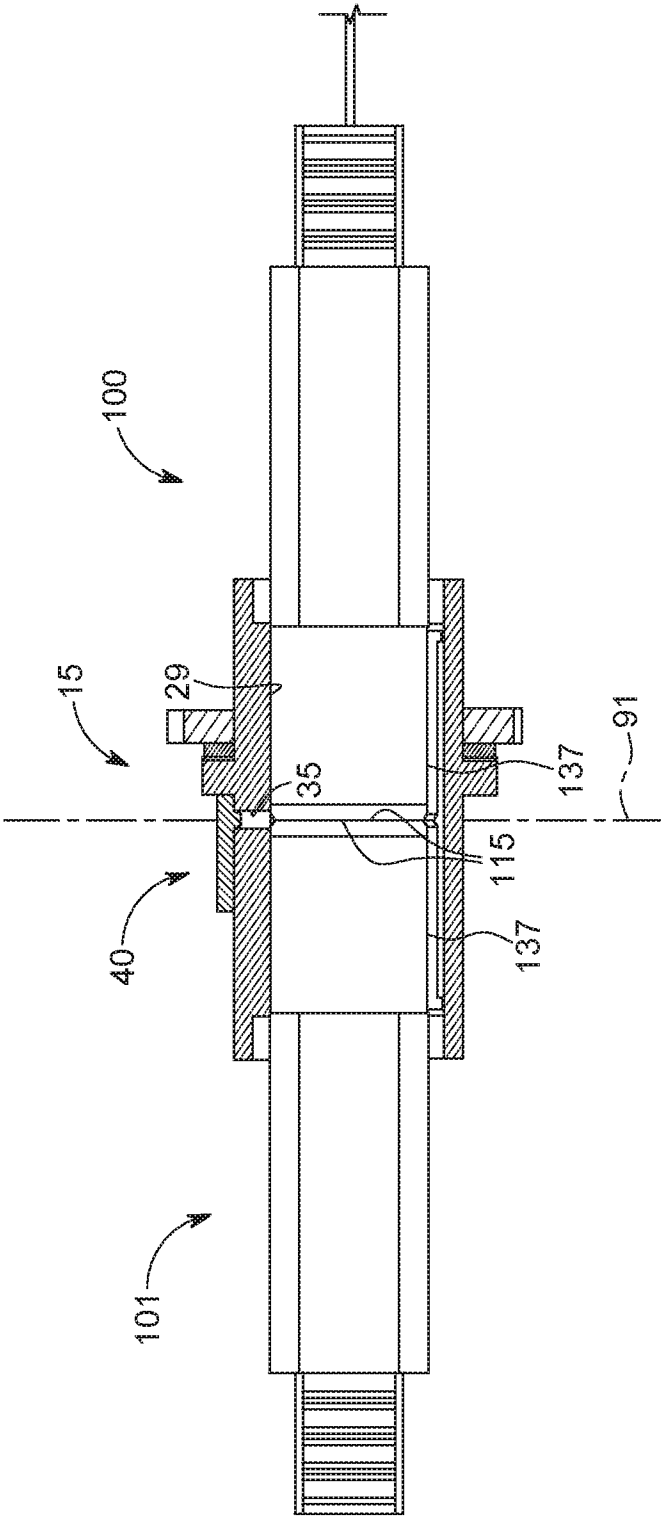


FIG. 15



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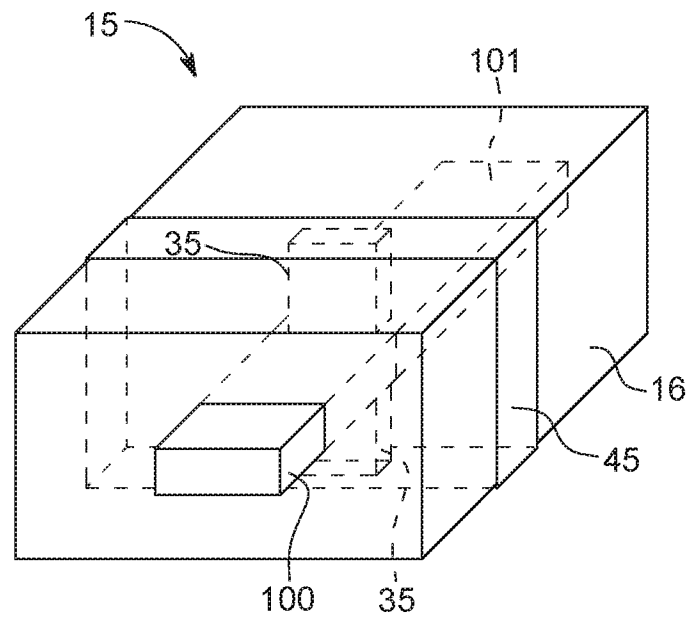


FIG. 17

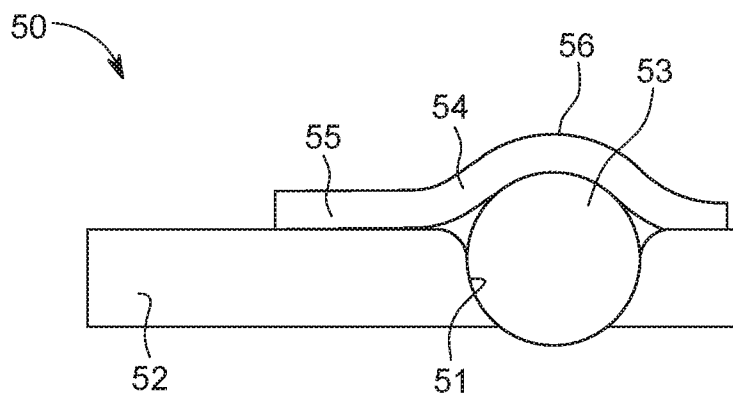


FIG. 18

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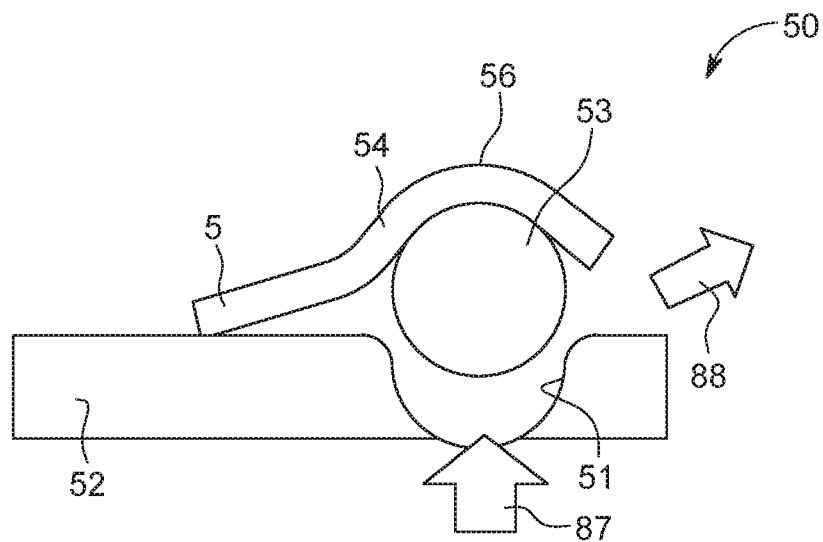


FIG. 19

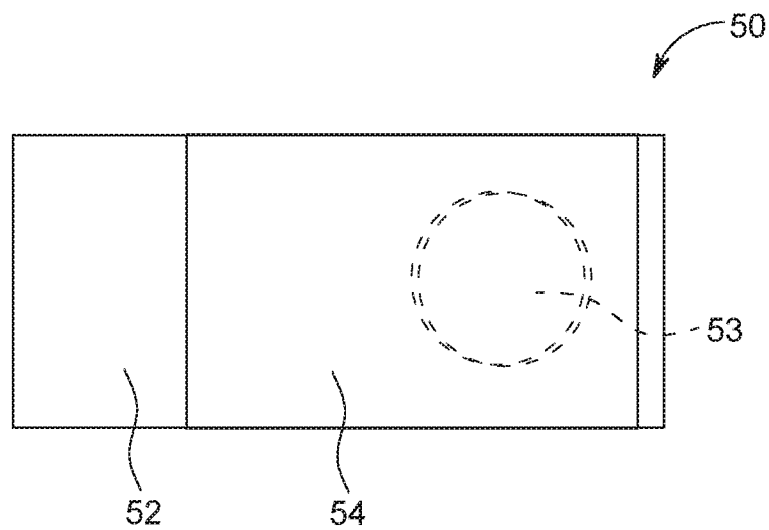


FIG. 20

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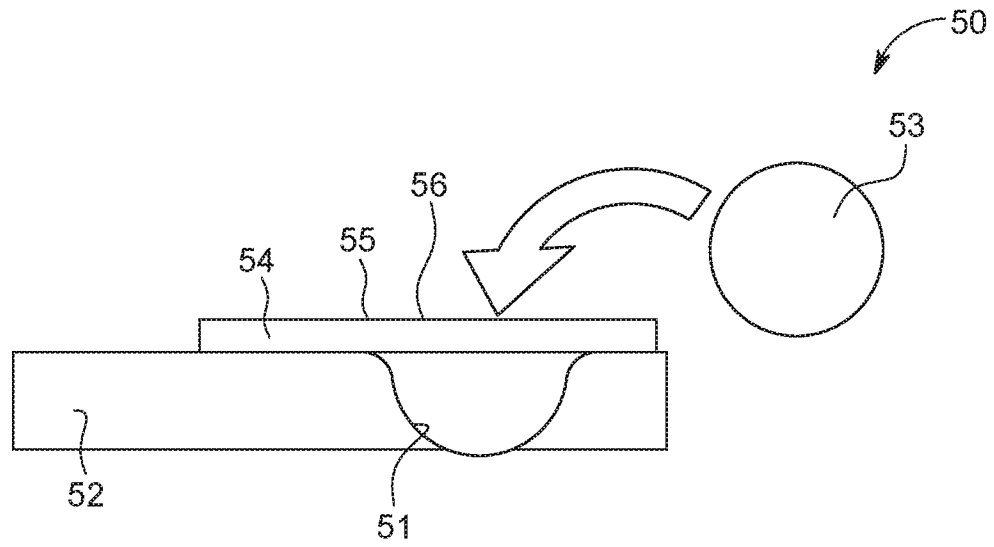


FIG. 21

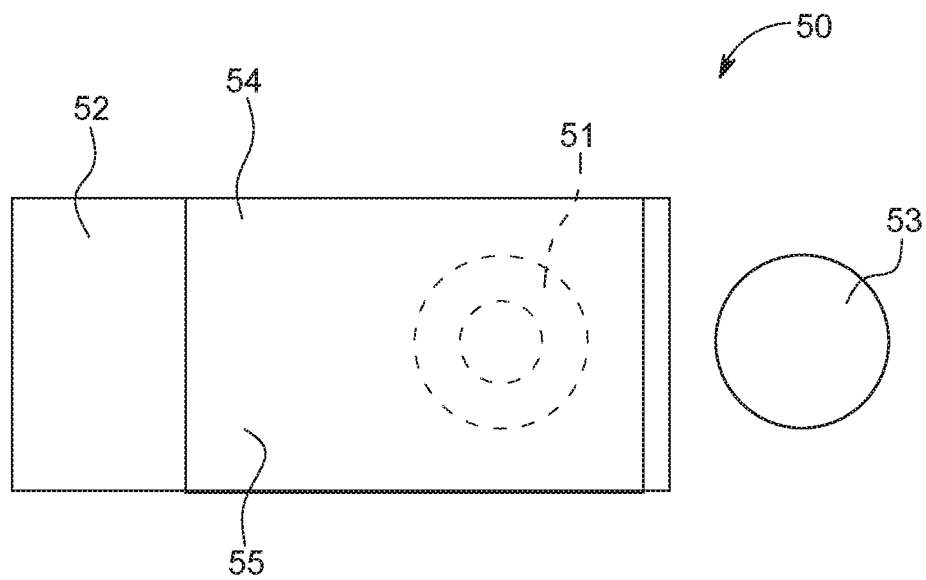


FIG. 22

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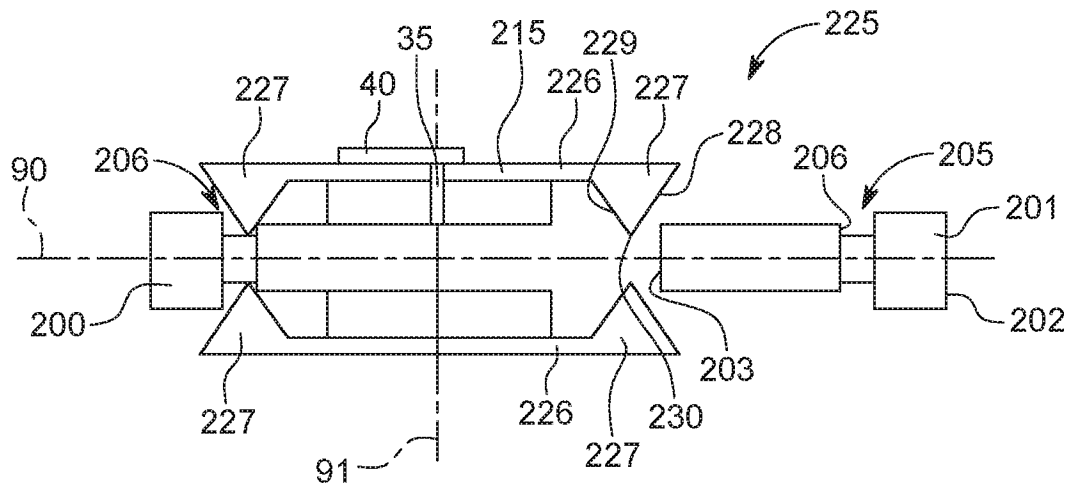


FIG. 23

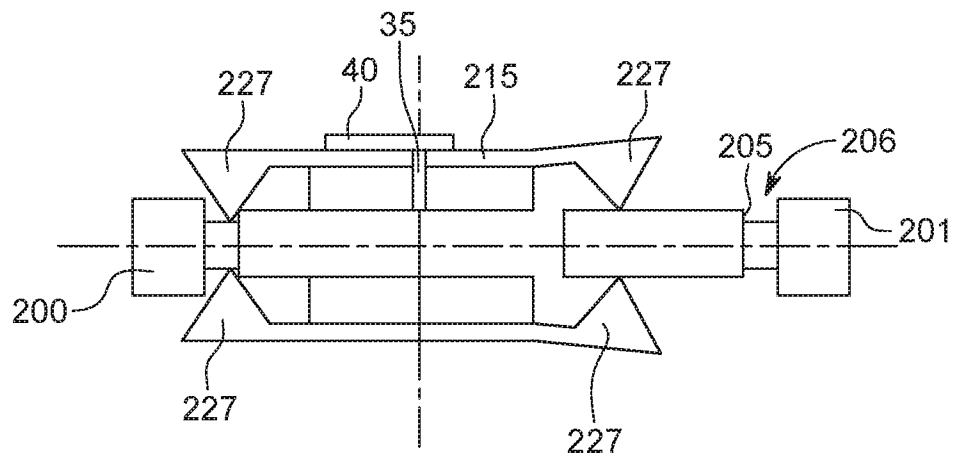


FIG. 24

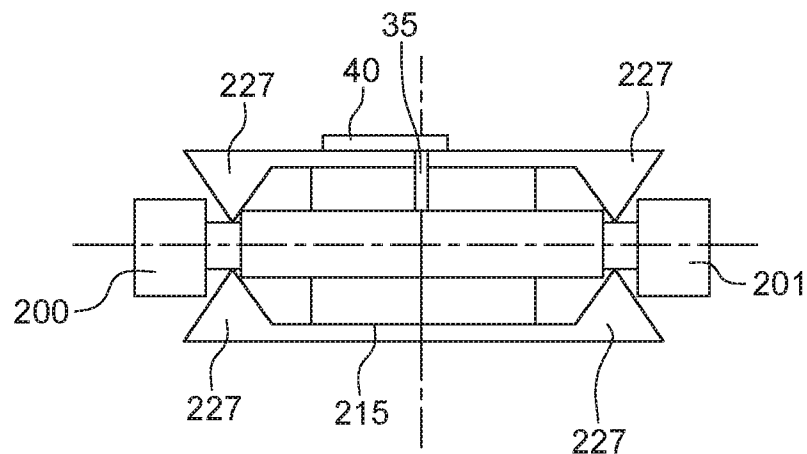


FIG. 25

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2018/021564****A. CLASSIFICATION OF SUBJECT MATTER****G02B 6/38(2006.01)i**

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)

G02B 6/38; A61B 1/00; G02B 23/24; G02B 6/42; H01R 13/523; H01R 13/52; H01R 17/04; H01R 4/02

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; keywords: mate, adapter, valve, air

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                    | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------|-----------------------|
| Y         | US 2016-0306123 A1 (COMMSCOPE CONNECTIVITY SPAIN, S.L.) 20 October 2016<br>See paragraphs [0020]-[0021] and figure 1. | 1-21                  |
| Y         | JP 07-159654 A (TOSHIBA MEDICAL ENG CO., LTD. et al.) 23 June 1995<br>See paragraphs [0009]-[0012] and figure 1.      | 1-21                  |
| A         | JP 2001-110513 A (NEC CORP.) 20 April 2001<br>See claims 1-4 and figures 1-4.                                         | 1-21                  |
| A         | US 2016-0324402 A1 (OLYMPUS CORPORATION) 10 November 2016<br>See claims 1-5 and figures 7-8.                          | 1-21                  |
| A         | JP 08-293358 A (DAI ICHI DENSHI KOGYO K.K.) 05 November 1996<br>See claim 1 and figures 1-2.                          | 1-21                  |



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

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"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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

14 May 2018 (14.05.2018)

Date of mailing of the international search report

**14 May 2018 (14.05.2018)**

Name and mailing address of the ISA/KR

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2018/021564**

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                                                                                 | Publication<br>date                                                              |
|-------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| US 2016-0306123 A1                        | 20/10/2016          | US 9939590 B2<br>WO 2015-059334 A1                                                                         | 10/04/2018<br>30/04/2015                                                         |
| JP 07-159654 A                            | 23/06/1995          | None                                                                                                       |                                                                                  |
| JP 2001-110513 A                          | 20/04/2001          | JP 3376974 B2                                                                                              | 17/02/2003                                                                       |
| US 2016-0324402 A1                        | 10/11/2016          | CN 105917260 A<br>EP 3098635 A1<br>EP 3098635 A4<br>JP 2015-138245 A<br>JP 6234243 B2<br>WO 2015-111413 A1 | 31/08/2016<br>30/11/2016<br>27/09/2017<br>30/07/2015<br>22/11/2017<br>30/07/2015 |
| JP 08-293358 A                            | 05/11/1996          | None                                                                                                       |                                                                                  |