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(54) **Connector housing with latch arm.**

(57) An electrical connector housing (8) was a pair of coplanar latch arms (116) which are connected by a U-shaped resilient strap (118) at their rear ends. The strap (118) has a bight (122) which is connected to the housing (8) to provide a pivot point (P) about which the latch arms (116) are pivotable between a normal position and a latching position. Each latch arm (116) terminates forwardly, in a latching head (134) which lies beneath a side wall (132) of a hood (60) enclosing the forward end of the housing (8). The remainder of each latch arm (116) is substantially coplanar with the hood side wall (132) whereby the latch arms (116) are in-line with the housing (8). The latch arms (116) are connected to the housing by way of the bight (122) of the strap (118). The in-line location of the latch arms (116) avoids the tangling with leads extending from terminals when the housing has been loaded with terminals. Moulding of the housing is also facilitated and the latch arms are protected against damage when the housing (8) is being handled.

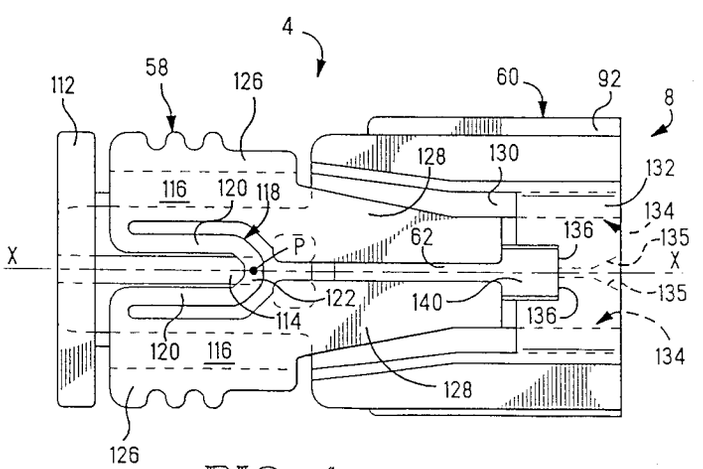

FIG. 4

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This invention relates to a connector housing according to the preamble of claim 1 and can relate to a one piece moulded electrical connector housing having latch arms for engagement with a mating electrical connector. The invention relates further to a method for forming a connector housing.

There is disclosed in GB-A-1196099, a one piece moulded electrical connector housing for mating with a mating electrical connector, the housing comprising a body having a forward mating face, a rear face, at least one terminal receiving passage opening into said faces and a forwardly directed hood for receiving a mating portion of the mating connector, coplanar latch arms extending from the housing in the forward direction thereof each terminating in a latching head with a rearwardly facing latching should for engaging a corresponding latching shoulder of the mating connector, the latch arms being resiliently deflectable between a normal position and a latching position.

In this known connector housing, the latch arms are connected to opposite sides of the housing in offset relationship thereto, and are unprotected so that a lead extending from a terminal in the, or each, passage in the housing may, when the housing has been loaded with terminals connected to leads, tangle with the latch arms when the loaded connector housing is being handled, and the latch arms are susceptible to damage during handling of the housing.

The present invention provides a connector housing as defined in claim 1 and a method of forming a connector housing, as defined in claim 9. Embodiments of the connector housing of the invention are defined in the dependent claims.

According to an embodiment of the present invention, an electrical connector housing as defined in the second paragraph of this specification, is characterized in that the latch arms comprise at least one pair of latch arms joined together towards the rear face of the housing by a resilient strap connected to the housing body to provide a pivot point about which the latch arms are deflectable between said normal and latching positions, the latching heads projecting beneath a side wall of the hood and the remainder of the latch arms being substantially coplanar with said side wall, whereby the latch arms are in line with the housing.

By virtue of the in-line location of the latch arms, the latch arms are protected, leads cannot tangle therewith and the moulding of the one piece housing is facilitated.

The resilient strap is preferably substantially U-shaped and thus comprises a pair of legs connected by a bight, each leg being connected at its end remote from the bight to the rear end portion of a respective latch arm and the centre of the bight being connected to the housing body to provide the pivot point. Thus the U-shaped strap may be conveniently accommodated between the rear portions of the latch arms in coplanar relationship therewith.

The rear ends of the latch arms may be protected by means of a frame connected to the housing body.

In the normal position of the latch arms, the latching heads are preferably proximate to each other, each latch head terminating in an inclined ramp surface, these ramp surfaces being oppositely inclined. Thus the mating electrical connector may be provided with a single latching member for engaging the ramp surfaces to cam the latch arms apart to enable the latch arms to resile so that the latching shoulders of the latching heads of the latch arms engage behind a latching shoulder of the latching member.

Further to enhance the ready mouldability of the housing, the hood may be provided with a recess allowing access to a core pin for forming the latching heads of the latch arms. The recess in the hood may also serve to provide access to the core pin for forming a notch in a part of the housing underlying the hood, for engagement by a latch member on a retaining ring for retaining a sealing grommet on said underlying part of the housing.

An embodiment of the present invention will now be described by way of example with reference to the accompanying drawings in which;

Figure 1 is a longitudinal sectional view of a sealed, vibration proof, electrical connector assembly comprising an electrical receptacle connector mated with an electrical pin connector;

Figure 2 is an enlarged, fragmentary view of a detail of Figure 1;

Figure 3 is a plan view of the detail shown in Figure 2;

Figure 4 is a side view of the receptacle connector;

Figure 5 is an enlarged side view of an inner spring member of an electrical terminal of the receptacle connector;

Figure 6 is a longitudinal sectional view of an insulating housing of the receptacle connector;

Figure 7 is a longitudinal sectional view of the housing shown in Figure 6 having been taken at right angles to the view shown in Figure 6;

Figure 8 is a front end view of the housing of the receptacle connector, drawn to a reduced scale;

Figure 9 is a similar view to that of Figure 7 drawn to the same scale as Figure 8 and showing a sealing grommet and a retaining ring assembled to the housing;

Figure 10 is a rear end view of the housing drawn to the same scale as Figures 8 and 9;

Figure 11 is an axial sectional view of the retaining ring;

Figure 12 is a fragmentary front view of the pin connector;

Figure 13 is a fragmentary side view of the pin connector;

Figure 14 is a view taken on the lines 14-14 of Figure 12; and

Figure 15 is a view taken on the lines 15-15 of Figure 12.

As shown in Figure 1, a sealed, vibration proof electrical connector assembly 2 comprises an electrical receptacle connector 4 and an electrical pin connector 6. The assembly 2, may, when in use, serve to connect a pair of insulated electrical leads L (only one of which is shown) to sensors (not shown) incorporated in the pin connector 6, in the engine compartment of an automotive vehicle and thus in a vibratory and temperature cycling environment.

The receptacle connector 4 comprises an insulating housing 8, a pair of electrical receptacle terminals 10 (only one of which is shown), an elastomeric grommet 9 and a grommet retaining ring 11. Each terminal 10 comprises an inner spring member 12 and an outer spring member 14.

The inner spring member 12 will now be described with particular reference to Figures 1, 3 and 5. The inner spring member 12 which has been stamped and formed from a single piece of sheet metal stock, comprises a forward, pin receptacle box portion 16, intermediate box portions 18 and 20, respectively, and a lead connecting rear portion 21. The portion 21 comprises a box portion 23 and a crimping ferrule having a wire barrel 22 crimped about the metal core of the respective lead L, and an insulation barrel 24 crimped about a bung seal B surrounding the insulation of the lead L as shown in Figure 1. The crimping ferrule is shown in its uncrimped condition in Figure 5. The portions 16, 18, 20 and 23 are of substantially rectangular cross section. At the ends of the portions 16 and 18, which are proximate to each other, three side walls of each of the portions 16 and 18 cooperate to define a peripheral slot 26. At the ends of the portions 18 and 20, which are proximate to each other, three side walls of each of these portions cooperate to define a peripheral slot 28. At the ends of the portions 20 and 23, which are proximate to each other, three side walls of each of the portions 20 and 23 co-operate to define a peripheral slot 30. The remaining side wall 31 of the portion 18 is connected to the remaining side wall 33 of the portion 20 by a first web 32, the remaining side walls 35 and 37 of the portions 16 and 18 being connected by a second and similar web 39 and the remaining side walls 41 and 43 of the portions 20 and 23 being connected by a third and similar web 45. The box portions 16, 18 and 20 are, by virtue of the slots 26, 28 and 30 relatively moveable on the webs 32, 39 and 45, respectively (in relation to the box portion 23 which is fixed, as described below), so that the receptacle portion 16 is displaceable along the longitudinal axis X-X of the inner spring member 12, as well as transversely of the axis X-X, in accordance with the general teaching of EP-A-0492479, the disclosure of which is incorporated herein by reference.

Opposite side walls 34 of the box portion 16 have extending from their forward edges, bights 48 from which in turn extend re-enterant contact springs 36 having opposed, inwardly bowed contact surfaces 38 within the receptacle box portion 16.

The outer spring member 14, which has been stamped and formed from a single piece of sheet metal stock, is of rectangular cross section corresponding to that of said box portions. The outer spring member 14 encloses the box portions 16, 18, 20 and 23 of the inner spring member 12. The outer spring member 14 has a first pair of opposite side walls 40 and a second pair of opposite side walls 42 (only one of which is shown) which are adjacent to the side wall 40. A resilient, rearwardly directed latching tongue 44 stamped out from each of the side walls 40, extends obliquely away therefrom. At the forward end of the spring member 14, arcuate extensions 46 of the side walls 40 overlie the bights 48 of the inner spring member 12, to limit forward movement of the receptacle box portion 16. The outer spring member 14 is fixed to the inner spring member 12 by means of tabs 49 (only one of which is shown, in Figure 1), sheared from the rearward end portions of the side walls 42 and which have been clinched into respective slots 50 (Figure 5) in the box portion 23 of the spring member 12. The spring member 12 is thus secured in the outer spring member 14 such that the box portions 16, 18 and 20 can move within the spring member 14 in the direction of the axis X-X.

Each side wall 40 of the outer spring member 14 has stamped out therefrom, about midway between the respective latching tongue 44 and extension 46, an antifretting detent 52 which is best seen in Figures 2 and 3. Each detent 52 is shaped substantially as an acute angled triangle, as seen in plan view, and comprises a pair of resiliently depressible wings 54 each of which is shaped substantially as a right angle triangle as seen in plan view. The inner edges of the wings 54 are slightly spaced from each other to define a central slot 55. The apex of said acute angled triangle is directed towards the extension 46 and its base is directed towards the latching tongue 44. Each wing 54 has

an arcuate free base edge 56 remote from said apex, so that as seen in the direction of the extension 46, the detent 52 has an end view profile which is substantially of half moon shape.

The housing 8 of the receptacle connector 4, which has been moulded in one piece, will now be described with particular reference to Figures 4 and 6 to 10. The housing 8 basically comprises a body 58 to which is connected a forward hood 60, into which a forward part 62 of the body 58 projects, a peripherally continuous socket 63 being defined between the hood 60 and the forward part 62. There extend through the body 58, a pair of terminal receiving passages 64, each of which opens into a terminal receiving face 68 of the body 58 and into a mating face 66 thereof by way of pin receiving mouth 70. Each passage 64 comprises a rear part 72 in which the bung seal B of the respective terminal 10 is tightly engaged in sealing tight fashion as shown in Figure 1, and a forward rectangular cross section part 74 extending into the hood 60. The forward part 74 of each passage 64 has therein opposed shoulders 76 each of which is engaged by a respective latching lance 44 of the outer spring member 14. The terminals 10 are thereby restrained against withdrawal from the passages 64. Rearwardly of the shoulders 76, the rear part of each outer spring member 14, enclosing the box portion 23 of the spring member 12, is snugly received in the part 74 of each passage 64. Forwardly of the shoulders 76, opposite side walls 77 of each passage part 74 are each formed with a pair of slots 78 (Figures 7, 8 and 9) so that a section 80 of each wall 77, between the respective pair of slots 78 is resiliently flexible inwardly of the respective passage part 74. As shown in Figure 8, the slots 78 have L-cross section, blind portions opening into the mating face 66. Each wall section 80 thereby constitutes a flexible beam supported at both of its ends. Each side wall section 80 has a forwardly tapered recess 82 for receiving a respective antifretting detent 52 and terminating rearwardly in a shoulder 84. Opposite to each recess 82, the outer surface of each wall section 80 is formed with a ramp surface 86 (Figures 1 and 6) and is of increased thickness between the surface 86 and an inclined internal surface 88 of the wall section 80. The holder 60 is formed with internal keyways 92.

As shown in Figures 1 and 9, the sealing grommet 9 surrounds the forward part 62 of the body 58 of the housing 8 and is engaged between the rear wall 90 of the hood 60 and the grommet retaining ring 11. The grommet retaining ring 11 (Figure 1), which is annular and is of substantially rectangular cross section comprises first opposed side walls 94 each having therein slots 96 opening into a forward edge 97 of the wall 94. The ring 11 has second opposed side walls 98 each having an inwardly inclined latching tongue 100, the free end of which latchingly engages a shoulder 102 (Figure 7) provided by an external notch 104 in a respective side wall 106 of the forward part 62 of the housing body 58. Returning to Figure 11, each side wall 94 of the ring 11 is formed with a rectilinear transverse slot 108 to enhance the resilience of the retainer 11 in the direction of its central axis C-C.

As shown in Figures 9 and 10, the body 58 of the housing 8 comprises a rectangular rear portion 110 defining the rear part 72 of each terminal receiving passage 64, and a rectangular rear frame 112 connected to the rear portion 110 by longitudinal struts 114 and surrounding the rear end of the portion 110. On each side of the rear portion 110 of the body 58 is a pair of latch arms 116, best seen in Figure 4, which are connected together by means of a resilient, U- shaped spring strap 118 comprising legs 120 connected at their forward ends by a bight 122. The centre of the bight 122 of each strap 118 is connected to the respective strut 114 by way of a lateral stub 124 extending therefrom (Figure 7). The rear end of each leg 120 is connected to the rear end of a respective latch arm 116. The stub 124 provides a pivot point P (Figure 4) about which the legs 120 are pivotable, the stub 124 being the sole connection between the strap 118 and the remainder of the housing 8. The latch arms 116 are not connected to the housing 8 at all, excepting by way of the strap 118. Each latch arm 116 comprises a rear handle 126 from which projects forwardly, a shank 128 into a rearwardly opening recess 130 in a side wall 132 of the hood 60. Each latch arm 116 of each pair of those arms is, as a whole, coplanar with the hood side wall 132 and with the other latch arm of the pair, whereby the latch arms 116 do not project from the housing 8 but are substantially in line therewith. At its forward end, each latch arm shank 128 has a latching head 134 protruding beneath the respective side wall 132 of the hood 60 (Figures 7 to 9), and projecting inwardly towards the latching head 134 of the other latch arm of the pair. Each latching head 134 has a forwardly inclined ramp surface 135 and a rearwardly facing latching shoulder 136. The latch arms 126 have a normal closed, latching position as shown in Figure 4, in which the latching heads 134 of the latch arms 116 of each pair are proximate to each other. The latch arms 116 can be pivoted to an open position in which the latching heads 134 are more widely spaced from each other, by pressing the handles 126 of the latch arms 126 of the pair towards each other. Upon release of the handles 126, the latch arms 116 resile to their normal position by virtue of the resilience of the straps 118. Overstress of the latch arms 116 when they are pivoted to their open position is prevented by shoulders 138 (Figure 8)

of the hood 60, bounding the hood side walls 132 to limit outward movement of the latching heads 134. Each side wall 132 of the hood 60 has a rearwardly opening rectangular recess 140 (Figure 4) to allow access for a core pin (not shown) for moulding the latching shoulders 136 and for providing the notch 104 in the respective side wall 106 in the forward part 62 of the housing 8; as will best be appreciated from Figure 7.

The pin connector 6 will now be described with reference to Figures 12 to 15. The connector 6 comprises an insulating housing 142, shown in fragmentary form, which may contain sensors for connection to the leads L of Figure 1. There projects from the housing 142, a substantially rectangular cross section hood 144 for mating reception in the socket 63 of the connector 4. The hood 144 is defined by a first pair of opposed side walls 166 and a second pair of opposed side walls 168. A pair of terminal pins 170 in the housing 142 have mating end portions 172 projecting into the hood 144 for mating with respective receptacle terminals 10 of the connector 4. The terminal pins 170 are connected to the sensors, for example, by means not shown. Each side wall 166 has a pair of spaced camming ribs 174 projecting into the hood 144 and terminating in camming faces 176, as best seen in Figure 15, for cooperation with respective ramp surfaces 86 of the housing 8 (Figure 14). The ribs 174 have flat free ends 177. Each rib 174 on one wall 166 is opposite to and is aligned with a corresponding rib 174 on the opposite wall 166. Each wall 168 has a central external latch member 178 having a rear latching shoulder 179 and a tapered camming nose 180 for cooperation with respective latching heads 134 of the housing 8. The walls 166 have external keys 182 for reception in respective keyways 92 of the housing 8. Each wall 166 and 168 has a chamfered free edge 184 for guiding it into the socket 63 of the connector 4.

The connector 6 is mated with the connector 4 by inserting the hood 144 of the connector 6 into the socket 63 of the connector 4 as shown in Figure 1, each key 182 slidably engaging in a respective keyway 92 of the housing 8. During the mating operation, the mating portion 172 of each pin 170 enters the mouth 70 of a respective terminal receiving passage 64 and is received between the contact surfaces 38 of the contact springs 36 of the terminal 10 in the passage 64. The inner surfaces of the side walls 166 and 168 of the connector 6 engage the sealing grommet 9 in sealing tight relationship therewith. Also during the mating operation, the camming face 176 of each camming rib 174 of the connector 6, engages against the respective ramp surface 86 of the housing 8 thereby camming the underlying wall section 80 resiliently inwardly by virtue of the slots 78, against the respective side wall 40 of the respective spring member 14,and the detent 52 thereon, the detent 52 being received in the respective recess 82 and being resiliently depressed to some extent, by the bottom wall of the recess 82. The free edge 56 of each wing 54 of the detent 52 engages the rear wall of the recess 82. An interference fit is thereby produced between the wall sections (80) and the outer spring member 14. Further during the mating operation, the camming nose 180 of each latch member 178 engages between the latching heads 134 of a respective pair of the latch arms 166 thereby camming them apart against the action of the respective spring strap 118 until, as the connectors 4 and 6 reach their mated position, the arms 116 resile as the shoulders 179 of the latch members 178 pass the latching shoulders 136 of the heads 134 so that the shoulders 136 are carried inwardly to latch against the shoulders 179 thereby securing the connectors 4 and 6 in their mated relationship. The shoulders 179 are drawn tightly against the shoulders 136 because the flat free ends 177 of the camming ribs 174 resiliently and axially compress the sealing grommet retaining ring 11 by virtue of the slots 108 therein, given that the grommet 9 having been compressed between the side walls 116 and 118 of the hood 114 will have little axial resilience.

As mentioned above, the connector assembly 2 comprising the connectors 4 and 6, is intended for use in a vibratory and temperature cycling environment, for example in the engine compartment of an automotive vehicle. Fretting and consequent frictional corrosion of parts of the connector assembly 2, which are susceptible to a fretting action, must, therefore, be avoided. Fretting between the pins 170 and the contact surfaces 38 of the contact springs 36 is avoided, because the pin receptacle portion 16 of each inner spring member 12 can move both axially and laterally in its outer spring member 14. Fretting between the outer spring member 14 and the housing 8 is prevented by virtue of the interference fit between the wall sections 80 and the spring member 14. Also, relative movement between the connectors 4 and 6 is restrained because the grommet retaining ring 11 urges the latching shoulders 179 firmly against the latching shoulders 136.

Since the latch arms 116 are in line with the housing 4 and so do not project therefrom, the moulding of the housing 4 as a one piece item, is simplified, and the latch arms are not free to tangle with the leads L so as to be damaged, when the terminals 10 are being loaded into the housing 4 or during the assembly of the connectors 4 and 6. The connectors 4 and 6 can be released from each other by pressing the handles 126 of each pair of latch arms towards each other.

It is envisioned that the connector housing 8 may be produced with a single latching arm 116, a single pair of latching arms, or a plurality of pairs of latching arms. It is further envisioned that in any of the above described possibilities that it may be advantageous to interconnect at least some of the latching arms so that displacement of one arm produces a displacement in the corresponding interconnected arm.

Claims

1. A connector housing (8) for mating with a mating connector (5), the housing (8) comprising a body (58), a hood (60) for receiving a mating portion (164) of the mating connector (6), and a latch arm (116) terminating in a latching head (134) with a latching shoulder (136) for engaging a corresponding latching shoulder (179) of the mating connector (6), the latch arm (116) being displacable between a normal position and a latching position; characterized in that the latching head (134) projects beneath, and is protected by, the hood (60).

2. A housing as claimed in Claim 1, characterized in that the latch arms comprise at least one pair of latch arms (116) joined together by a resilient strap (118) that is connected to the housing body (58) to provide a pivot point (P) about which the latch arms (116) are deflectable between the normal and latching positions.

3. A housing as claimed in Claim 2, characterized in that the resilient strap (118) is substantially U-shaped comprising a pair of legs (120) connected by a bight (122), each leg (120) being connected at its end remote from the bight (122) to the rear end portion of a respective latch arm (116) and the centre of the bight being connected to the housing body (6) to provide said pivot point (P).

4. A housing as claimed in Claim 2 or Claim 3, characterized in that each latch arm (116) has an enlarged rear handle portion (126) opposite to, and proximate to, the respective leg (120) of the strap (118), a shank (128) of reduced cross section extending forwardly from each handle portion (126) and terminating in a respective latching head (134).

5. A housing as claimed in Claim 4, characterized in that the strap (118) is coplanar with the handle portions (126).

6. A housing as claimed in any one of the preceding claims, characterized in that the rear ends of the latch arms (116) are covered by a frame (112) connected to the housing body (58).

7. A housing as claimed in Claim 6, characterized in that the frame (116) is connected to the housing body (58) by opposed, forwardly extending struts (114), each strut (114) being connected to the strap (118) of a respective pair of the latch arms (116) at said pivot point (P).

8. A housing as claimed in any one of the preceding claims, characterized in that in the normal position of the latch arms (116) the latching heads (134) thereof are proximate to each other, each latching head (134) terminating in an inclined ramp surface (135), said ramp surfaces (135) being oppositely inclined away from each other.

9. A housing as claimed in any one of the preceding claims, characterized in that said side wall (132) of the hood (60) has a recess (140) therein for receiving a core pin for forming the latching heads (134) during moulding of the housing (8).

10. A housing as claimed in Claim 9, characterized in that a forward part (62) of the housing body (56), defining said passage (64) projects into the hood (60), the hood (60) and said forward part (62) defining a forwardly open slot (63), a sealing grommet (9) surrounding said forward part (62) being retained thereon by a grommet retainer ring (11) which is in turn retained on said forward part (62) by a latching member (100) engaged in a recess (104) in said forward part (62), the recess (140) in the hood side wall (132) being aligned with the recess (104) in said forward part (62), to allow that recess (104) to be formed by said core pin.

11. A method of forming a one piece connector housing (8) for mating with a mating connector (5), comprising the steps of:

forming the connector housing (8) comprising a body (58) and a hood (60) for receiving a mating portion (164) of the mating connector (6); characterized by the steps of

providing a recess (140) in the housing (8) for a core pin;

forming a latch arm (116) that is integral with the connector housing (8) and disposed therealong, the latch arm (116) terminating in a latching head (134) within the hood (60), where

the latch arm (116) is displacable between a normal position and a latching position;

inserting the core pin through the recess (140) to form a latching shoulder (136) on the latching head (134) for engaging a corresponding latching shoulder (179) of the mating connector (6).

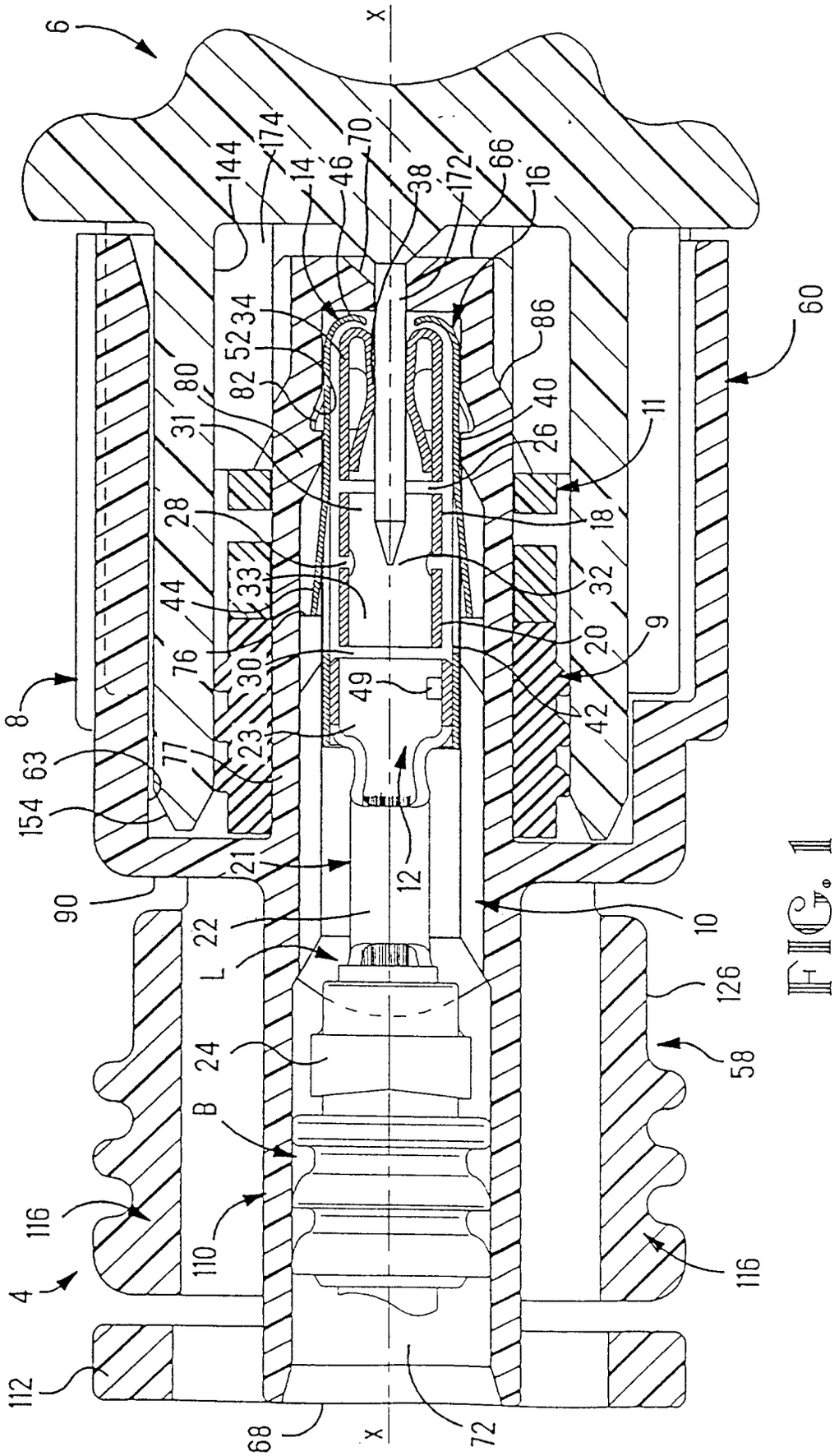
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FIG. 11

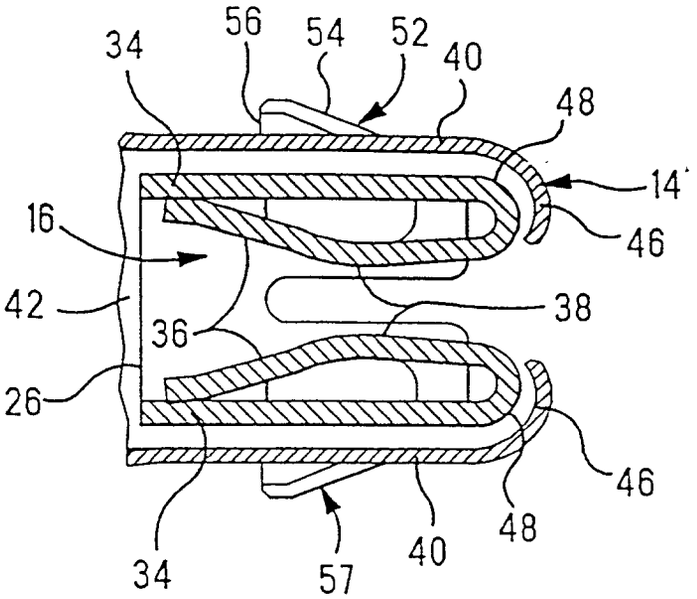

FIG. 2

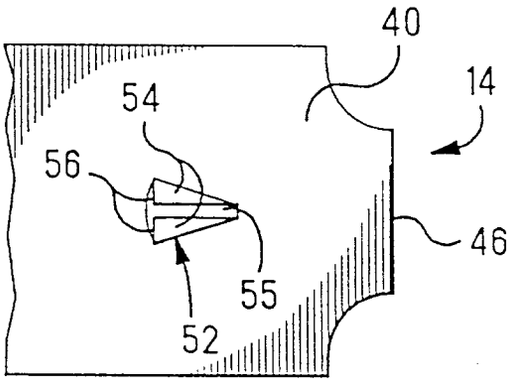

FIG. 3

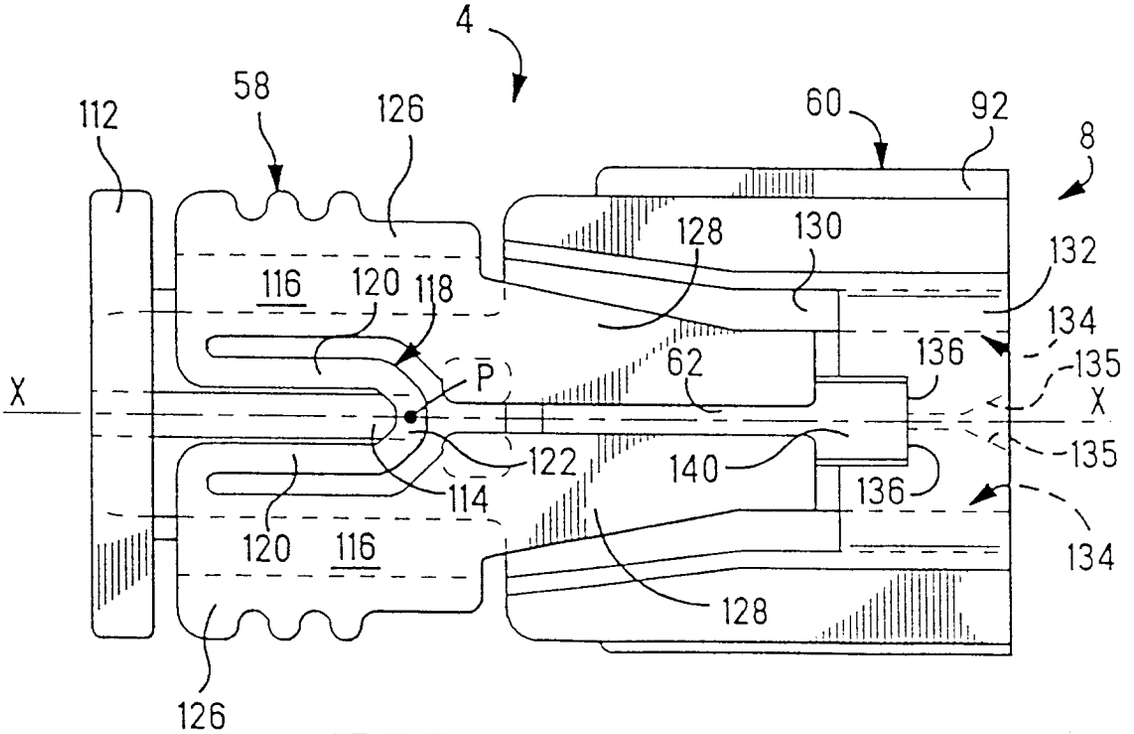

FIG. 4

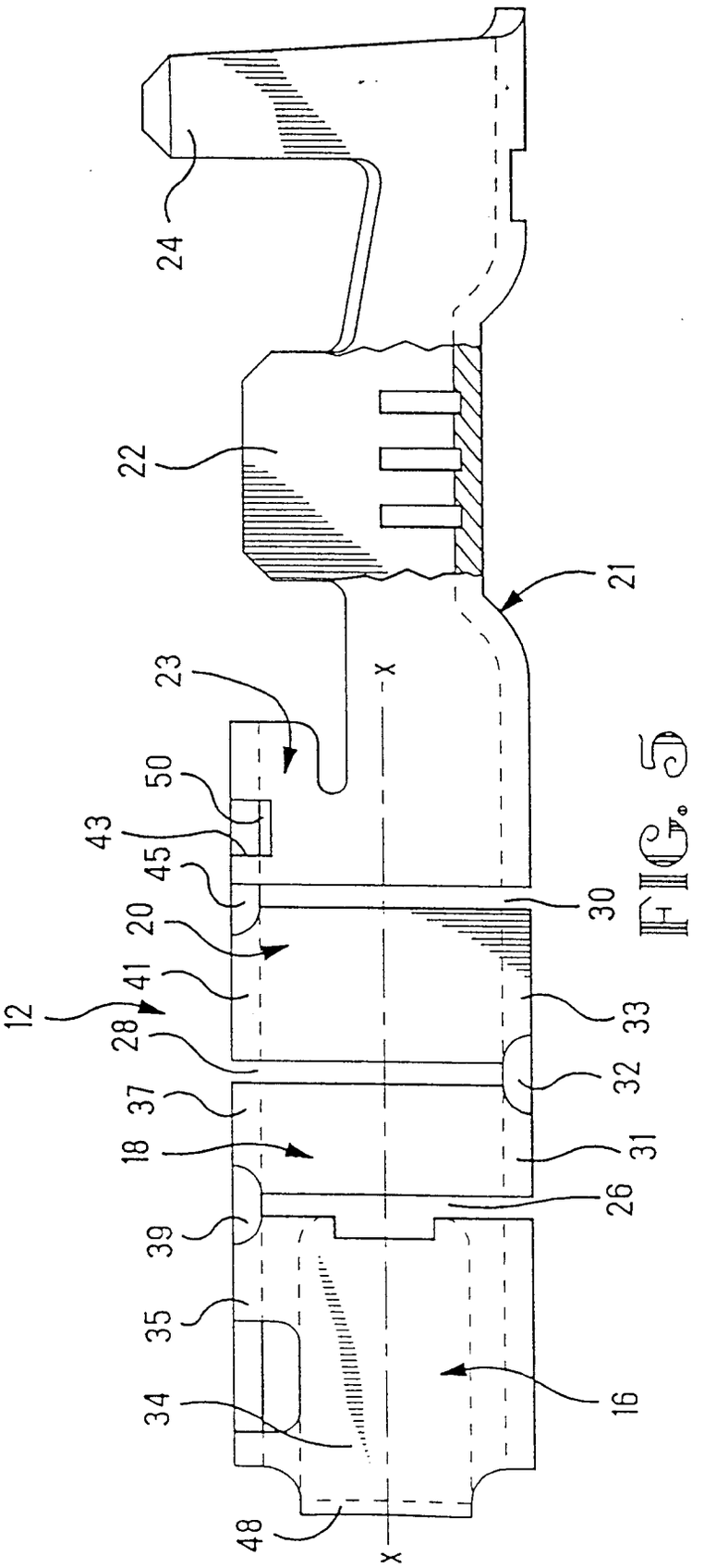

FIG. 5

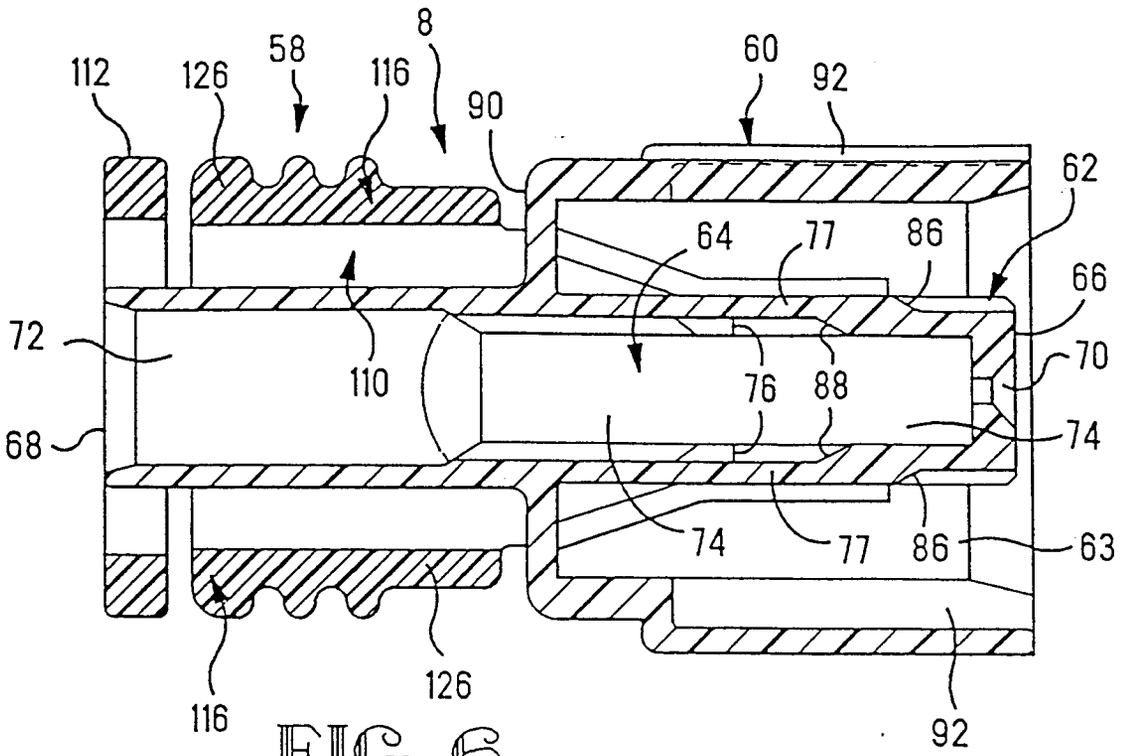
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FIG. 6

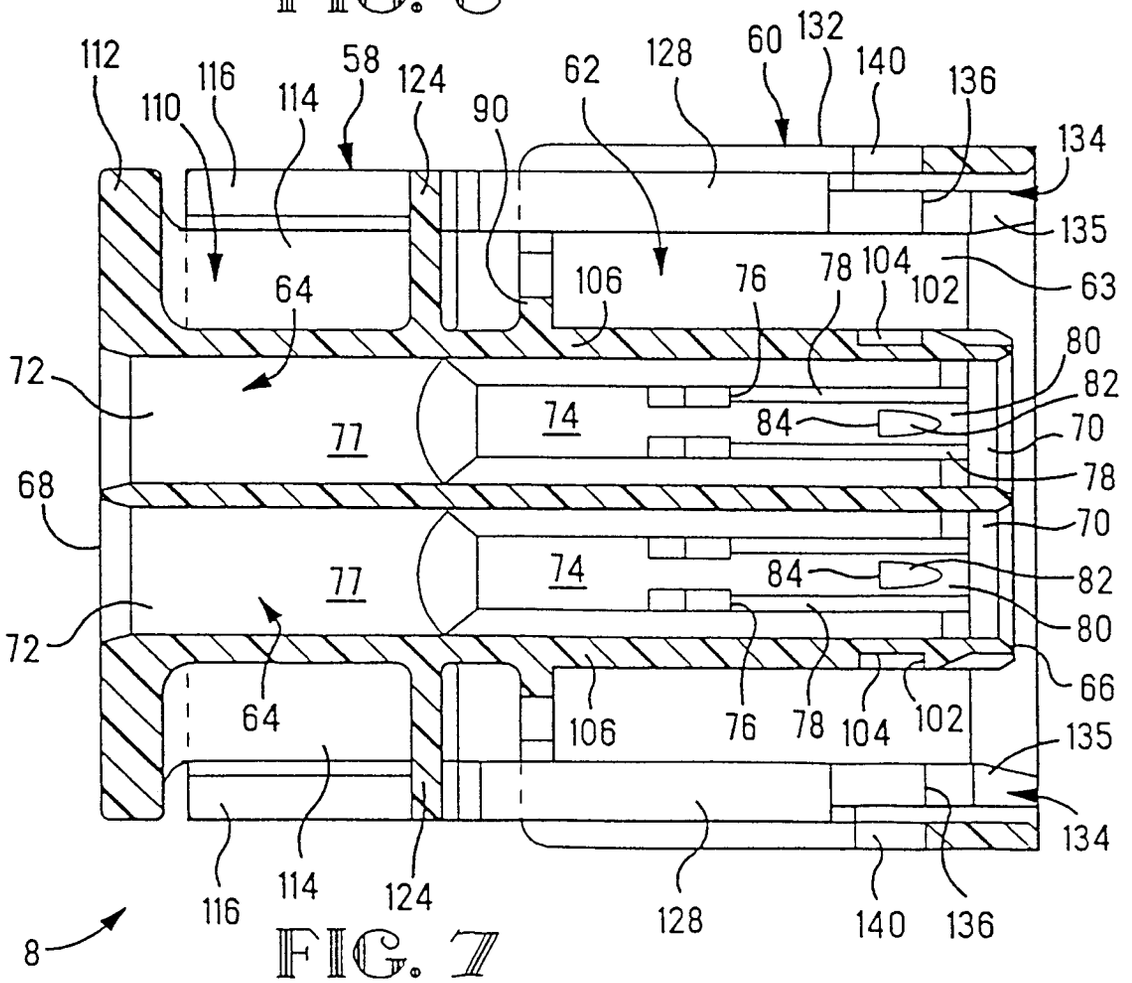
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FIG. 7

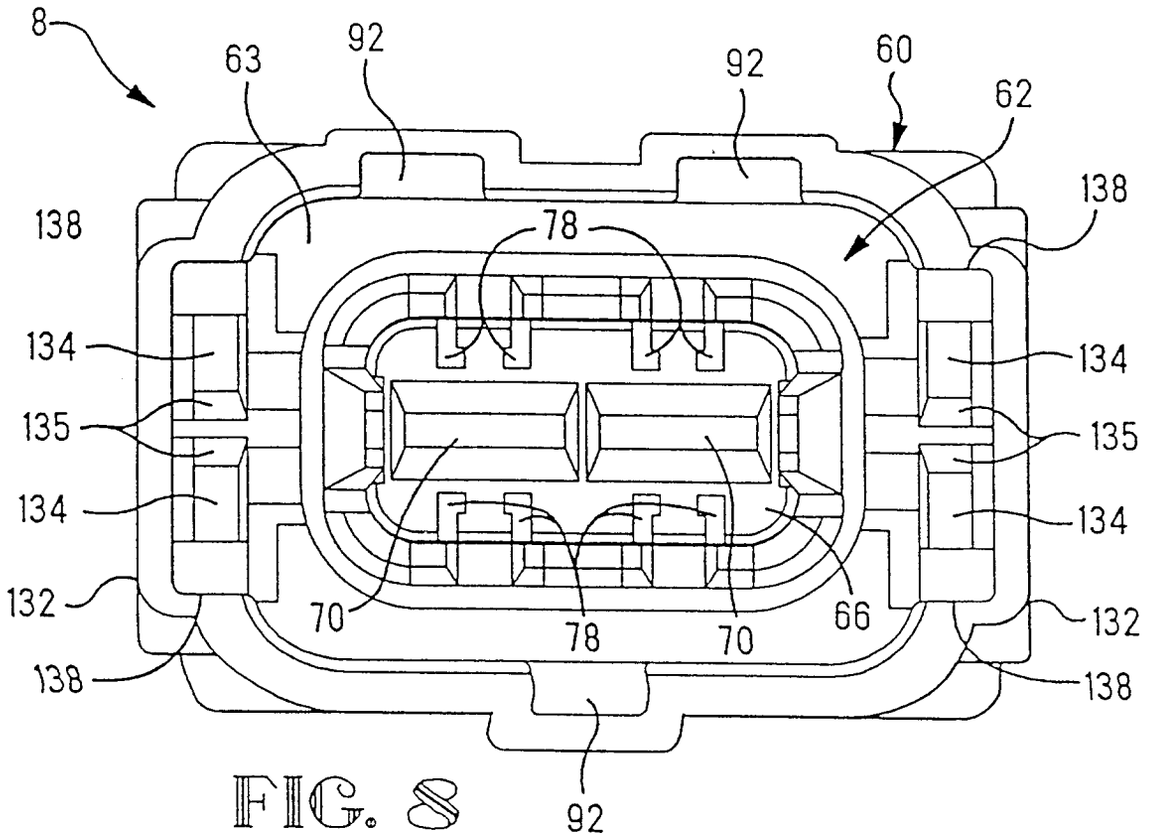
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FIG. 8

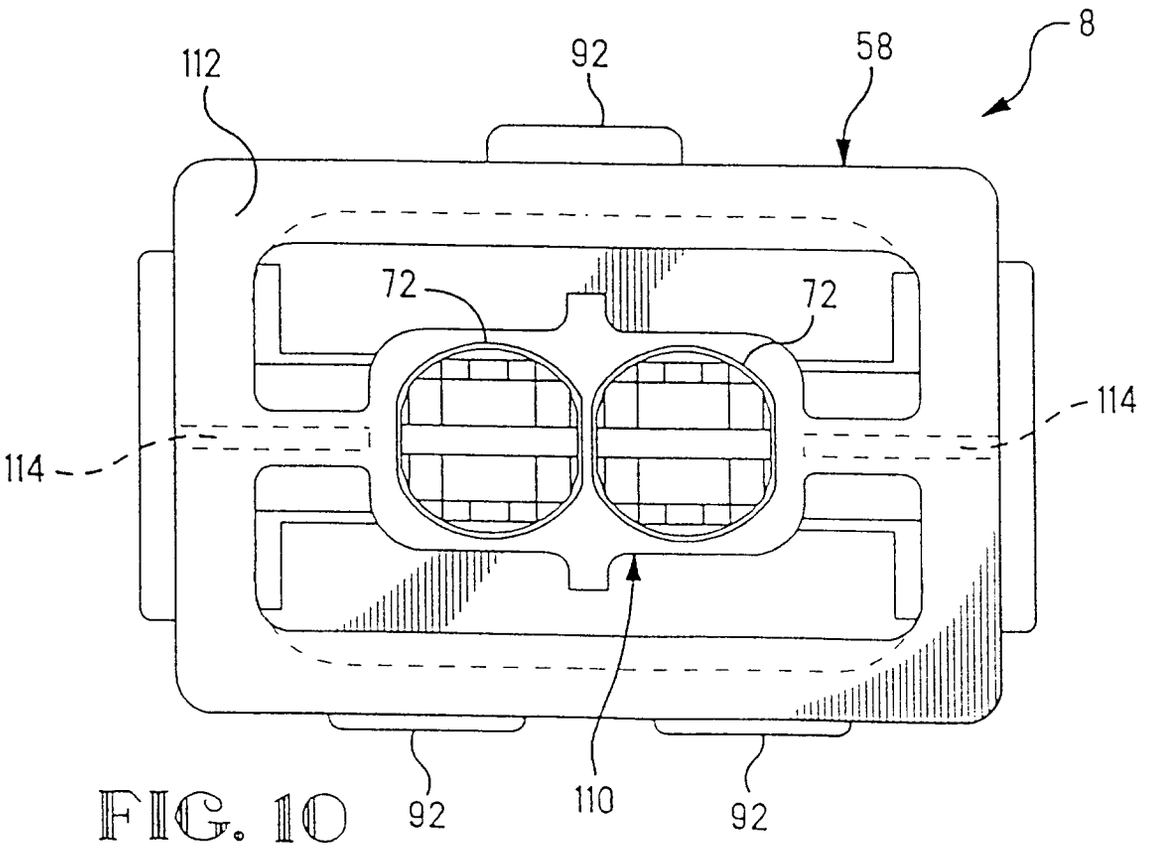
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FIG. 10

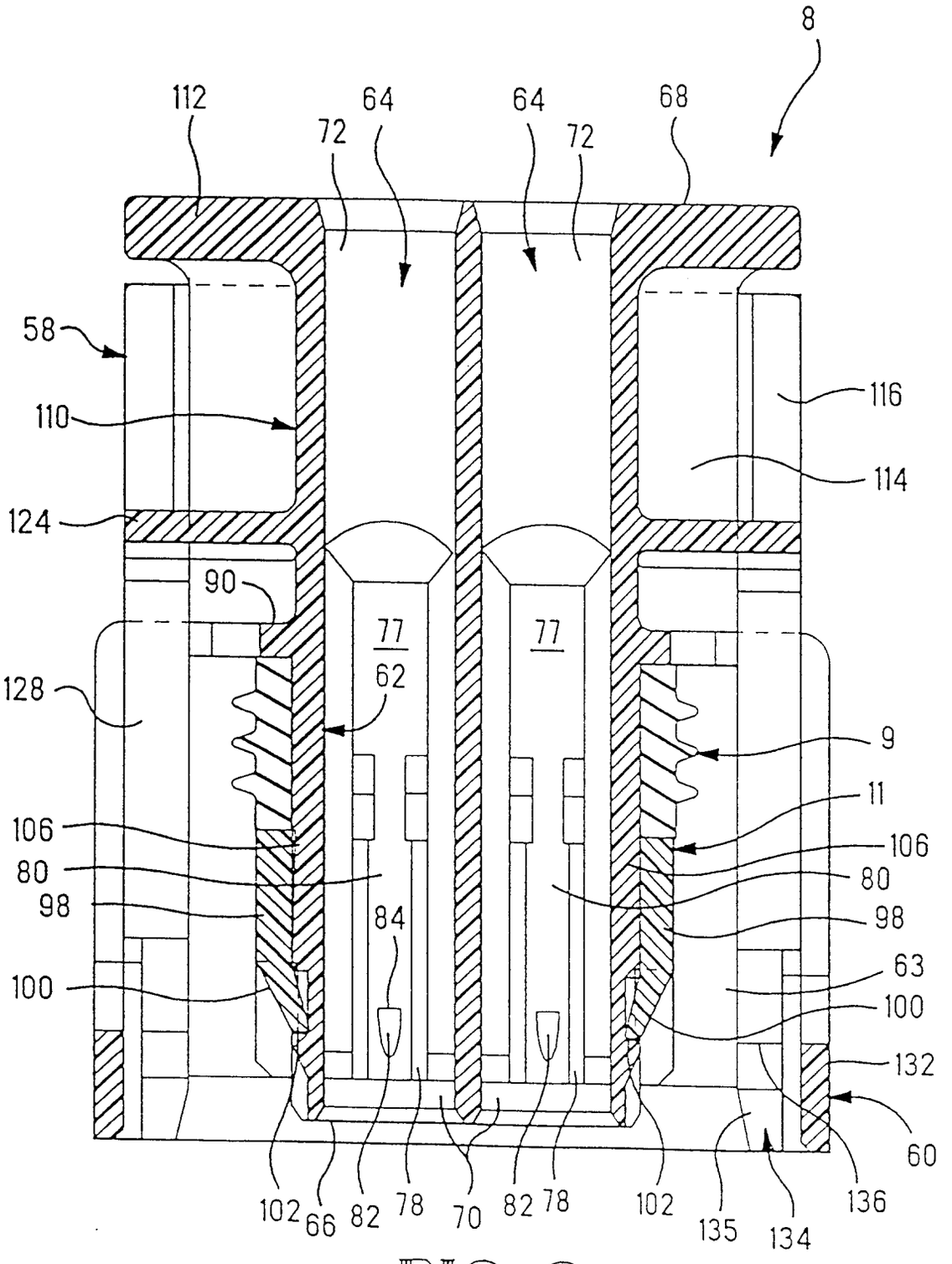
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FIG. 9

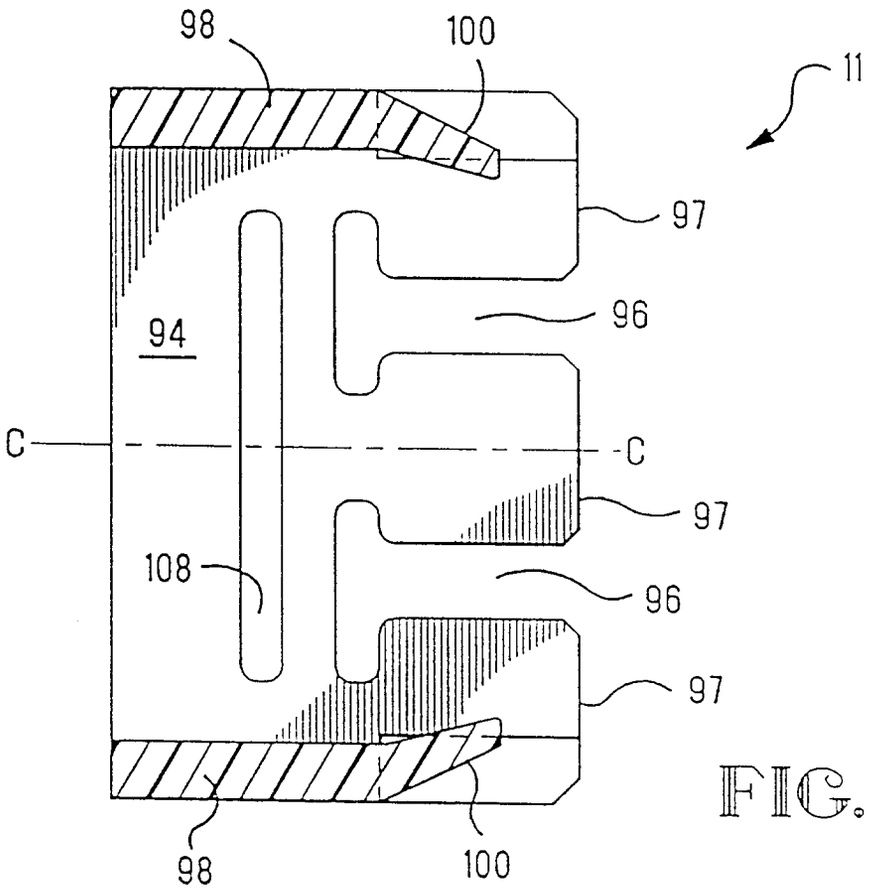

FIG. 11

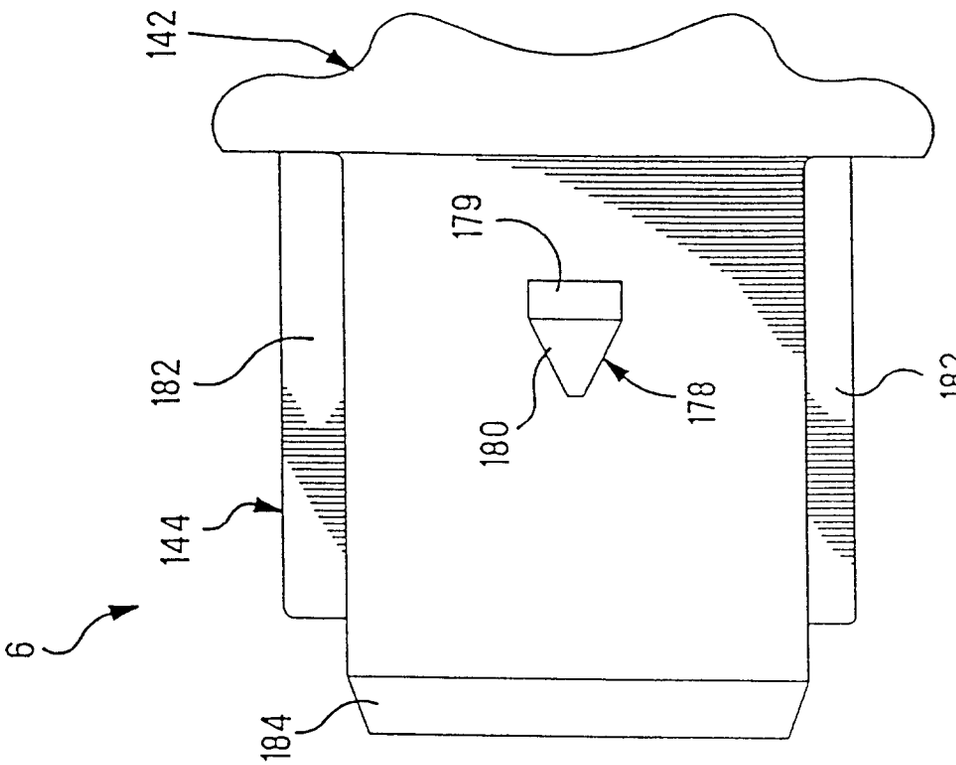

FIG. 11B

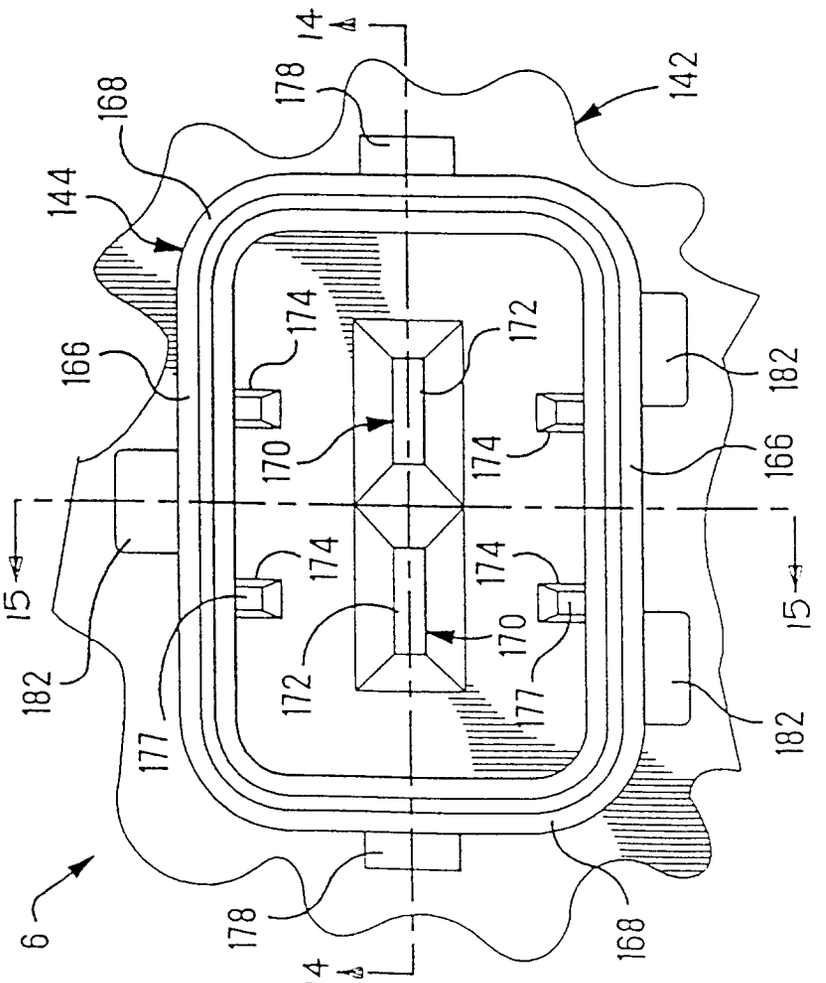

FIG. 12

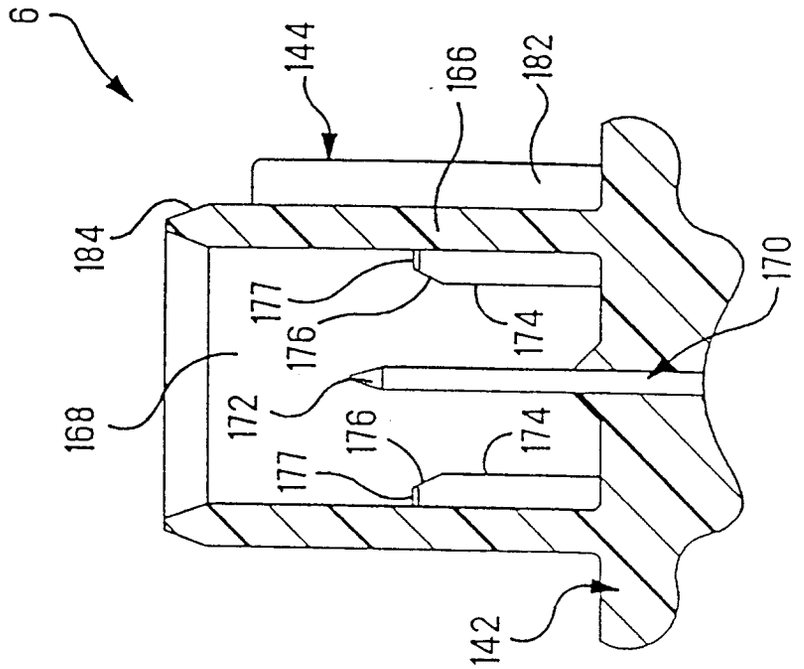
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FIG. 15

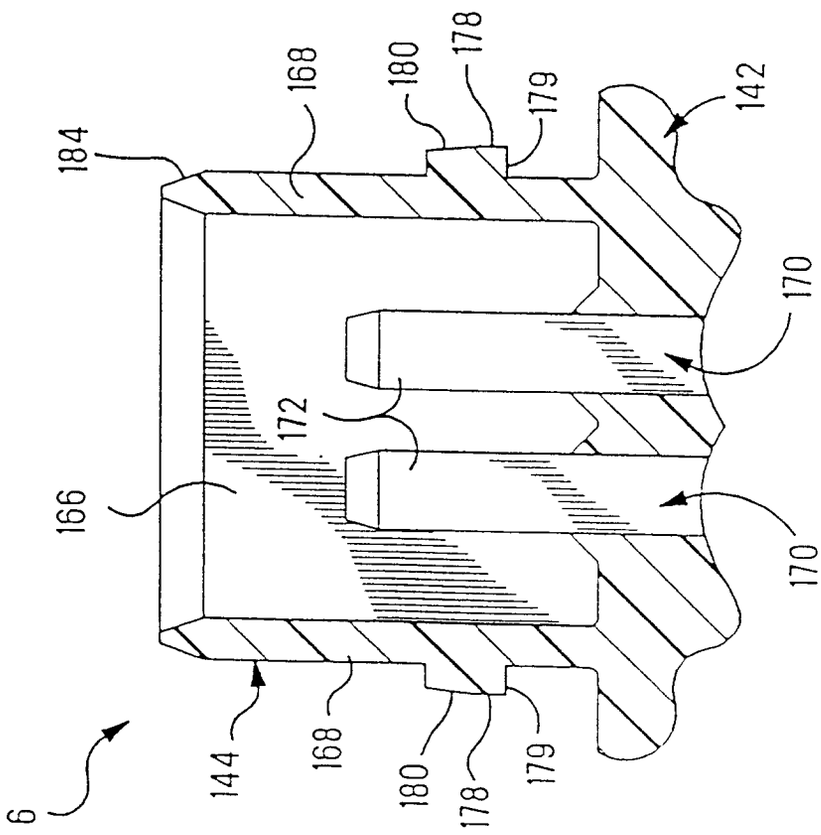
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FIG. 14