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(72) Inventors:
• **Colombo, Massimo**
10140 Leini (TO) (IT)
• **Prigione, Paolo Lorenzo**
10064 Pinerolo (IT)

(71) Applicant: **THE WHITAKER CORPORATION**
Wilmington, DE 19808 (US)

(74) Representative: **Heinz-Schäfer, Marion**
AMP International Enterprises Limited
AMPèrstrasse 3
9323 Steinach (SG) (CH)

(54) **Connector for terminating communication cables**

(57) A connector for terminating at least one pair of wires, the connector comprising a housing (104, 104') and at least one pair (A, B) of contacts (106, 108, 106', 108') mounted in the housing, each contact having an

insulation displacing contact (IDC) blade portion (107, 107') arranged in a row along the housing, wherein each contact (106', 108') further comprises a capacitive coupling portion (200, 200') overlapping the respective other contact of the same pair (A, B).

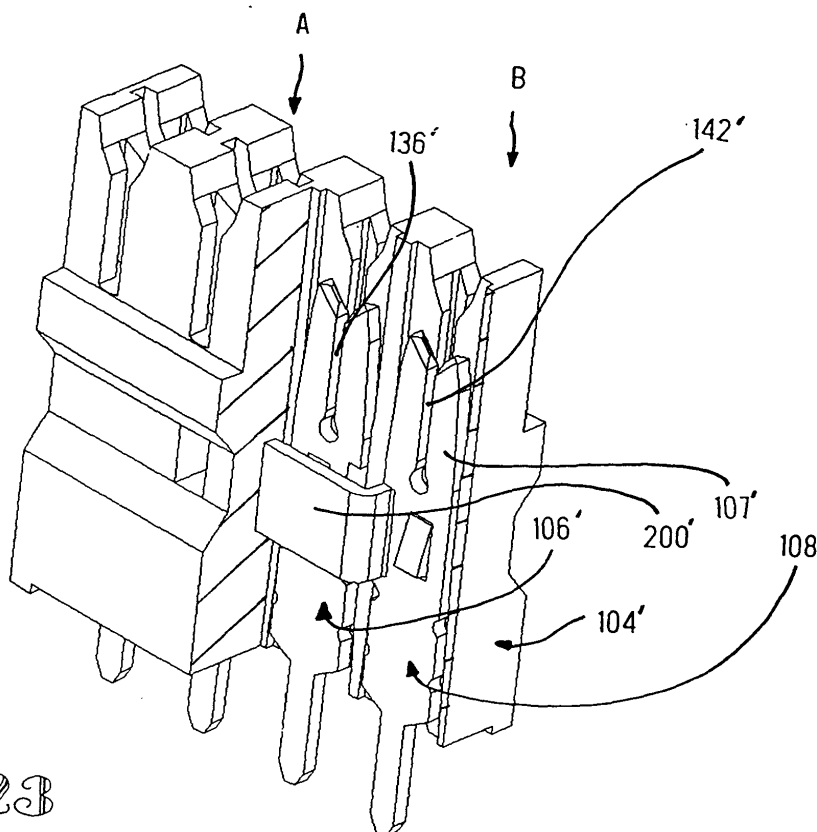


FIG. 23

Description

[0001] This invention relates to a connector for termination of electrical cabling and in particular electrical cabling for communication systems. The invention is especially applicable to the termination of twisted pair cables.

[0002] As the data transmission rates rise in modern communication systems, the problem of cross-talk between adjacent signal pairs becomes quite large. Typically, signals are transmitted along a pair of wires where one of the wires carries the positive signal and the other carries the negative signal. In order to compensate for any interference, the two wires are typically wrapped to form a twisted pair so that any electronic interference will effect both of the wires equally and the signals carried therein.

[0003] It has been recognised that in electrical connectors that carry high frequency signals there will be cross-talk between the connector contacts. US 5,186,647 utilises contacts that incorporate a cross-over to compensate for the capacitive and inductive coupling between adjacent contacts such that signal degradation is minimised. US 5,547,405 incorporates lateral extensions onto signal contacts such that a capacitor can be formed to compensate for any capacitance/inductance induced by data transmission through the contacts.

[0004] While the transmission line has been constructed to minimise cross-talk by way of the twisting of the pair and the connector itself can be optimised to minimise the capacitive or inductive coupling between signal contacts, a problem still exists where the transmission line needs to be connected to the contacts of the connector. The reason this is a problem is that typically the twisted pair will need to be untwisted and the separate wires connected to each of the contacts. Over this untwisted distance, it is possible that the signal carried within these lines is adversely effected. It is an additional problem that any shielding that might have been provided about these signal lines must typically end where the separate lines travel to their respective contacts.

[0005] Therefore, it would be highly desirable to provide a connector with reduced crosstalk. It would be desirable to provide a connector that enables the twisted pair to remain twisted as close as possible to their respective termination. In addition, as the termination must occur in the field, it is highly desirable that the termination be simple and easy to operate. Finally, as there are large quantities of these terminations, the termination should be inexpensive. Also, it would be highly desirable to accommodate any shielding that may be in the signal wire such that it can be brought to ground.

Objects of this invention are accomplished by providing a connector according to claim 1. A connector for terminating at least one pair of wires, the connector comprising a housing and at least one pair of contacts mounted in the housing, each contact having an insulation displacing contact IDC blade portion arranged in a row

along the housing, wherein the contacts further comprise capacitive coupling portions overlapping the respective other contact of the same pair A, B. Advantageously therefore, a simple and compact connector with reduced cross-talk is provided.

Objects of this invention are accomplished by providing a connector according to claim 9. Disclosed herein is a terminator for a pair of wires comprising a housing having a shell extending from a base thereof; a pair of IDC contacts located within the housing and open within the shell for receiving the corresponding wire; a stuffer having a pair of openings for receiving the wires and positioning the wires relative to the IDC contacts, the stuffer being receivable by the housing and moveable therein between a pre-terminated position and a terminated position where the wires would be set in the respective IDC. Advantageously a connector enabling twisted pair to remain twisted as close as possible to the termination, whereby the termination is simple and easy to operate is provided. In a compact embodiment with low electromagnetic noise emission, the IDC contacts may have a cylindrical form where one contact is nested within the other.

[0006] Further advantageous aspects of the invention are set forth in the claims, or will be apparent from the following description and drawings.

[0007] The invention will now be described by way of example with reference to the accompanying drawings wherein:

Figure 1 is a front perspective view of a terminator according to the present invention;

Figure 2 is front perspective view of a base housing incorporated into the connector of figure 1;

Figure 3 is front perspective view showing an inner contact in the base housing of figure 2;

Figure 4 is front perspective view showing an outer contact mounted in the assembly of figure 3;

Figure 5 is front perspective view showing a stuffer cap in a pre-terminated position on the assembly of figure 4;

Figure 6 is front perspective view showing the stuffer cap in the terminated position;

Figure 7 is front perspective view of the assembly of figure 6 showing a shield fitted thereabout;

Figure 8 is front view of the terminator of figure 7;

Figure 9 is sectional view taken along line 9-9 of figure 7;

Figure 10 is alternative embodiment of the present invention;

Figure 11 is front perspective view of a housing and rear contact of the terminator of figure 10;

Figure 12 is front perspective view of the assembly of figure 11 showing a front contact inserted therein;

Figure 13 is front perspective view of the assembly of figure 12 showing a stuffer cap in the terminated position;

Figure 14 is sectional view taken along line 14-14

of figure 16;

Figure 15 is sectional view taken along line 15-15 of figure 16;

Figure 16 is front perspective view of the assembly of figure 13 showing a shield thereabout;

Figure 17 shows a top view of a pair of assemblies mounted adjacent each other;

Figure 18 is an other embodiment of a contact, particularly for use in assemblies mounted adjacent each other;

Figure 19 shows an embodiment similar to figure 17 but assembled with the contact of figure 18;

Figure 20 shows an assembly with an outer conductive shell and a stuffer in a pre-terminated position;

Figure 21 shows the assembly of figure 20 in the terminated position;

Figure 22 is an isometric view of the assembly of figure 21 viewed from the other side;

Figure 23 is a perspective view with partial cross-section of yet another connector embodiment of this invention;

Figure 24 is a perspective view of contacts of the embodiment of figure 23;

Figure 25 is top plan view of the contacts shown in figure 24.

[0008] With respect to figure 1, a connector or wire terminator according to the present invention is shown generally at 2. The connector 2 includes a base 4 that holds a first inner contact 6 and a second outer contact 8 that are visible through the respective openings 10, 12 in a stuffer 14. An outer shield 16 surrounds the afore-described structure.

[0009] With respect now to figure 2, the base 4 will be described in greater detail. The base 4 is a moulded piece of insulative material having a bottom 18 with a C-shaped shell formed by a segment of a cylindrical wall 20 extending therefrom. In addition, a positioning post 22 extends upward from the base 18 and includes a locating surface 24. The cylindrical wall 22 includes a plurality of stuffer guide grooves 26 and bearing surfaces 28 therebetween for guiding and stabilising the stuffer 14 during termination of the wires (not shown). In addition, the cylindrical wall 20 includes two sets of opposing ports 30 located in-line with one another for establishing the pre-terminated position of the stuffer 14 as shown in figure 5 and the terminated position of the stuffer as shown in figure 6. On the outer surface of the cylindrical wall 20, a plurality of tabs 32 are provided to fix the shield 16 in position relative thereto. A notch 34 is formed in the base 18 for purposes to be described below.

[0010] With reference now to figure 3, the inner contact 6 is positioned upon the post 22 of the housing 4. The inner contact 6 is a rolled piece of conductive material formed such that a resultant seam forms an insulation displacement contact (IDC) 36 for engaging one of the wires of the twisted pair. Tapered lead-in sections 38 are formed with a cutting edge such that insulation

about the wire is displaced as the wire is pushed into the IDC 36. Additionally, the inner contact 6 includes notches 40 below the IDC 36 for exposing a portion of the insulative post 22. The notches 40 serve to eliminate the possibility of shorting a wire terminated in the outer contact 8 to the inner contact 6, as best seen in figure 4. A pin or post 41 extends through an opening (not shown) in the housing for engaging a complementary conductor, for example a circuit trace on a PCB. Support surface 24 of the post 22 is disposed along IDC 36 to prevent over insertion of the wire.

[0011] With respect to figure 4, the outer contact 8 is shown inserted into the assembly of figure 3. The outer contact 8 is also a rolled piece of flat conductive material having an IDC slot 42 preceded by cutting edges 44. The inner contact 6 and outer contact 8 are nested generally concentrically within the cylindrical wall section 20. It may be desirable to additionally form locating members along the base 18 to assure positioning of the outer contact 8. The IDC slot 36 of the inner contact 6 and the IDC 42 of the outer contact 8 are generally aligned with one another and the IDC 42 of the outer contact 8 is positioned in front of the exposed position of the support post 22 realised by the notches 40. The outer contact 8 also includes a complementary contacting member 46 that in this case is configured to engage a circuit trace on a printed circuit board. Similar to that described above concerning the complementary contact 41 of the inner contact 6.

[0012] With reference now to figure 5, the stuffer cap 14 is a generally cylindrical member having an outer wall 48 sized to generally correspond to the bearing surfaces 28 of the base member 4. Along this outer surface 48 linear ribs 50 protrude and are received within the guide grooves 26 for stabilising the stuffer 14 within the base 4. Additionally, positioning tabs 52 are formed toward an open bottom end 54 for co-operating with the openings 30 in order to establish the wire receiving position a pre-terminated position and the terminated position. Opposite the bottom end 54 is a closed top surface 56 upon which a force in the direction of arrow A can be exerted to move the stuffer 14 from the pre-terminated to the terminated positions. As can also be seen toward the open free end 54 of the stuffer 14 a tongue 58 extends perpendicularly outward therefrom and is located generally above the notch 34 and below wire insertion openings 10, 12. As can also be seen through these openings 10, 12 the stuffer 14 includes a second internal wall 60 concentrically formed inside the cylindrical wall 48, as best seen in figure 9. The outer wall 40 and the inner wall 60 define an angular space 62 for receiving the outer contact 8 therebetween. The walls 48, 60 further co-operate to prevent excessive expansion of the outer contact 8 during stuffing of the wire within the IDC slot 42. A post 64 extends from the top 56 concentric with the inner wall 60 and is received within the inner contact 6. The post 64 has a lower stuffing surface 66 for biasing the wire into the IDC slot 36. With reference once again

to figure 5, the internal wall includes openings 10', 12' inline with their respective openings 10, 12 in the outer wall 48 such that the wires to be terminated will be inserted therethrough and positioned above respective IDC 36, 42. As a result of the wires being supported on either side of the IDC slots 36, 42 especially effective stuffing is accomplished.

[0013] With respect now to figure 6, as a result of force in the direction of arrow A, the stuffer 14 is moved downward from the position of figure 5 such that the walls 48, 60 and the stuffing surface 66 (figure 9) will bias the wires into the IDC slots 36, 42, thereby effecting termination of the wires. As can be seen in figure 6 and further realized from figure 9, the spacing between the IDC slots in all directions is minimal such that the twist may be maintained in the wires.

[0014] With reference now to figure 7, it may be desirable to shield the terminating structure by the provision of a conductive metal member thereabout. In this case the shield 16 is attached to the base by way of the tabs 32. The shield 16 is generally C-shaped having a pair of deflectable arms 68 extending from the free ends. The deflectable arms 68 define a slot 70 corresponding to the wire insertion openings 10, 12 and the stuffer 14. The longitudinal slot 70 enables the wires to be put in place. In addition, the resilient arms 68 that are turned outward can be biased outward by the tongue 58 as can best be seen by comparing figures 7 and 1. In the pre-terminated position of the stuffer 14 shown in figure 1, the tongue 58 extends between the free ends 68 of the shield members 16. In this case, the free ends 68 are biased apart such that the conductive wires may be inserted into the openings 10, 12. If it has been decided to use cable having shielded conductive pairs a foil or other type of shielding will be wrapped around the pair. By having the shielding extend into the area between the free ends 68, during stuffing as a result of pushing the stuffer cap 14 into the terminated position of figure 7 and 8, the tongue 58 will move out of engagement with the free ends 68. The resiliency of the shield member 16 closes the free ends 68 about the cable shielding such that the shielding can be electrically drained by way of contact legs 70' that may be fixed to traces on a printed circuit board.

[0015] Therefore, the foregoing connector 2 is especially advantageous in that simple and easy termination of twisted pair of wiring can occur and as a result of the spacing between the inner contact 6 and the outer contact 8 along with the spacing between the between the openings 10, 12 an especially attractive wire termination is presented that enables the twist to be maintained in the wire until the wires are actually terminated. In addition, shielding termination is provided that can occur simultaneously with the termination of the wires of the twisted pair. Finally, while it is shown to terminate these contacts to a printed circuit board by way of the contacting legs 41, 46, 70' other termination configurations may be desired such as inwardly forming the contacts of the

connector that mate with the complementary connector.

[0016] With respect now to figures 10-16, an alternative embodiment of the present invention will be described. In particular, with reference to figure 10, a connector according to this embodiment is shown generally at 102. As a result of similarities between this embodiment and the previously described embodiment, corresponding features will be designated by the same reference numbers added to 100. The connector 102 includes a housing 104 having contacts 106, 108 therein where a stuffer 114 is provided for pushing wires (not shown) of the twisted pair into the respective contacts. The contacts 106, 108 have IDC blade portions 107 with respective IDC slots 136, 142. The wires are received in openings 110, 112 and an outer shield 116 is provided that generally surrounds the aforescribed structure. A primary difference between the embodiment of the terminator 102 and the aforescribed terminator 2 is that the present embodiment is generally rectangular in configuration whereby the wires which would be received in openings 110, 112 are horizontally adjacent as opposed to the previous embodiment where they are vertically adjacent. This allows a number of particularly advantageous features to be realised as apparent from the description below.

[0017] With respect now to figure 11, the housing 104 will be described. The housing 104 includes a base 118 and a surrounding box-like shell. Above the base 118 the walls 120 of the box-like shell include guide groups 126 for guiding the stuffer gap 114 as will be described below and the inner surfaces 128 also co-operate to guide the stuffer cap 114. Positioning windows 130 are formed in the shell 120 in order to establish the pre-terminated and terminated positions. Additionally, tabs 132 are provided for locating the shield 116 thereabout. The inner contact 106 is received in an inner channel 133 of the base 118. A similar outer channel 135 is also formed in the base 118. As the shell 120 is not fully closed on one side, a channel 134 is formed along the base 118. The inner contact 106 includes a pair of plate section 135 with an IDC 136 therebetween having a lead-in cutting edge 138. The inner contact 106 further includes a connection portion 141 for connecting to a complementary component.

[0018] With reference now to figure 12, the outer contact 108 is seen disposed within the outer groove 135. The outer contact 108 is configured generally according to the inner contact 106 where a pair of plates 143 and an IDC 142 is preceded by lead-in cutting edges 144. The outer contact 108 further includes an engaging portion 146 for mating with the complementary conductors.

[0019] With reference now to figure 13, the stuffer 114 is shown in the terminated position. The stuffer 114 includes lances 152 that are seen in the terminated opening 130. And guide ribs 150 positioned within guide grooves 126. The stuffer 114 further includes a raised pedestal portion 151 between the open side walls of the shell 120 in order to carry a biasing tongue 158 therein.

The stuffer 114 can be further viewed in figures 14 and 15. Additionally, in figure 14 it is apparent that advantageously a single stamping can be used for both the inner contact 106 and outer contact 108 by simply reversing the position. This reduces the numbers of parts that need to be manufactured and thereby reduces costs.

[0020] With respect now to figure 16, the shielding shell 116 is shown fixed to the structure of figure 13 by way of mounting tabs 132. As a result of moving the stuffer 114 into the terminated position, the tongue 158 associated therewith moves free of resilient free ends 168 of the shielding shell 116 allowing their natural resiliency to close about an inserted cable in order to form an electrical connection with the shielding as was previously described.

[0021] Advantageously then, the second embodiment has all of the advantages of the first embodiment combined with a reduction in the number of parts required by enabling a single contact stamping to be used for both of the contacts. Additionally, in the construction of components of the base 104 and stuffer 114 are also simplified. Additionally the pair can be cut to the same length, while in the first embodiment the wires of the pair had to be cut at different length.

[0022] Moreover, when pair connectors are placed side by side, mainly due to space constraints on amount of energy flows from one pair connector to the adjacent one. This energy flows via the parasitic capacitor that appears between the contacts of pair connector A and pair connector B, whereby the value of this parasitic capacitor is inversely proportional to their distance.

[0023] Figure 17 shows two pair terminators placed side by side where the distance Y (distance from contact 106 of pair connector A and contact 106 of pair connector B) is much higher than the distance X (distance from contact 106 of pair connector A and contact 108 of pair connector B). Thus the two parasitic capacitors have different values. The energy that flows from the contact 106 of pair connector A to the contact 106 of pair connector B is lower than the energy that flows from the contact 106 of pair connector A to the contact 108 of pair connector B. As result the residual noise between the contact 106 and contact 108 of pair connector B is greater than zero and will affect the high frequency performance of the pair connector B. The same relation and results are valid for other combinations of contacts for two adjacent pair connectors.

[0024] A solution to this problem foresees the addition of a capacitive coupling portion area 200 to the contact, as shown in figure 18. This overlapping portion is used to compensate the noise from one pair connector to the other.

[0025] Figure 19 shows two pair connectors placed side by side where the distance Y (distance from contact 106 of pair connector A to coupling portion 200 of contact 106 of pair connector B) is nearly equal to the distance X (distance from contact 106 of pair connector A to contact 108 of pair connector B). Thus the two parasitic

capacitors have very similar values. The energy that flows from the contact 106 of pair connector A to the coupling portion 200 of the contact 106 of pair connector B is nearly equal to the energy that flows from the contact 106 of pair connector A to the contact 108 of pair connector B. As result the residual noise between the contact 106 and contact 108 of pair connector B is nearly equal to zero, so the high frequency performance of the pair connector B is increased. In addition, the overlapping of contacts of the same pair have a similar effect to twisting (wire) conductors, thereby reducing electromagnetic noise emission and reception. The same relation and results are valid for other combinations of contacts and additional areas for two adjacent pair connectors.

[0026] Figure 20 shows a pair connector with an outer metallic shell 216 and the stuffer 214 in the pre-terminated position. The metallic shell 216 has two deflectable arms 268 placed below the openings 210 and 212. Due to their elasticity the arms 268 will provide a normal force on the conductive foil or on any other type of shielding around the pair. The stuffer in the terminated position (figure 21) reacts the normal force from the arms 268 via the feature 300. The shielding can be drained by way of contact legs 270 that would also be fixed to traces of a printed circuit board or similar contacts. Figure 22 shows the metallic shell 216 that surrounds the housing 204 and is retained on it via the tabs 232.

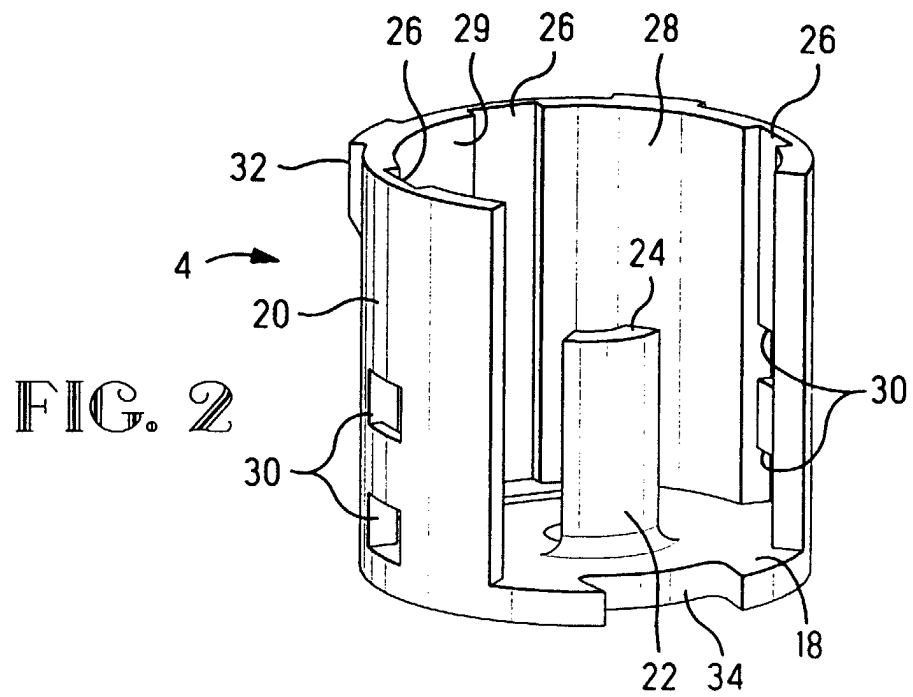
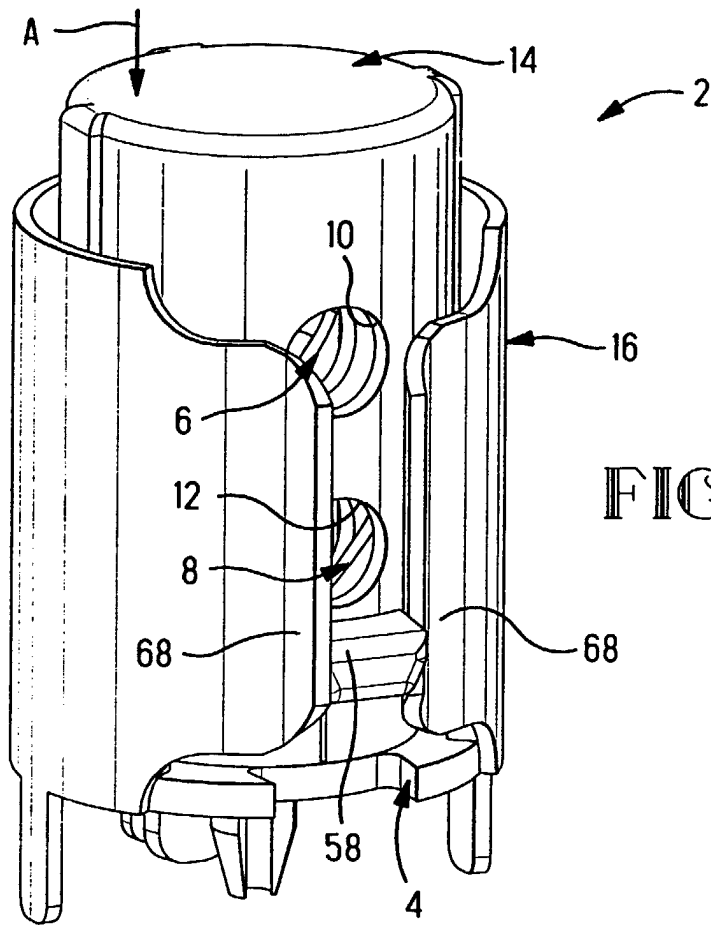
[0027] Referring to figures 23-25, another embodiment of a connector according to this invention is shown comprising a housing 104' and two pairs A, B of contacts 106', 108'. The housing may be provided with only a single pair of contacts, or a plurality of contact pairs greater than two. The connector embodiment of figures 23-25 differs from the embodiment shown in figures 17 and 19 in that the plurality of contact pairs are provided in a single housing, which renders the design more compact and cost-effective. Similar to the previously described embodiment, the contacts 106', 108' of a same pair have overlapping capacitive coupling portions 200' for the same purpose as the portions 200 of the previously described embodiment. In the embodiment of figures 23-25, the overlapping portions 200' extend in a plane parallel to the IDC blade portions 107', but spaced therefrom such that the IDC blade portions 107' of the plurality of contacts 106', 108' are positionable in substantially the same plane. As in the previous embodiment, the capacitive coupling portions 200' may be integrally stamped and formed with the IDC blade portions 107' of the contacts. The plurality of contacts 106', 108' may be identically formed whereby the contacts 106', 108' of a pair A, B are rotated with respect to each other 180°.

[0028] In the embodiment of figures 23-25, conducting wires W are received in open ended slots 110', 112' of the housing that guide the wires into the IDC blade slots 136', 142'. The wires may be inserted in the slots by means of stuffer tool, or the housing may be further

associated with a cover member that stuffs the wires into the slots in a similar manner to the previously described embodiments.

Claims

1. A connector for terminating at least one pair of wires, the connector comprising a housing (104, 104') and at least one pair (A, B) of contacts (106, 108, 106', 108') mounted in the housing, each contact having an insulation displacing contact (IDC) blade portion (107, 107') arranged in a row along the housing, wherein each contact (106', 108') further comprises a capacitive coupling portion (200, 200') overlapping the respective other contact of the same pair (A, B). 5 10
2. The connector of claim 1 wherein the IDC blade portions (107') of the connector are parallel to each other. 15
3. The connector of any one of the preceding claims wherein the contacts (106, 108, 106', 108') are identical to each other. 20 25
4. The connector of any one of the preceding claims wherein the capacitive coupling portions (200, 200') extend integrally from the IDC blade portions (107, 107'). 30
5. The connector of any one of the preceding claims wherein a plurality of pairs (A, B) of contacts (106', 108') are provided in a row in the connector housing (104'). 35
6. The connector of any one of the preceding claims wherein the connector comprises a stuffer (114) having a pair of openings (110, 112) for receiving wires and positioning them relative to the IDC contacts (106, 108) the stuffer being receivable by the housing (104) and moveable therein between a pre-terminated position and a terminated position. 40
7. The connector of claim 1 wherein the IDC contacts (106, 108) of a pair are staggered with respect to each other. 45
8. The connector of any one of claims 1-6 wherein the IDC blade portions (107') are arranged in the same plane. 50
9. The connector of claim 8 wherein the coupling portions (200') are arranged in a plane offset from the IDC blade portion (107'). 55
10. A connector for a pair of wires comprising a housing having a shell extending from a base thereof;
- a pair of IDC contacts located within the housing and open within the shell for receiving the corresponding wire;
- a stuffer having a pair of openings for receiving the wires and positioning the wires relative to the IDC contacts, the stuffer being receivable by the housing and moveable therein between a pre-terminated position and a terminated position where the wires would be set in the respective IDC.
11. The connector of claim 10, wherein the IDC contacts cylindrical in form and nested one inside the other.
12. The connector of claim 10, wherein the IDC contacts are located adjacent one another.
13. The connector of claim 12, wherein the contacts are staggered.
14. The connector of any one of claims 10-13, wherein a shield is provided about the housing having an opening corresponding to the openings in the stuffer.
15. The connector of claim 14, wherein the shield includes resilient portions on either side of the opening and the stuffer includes a tongue extending between the resilient portions to bias them apart in the pre-terminated position and then disengages therefrom in the terminated position.



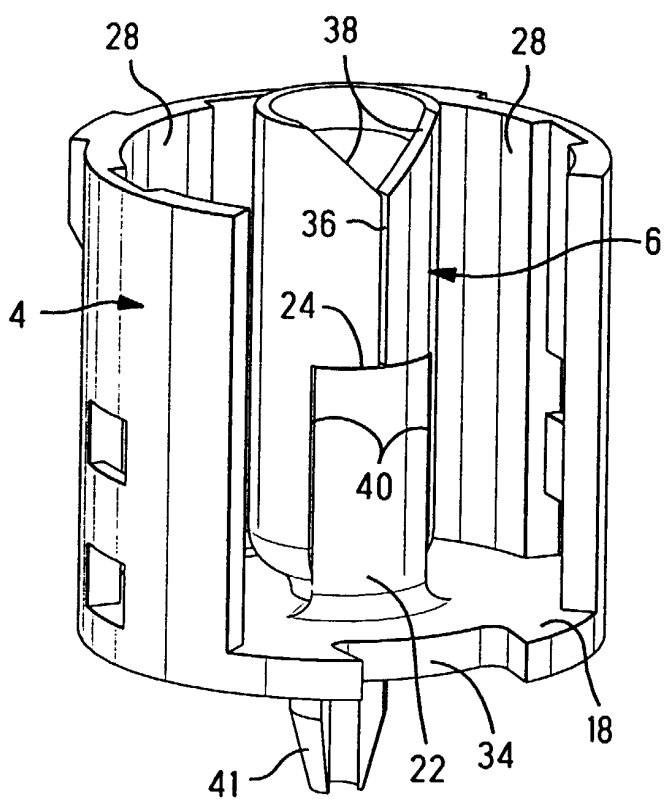


FIG. 3

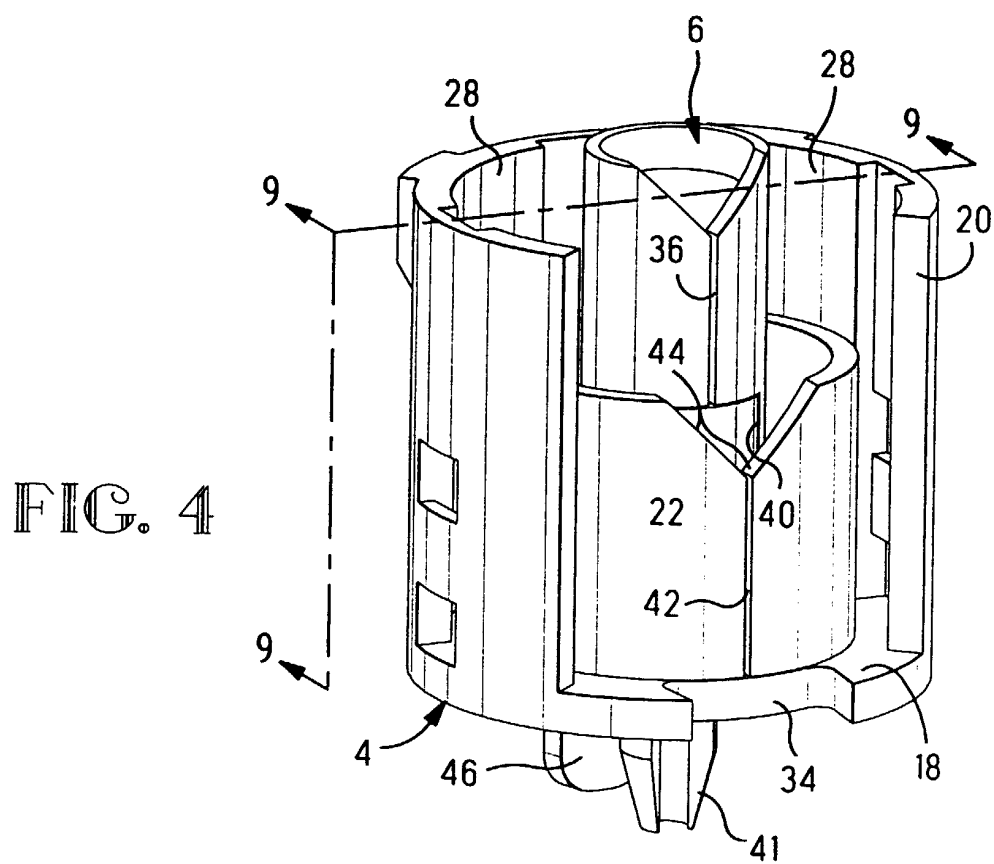


FIG. 4

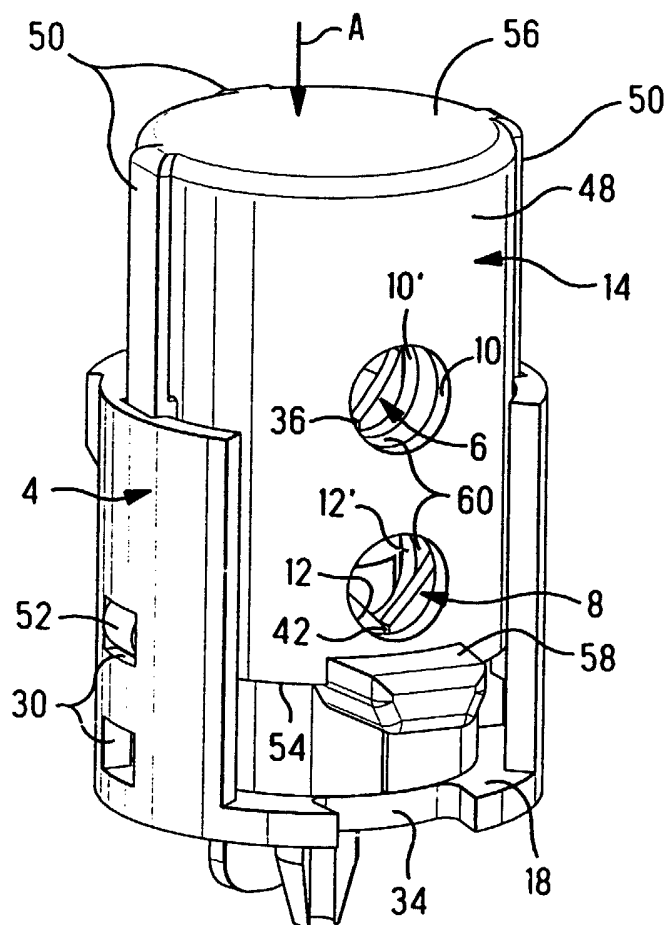
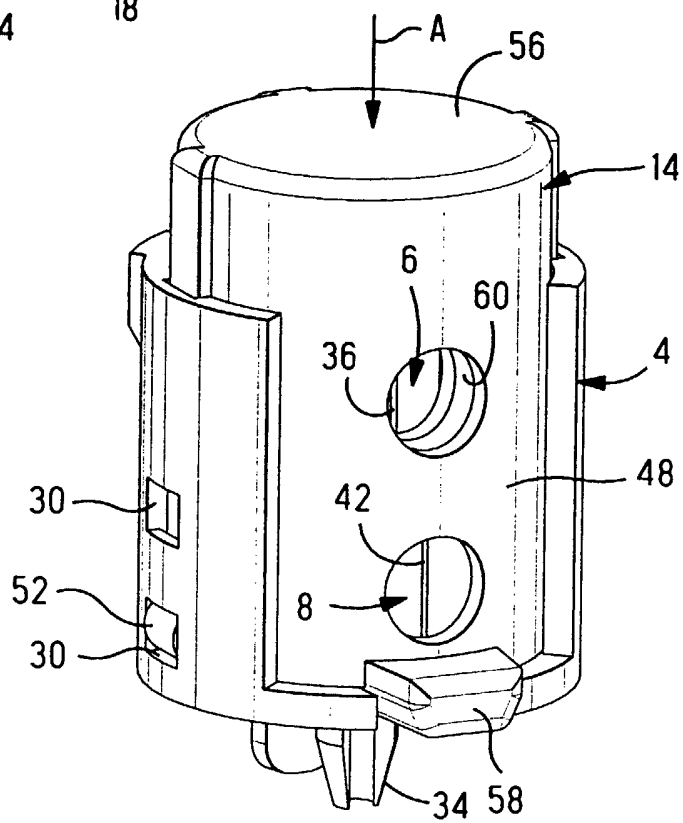


FIG. 5

FIG. 6



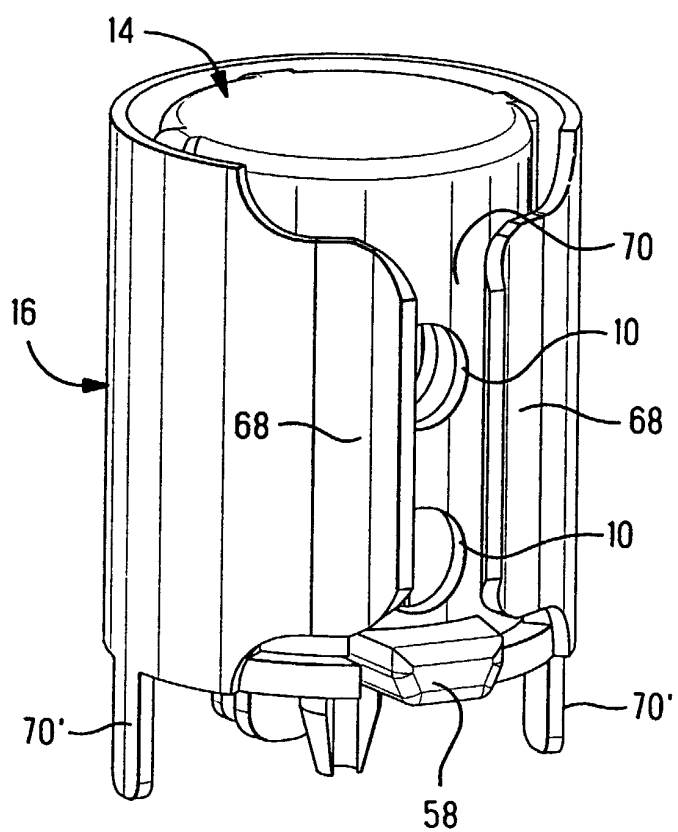


FIG. 7

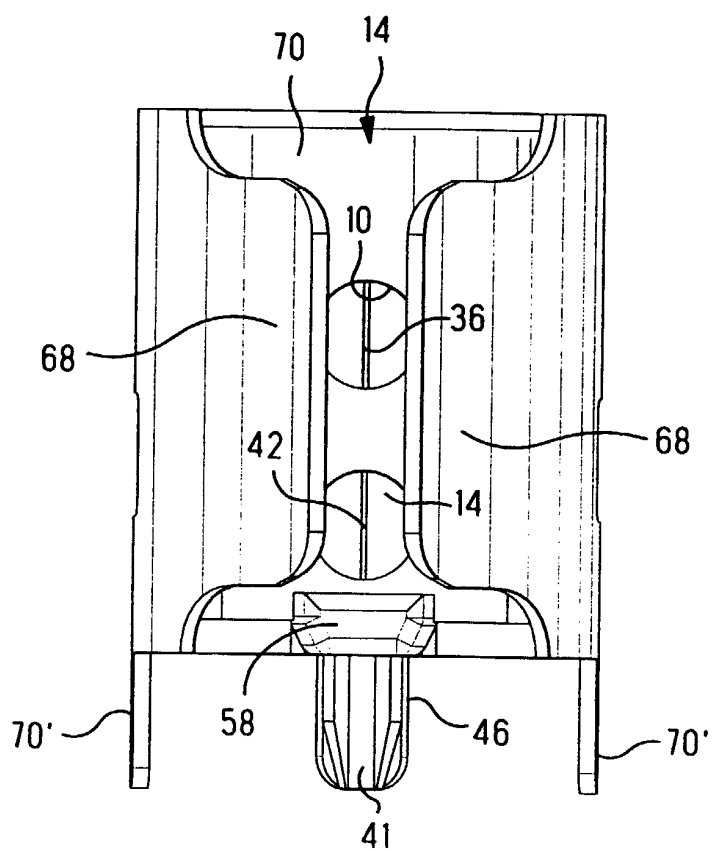
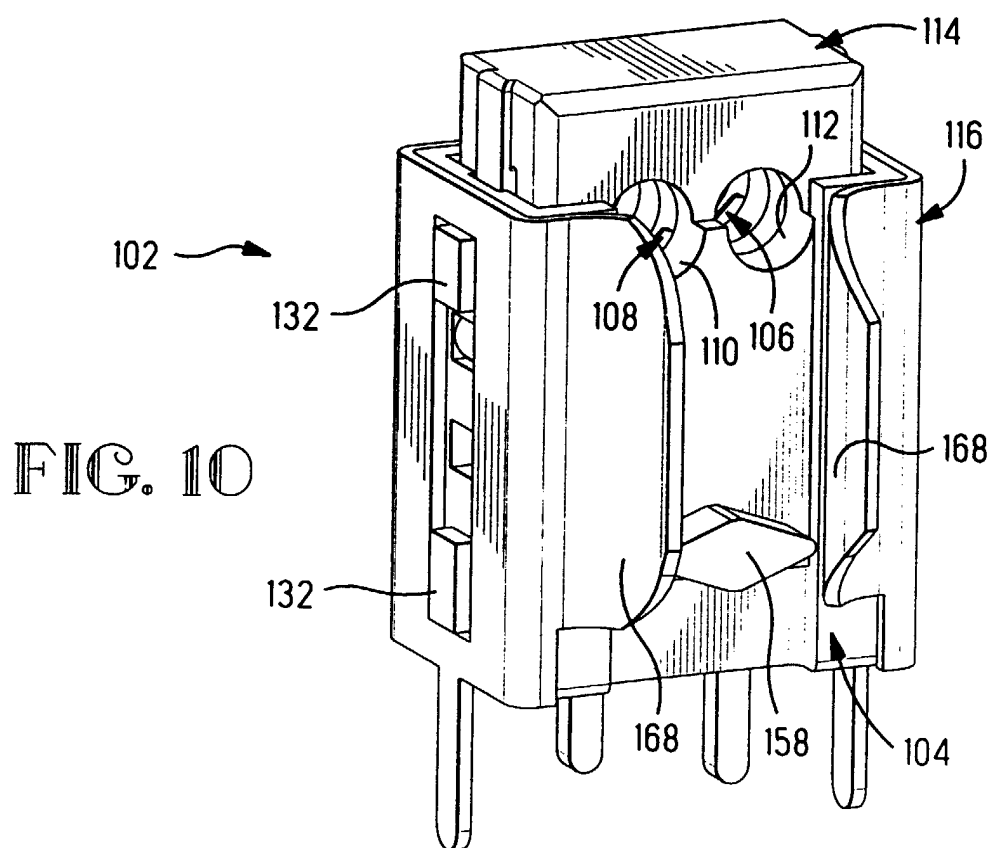
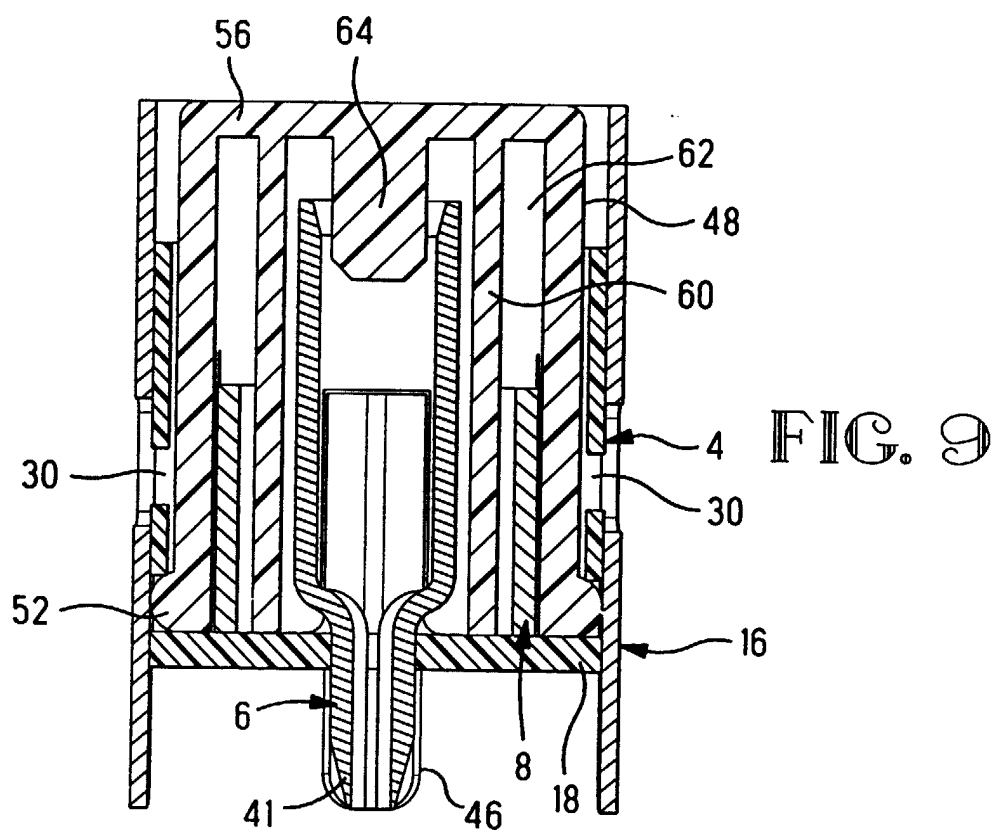


FIG. 8



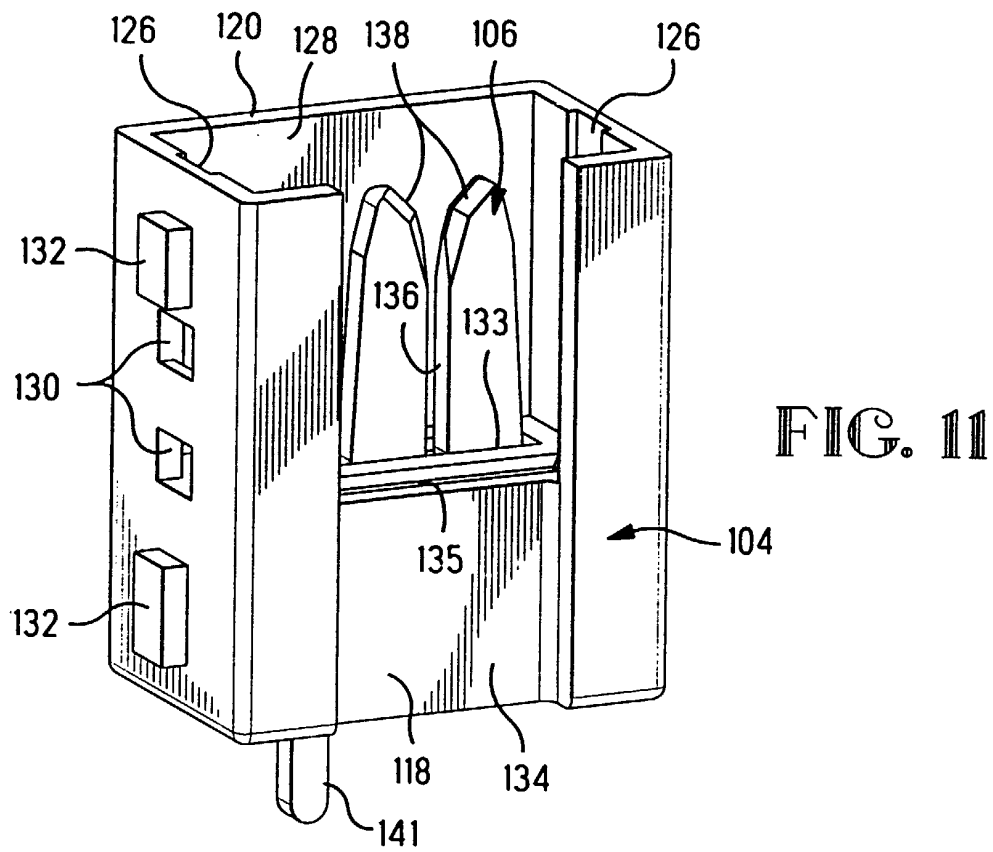
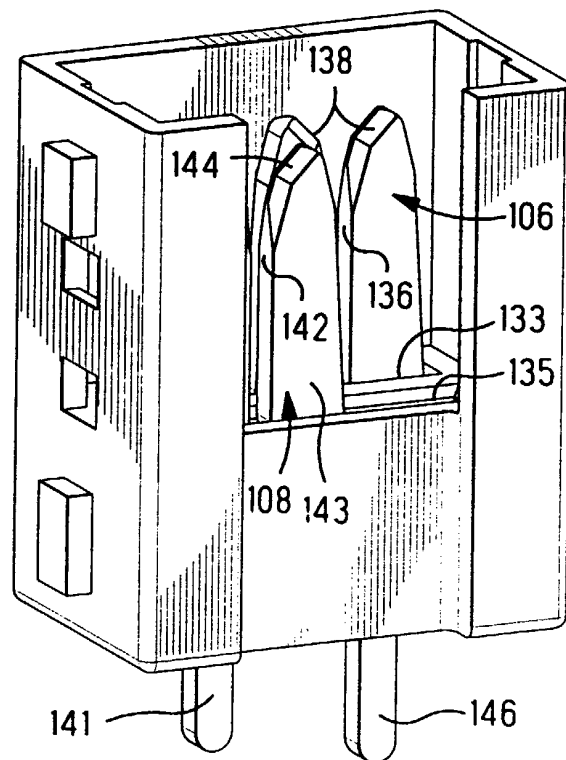


FIG. 12



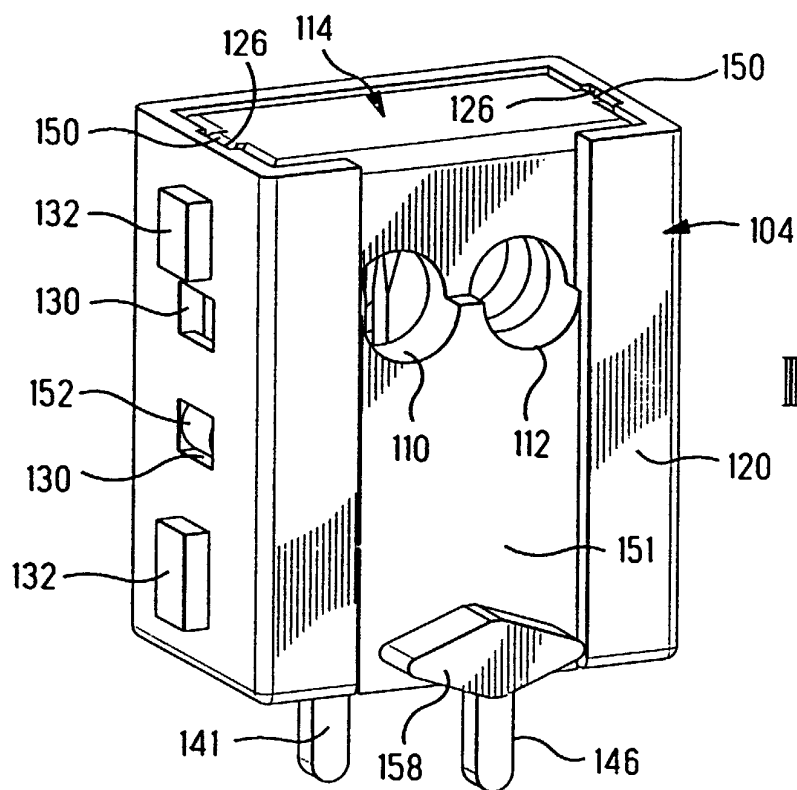


FIG. 13

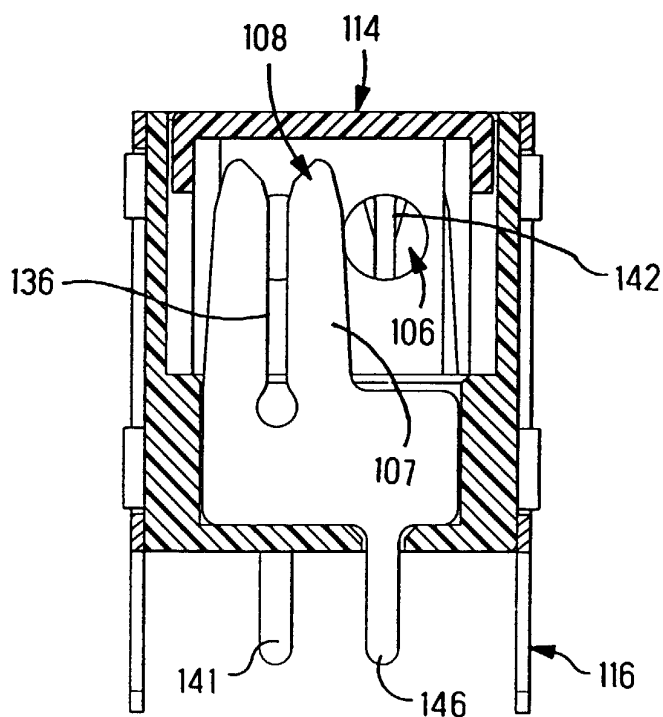


FIG. 14

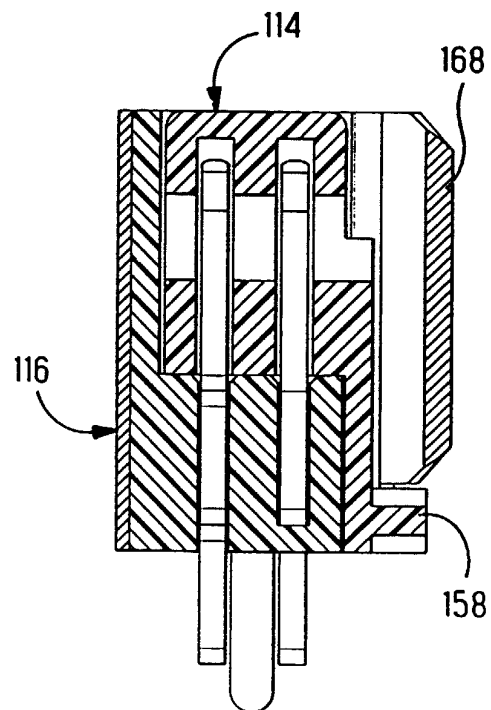
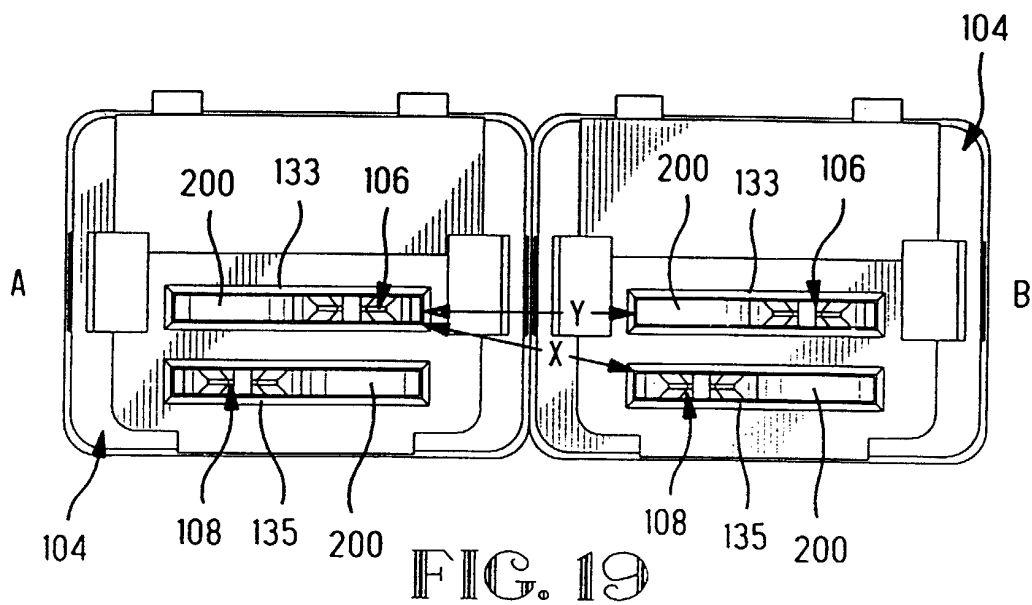
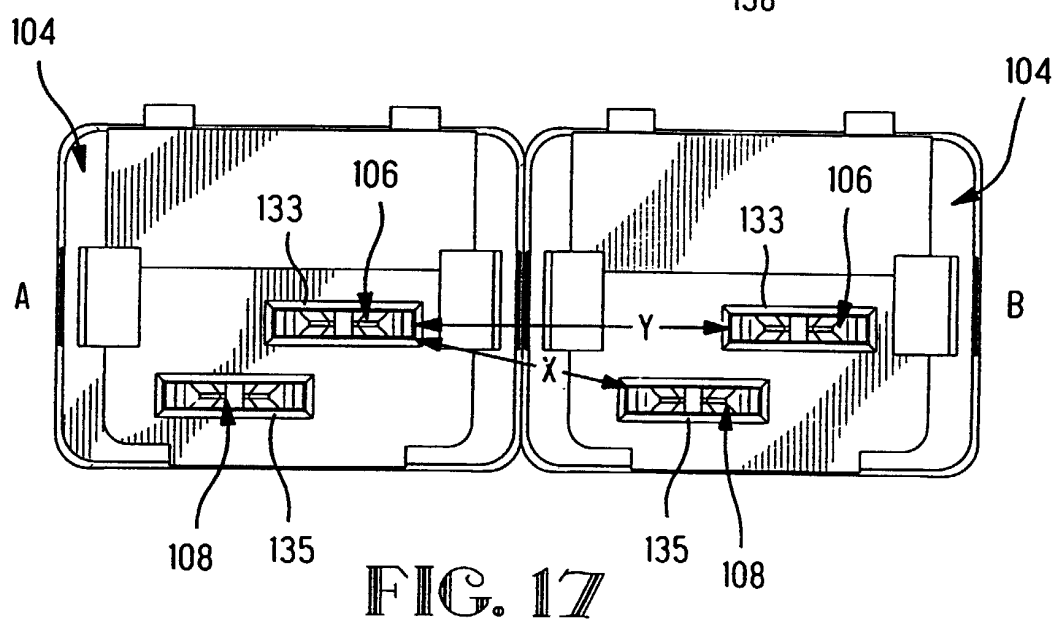
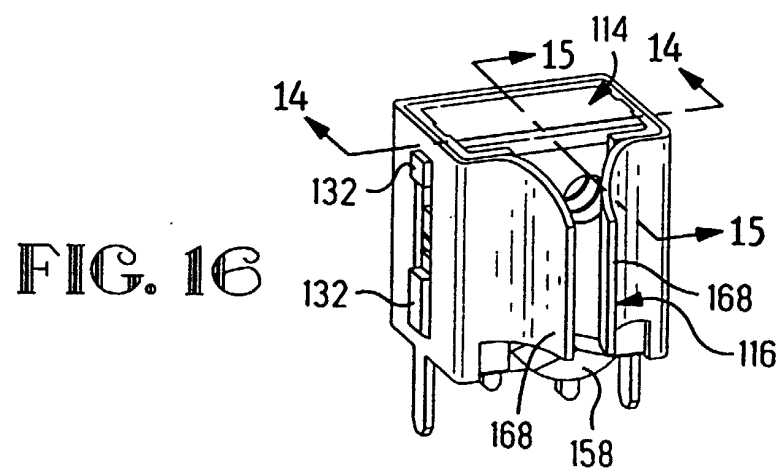
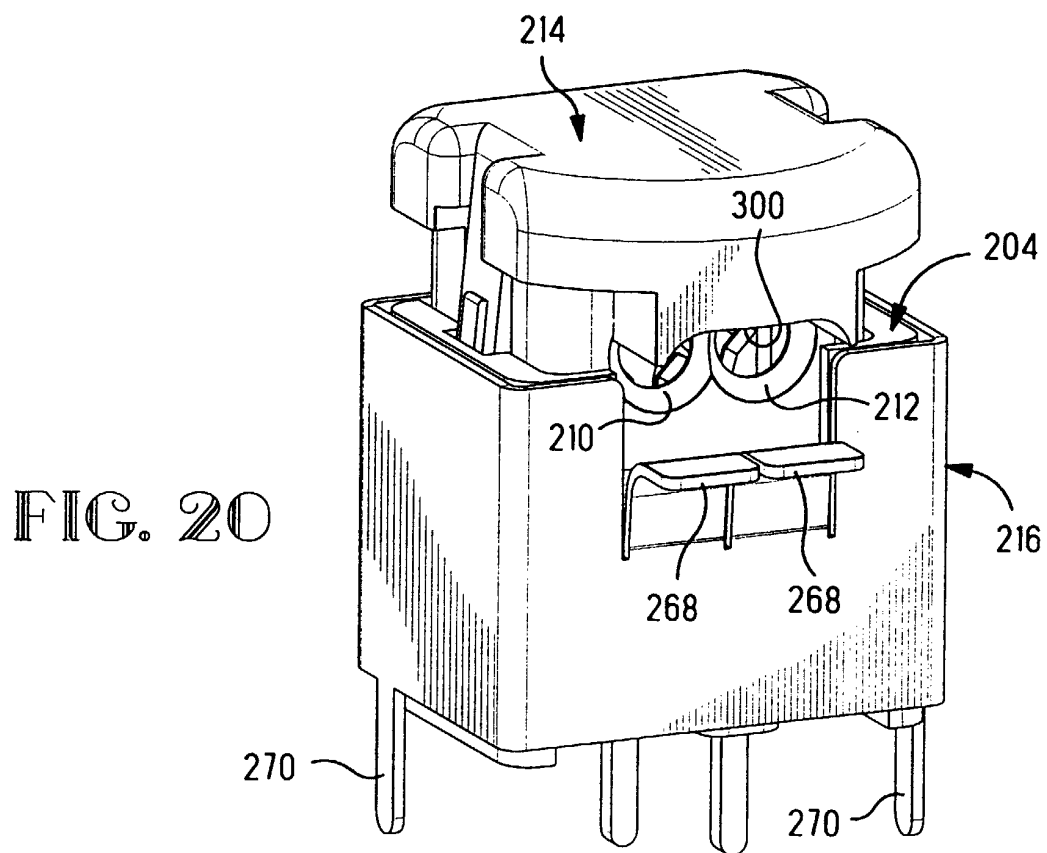
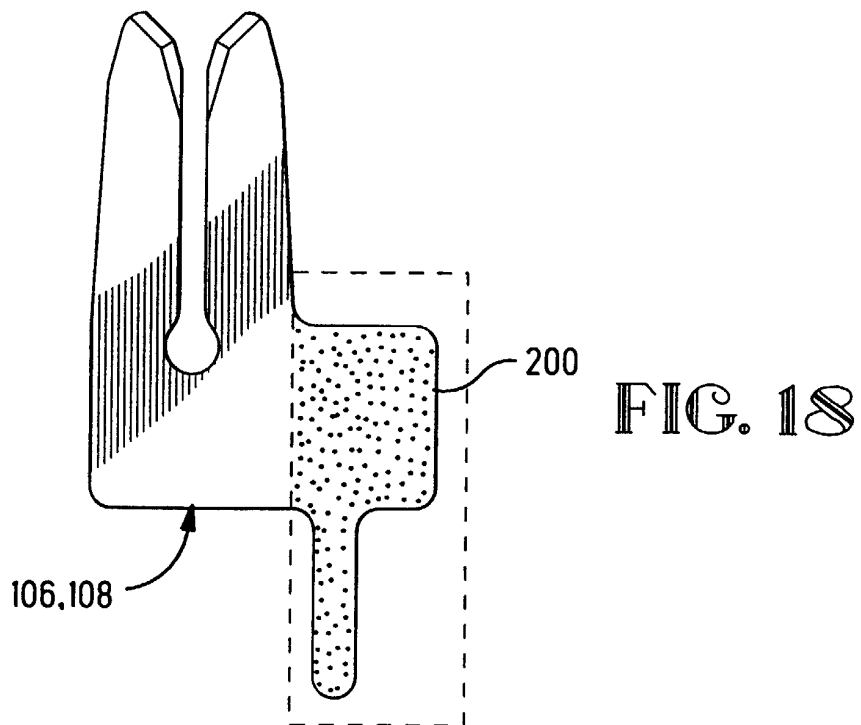


FIG. 15





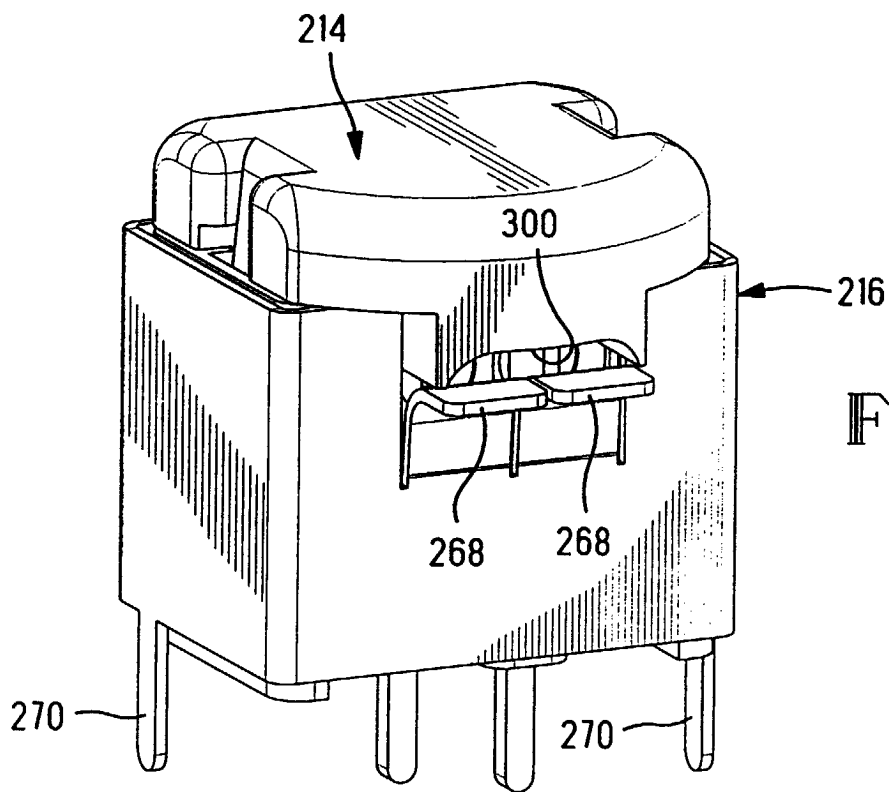


FIG. 21

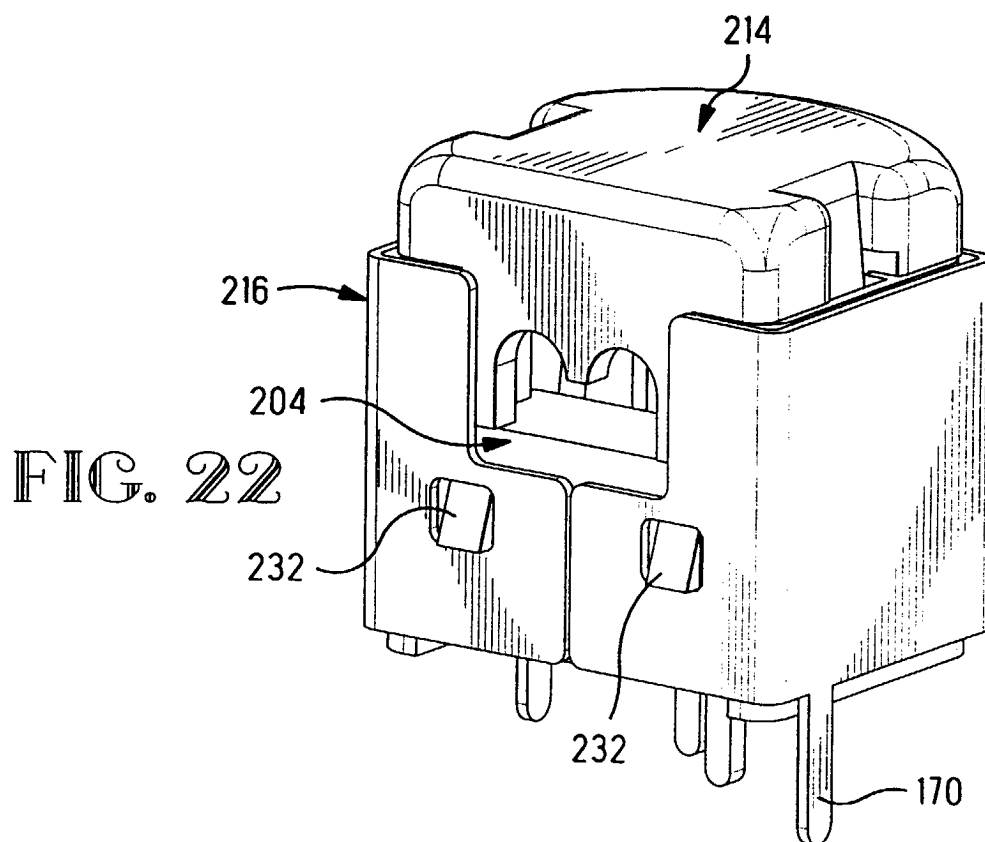


FIG. 22

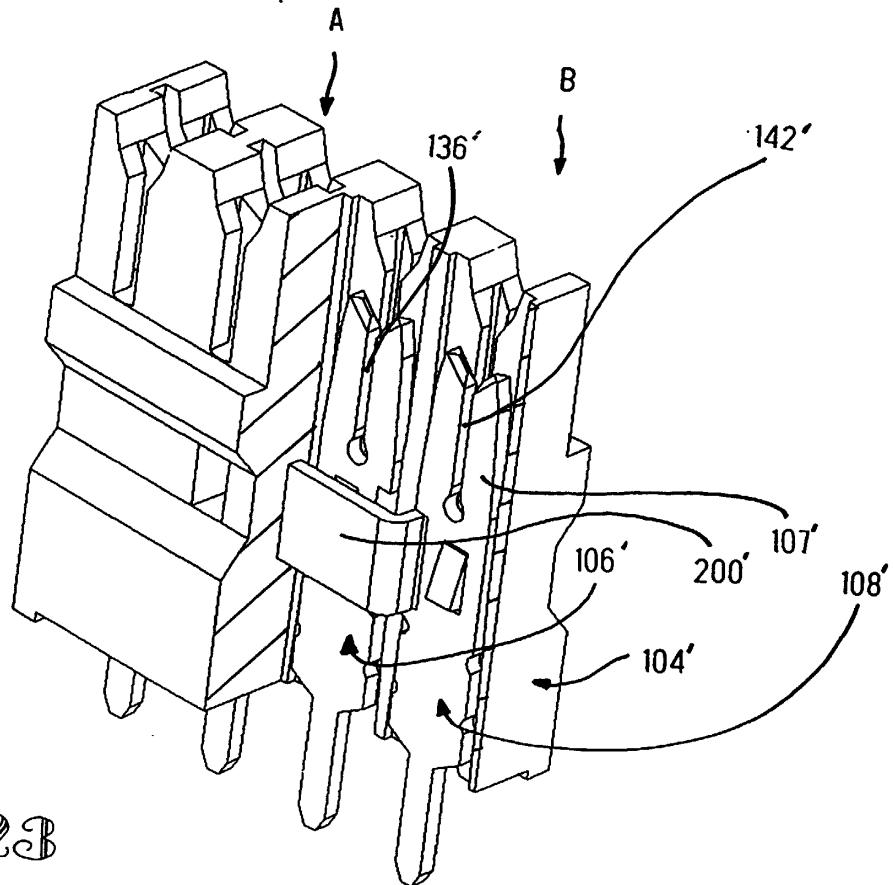


FIG. 23

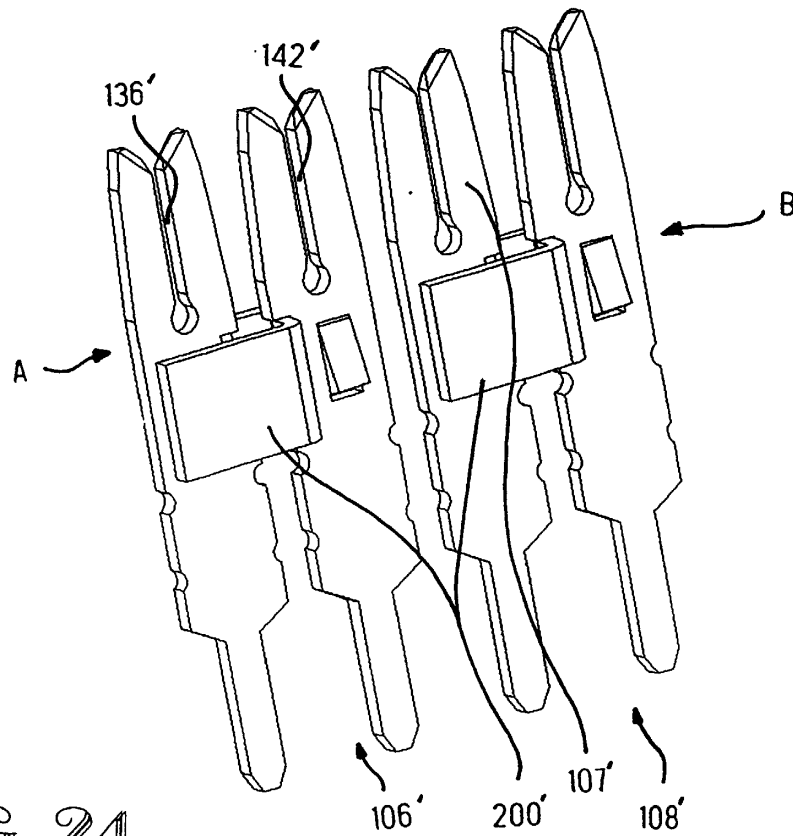


FIG. 24

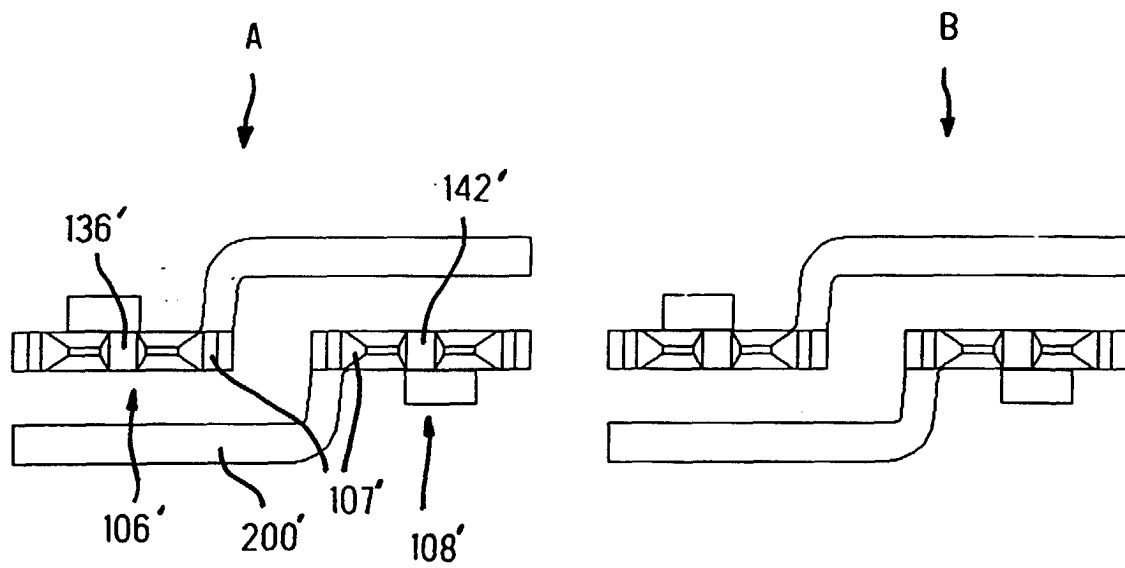


FIG. 25



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EUROPEAN SEARCH REPORT

Application Number
EP 99 10 0687

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO 98 13902 A (WHITAKER CORP) 2 April 1998 (1998-04-02) * page 1, line 12 - page 3, line 16; figure 1 * * page 9, line 29 - page 10, line 26; figures 9,10 *	1-5,7	H01R23/00 H01R4/24
A	WO 96 37015 A (WHITAKER CORP ;GEURTS GERARDUS HUBERTUS JOHAN (GB); STEPHENSON BRI) 21 November 1996 (1996-11-21) * page 4, line 21 - page 5, line 13; figure 3 *	1,9	
A	US 5 788 539 A (FEDDER JAMES LEE) 4 August 1998 (1998-08-04) * column 4, line 30 - line 49; figure 1 *	6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01R
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 May 1999	Examiner KOHLER, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-9



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**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 99 10 0687

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-9

A connector for at least a pair of wires comprising contacts with capacitative coupling portions

2. Claims: 10-15

A connector for a pair of wires having a stuffer for inserting the wires in IDC contacts

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 10 0687

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information

28-05-1999

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WO 9637015	A	21-11-1996	CN	1184565 A	10-06-1998
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82