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(54) Title: TERMINAL BLOCK AND BOARD ASSEMBLY FOR AN ELECTRICAL CONNECTOR

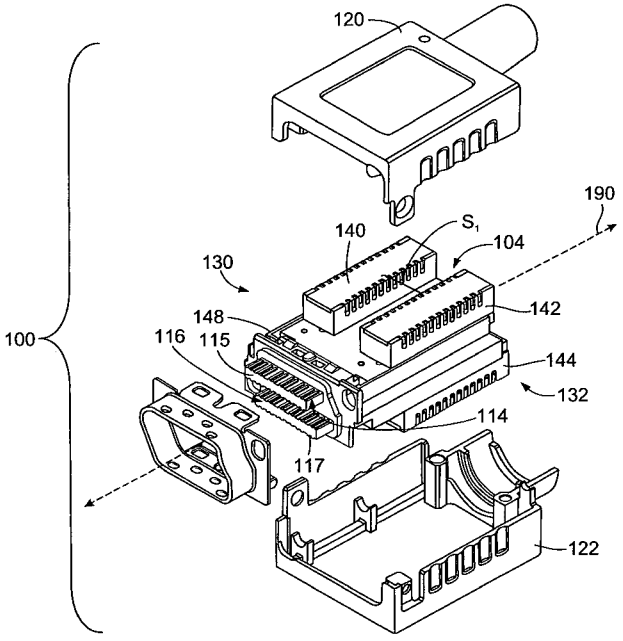

FIG. 2

(57) Abstract: A terminal block (142) that electrically couples conductors (276) and terminal contacts (218) is provided. The terminal block includes a terminal base portion (230) that has a mounting side configured to be mounted to a surface of an electrical component. The base portion has contact slots (240) that extend from the mounting side therethrough. The contact slots (240) are configured to receive terminal contacts (218) that are electrically coupled to the electrical component. The terminal block also includes an organizer portion (232) that extends from the base portion (230) and includes channels (256) that extend substantially parallel to the surface of the electrical component. The channels (256) are configured to receive corresponding conductors (276). The contact slots (240) of the base portion (230) align with corresponding channels (256) of the organizer portion (232) so that the terminal contacts (218) electrically couple the conductors (276).

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TERMINAL BLOCK AND BOARD ASSEMBLY FOR AN ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

[0001] The subject matter herein relates generally to electrical connectors, and more particularly, to modular connectors that receive and facilitate interconnecting a plurality of differential pairs.

[0002] Multi-port or high-density modular connectors, such as RJ-21 connectors, receive and interconnect numerous differential pairs. For example, a cable holding several twisted pairs may couple to a loading end of the modular connector. The conductors from the twisted pairs are separated from each other within an interior of the modular connector and electrically coupled to contacts therein. The contacts generally extend to a mating end of the modular connector and form a predetermined array of pins. The pins are then mated with corresponding contacts or beams in another electrical connector.

[0003] More specifically, known modular connectors electrically couple the conductors of the twisted pairs to corresponding contacts within the interior by soldering a terminal of each conductor to the corresponding contact. However, soldering the conductors to the contacts may be costly and time-consuming, especially when the modular connector is a high-density connector. High-density connectors may have fifty (50) or more contacts that are each soldered to a terminal end of a conductor. Furthermore, modular connectors that solder the terminals and contacts together may have limited capabilities with respect to tuning the performance (e.g., compensating crosstalk or return loss) within the interior of the modular connector.

[0004] Accordingly, there is a need for a high-density modular connector that provides an easier and less expensive method of assembling compared to known methods. Furthermore, there is a need for alternative configurations for arranging the conductors within an interior of a modular connector.

BRIEF DESCRIPTION OF THE INVENTION

[0005] The solution is provided by a terminal block for electrically coupling conductors and terminal contacts. The terminal block includes a terminal base portion that has a mounting side configured to be mounted to a surface of an electrical component. The base portion has contact slots that extend from the mounting side therethrough. The contact slots are configured to receive terminal contacts that are electrically coupled to the electrical component. The terminal block also includes an organizer portion that extends from the base portion and includes channels that extend substantially parallel to the surface of the electrical component. The channels are configured to receive corresponding conductors. The contact slots of the base portion align with corresponding channels of the organizer portion so that the terminal contacts electrically couple the conductors.

[0006] The solution is also provided by a board assembly for an electrical connector or device. The board assembly includes a circuit board and terminal contacts that are electrically coupled to the circuit board. The board assembly also includes a terminal block that is mounted on the circuit board. The terminal block includes a terminal base portion that has a mounting side configured to be mounted to a surface of the circuit board. The base portion has contact slots that extend from the mounting side therethrough. The contact slots are configured to receive terminal contacts that are electrically coupled to the circuit board. The terminal block also includes an organizer portion that extends from the base portion and includes channels that extend substantially parallel to the surface of the circuit board. The channels are configured to receive corresponding conductors. The contact slots of the base portion align with corresponding channels of the organizer portion so that the terminal contacts electrically couple the conductors.

BRIEF DESCRIPTION OF THE DRAWINGS

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

[0008] Figure 1 is a perspective view of an electrical connector formed in accordance with one embodiment.

[0009] Figure 2 is a partially exploded view of the connector shown in Figure 1.

[0010] Figure 3 is an exploded perspective view of a board assembly having a terminal block that is formed in accordance with an embodiment.

[0011] Figure 4 is a perspective view of a mating side of an organizer portion that may be used with the terminal block shown in Figure 3.

[0012] Figures 5A, 5B and 5C are cross-sectional views of the board assembly shown in Figure 3 when conductors are electrically coupled within the terminal block.

[0013] Figure 6 is a perspective view of a terminal base portion formed in accordance with another embodiment.

[0014] Figure 7 is a perspective view of a board assembly formed in accordance with an alternative embodiment.

[0015] Figure 8 is a perspective view of a pair of board assemblies formed in accordance with alternative embodiments.

[0016] Figure 9 is a cross-sectional view of a terminal block formed in accordance with another embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0017] Figure 1 is a perspective view of an electrical connector 100 formed in accordance with one embodiment. The connector 100 has a mating end 102, a loading end 104, and a central axis 190 extending between the mating and loading ends 102 and 104. The connector 100 also includes a cable boot 108 that is coupled to the loading end 104 and configured to receive a cable (not shown) of conductors. The conductors may be, for example, twisted differential pair conductors,

differential pair conductors with a common mode or ground conductor, single conductors, and the like. The mating end 102 is configured to engage a mating connector (not shown) and includes a shroud 110 that defines a cavity 112 where circuit boards 114 and 116 are positioned to engage the mating connector. The circuit boards 114 and 116 may have contacts or pads at mating ends 115 and 117, respectively, that are configured to mate with contact beams or pads of the mating connector. However, in alternative embodiments, the connector 100 may have pin contacts or socket contacts within the mating cavity that are configured to engage corresponding contacts within the mating connector.

[0018] The connector 100 also includes a housing 118 that includes housing shells 120 and 122 that mate along an interface 124 to surround an interior of the connector 100. In the illustrated embodiment, the connector 100 is a modular plug connector, however, the connector 100 may also be a receptacle connector or another type of connector. Furthermore, the connector 100 may be a high-density connector, such as a GbE RJ45 or RJ21 connector, that receives and electrical interconnects numerous conductors. As used herein, "a plurality" means more than one and "numerous conductors" or "numerous differential pairs" means more than 8 conductors and/or 4 differential pairs. For example, the connector 100 may receive and interconnect fifty (50) conductors and arrange them into 6 ports. Furthermore, the connector 100 may satisfy certain industry standards, such as Category 5, 6, 6a, or 7 standards, and operate at frequencies up to 500 MHz or higher. However, embodiments of the connector 100 are not limited to the above types of connectors and benefits of the features described herein may be used by other types of electrical connectors. Furthermore, electrical current transmitted by the connector 100 may be at least one of data signals and electrical power.

[0019] Figure 2 is a partially exploded view of the connector 100. As shown, the connector 100 includes a pair of board assemblies 130 and 132 that are configured to be enclosed by the housing shells 120 and 122 (i.e., within the interior of the connector 100) when the connector 100 is fully assembled. The housing shells 120 and 122 may be manufactured (e.g., die-cast) from a metal material or a nonconductive material. As shown, the board assembly 130 includes the circuit board

114 and a pair of shielded terminal blocks 140 and 142 mounted to the circuit board 114, and the board assembly 132 includes the circuit board 116 and a shielded terminal block 144 mounted thereto. (Although not shown, the board assembly 132 may also include another terminal block mounted thereto.) In alternative embodiments, the board assemblies 130 and 132 may have only one or more than two terminal blocks mounted to each other. Furthermore, in alternative embodiments, the circuit boards 114 and 116 may sandwich one or more terminal blocks between the circuit boards 114 and 116. The sandwiched terminal block(s) may be mounted or electrically connected to both circuit boards 114 and 116.

[0020] The terminal blocks 140 and 142 may be located proximate to the loading end 104 and extend parallel to or along the central axis 190. As shown, the terminal blocks 140 and 142 may be separated or spaced apart from each other by a spacing S_1. Also shown, the board assemblies 130 and 132 may be held side-by-side (e.g., stacked) by a board frame 148. The circuit boards 114 and 116 may also be staggered so that the mating ends 115 and 117 are not aligned with each other.

[0021] Figure 3 is a rear exploded perspective view of the board assembly 130 and is shown with reference to a longitudinal axis 290, a lateral axis 292, and a vertical axis 294. In the illustrated embodiment, the longitudinal axis 290 extends parallel to the central axis 190 (Figure 1) of the connector 100 (Figure 1). As shown, the circuit board 114 has a length L_1 that extends between a loading end 160 and the mating end 115 and a width W_1 that extends between a pair of side edges 204 and 206. The circuit board 114 also has opposing board surfaces 208 and 210 with a thickness T_1 of the circuit board 114 extending therebetween. Although the circuit board 114 is shown as being substantially rectangular, the circuit board 114 may have other shapes in alternative embodiments.

[0022] As shown, the circuit board 114 has an array 215 of plated thru-holes or vias 214 that are configured to receive and electrically engage terminal contacts 218. The array 215 may be configured to achieve a desired performance for the connector 100. For example, moving from the loading end 160 to the mating end 115, the vias 214 may be staggered with respect to each other such that the vias 214

alternate between a first lateral distance X_1 and a second lateral distance X_2 away from the side edge 204. Furthermore, the vias 214 may be grouped in pairs 220. The vias 214 of one pair 220 may be separated from each other by a longitudinal distance Y_1 and adjacent vias 214 of different pairs 220 may be separated from each other by a longitudinal distance of Y_2. The distances X_1, X_2, Y_1, and Y_2 may be configured to achieve a desired performance for the connector 100. However, the array 215 of vias 214 may have different configurations. For example, in an alternative embodiment, the vias 214 may be located on the circuit board 114 widthwise (i.e., along the lateral axis 292). The vias 214 may have other arrangements in order to achieve a desired performance. For example, the vias 214 may be arranged in rows and columns.

[0023] The mating end 115 includes a mating edge 202 having a plurality of pads 212 that are located proximate thereto and on both surfaces 208 and 210. The pads 212 may be arranged in a predetermined array and configured to engage mating contacts or beams of another electrical connector that mates with the connector 100. In addition, the pads 212 are electrically connected through the circuit board 114 to corresponding vias 214. In some embodiments, the circuit board 114 includes traces (not shown) that extend through the circuit board in predetermined patterns that are configured to tune the transmission of signals through the connector 100. For example, the circuit board 114 may include non-ohmic plates, fingers, and the like that are configured to reduce return loss and/or compensate for offending crosstalk.

[0024] In alternative embodiments, the pads 212 (or the mating end 115) and the vias 214 are not directly connected through the circuit board 114. For example, the connector 100 may be configured like an RJ-45 jack where each via 214 is electrically coupled to another plated thru-hole within the circuit board 114, which, in turn, is coupled to a pin contact that engages a plug contact at a mating end. As such, the terminal blocks 140, 142, and 144 (Figure 1) are not required to be mounted to a circuit board that also directly engages a mating connector. Furthermore, in other embodiments, the connector 100 does not include the circuit board 114 and may use, alternatively, a non-conductive electrical component or body configured to house conductive pathways that interconnect the terminal contacts 218 and the pads 212 (or

other contacts configured to engage the mating connector). Accordingly, as used herein, an "electrical component" includes a circuit board and as well as other bodies formed from a non-conductive material that house conductive pathways.

[0025] Also shown in Figure 3, the terminal block 142 includes a terminal base portion 230 and an organizer portion 232 having a body 234. The base portion 230 may be substantially rectangular and have a length L_2 that extends along the direction of longitudinal axis 290 and a width W_2 that extends along the direction of lateral axis 292. The width W_2 may be configured to reduce or optimize electrical coupling between adjacent conductors. In other words, the width W_2, as shown in Figure 3, may be reduced to limit a length of the conductors in which the conductors are not in a preferred arrangement (e.g., twisted pair arrangement).

[0026] The base portion 230 is configured to be mounted to the circuit board 114 and to facilitate holding terminal contacts 218 in a predetermined orientation. As shown, the base portion 230 also has a mating side 235 that includes a plurality of contact slots 240A and 240B and shield slots 242. The contacts slots 240A and 240B are configured to support the terminal contacts 218 therein, and the shield slots 242 are configured to support shields 246 therein. When the terminal block 142 is fully assembled, the organizer portion 232 is stacked onto the mating side 235 of the base portion 230. As shown, the base portion 230 may include holes 248 along the mating side 235.

[0027] The contact slots 240A and 240B are located in predetermined positions with the base portion 230. More specifically, the contacts slots 240 are positioned so that the terminal contacts 218 may electrically engage with the vias 214. As such, in the illustrated embodiment, the contact slots 240A and 240B have a staggered relationship similar to the vias 214. The terminal contact 218 may be, for example, an insulation piercing contact (IPC). In other embodiments, the terminal contacts 218 may be an insulation displacement contact (IDC). Moreover, the terminal contacts 218 may include tails or pin portions 219. In the illustrated embodiment, the contact slots 240 extend entirely through a thickness T_2 of the base portion 230 so that the pin portions 219 of the terminal contacts 218 may be inserted

into corresponding vias 214 to electrically and mechanically couple corresponding terminal contacts 218 and vias 214.

[0028] Figure 4 illustrates the organizer portion 232 in greater detail. The body 234 of the organizer portion 232 has a length L_3 that extends along the direction of the longitudinal axis 290, a width W_3 that extends along the direction of the lateral axis 292, and a thickness T_3 that extends along the direction of the vertical axis 294. The organizer portion 232 includes opposite mating and distal sides 250 and 253 and a loading side 252. The mating side 250 is configured to engage the mating side 235 (Figure 3) of the base portion 230 (Figure 3) when the organizer portion 232 is stacked with respect to the base portion 230. The loading side 252 has a plurality of openings 254 that lead into corresponding channels 256 (shown in Figure 5). The channels 256 may extend in an axial direction from the loading side 252 to the distal side 253. Each opening 254 may be configured to receive one or more conductors 276 (shown in Figure 5) and lead into one or more channels 256. For example, each opening 254 shown in Figure 4 has a pair of opposing protrusions 255 and 257 that are configured to hold separate two conductors 276 within a common channel 256. The two conductors 276 may be from one differential pair. The channels 256 may extend along the direction of the lateral axis 292 perpendicular to the longitudinal axis 290. In some embodiments, the channels 256 may extend substantially parallel to the board surface 208. Alternatively or in addition to, the channels 256 may extend substantially perpendicular to the slots 240. As shown, the organizer portion 232 may receive twelve total conductors 276. However, in alternative embodiment, the organizer portion 232 may receive more or less conductors 276.

[0029] The mating side 250 includes several openings 260 that lead into corresponding passages 270 (shown in Figure 5). For instance, the mating side 250 has several pairs of openings 260A and 260B. The openings 260A and 260B are configured to have a similar spatial relationship as the vias 214 (Figure 3). For example, the openings 260A and 260B may have a staggered relationship. Furthermore, the mating side 250 may have a plurality of openings 262 that lead into corresponding passages 272 (shown in Figure 5). The passages 270 are sized and

shaped to receive the terminal contacts 218 (Figure 3) that project from the mating side 235 of the base portion 230, and the passages 272 are sized and shaped to receive the shields 246 (Figure 3) from the base portion 230. Also shown, the mating side 250 may have guide posts 268 that project from the mating side 250 along the vertical axis 294. The guide posts 268 are sized and shaped to be received by the holes 248 (Figure 3) of the base portion 230.

[0030] Figure 5A is a cross-sectional view of the terminal block 142 taken along a plane that is parallel to the axes 290 and 292 (Figure 3) and intersects the channels 256. In the illustrated embodiment, the channels 256 are enclosed such that the conductors are surrounded by the body 234. The channels 256 may be co-planar with respect to each other (i.e., extend along a common plane) and/or oriented in a common direction. However, the channels 256 may not be co-planar and may be oriented in different directions in alternative embodiments.

[0031] Figures 5B and 5C are cross-sections taken along a plane that extends along the axes 292 and 294 (Figure 3). Figures 5B and 5C are through adjacent passages 270A and 270B, respectively, of one channel 256. The base portion 230 may have a mounting side 236 that is configured to be mounted on the board surface 208 of the circuit board 114. The contact slots 240 may extend from the mounting side 236 therethrough. When the base portion 230 is mounted on the board surface 208, the board surface 208 and the mounting side 236 extend along an interface I_1. In order to assemble the terminal block 142, the terminal contacts 218 and shields 246 may be inserted into the corresponding contact slots 240 and shield slots 242 (Figure 4) within the base portion 230. The base portion 230 may then be mounted onto the circuit board 114 by inserting pin portions 219 of the terminal contacts 218 into corresponding vias 214. With respect to the organizer portion 232, the conductors 276 may be inserted into the openings 254 and advanced through the corresponding channels 256 for a predetermined length. With the terminal contacts 218 and shields 246 projecting from the mating side 235 of the base portion 230 as shown in Figure 3, the organizer portion 232 may be mounted or stacked onto the base portion 230. The terminal contacts 218 advance into the corresponding passages 270 and electrically couple to the corresponding conductor 276.

[0032] However, in alternative embodiments, the terminal block 142 may be assembled by other methods. For example, the terminal contacts 218 and the shields 246 may first be inserted into the organizer portion 232 and then lowered onto the base portion 230 such that the terminal contacts 218 are inserted into the corresponding contacts slots 240 and the shields 246 are inserted into the corresponding shield slots 242.

[0033] As shown in Figures 5B and 5C, when the organizer portion 232 is engaged with the base portion 230, the mating sides 235 and 250 extend along an interface I_2. In some embodiments, the mating sides 235 and 250 are substantially planar. However, in other embodiments, the mating sides 235 and 250 may not be substantially planar and may (or may not) have complementary surfaces. Each contact slot 240A aligns with a corresponding opening 260A of a corresponding passage 270A, and each contact slot 240B aligns with a corresponding opening 260B of a corresponding passage 270B. The terminal contacts 218 advance through corresponding passages 270 when the organizer portion 232 and the base portion 230 are engaged. When the terminal contacts 218 reach the corresponding channels 256, the terminal contacts 218 electrically couple or engage with the corresponding conductor 276. For example, the terminal contact 218 may pierce or slice through a jacket of the conductor 276 and connect to a conductive core therein.

[0034] As shown, the terminal contact 218 within the passage 270A electrically couples to the conductor 276A approximately at a point P_1, and the terminal contact 218 within the passage 270B electrically couples to the conductor 276B approximately at a point P_2. The points P_1 and P_2 are separated from each other by the longitudinal distance Y_1 and by a lateral distance X_3. (The lateral distance X_3 is approximately equal to a difference between lateral distances X_1 and X_2 shown in Fig 3.) Accordingly, two conductors 276 of one differential pair may be engaged at separate axial locations within one channel 256. Separating the points P_1 and P_2 may facilitate improving the performance of the connector 100 (Figure 1).

[0035] Furthermore, in the illustrated embodiment, the shields 246 are located within the passages 272. The passages 272 extend between adjacent

conductors 276 from separate differential pairs. The shield 246 may be sized and shaped to improve the performance of the connector 100. For example, the shields 246 may be configured to reduce electromagnetic coupling between adjacent conductors 276 and/or to dissipate heat generated by the conductors 276 within the channels 256. Accordingly, the distances X_3 and Y_1 and the shields 246 may be configured for a desired performance.

[0036] Figures 6-8 illustrate alternative embodiments of terminal blocks and board assemblies. Figure 6 is a perspective view of a terminal base portion 330. The base portion 330 has a mating side 335 and a mounting side 336 that is configured to be mounted onto a board surface of a circuit board (not shown). The base portion 330 also includes pairs 320 of contact slots 340 that are configured to hold terminal contacts 318. The contact slots 340 of each pair 320 are aligned with one another side-by-side (i.e., each contact slot 340 of one pair 320 is a common distance X_4 or X_5 away from a loading side 352 of the base portion 330). As such, the pairs 320 of the contact slots 340 are staggered along a length L_4 of the base portion 330.

[0037] Also shown in Figure 6, each pair of terminal contacts 318 may be separated by two shields 346. The shields 346 are sized and shaped to prevent electrical interference between adjacent pairs of terminal contacts 318. As shown, the terminal contacts 318 are similar to the terminal contacts 218, and the shields 346 are similar to the shields 246. However, other terminal contacts and shields may be used. Furthermore, although not shown, an organizer portion may have channels with or without passages leading into the channels that align with the terminal contacts when the organizer portion is mounted onto the base portion.

[0038] Figure 7 is a perspective view of a board assembly 430 formed in accordance with an alternative embodiment. The board assembly 430 may have similar features as described above with respect to the board assembly 130. For example, the board assembly 430 has a loading end 460, a mating end 415, and a length L_5 of a circuit board 414 extending therebetween. Furthermore, the board assembly 430 may include a pair of terminal blocks 442 and 443 that are mounted

onto a board surface 408 of the circuit board 414. The terminal blocks 442 and 443 may each include a terminal base portion 431 and an organizer portion 432 that facilitate electrically coupling terminal contacts 418 to conductors (not shown). The base portion 431 may have contact slots 440 and shield slots 444 configured to hold the terminal contacts 418 and shields 446, respectively.

[0039] However, as shown in Figure 7, the organizer portion 432 may include a mating side 450 that has open-sided channels 456 extending therealong. The open-sided channels 456 may be configured to receive two conductors, such as two conductors from a differential pair. The organizer portion 432 also includes a loading side 452 having openings 454 therealong. In the illustrated embodiment, the open-sided channels 456 are configured for an interference fit with the corresponding conductors.

[0040] Also shown in Figure 7, the shields 446 may be substantially cross-shaped and configured for an interference fit with the shield slots 444 and corresponding passages (not shown) within the organizer portion 432. More specifically, the shield 446 may include a laterally oriented base 448 and a pair of vertically oriented retention features 447 and 449. The retention features 447 and 449 may extend away from the base 448 in opposite directions with respect to each other. Also, the retention features 447 and 449 may extend substantially perpendicular to the base 448. As shown, the retention features 447 and 449 may be shaped to form interference fits with the base and organizer portions 431 and 432. For example, the retention features 447 and 449 may include barbs 451 that project laterally away from the corresponding retention feature 447 or 449. As such, the shields 446 may facilitate shielding and/or dissipating heat generated by the conductors and may also facilitate securing the base and organizer portions 431 and 432 together.

[0041] Also shown, when the terminal block 442 is fully assembled, the loading side 452 of each terminal block 443 and 442 may be separated by and face each other across a spacing S_2 along a width W_4 of the board assembly 430. The spacing S_2 is sized so that a plurality of twisted pairs of conductors (not shown) may fit between the terminal blocks 443 and 442. In particular, the spacing S_2 may be

sized so that numerous differential pairs may be received along the board surface 408 of the circuit board 414. The conductors may extend lengthwise along the circuit board 414 and then bend into the corresponding openings 454 along the loading sides 452. Accordingly, the board assembly 430 may be configured to receive numerous differential pairs and electrical engage the corresponding conductors to the circuit board 414.

[0042] Figure 8 illustrates a pair of board assemblies 530 and 531 that are coupled together by a board frame 502. The board assemblies 530 and 531 may have similar or identical elements and features and include circuit boards 514 and 513, respectively, with respective board surfaces 508 and 509. However, the board surfaces 508 and 509 may face away from each other in opposite directions. The board assembly 530 includes terminal blocks 541 and 542, and the board assembly 531 includes terminal blocks 543 and 544. Each terminal block 541-544 includes an organizer portion 532 that has open-sided channels 556 extending along a mating side 550 of the organizer portion. Each open-sided channel 556 may be configured for an interference fit with a corresponding conductor (not shown). As such, the organizer portion 532 can hold conductors therein during the assembly of the corresponding terminal block and the board assemblies 530 and 531 such that the conductors do not inadvertently fall out of the channels 556.

[0043] Each terminal block 541-544 may electrically couple twelve conductors (not shown) to corresponding terminal contacts 518. The terminal contacts 518 are shown as IDC's in Figure 8 having eye-of-needle contacts that form an interference fit with corresponding vias 517. In the illustrated embodiment, the terminal contacts 518 are staggered with respect to each other and do not have a shield therebetween. Accordingly, the board assemblies 530 and 531 may be coupled together by the board frame 502 and inserted into an interior of a connector housing (not shown). The coupled board assemblies 530 and 531 may electrically interconnect, for example, forty-eight (48) conductors from a cable.

[0044] In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing

from its scope. For example, although Figures 3-8 show terminal blocks as being constructed by separate base portions and organizer portions, embodiments may include terminal blocks that are integrally formed with the features of the base portions and organizer portions described above. Figure 9 illustrates such an example and, more particularly, a cross-section that is similar to the cross-sections shown in Figures 5B and 5C, except without the interface I_2. As shown, a base portion 630 and organizer portion 632 may be integrally formed into a terminal block 642 (e.g., through an injection molding process). As such, the base portion 630 is positioned between the organizer portion 632 and a circuit board 614, and the organizer portion 632 extends away from the base portion 630 and the circuit board 614.

[0045] As shown in Figure 9, a terminal contact 618 may be inserted through the bottom of the terminal block (i.e., through a mounting side 636 that eventually forms an interface I_3 with a board surface 608 of the circuit board 614). Conductors 676 may be inserted into channels 656 before the terminal block 642 is interfaced with the circuit board 614 along the interface I_3 and before the terminal contacts 618 are inserted into the terminal block 642. After the conductors 676 are inserted into the channels 656, the integrally formed terminal block 642 may be mounted on the board surface 608. Accordingly, a "base portion" and an "organizer portion" may be portions of a terminal block having one integrally formed body or may be separate components. Also, although not shown, the terminal block 642 may include shield slots configured to form an interference fit with shields. The shields may be inserted into the terminal block 642 through the mounting side 636 or any other side of the terminal block 642.

[0046] In other alternative embodiments, the base portions and the organizer portions may be integrally formed with other components of the connector. For example, the organizer portion 232 of Figure 3 may be integrally formed with the housing shell 120 (Figure 1). Furthermore, in alternative embodiments where the circuit board 114 is substituted with a plastic electrical component that houses conductive pathways, the base portion 230 may be integrally formed with the plastic component.

WHAT IS CLAIMED IS:

1. A terminal block (140, 142, 144, 442, 443, 541-544, 642) for electrically coupling conductors (276, 676) and terminal contacts (218, 318, 418, 518, 618), the terminal block comprising:

a terminal base portion (230, 330, 431, 660) having a mounting side configured to be mounted to a surface of an electrical component, the base portion having contact slots (240, 340, 440) extending from the mounting side therethrough, the contact slots being configured to receive terminal contacts (218, 318, 418, 518, 618) that are electrically coupled to the electrical component; and

an organizer portion (232, 432, 532, 632) extending from the base portion and comprising channels (256, 456, 556, 656) extending substantially parallel to the surface of the electrical component, the channels configured to receive corresponding conductors (276, 676), wherein the contact slots of the base portion align with corresponding channels of the organizer portion so that the terminal contacts electrically couple the conductors.

2. The terminal block (140, 142, 144, 442, 443, 541-544) of claim 1 wherein the base and organizer portions are separate components having respective mating sides, the mating sides of the base and organizer portions configured to engage each other along an interface such that the contact slots (240, 340, 440) are aligned with the corresponding channels (256, 456, 556).

3. The terminal block (140, 142, 144, 442, 443, 541-544) in accordance with claim 2 wherein the channels (456, 556) are open-sided channels that open towards the mating side of the base portion.

4. The terminal block (140, 142, 144, 442, 443, 541-544) in accordance with claim 2 wherein the channels (256) are enclosed channels configured to hold the conductors (276) therein, the organizer portion (232) having passages (270) that extend from the mating side and into corresponding channels the passages configured to receive the terminal contacts (218) from the base portion.

5. The terminal block (140, 142, 144, 442, 443, 541-544, 642) in accordance with claim 1 wherein each channel (256, 456, 556, 656) is configured to hold multiple conductors (276, 676).

6. The terminal block (140, 142, 144, 442, 443, 541-544, 642) in accordance with claim 1 wherein the channels (256, 456, 556, 656) extend along a common plane.

7. The terminal block (140, 142, 144, 442, 443, 541-544, 642) in accordance with claim 1 wherein the organizer portion (232, 432, 532, 632) further comprises a passage (272) located between adjacent channels (256, 456, 556, 656) and configured to hold a shield (246, 346, 446) therein.

8. The terminal block (140, 142, 144, 442, 443, 541-544, 642) in accordance with claim 1 wherein each channel (256, 456, 556, 656) extends along an axis between a loading side and an opposite distal side of the organizer portion (232, 432, 532, 632), wherein adjacent contact slots (240, 340, 440) of the base portion (230, 330, 431, 660) have different axial positions so that the terminal contacts (218, 318, 418, 518, 618) electrically couple to the conductors (276, 676) at different axial positions along the axis.

9. The terminal block (140, 142, 144, 442, 443, 541-544, 642) in accordance with claim 1 wherein the terminal contacts (218, 318, 418, 518, 618) are one of insulation piercing contacts (IPC) and insulation displacement contacts (IDC),

10. A board assembly for an electrical connector or device:

a circuit board (114, 414, 514, 614) having a surface;

terminal contacts (218, 318, 418, 518, 618) electrically coupled to the circuit board; and

a terminal block (140, 142, 144, 442, 443, 541-544, 642) mounted on the surface of the circuit board, the terminal block (140, 142) comprising:

a terminal base portion (230, 330, 431, 660) having a mounting side configured to be mounted to the surface of the circuit board, the base portion having contact slots (240, 340, 440) extending from the mounting side therethrough, the contact slots being configured to receive terminal contacts (218, 318, 418, 518, 618) that are electrically engaged to the circuit board; and

an organizer portion (232, 432, 532, 632) comprising channels (256, 456, 556, 656) extending substantially parallel to the surface of the circuit board, the channels configured to receive corresponding conductors (276, 676), wherein the contact slots of the base portion align with corresponding channels of the organizer portion so that the terminal contacts electrically engage the conductors.

11. The board assembly of claim 10 wherein the base and organizer portions are separate components having corresponding mating sides, the mating sides of the base and organizer portions configured to engage each other along an interface such that the contact slots (240, 340, 440) are aligned with the corresponding channels (256, 456, 556, 656).

12. The board assembly in accordance with claim 10 wherein the channels (256, 456, 556, 656) extend along a common plane.

13. The board assembly in accordance with claim 11 wherein the organizer portion (232, 432, 532, 632) further comprises passages (270) that extend from the mating side of the body and into a corresponding channel, each passage (270) configured to receive the terminal contact (218, 318, 418, 518, 618) that is configured to electrically engage the conductor within the corresponding channel.

14. The board assembly in accordance with claim 13 wherein the passages (270) of adjacent channels (256, 456, 556, 656) have different axial positions with respect to each other.

15. The board assembly in accordance with claim 10 further comprising shields (246, 346, 446) located between adjacent channels (256, 456, 556, 656), each shield including a laterally oriented base and first and second vertically oriented retention features, the first and second retention features extending away from the base in opposite directions with respect to each other and substantially perpendicular to the base, the first and second retention features being shaped to form interference fits with the base and organizer portions, respectively.

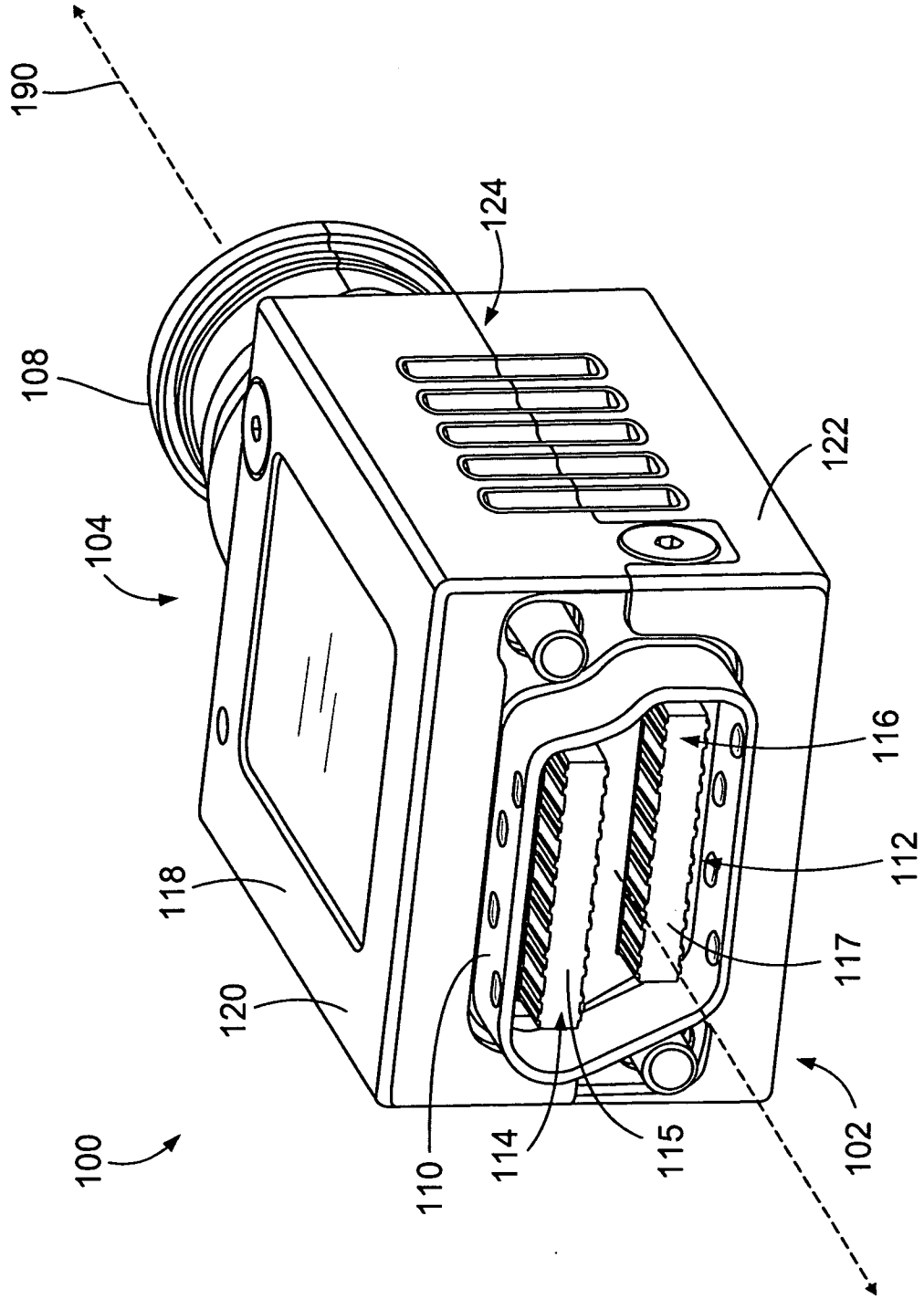


FIG. 1

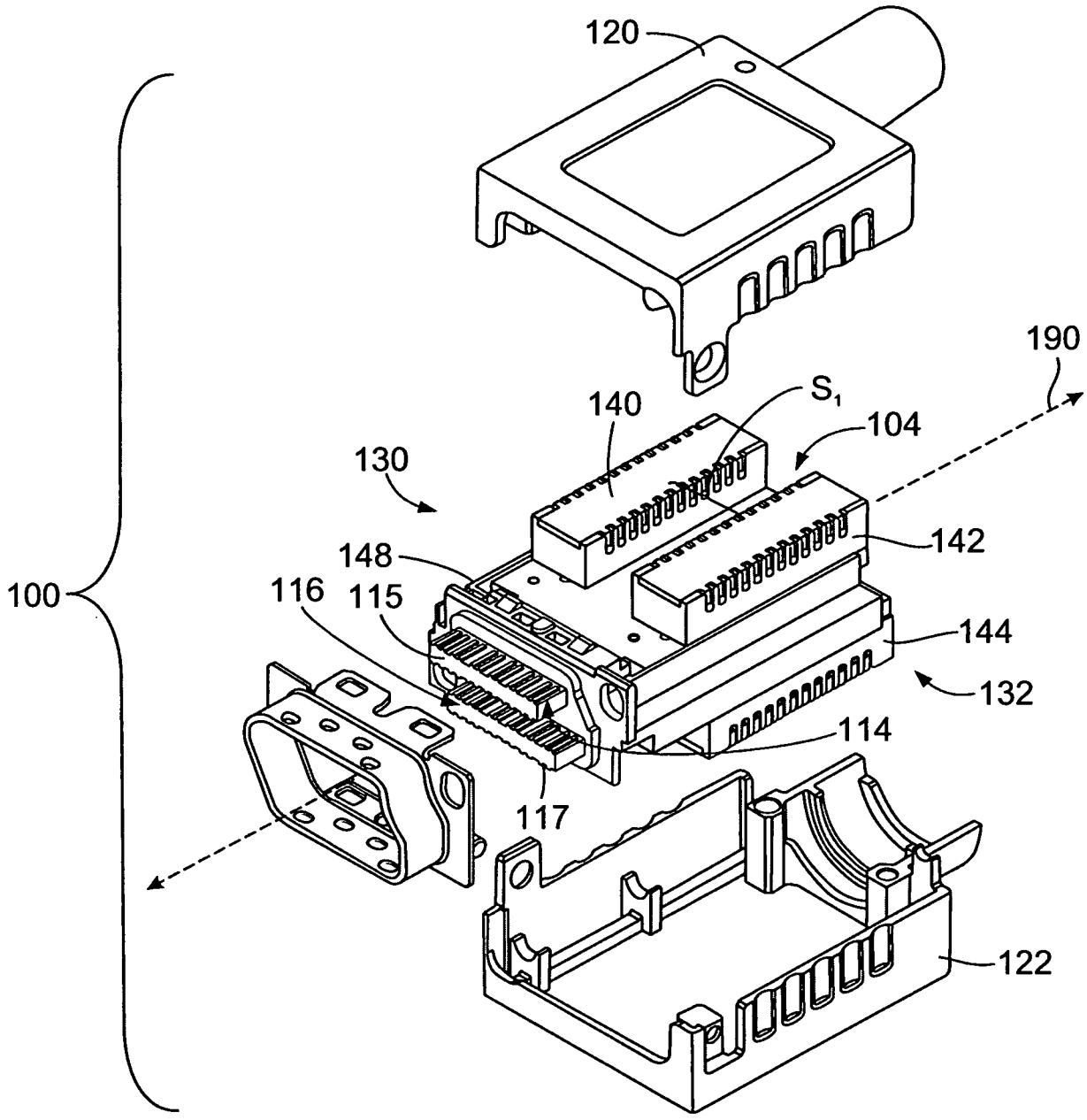
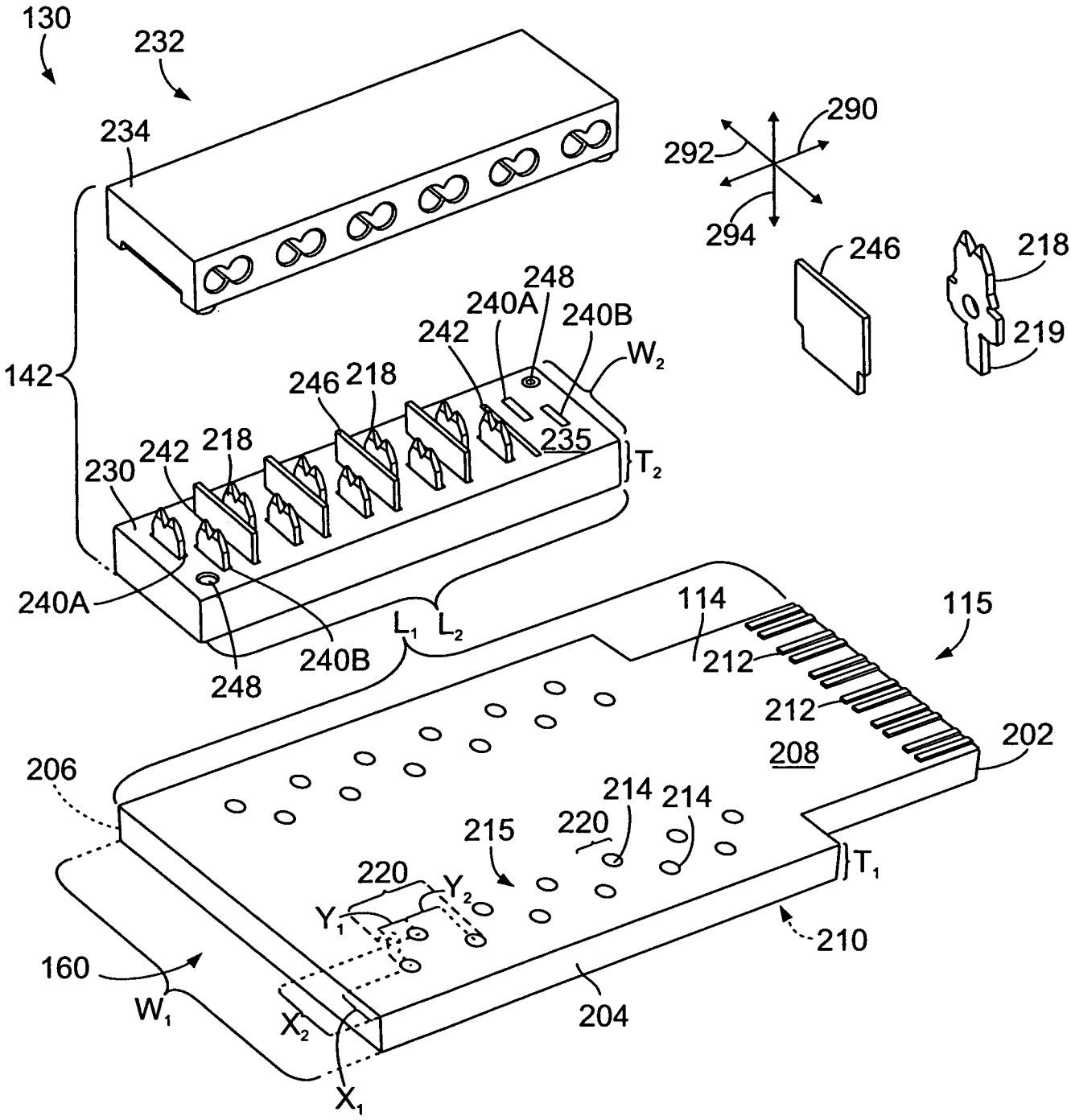


FIG. 2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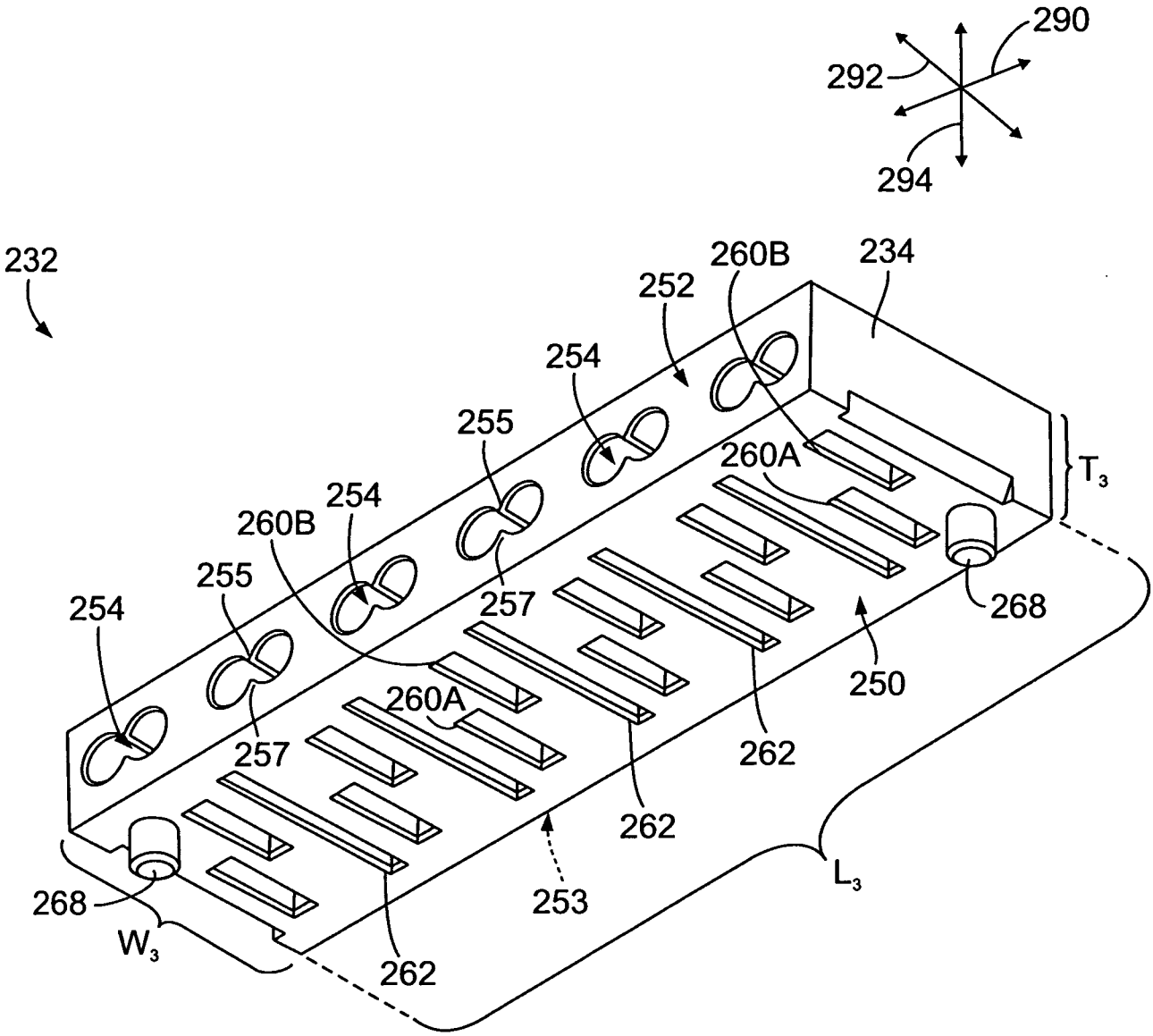
232
234
290
292
294
246
218
219
248
240A
240B
242
W_2
142
246
218
235
T_2
230
242
218
240A
240B
248
L_1
L_2
114
115
212
212
202
208
206
214
214
220
215
220
Y_2
Y_1
T_1
210
160
W_1
X_2
204
X_1

FIG. 3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260B
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260A
T_3
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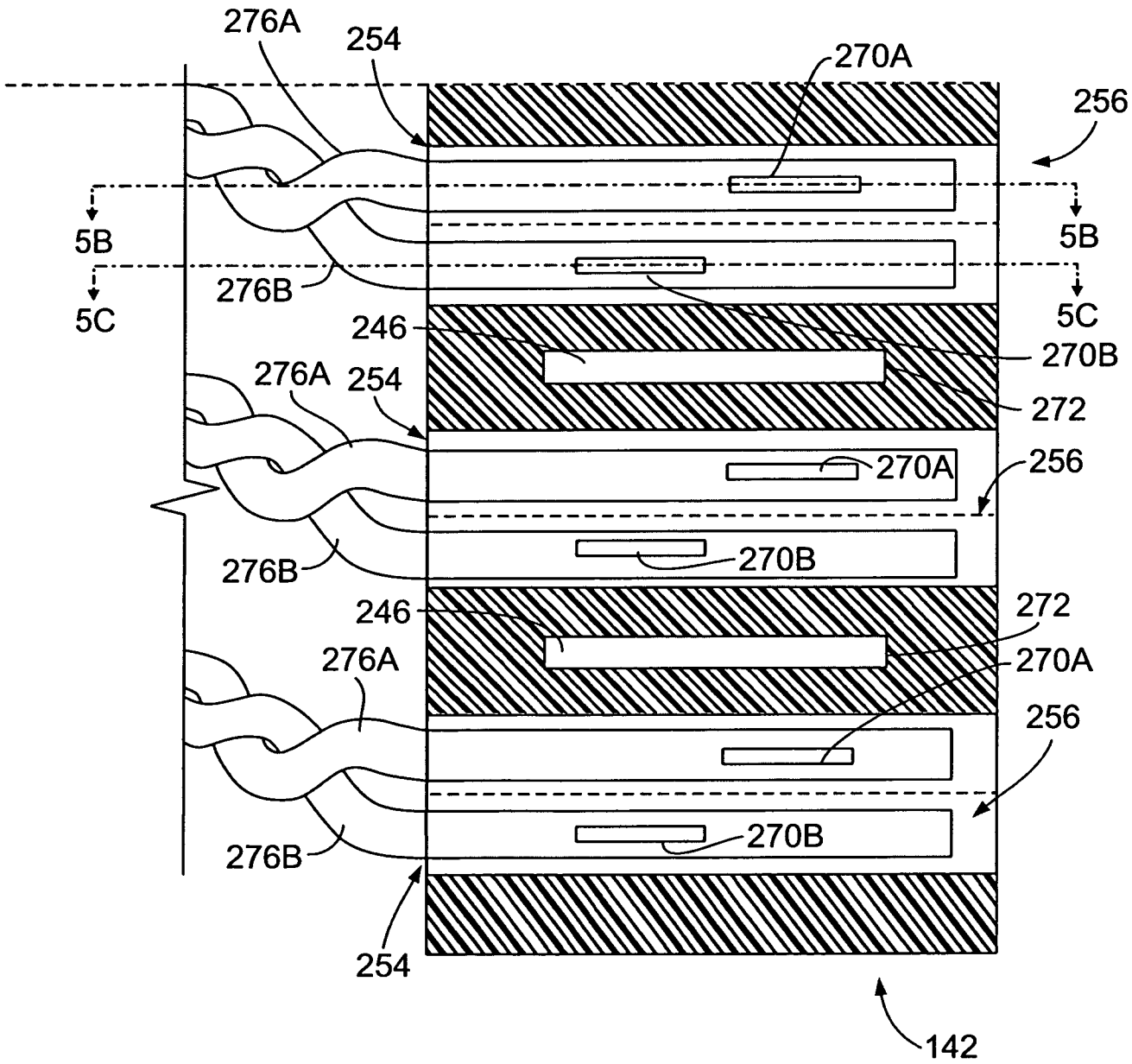
268
250
262
253
L_3
W_3

FIG. 4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254
270A
256
5B
5B
276B
5C
5C
246
270B
276A
254
272
270A
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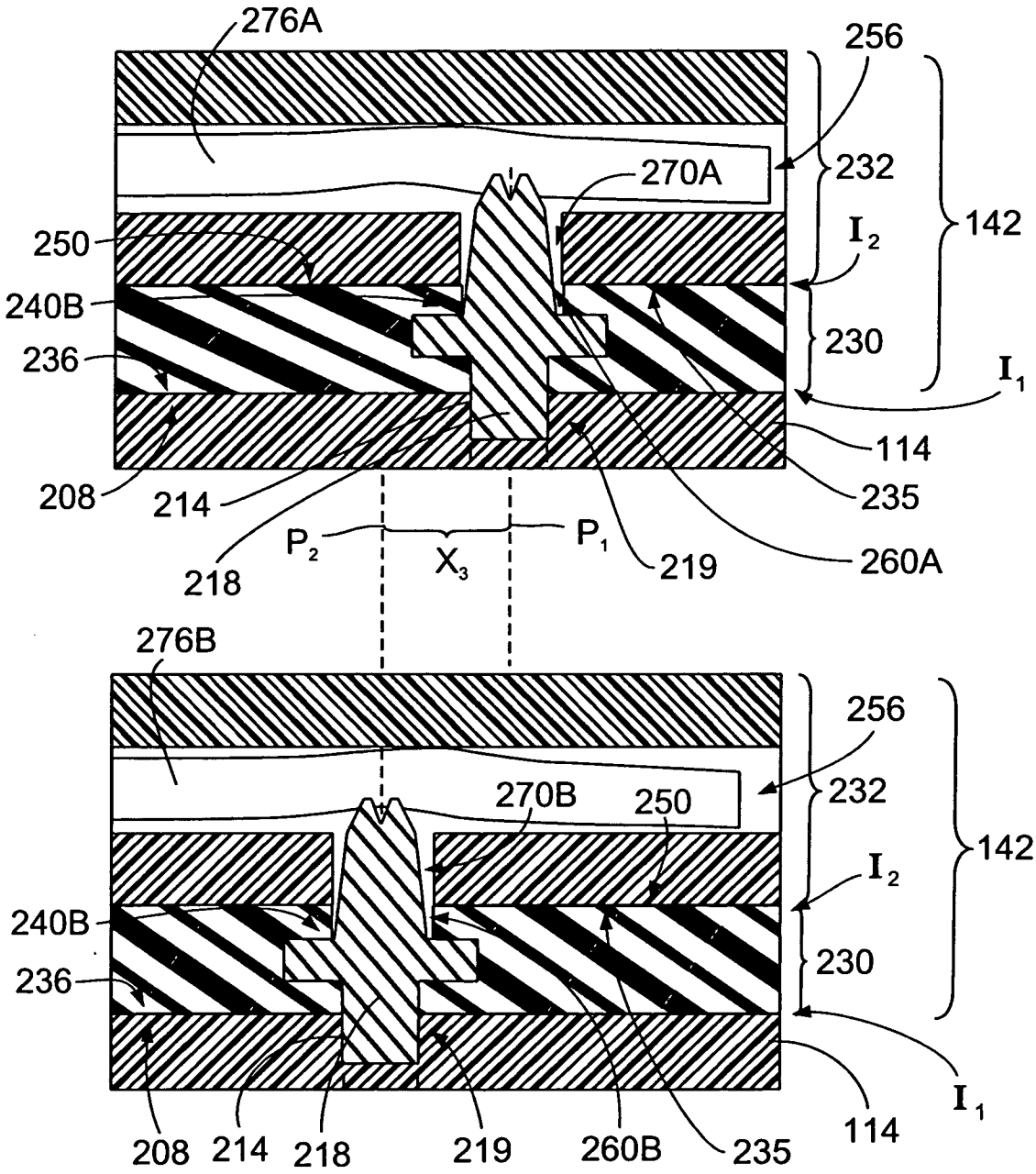
276B
270B
246
272
276A
270A
256
276B
270B
254
142

FIG. 5A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270A
142
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I_2
240B
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236
I_1
114
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214
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P_2
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X_3
219
260A
276B
256
270B
250
232
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I_2
240B
230
236
I_1
114
208
214
218
219
260B
235

FIG. 5B

FIG. 5C

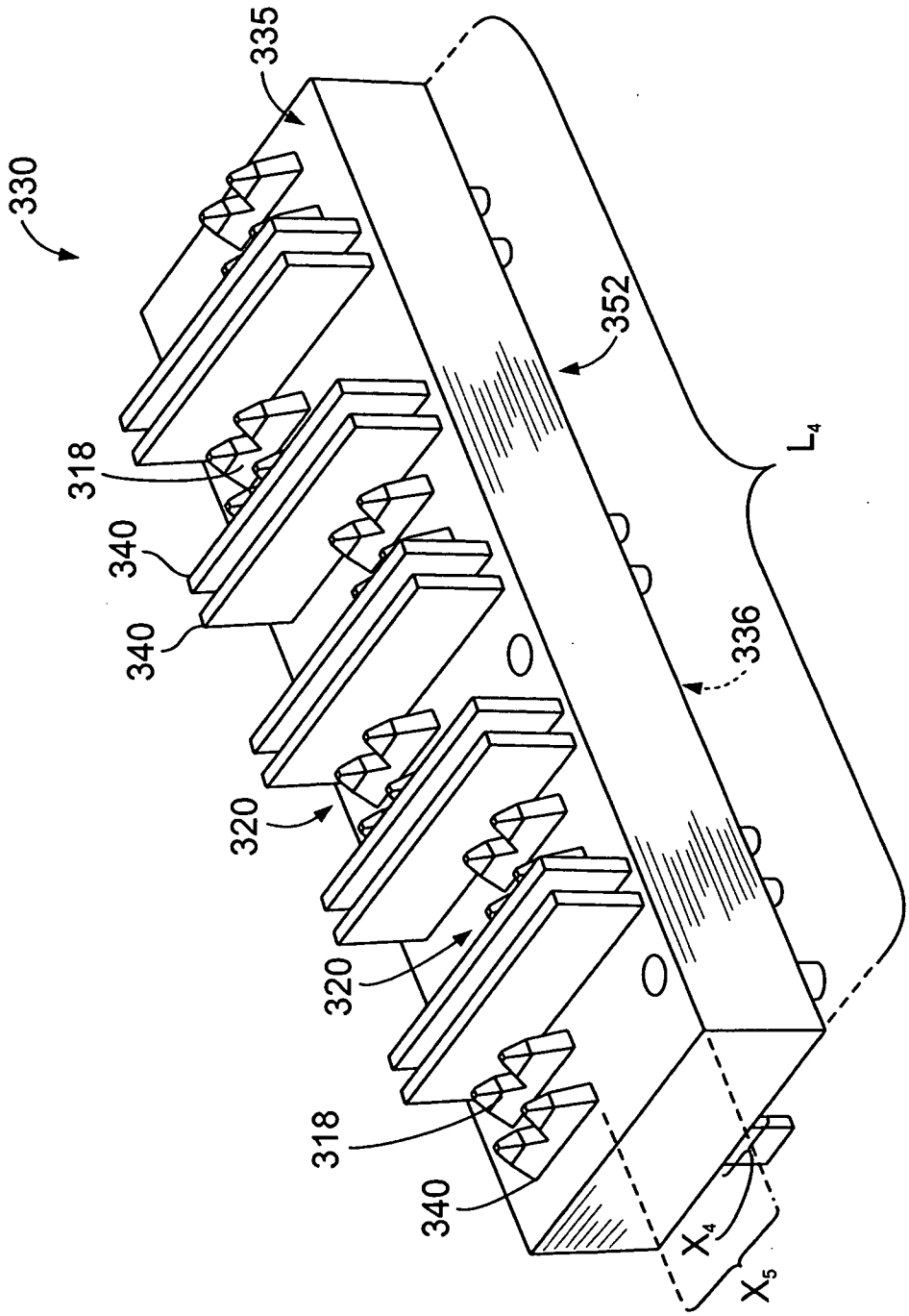
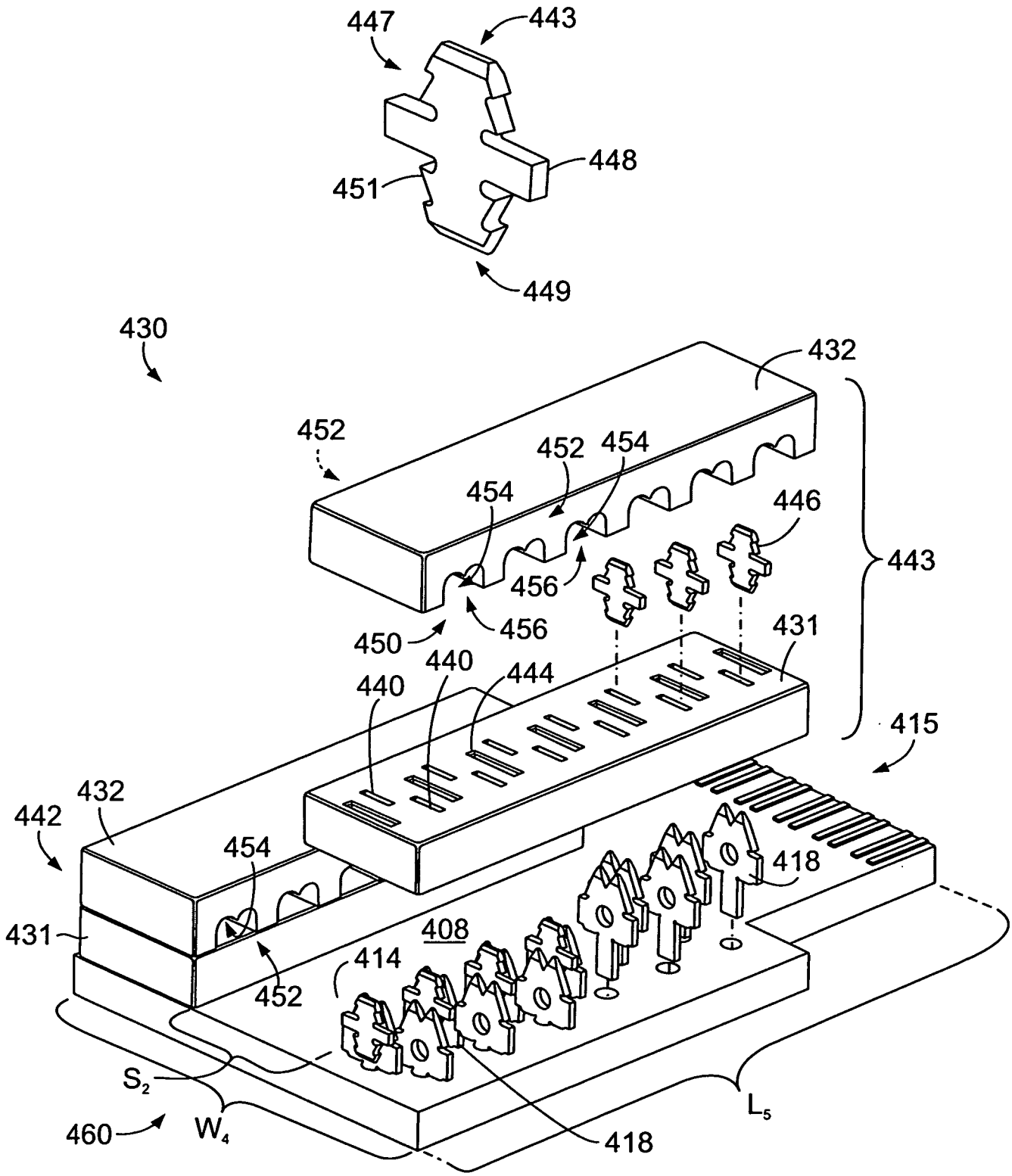


FIG. 6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418
431
408
414
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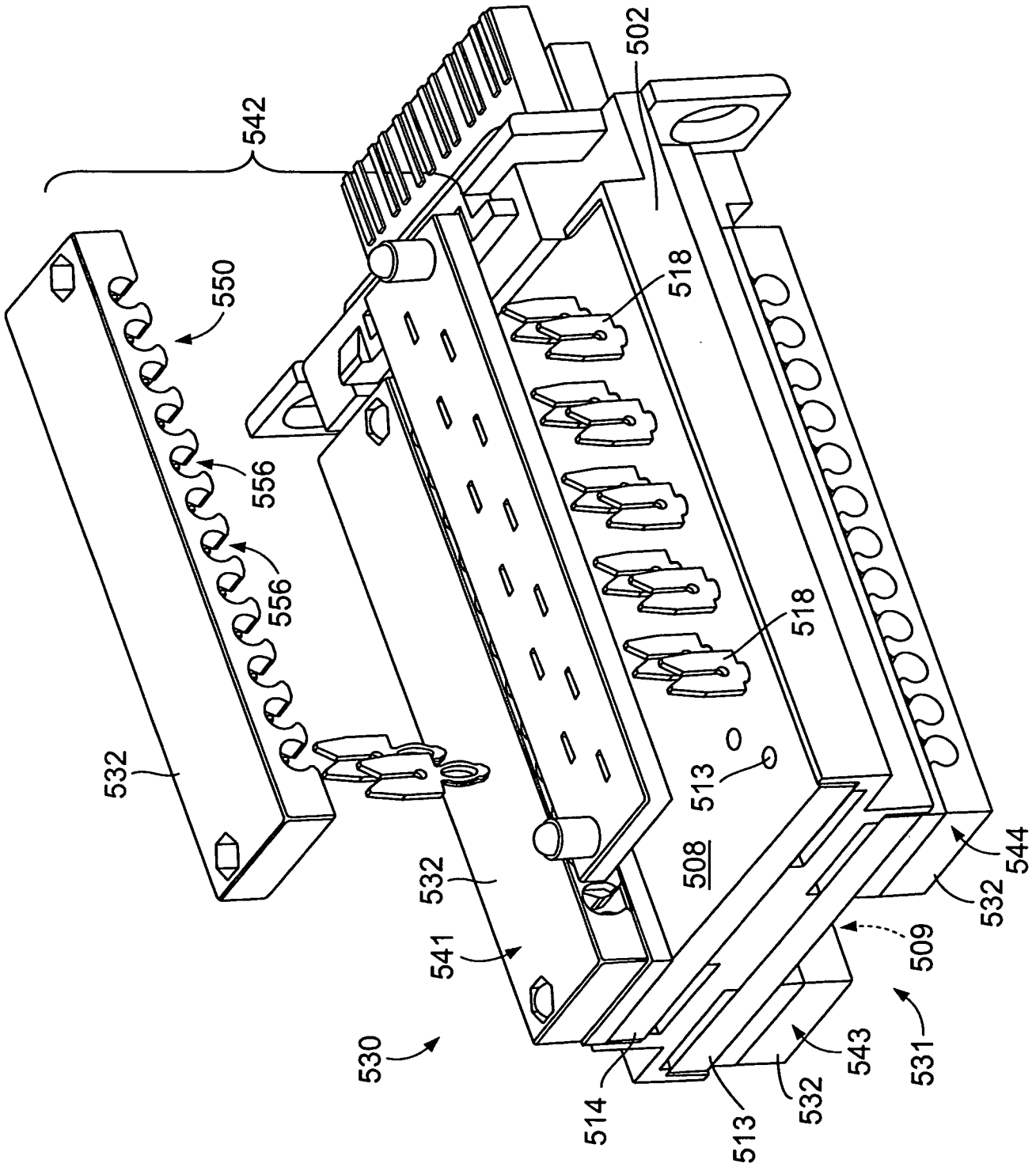
S_2
460
W_4
418
L_5

FIG. 7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513
532

FIG. 8

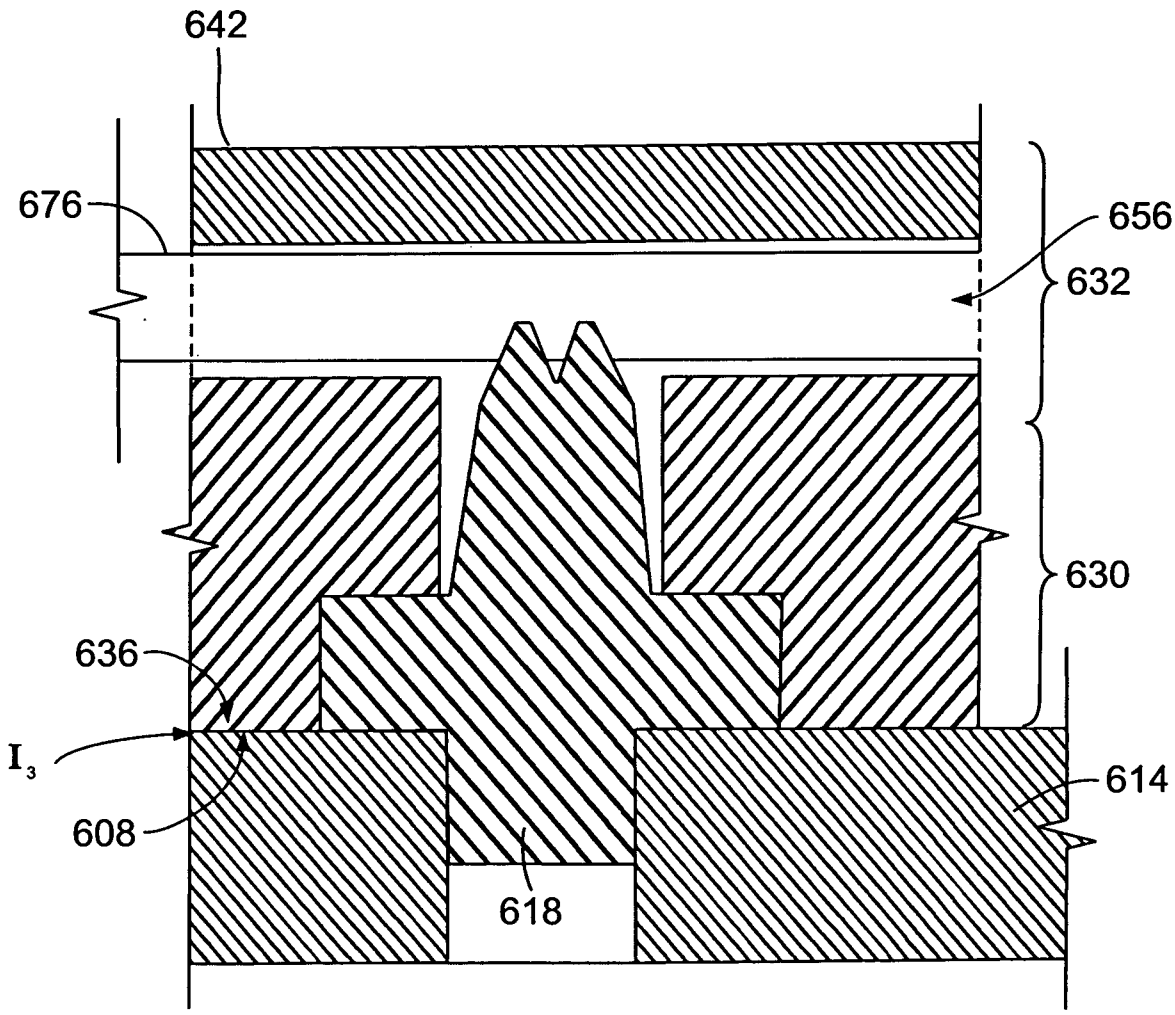

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2010/002196

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R4/24
ADD.

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)
H01R

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96/01510 A1 (MAGNIER BERNARD [FR]) 18 January 1996 (1996-01-18) the whole document	1-15
X	DE 198 23 647 C1 (METZ ALBERT RIA ELECTRONIC [DE]) 23 September 1999 (1999-09-23) column 2, line 56 - line 67; figures 1,2 column 3	1-15
X	EP 0 700 126 A1 (BKS KABEL SERVICE AG [CH]) 6 March 1996 (1996-03-06)	1,10
A	column 4, line 46 - line 59; figures 2,3 column 5 - column 8	2-9, 11-15
X	WO 97/23020 A1 (WHITAKER CORP [US]) 26 June 1997 (1997-06-26) page 5 - page 8; figures 1-7	1-15

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

☒ See patent family annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 November 2010	17/11/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Durand, François

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2010/002196

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		DE 59404901 D1	05-02-1998
WO 9723020 A1	26-06-1997	DE 69622604 D1	29-08-2002
		DE 69622604 T2	20-03-2003
		EP 1016167 A1	05-07-2000
		JP 2000502207 T	22-02-2000
		US 5667402 A	16-09-1997