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(54) **CONNECTOR FOR A SINGLE TWISTED PAIR OF CONDUCTORS**

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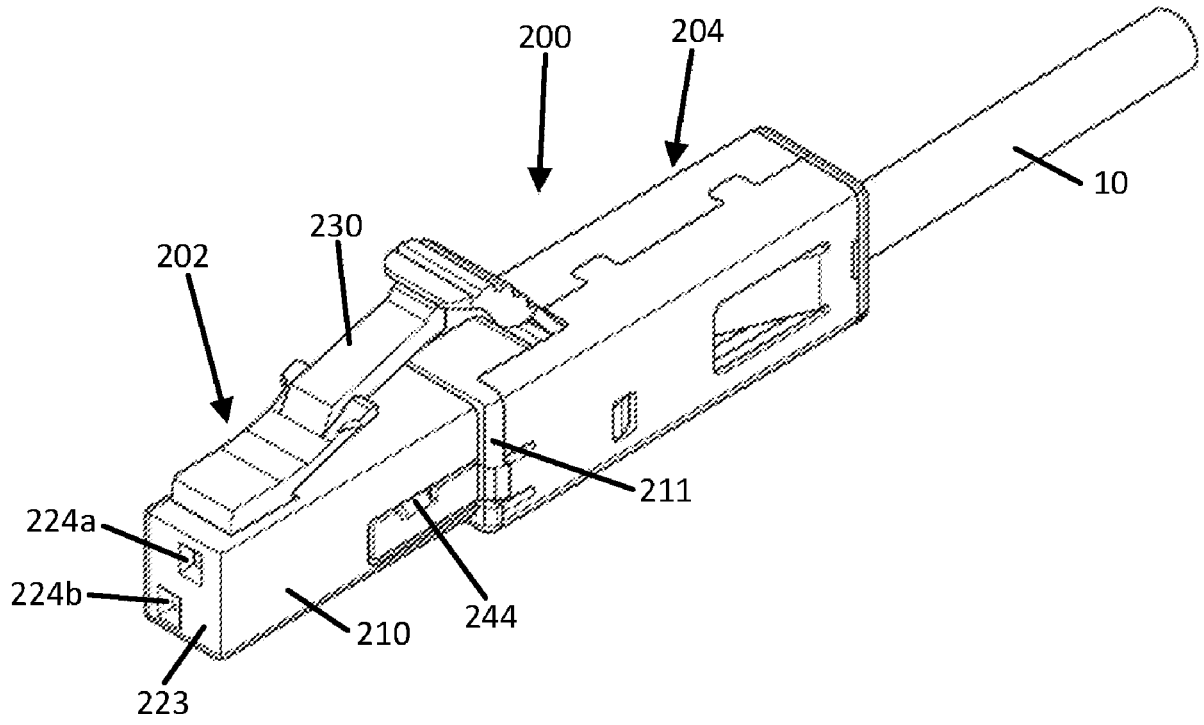
(52) **U.S. Cl.**

CPC ***H01R 13/502*** (2013.01); ***H01R 4/2425*** (2013.01); ***H01R 13/6463*** (2013.01); ***H01R 43/18*** (2013.01)

(57) **ABSTRACT**

A connector includes a forward connector body, a rear connector body that interfaces with the forward connector body and a metal frame positioned about the forward and rear connectors bodies. The rear connector body defines a central channel to receive a single pair of conductors. Each of a first and second side face of the rear connector body includes an elongate opening that extends through a front face of the rear connector body to provide access to an upward channel and a downward channel, respectively, of a contact receiving portion of the rear connector body. The metal frame includes a rearward portion and a forward portion. The rearward portion of the metal frame is positioned about the rear connector body as well as a rearward portion of the forward connector body while the forward portion of the metal frame is positioned about a forward portion of the forward connector body.



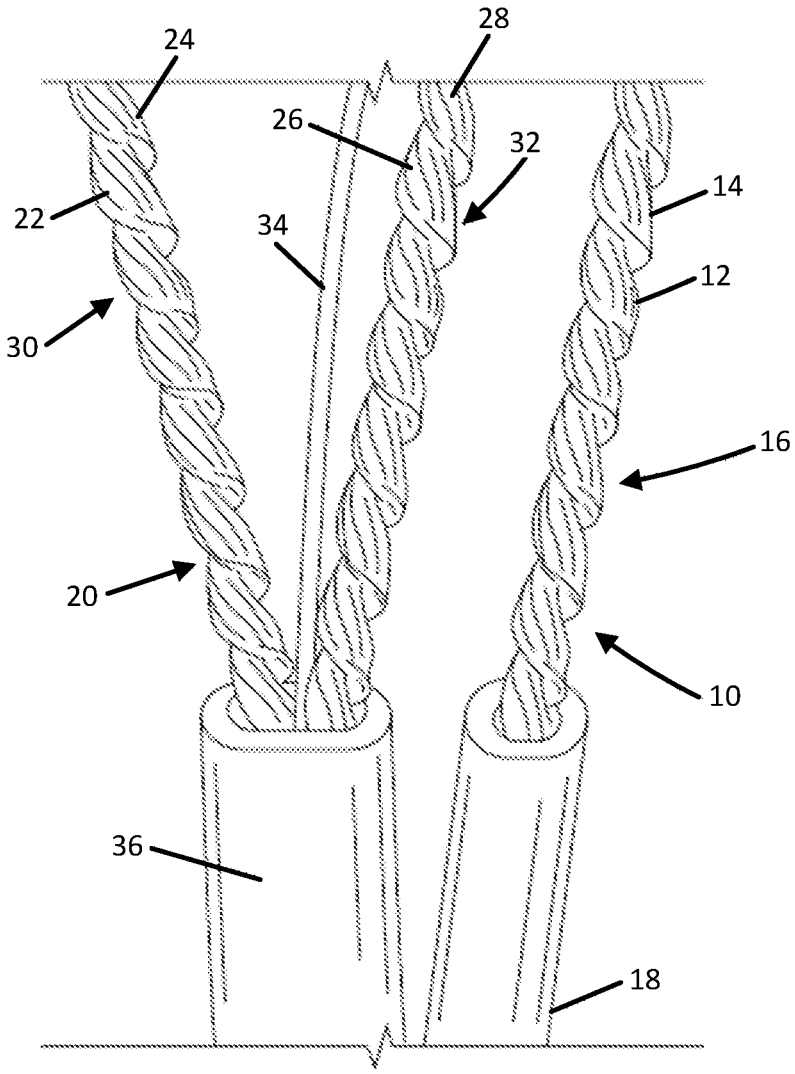


FIG. 1A

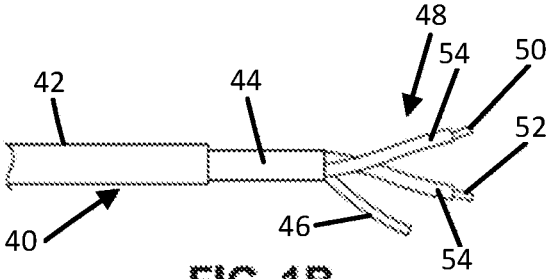


FIG. 1B

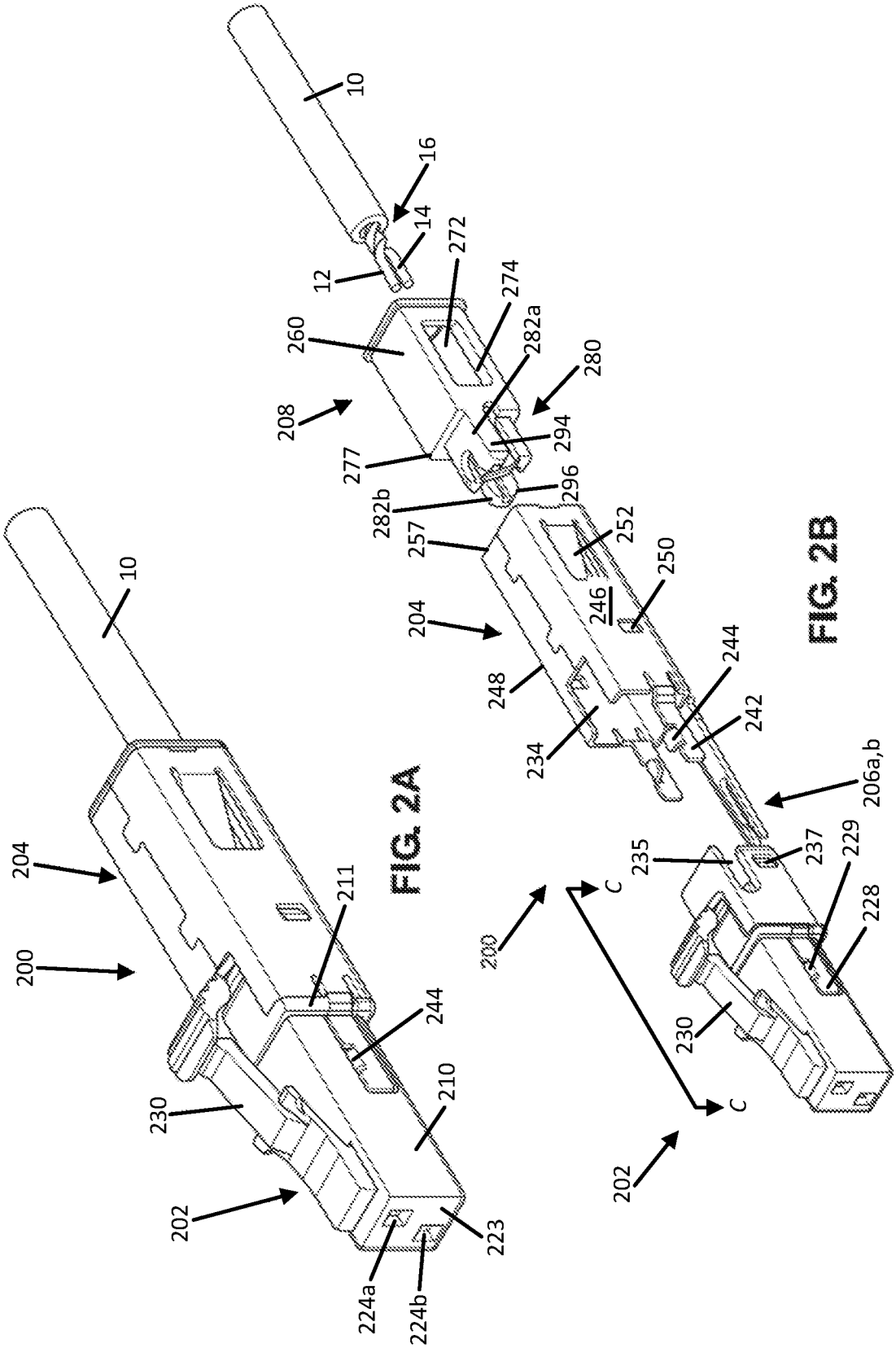

10
16
14
12
272
274
260
282a
280
208
277
294
296
282b
257
252
250
246
204
248
244
242
234
206a,b
235
237
229
228
230
C
C
210
202
200
211
223
224a
224b

FIG. 2A

FIG. 2B

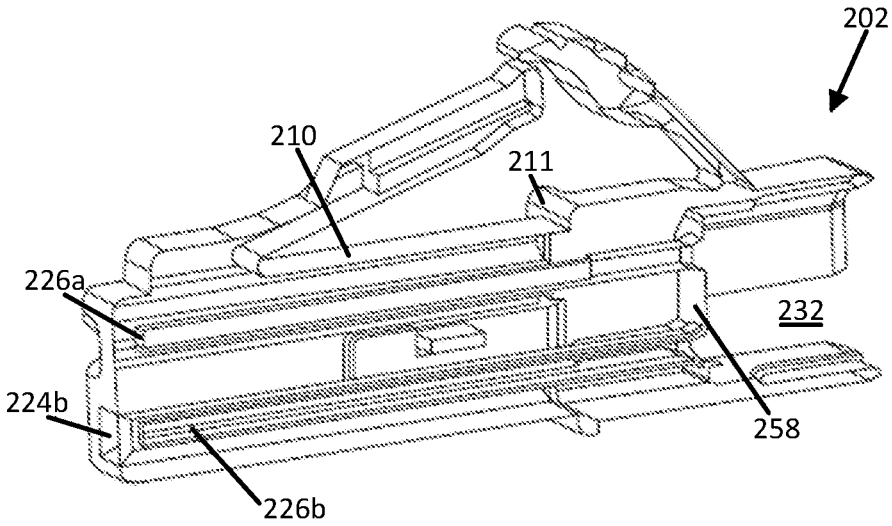

202
210
211
226a
232
224b
258
226b

FIG. 2C

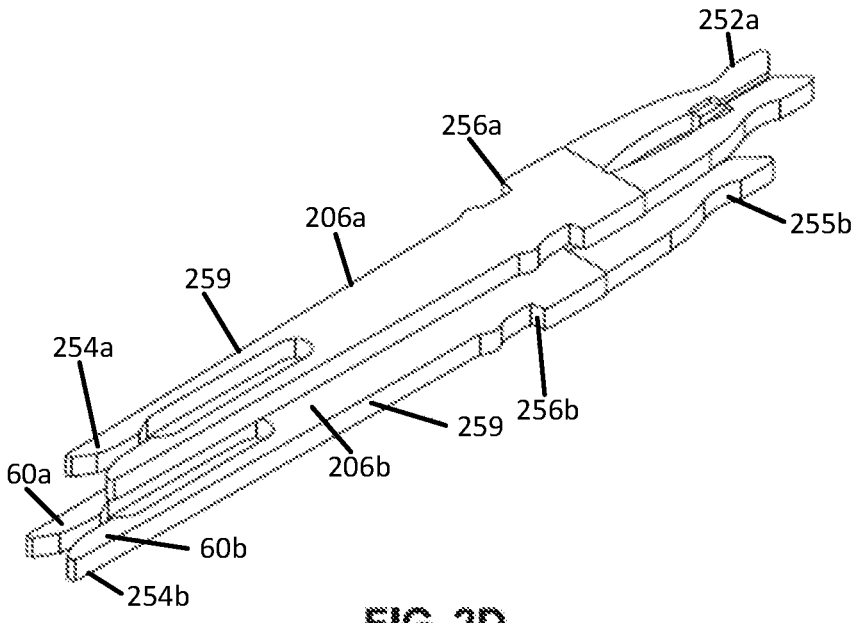

252a
256a
206a
255b
259
254a
256b
259
206b
60a
60b
254b

FIG. 2D

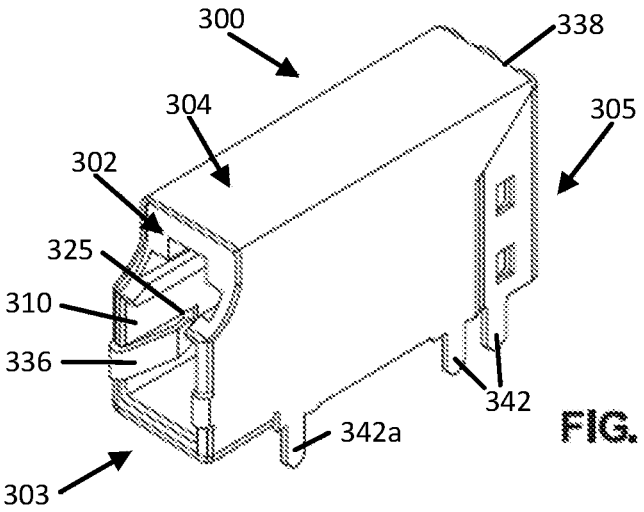


FIG. 3A

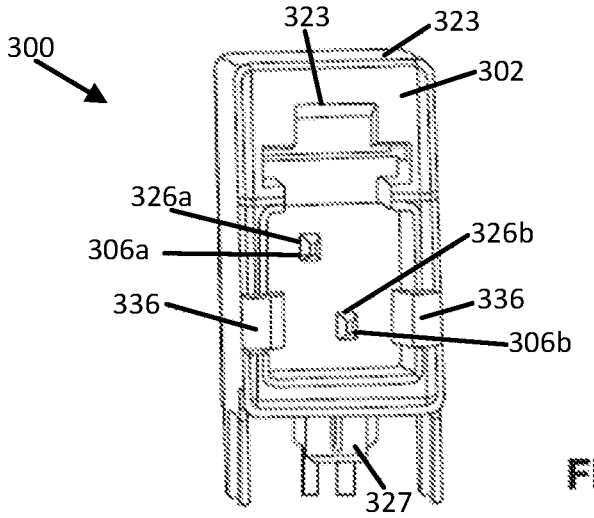


FIG. 3B

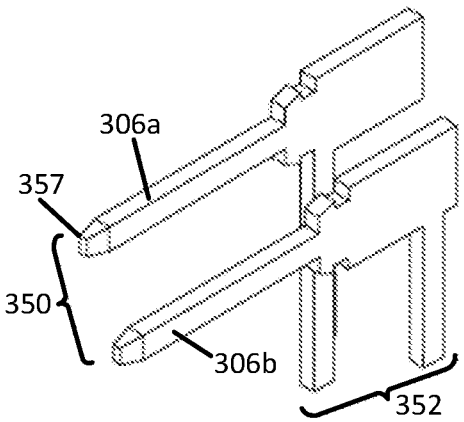


FIG. 3C

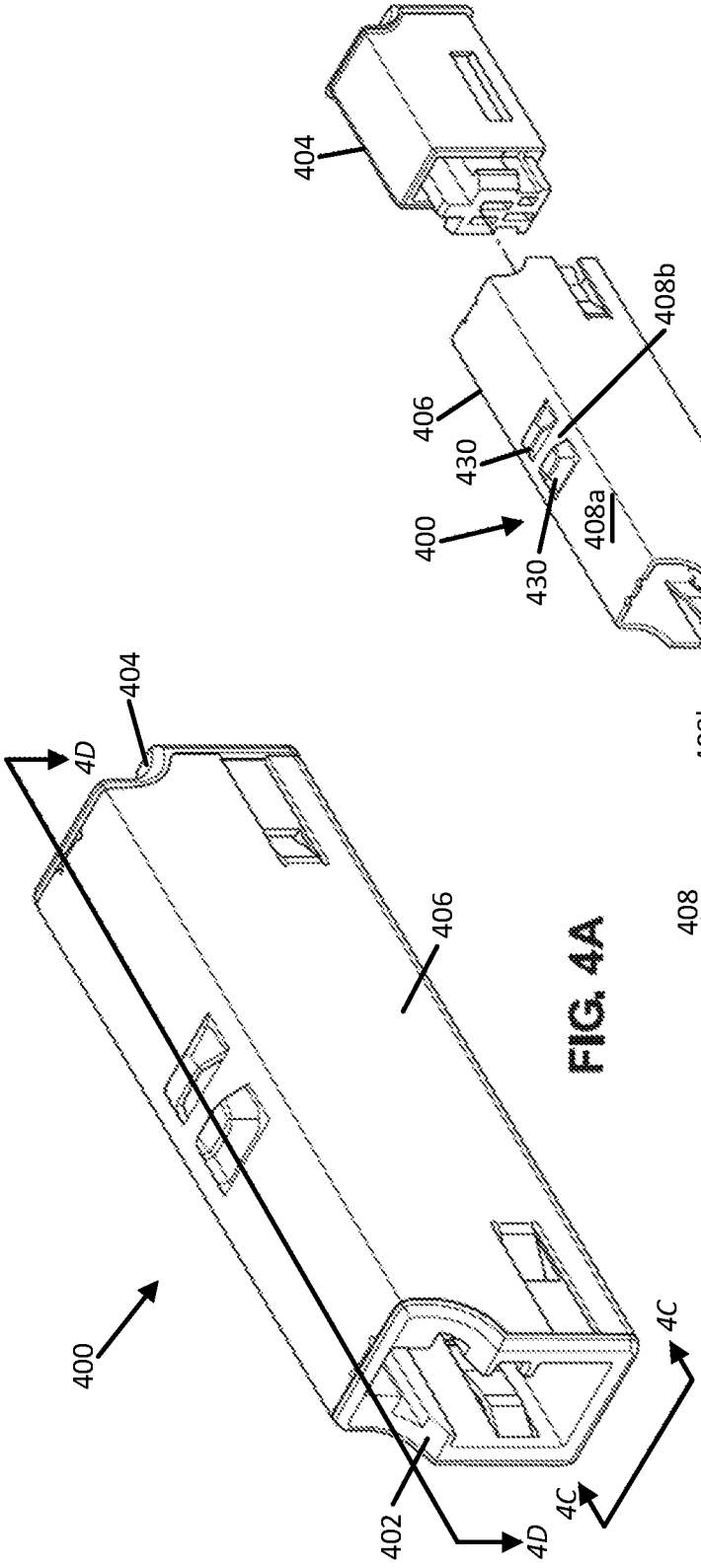

400
402
404
406
4C
4D
4D
4C

FIG. 4A

400
402
404
406
408
408a
408b
408c
430
430

FIG. 4B

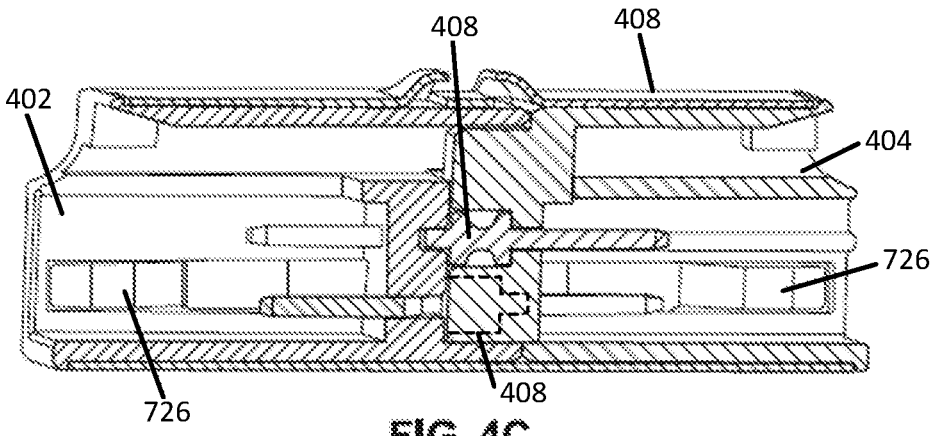


FIG. 4C

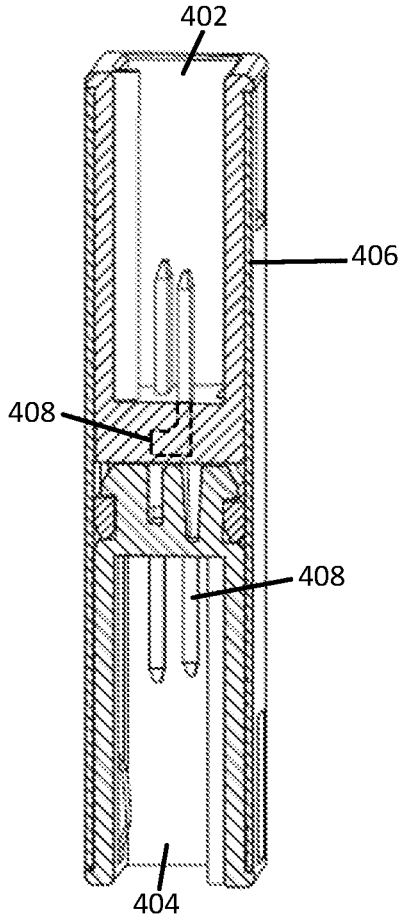


FIG. 4D

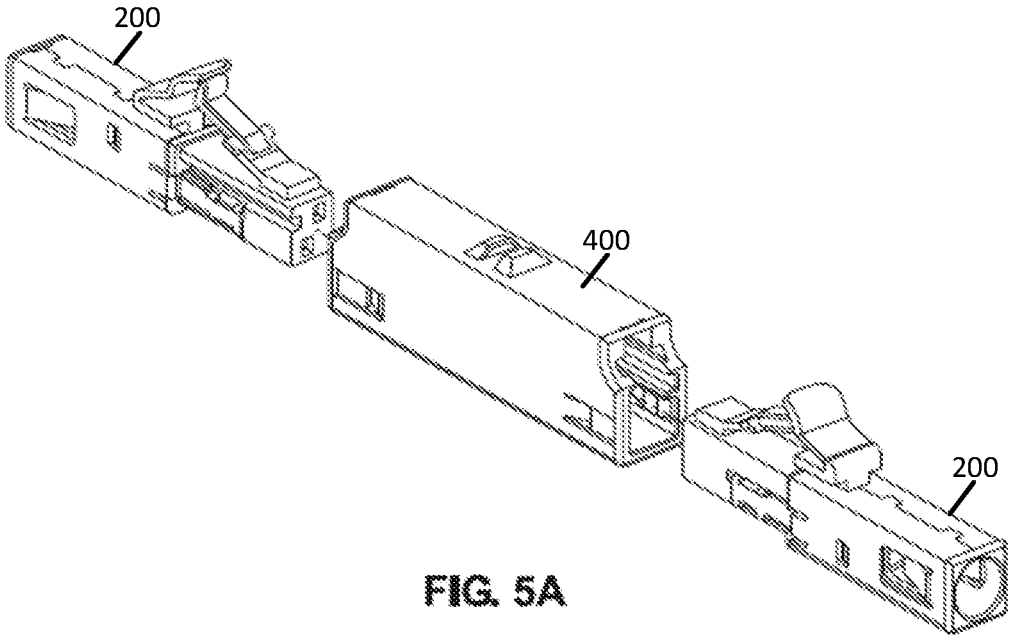


FIG. 5A

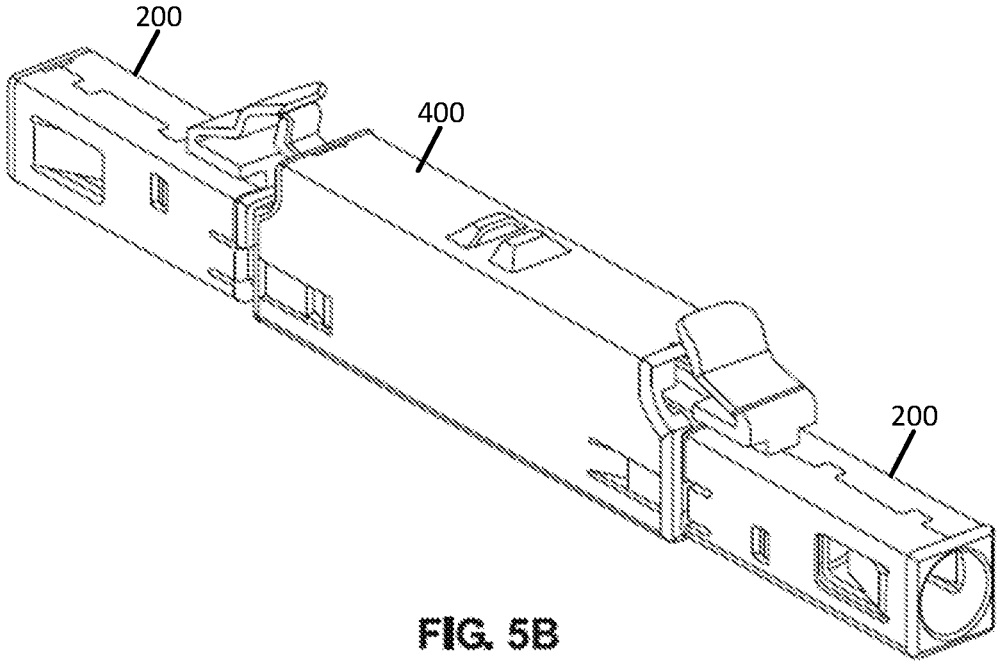


FIG. 5B

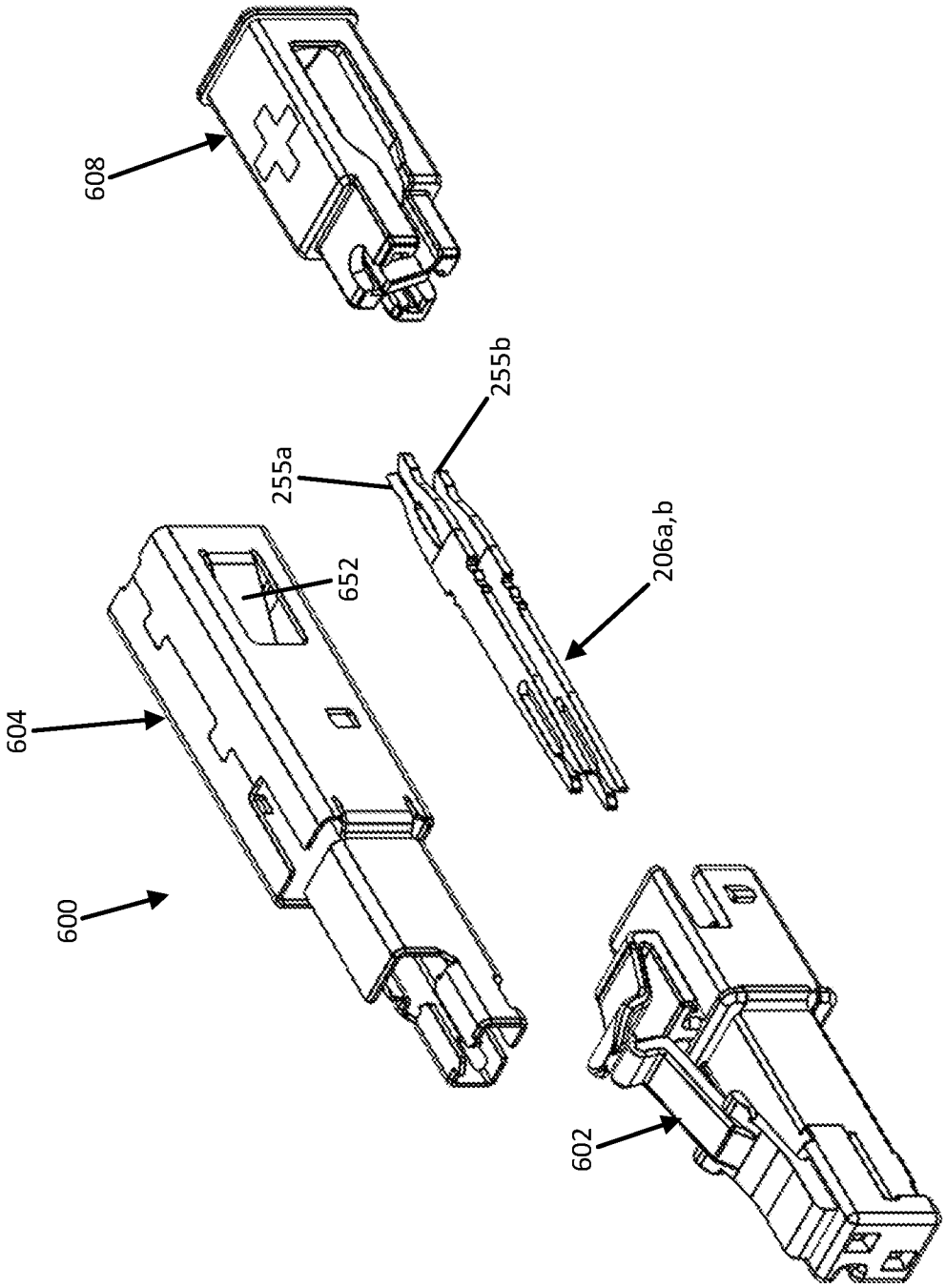


FIG. 6

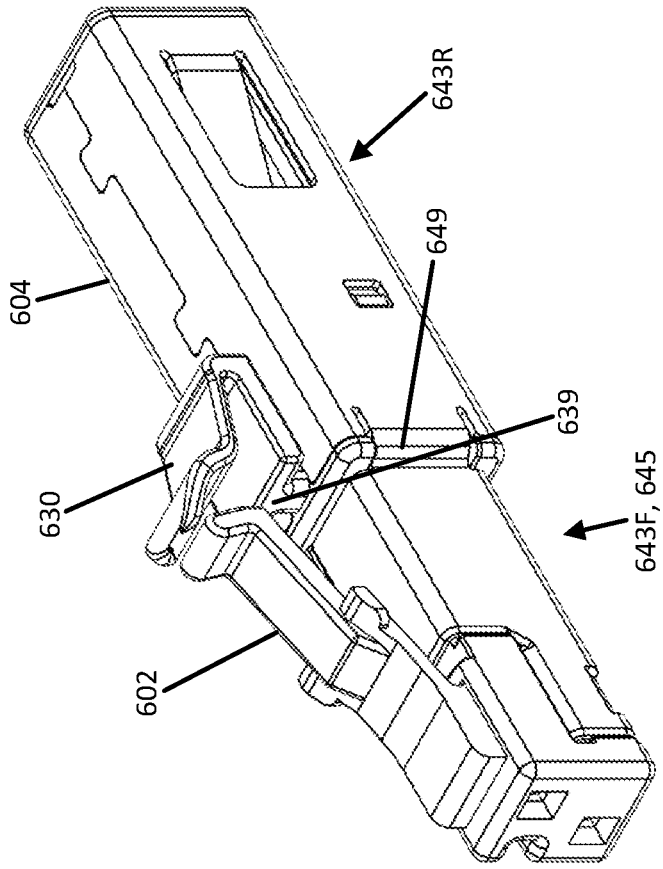

643R
649
604
639
630
643F, 645
602

FIG. 7A

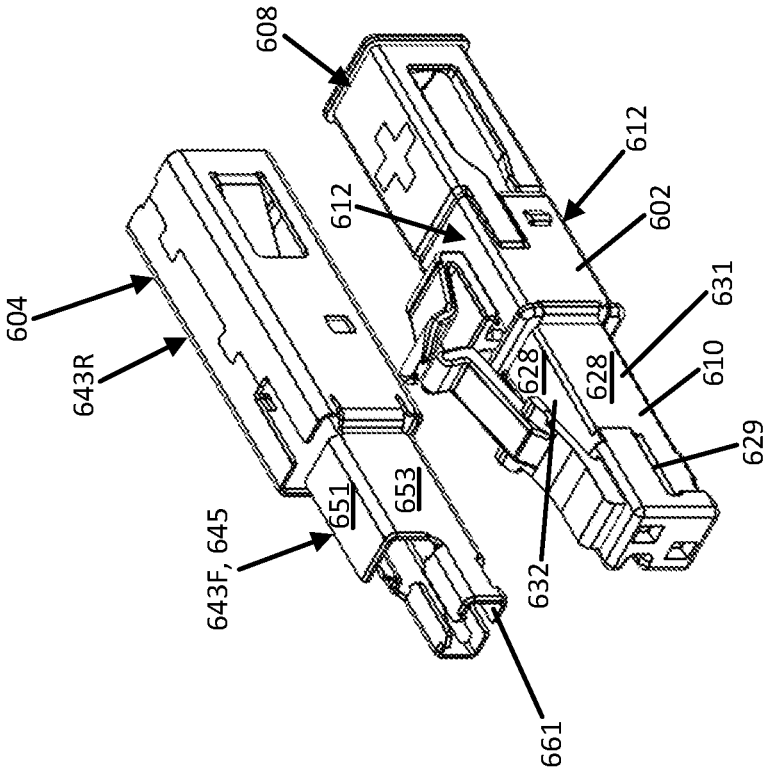
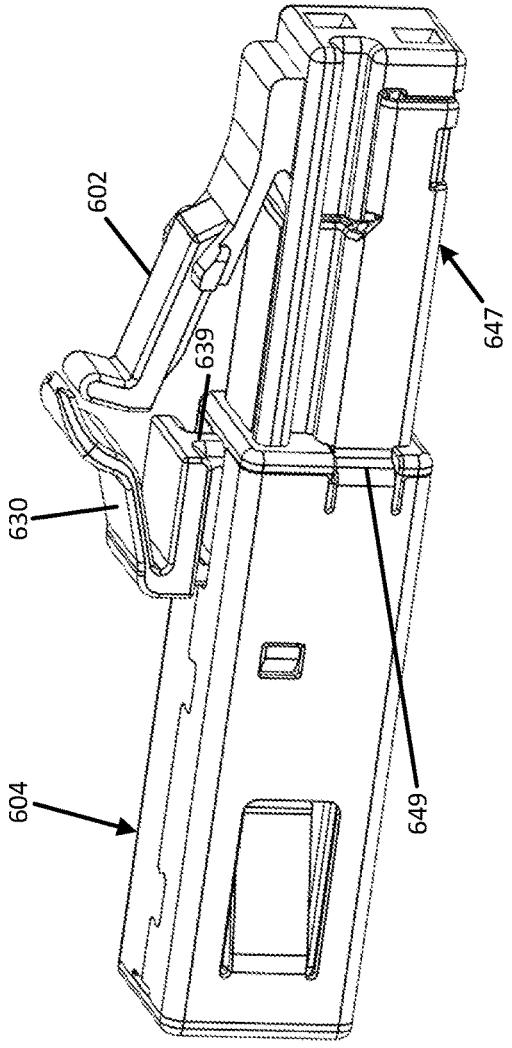

608
612
612
602
604
643R
631
610
628
628
629
651
653
643F, 645
632
661

FIG. 7B


602
639
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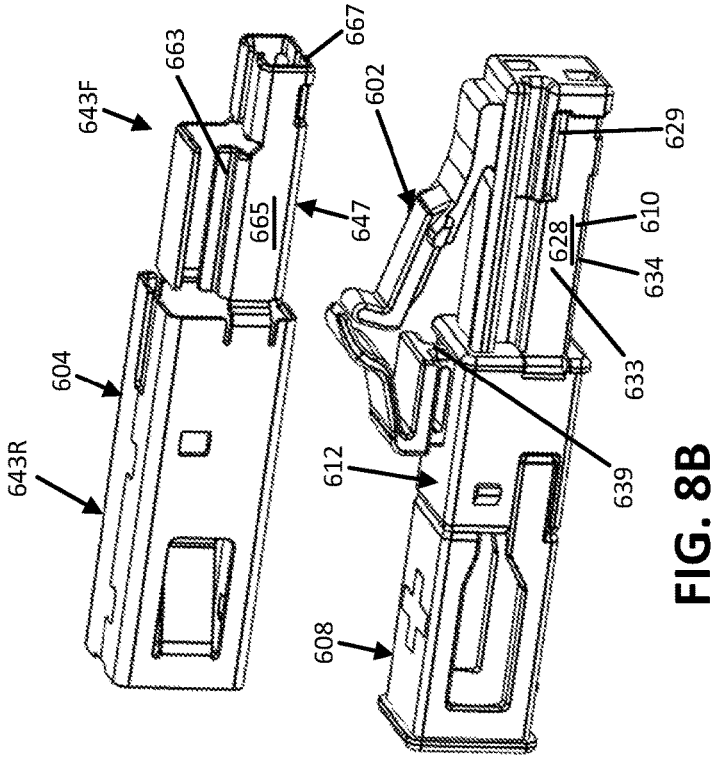
604
649

FIG. 8A


643F
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667
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629
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604
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643R
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608

FIG. 8B

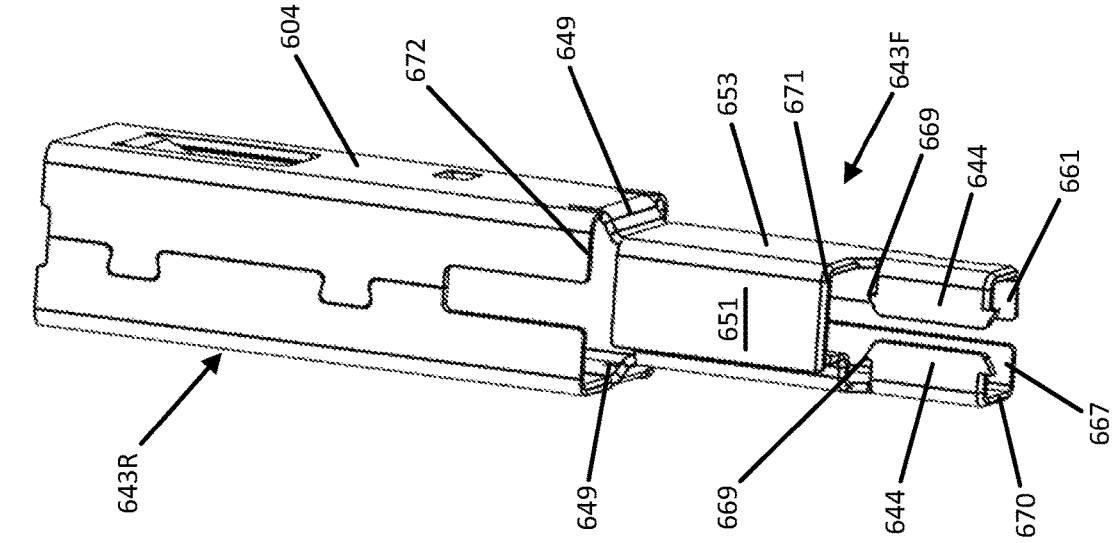

FIG. 10

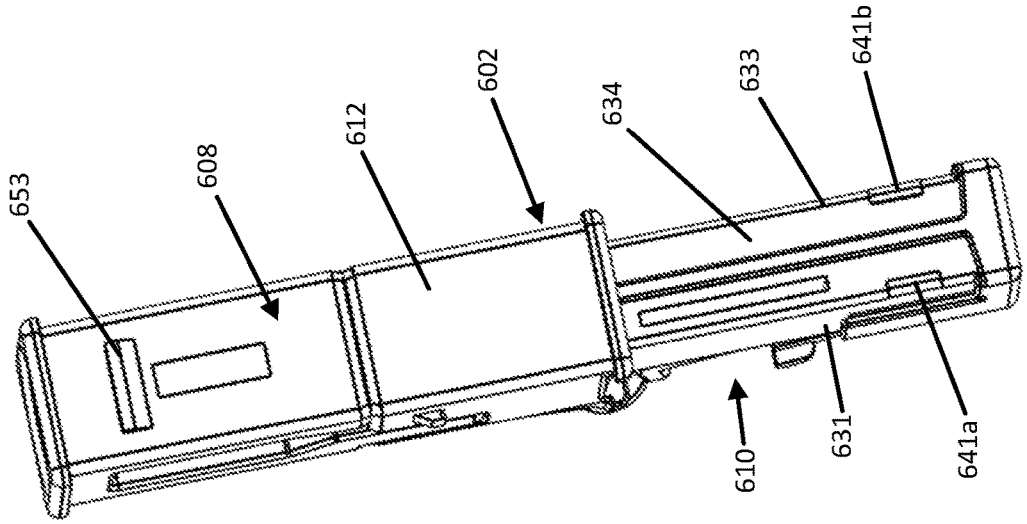

FIG. 9B

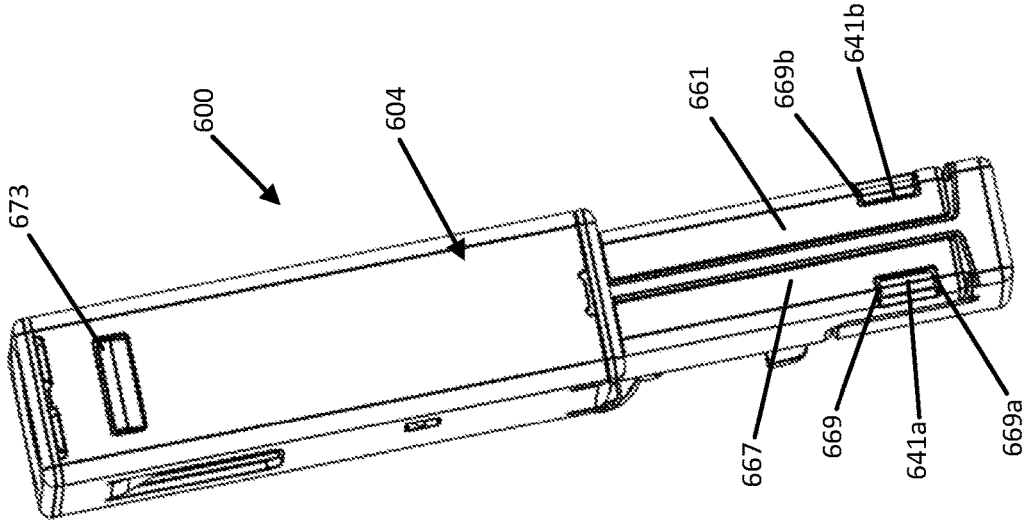

FIG. 9A

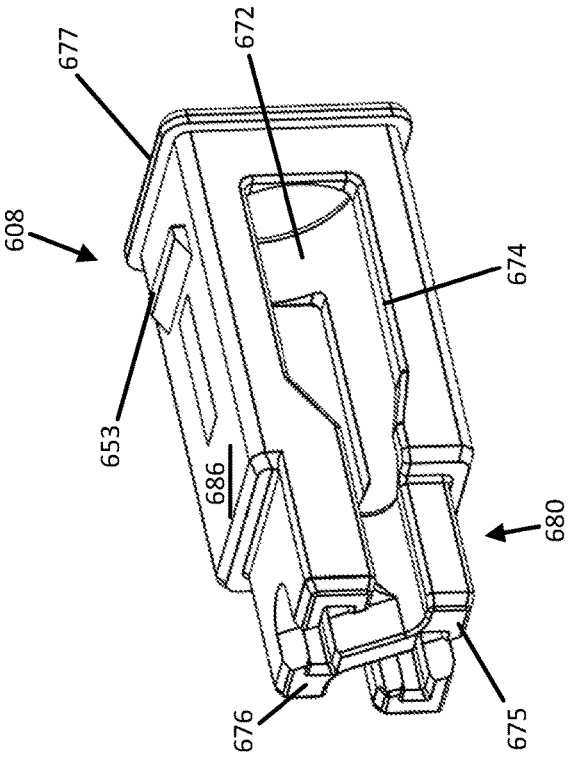

FIG. 11B

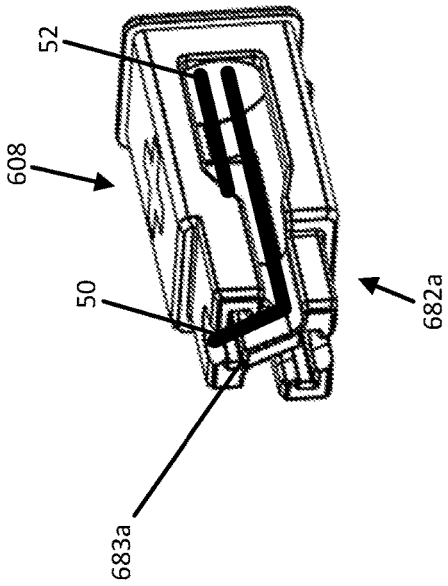

FIG. 12B

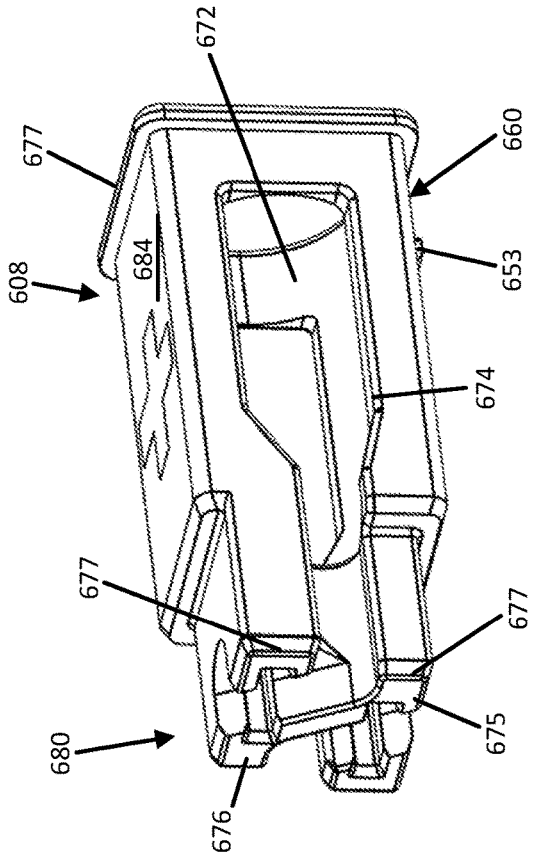

FIG. 11A

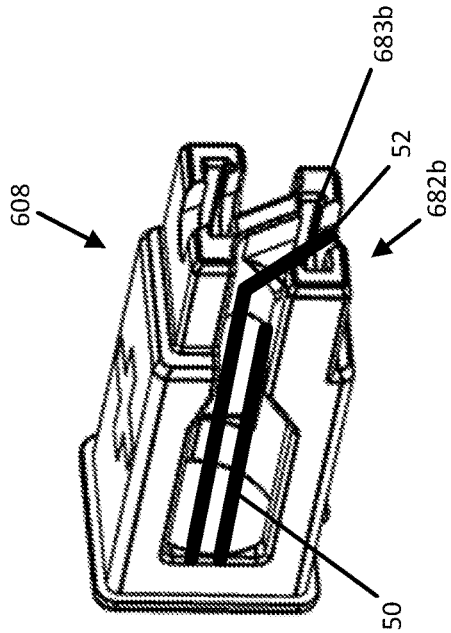

FIG. 12A

CONNECTOR FOR A SINGLE TWISTED PAIR OF CONDUCTORS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is being filed on Jan. 20, 2022 as a PCT International Patent Application and claims benefit of U.S. Patent Application Ser. No. 63/139,891, filed on Jan. 21, 2021, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure is directed to connectors and, more specifically, to connectors for use with a single-twisted pair of conductors.

BACKGROUND

[0003] A single twisted pair of conductors can be used to transmit data and/or power over a communications network that includes, for example, computers, servers, cameras, televisions, and other electronic devices including those on the internet of things (VT), etc. In the past, this has been performed through use of Ethernet cables and connectors that typically include four pairs of conductors that are used to transmit four differential signals. Differential signaling techniques, where each signal is transmitted over a balanced pair of conductors, are used because differential signals may be affected less by external noise sources and internal noises sources such as crosstalk as compared to signals that are transmitted over unbalanced conductors.

[0004] In Ethernet cables, the insulated conductors of each differential pair are tightly twisted about each other to form four twisted pairs of conductors, and these four twisted pairs may be further twisted about each other in a so-called "core twist." A separator may be provided that is used to separate and hence reduce coupling between) at least one of the twisted pairs from at least one other of the twisted pairs. The four twisted pairs and any separator may be enclosed in a protective jacket. Ethernet cables are connectorized with Ethernet connectors; a single Ethernet connector is configured to accommodate all four twisted pairs of conductors. However, it is possible that data and power transfer can be effectively supported through a singled twisted pair of conductors with its own more compact connector and cable. Couplers that can enable electrical coupling of connectors, with each connector coupled to a single pair of electrical conductors, are an important element in broadening the use of data and power transfer over a single pair of electrical conductors.

SUMMARY

[0005] A connector includes a forward connector body, a rear connector body that interfaces with the forward connector body and a metal frame positioned about the forward and rear connectors bodies. The rear connector body defines a central channel to receive a single pair of conductors. Each of a first and second side face of the rear connector body includes an elongate opening that extends through a front face of the rear connector body to provide access to an upward channel and a downward channel, respectively, of a contact receiving portion of the rear connector body. The metal frame includes a rearward portion and a forward portion. The rearward portion of the metal frame is positioned about the rear connector body as well as a rearward portion of the forward connector body while the forward portion of the metal frame is positioned about a forward portion of the forward connector body. The connector provides transmission of both power and data.

[0006] In certain embodiments, the front face of the rear connector body presents a flat surface while the edges of the front face are beveled. In certain embodiments, the metal frame is a unitary component having beveled forward-facing edges. In certain embodiments, the metal frame includes first and second cantilevered side arms where each of the first and second cantilevered side arms includes a cut-out that interfaces with a projections located on the forward portion of the forward connector body. In certain embodiments, the first cantilevered side arm is positioned about an upper face, a first side and a lower face of the forward portion of the forward connector body while the second cantilevered side arm includes a recessed portion that is conformed to a keying notch in a second side of the forward portion of the forward connector body; the second cantilevered side arm is positioned about a second side and the lower face of the forward portion of the forward connector body. In certain embodiments, the forward connector body includes a cantilevered latch that is supported by a t-mount. In certain embodiments, the connector further includes exactly two contacts with each having first ends that comprise a tuning fork contact and having second ends that comprise insulation displacement contacts (IDCs). In certain embodiments, the single pair of conductors, comprising a first conductor and a second conductor, are electrically coupled to first and second contacts of the exactly two contacts with the electrically coupled conductors and contacts transmitting both power and data.

[0007] A method of assembling a connector that includes a metal frame having a forward portion and a rearward portion, a rearward connector body, and a forward connector body interfacing with the rearward connector body includes: (a) positioning the rearward portion of the metal frame about both the rearward connector body and a portion of the forward connector body; (b) flexing the first cantilevered arm to place the first cantilevered arm in contact with the forward connector body including contact with an upper face, a first side face and a lower face of the forward connector body and securing the first cantilevered arm in position; and (c) flexing the second cantilevered to place the second cantilevered arm in contact with the forward connector body including with contact with a second side face and the lower face of the forward connector body and securing the second cantilevered arm in position.

[0008] In certain embodiments, positioning the rearward portion of the metal frame additionally includes positioning a portion of the metal frame beneath a cantilevered latch of the connector and immediately proximate a t-shaped mount of the cantilevered latch. In certain embodiments, the second cantilevered arm is additionally placed in contact with a keying notch of the forward connector body and is conformed to a shape of the keying notch. In certain embodiments, the contact of the first cantilevered arm with the upper face of the forward connector body extends from the first side face of the forward connector body to the second side face of the forward connector body. In certain embodiments, the method additionally includes beveling at least a position of forward facing edges of the metal frame. In

certain embodiments, the method further comprises housing exactly two power- and data-transmitting contacts within the forward connector body.

[0009] This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter.

BRIEF DESCRIPTION OF THE FIGURES

[0010] FIGS. **1**A-**1**B illustrate example embodiments of cables having single twisted pairs of conductors.

[0011] FIGS. **2**A-**2**D illustrate an example embodiment of a free connector for a single pair of electrical conductors including an assembled view, an exploded assembly view, a cross section of a forward connector body of the connector and a pair of electrical contacts of the connector, respectively.

[0012] FIGS. **3**A-**3**C illustrate an example embodiment of a fixed connector, which is configured to mate with the free connector of FIGS. **2**A-**2**D, including an assembled perspective view, a front view and a pair of electrical contacts of the fixed connector, respectively.

[0013] FIGS. **4**A-**4**D illustrate an example embodiment of a shielded coupler including an assembled perspective, an exploded assembly perspective, a side cross-sectional, and a top cross-sectional view of the coupler, respectively.

[0014] FIGS. **5**A-**5**B provide perspective views of a pair of the connectors of FIGS. **2**A-**2**D before and after electrical coupling with the coupler of FIGS. **4**A-**4**D.

[0015] FIG. **6** is an exploded perspective view of a free connector.

[0016] FIGS. **7**A-**7**B comprise a first side perspective of the free connector of FIG. **6** and a first side perspective of the free connector of FIG. **6** with a metal frame separated from a coupled forward connector body and rear connector body, respectively.

[0017] FIGS. **8**A-**8**B comprise a second side perspective of the free connector of FIG. **6** and a second side perspective of the free connector of FIG. **6** with a metal frame separated from a coupled forward connector body and rear connector body, respectively.

[0018] FIGS. **9**A-**9**B comprise a lower face perspective of the free connector of FIG. **6** and the lower face perspective with a metal frame removed from the free connector, respectively.

[0019] FIG. **10** comprises an upper perspective view of a metal frame of the free connector of FIG. **6**.

[0020] FIGS. **11**A-**11**B comprise upper and lower perspective views of the rear connector body of the free connector of FIG. **6**.

[0021] FIGS. **12**A-**12**B comprises left and right perspective views of the rear connector body of the free connector of FIG. **6**.

DETAILED DESCRIPTION

[0022] A connector of the present disclosure includes a forward connector body, a rear connector body that interfaces with the forward connector body and a metal frame positioned about the forward and rear connectors bodies. The rear connector body defines a central channel to receive a single pair of conductors. Each of a first and second side face of the rear connector body includes an elongate opening that extends through a front face of the rear connector body to provide access to an upward channel and a downward channel, respectively, of a contact receiving portion of the rear connector body. The metal frame includes a rearward portion and a for and portion. The rearward portion of the metal frame is positioned about the rear connector body as well as a rearward portion of the forward connector body while the forward portion of the metal frame is positioned about a forward portion of the forward connector body. The connector is particularly suited to the combined transmission of both power and data.

[0023] FIG. **1**A illustrates two example embodiments of cables containing one or more single twisted pairs of conductors capable of transmitting electricity, data or both electricity and data. The first cable **10** includes first and second conductors **12**, **14** that are twisted together to form a single twisted pair **16**. The conductors **12**, **14** are enclosed by a protective jacket **18**. The second cable **20** includes first through fourth conductors **22**, **24**, **26**, **28**. Conductors **22** and **24** are twisted together to form a first single twisted pair **30**, and conductors **26** and **28** are twisted together to form a second single twisted pair **32**. The twisted pairs **30** and **32** are separated by a separator **34** and are encased in a protective jacket **36**. In certain example embodiments, the cables **10**, **20** include a number of twisted pairs greater than two. In certain example embodiments, each single twisted pair of conductors, e.g., **16**, **30**, **32**, is configured for both power and data transmission, e.g. data transmission up to 600 MHz (ifs) and a current carrying capacity up to **1**A. Each single twisted pair of conductors, e.g., **16**, **30**, **32**, can be connectorized with the various embodiments or combination of embodiments of free connectors and fixed connectors as described herein. FIG. is an example of a shielded cable **40**. The shielded cable **40** includes an outer jacket **42**, a foil shield **44**, a drain wire **46**, and a single twisted pair **48** of conductors **50** and **52**; each of the conductors **50** and **52** is provided with insulation **54**.

[0024] Referring to FIGS. **2**A-**2**D an example embodiment of a free connector **200** for a single twisted pair of electrical conductors is illustrated. Free connector **200** includes a forward connector body **202**, a metal frame **204**, a pair of electrical contacts **206***a*, **206***b* and a rear connector body **208**. Free connector **200** can be coupled to a single twisted pair of conductors, e.g., conductors **12** and **14** of the single twisted pair **16** of cable **10**.

[0025] The forward connector body **202** includes an elongate forward portion **210** and a rear receiving portion **212** that is separated by a shoulder **211**.

[0026] The elongate forward portion **210** of the forward connector body **202** includes a forward face **223** having a pair of offset openings **224***a*, **224***b* corresponding to contact receiving channels **226***a*, **226***b*; the openings **224***a*, **224***b* receive pin contacts that electrically interface with the tuning fork contacts **206***a*, **206***b*. In certain embodiments, a recess **228** is provided on each side face of the elongate forward portion **210** to interface with and retain the metal frame **204**. Each recess **228** includes a recessed notch **229** to receive an interfacing tab **244** of the metal frame **204** to further ensure that the metal frame **204** remains secured to the forward connector body **202**. The forward connector body **202** also includes a cantilevered latch **230**.

[0027] The rear receiving portion **212** of the forward connector body **202** is unitary (e.g. molded as a single unit)

with the elongate forward portion **210** of the forward connector body **202**, The rear receiving portion **212** defines a central cavity **232** that provides rear access to the contact receiving channels **226***a*, **226***b* of the elongate forward portion **210**, Each side face **231**, **233** of the rear receiving portion **212** includes a slot **235** to interface with the rear connector body **208** and an outward extending tab **237** to interface with the metal frame **204**.

[0028] The metal frame **204** of the free connector **200** comprises a metal shell body **240** having a central cavity **234** that is slidable over the rear receiving portion **212** of the forward connector body **202**. The metal frame **204** is held in place about the rear receiving portion **212** through use of a pair of flex tabs **242** that interface with corresponding recesses **228** of the forward connector body **202**, Each of the flex tabs **242** includes in inward facing tab **244** to interface with recessed notch **229** of the forward connector body **202**. Each side face **246**, **248** of the metal frame **204** includes an opening **250** to interface with outward extending tab **237** of the forward connector body **202**. Each point of interface between the metal frame **204** and the forward connector body **202** assists in securing the metal frame **204** to the forward connector body **202**. Each side face **246**, **248** of the metal frame **204** is additionally equipped with an inward directed beam **252** (e.g. shield beam) to establish an electrical interface with a cable shield (foil or drain wire) of the cable carrying the single pair of conductors (e.g., see FIG. **1**B). Note that, while the metal frame **204** includes a shield beam for interfacing with a shield of a shielded cable, the metal frame **204** can also be utilized in conjunction with a non-shielded cable. In the instance of a non-shielded cable, the metal frame provides additional structural support to the connector **200**. In certain non-shielded uses, the frame **204** is alternatively made of a non-metal material, e.g., plastic.

[0029] Electrical contacts **206***a*. **206***b* each include a forward portion having a tuning fork receptacle contact **254***a*, **254***b* while a rear portion of each of the electrical contacts **206***a*, **206***b* includes an insulation displacement contact (IDC) **255***a*, **255**E), Each tuning fork receptacle contact **254***a*, **254***b* includes a pair of opposing spring arms **60***a*, **60***b* presenting an angled opening to receive a pin contact. Each of the electrical contacts **206***a*, **206***b* includes a shoulder **256***a*, **256***b* that interfaces with a stop **258** (see FIG. **2**C) within the elongate forward portion **210** of the forward connector body **202**. The electrical contacts **206***a*, **206***b* include one or more tangs **259** to help retain each of the tuning fork receptacle contacts **254***a*, **254***b* within their respective contact receiving channels **226***a*, **226***b* of the forward connector body **202**.

[0030] The rear connector body **208** of the free connector **200** includes a rear body portion **260** that defines a central cavity **272** into which is inserted a pair of conductors (e.g., conductors **12**, **14**). Each side face is provided with an elongate opening **274** into which the inward directed beams **252** of the metal frame **204** extend wherein an electrical interface with the foil (or drain wire) of a conductor within the cavity **272** is established. A latch (now shown) on a lower face of the rear body portion **260** interfaces with a cut-out (not shown) of the metal frame **204** to secure the rear connector body **208** to the metal frame **204**. A lip edge **277** of the rear body portion **260** seats against a rear face **257** of the metal frame **204**.

[0031] The rear connector body **208** of the free connector **200** includes a contact receiving portion **280** that extends forward from the rear body portion **260**. The contact receiving portion **280** is essentially divided into a first half **282***a* to accommodate the upper positioned electrical contact **206***a* and a second half **282***b* to accommodate the lower positioned electrical contact **206***b*. The first half **282***a* of the contact receiving portion **280** includes an upward channel that is contoured to direct the end of a conductor upward (e.g., a 90 deg. bend) to extend through a contact receiving slot. The second half **282***b* of the contact receiving portion **280** includes a downward channel that is contoured to direct the end of a conductor downward (e.g., a 90 deg. bend) to extend through a contact receiving slot.

[0032] The IDC contacts **255***a*, **255***a* of the electrical contact **206***a*, **206***b* are inserted into their respective contact receiving slots to establish an electrical interface with the conductor extending there through. The IDC contacts **255***a*, **255***b* applies a normal force to the respective conductor and cuts through both the insulation of the conductor and a portion of the conductor itself to create the electrical interface. Note that the electrical interface is established without requiring crimping of the conductor to the electrical contact, i.e., the electrical interface is crimp-less. The upward channel is, in part, defined by an upper outward extending arm **294** while the downward channel is, in part, defined by a lower outward extending arm **296**. Each of upper outward extending arm **294** and lower outward extending arm **296** interface with respective corresponding slots **235** of the forward connector body **202** when the free connector **200** is assembled to assist in aligning and stabilizing the rear connector body **208** relative to the forward connector body **202**.

[0033] An example of a fixed connector **300**, suitable to mate with free connector **200** is illustrated in FIGS. **3**A-**3**C. The fixed connector **300** generally includes a housing body **302**, a metal frame **304** and a pair of pin contacts **306***a*, **306***b* (straight or bent for board mounting). A forward end **303** and a rearward end **305** further define the fixed connector **300**.

[0034] The housing body **302** of the fixed connector **300** includes a forward central channel **310** that receives the free connector **200**. A notch **323** is provided within the housing body **302** to interface with the cantilevered latch **230** of the free connector **200**. Further, side recesses **325** in each side face serve as an interface element for the metal frame **304**. A mounting pin **327** extends from the housing body **302** and through the metal frame **2602** for circuit board mounting of the connector **300**. The housing body further includes openings **326***a*, **326***b* to channels (not shown) into which the pin contacts **306***a*, **306***b* are inserted; when fully inserted, the pin contacts **306***a*, **306***b* extend into the forward central channel **310**.

[0035] The metal frame **304** of the fixed connector **300** is a metal shell defining a central cavity that is slidable over the housing body **302**. The metal frame **304** is held in place about the housing body **302** through use of a pair of clips **336** that interface with the side recesses **325**. In certain embodiments, a back face **338** of the metal frame is enclosed with a back panel **340** while in other embodiments t back face **338** is left open. Further, in certain embodiments, the metal frame **304** is provide with one or more shield pins **342** that are insertable into vias in an application where the fixed connector **300** is board mounted.

[0036] Each of the pin contacts **306***a*, **306***b* of the fixed connector **300** include a forward portion **350** and a rear portion **352** that can be electrically coupled to a conductor,

e.g., conductor **10**, in any suitable manner. The forward portion **350** includes tapered faces that form a four-sided pyramid shape with a flattened apex **357**; the flattened apex **357** having a rectangular or square cross-section.

[0037] Referring to FIGS. **4**A-**4**B an example embodiment of a coupler **400** is illustrated. As shown, the coupler **400** includes a first housing **402**, a second housing **404**, a metal shield **406** and a pair of contacts **408**, each having a forward contact **408***a* and a rearward contact **408***b* separated by a central portion **408***c*. The first housing and second housing **402**, **404** securely interface with one other to centrally support the first pair of contacts **408** enabling the first ends **408***a* of the contacts **408** to extend towards a first end **412** of the coupler **400** and the second ends **408***b* of the coupler **400** to extend towards a second end **414** of the coupler. FIGS. **4**C and **4**D provide cross-sectional views of the assembled coupler, including the metal shield **406**, taken along lines **4**C-**4**C and **4**D-**4**D, respectively, of FIG. **4**A, with each illustrating the placement of the first housing **402**, the second housing **404**, the metal shield **406** and the pair of contacts **408**.

[0038] FIGS. **5**A and **5**B illustrate the assembled coupler **400** with two of the free connectors **200** ready to be received by the coupler **400** and with the two connectors **200** removably received within the coupler **400** and electrically coupled, respectively. Each of the couplers **400** includes a pair of opposing projections **430** projecting away from a top face **432** of the coupler **400**; the projections **430** define a channel **434**. The projections **430** and channel **434** are used to position the coupler **400** in the high density panel **600** further described herein. Other coupler designs for coupling a pair of connectors, with each of the connectors coupled to exactly two electrical conductors, are also possible.

[0039] Further details regarding free connectors, fixed connectors and couplers can be found in PCT publications WO 2018/200528, WO 2019/165466, and WO 2020/190758 as well as PCT Application No. PCT/US2020/053283. The identified PCT publications and applications are hereby incorporated by reference.

[0040] FIG. **6** illustrates another example embodiment of a free connector **600**. The free connector **600** includes a forward connector body **602**, a metal frame **604**, the pair of electrical contacts **206***a*, **206***b*, which are also shown in use with free connector **200**, and a rear connector body **608**.

[0041] The forward connector body **602** generally corresponds to the forward connector body **202** of the free connector **200** while the metal frame generally corresponds to the metal frame **204** of the free connector **200**, However, modifications made to the forward connector body **202**, now evident in forward connector body **602**, and modifications made to the metal frame **204**, now evident in metal frame **604** can be appreciated with respect to FIGS. **7**A-**7**B, **8**A-**8**B, **9**A-**98** and **10**.

[0042] As shown, the forward connector body **602** of connector **600** includes an elongate forward portion **610** having a first side **631** and a second side **633** connected by an upper face **632** and a lower face **634** where each of the sides **631**, **633** and faces **632**, **634** includes a recessed portion **628** to accommodate a more expansive metal frame **604** that now covers a greater portion of each of the sides **631**, **633** as well as now covering a portion of both the upper and lower faces **632**, **634**; the more expansive metal frame **604** provides improved coupling attenuation over metal frame **204**. Further, the elongate forward portion **610** of the forward connector body **602** is provided with a recessed notch **629** on each of the first and second sides **631**, **633** enabling an interface with the metal frame **604**. A rear portion of the cantilevered latch **630**, located on the rear receiving portion **612** of the forward connector body **602**, is provided with a narrow t-shaped mount **639** enabling the expanded metal frame **604** to lie proximate the t-shaped mount **639** as well as lie beneath the rear portion of the cantilevered latch **630**. Referring to FIGS. **9**A-**9**B, the elongate forward portion **610** further includes projections **641***a*, **641***b* extending from respective first and second sides **631**, **633** to lower face **634** that further serve to interface with the metal frame **604** and assist in retaining the metal frame **604** in place relative to the forward connector body **602**.

[0043] The metal frame **604**, similar to metal frame **204**, includes a rear portion **643**R positioned about the rear body portion **608** of the connector **600** and about the rear receiving portion **612** of the forward connector body **602** of the connector **600**. The metal frame **604** additionally includes a forward portion **643**F' that is unitary with the rear portion **643**R. The forward portion **643**F, positioned about the elongate forward portion **610** of the forward connector body **602**, includes a cantilevered first side arm **645** and a cantilevered second side arm **647** each of which is coupled to the rear portion **643**R of the metal frame **604** by a flexible hinge **649** allowing the first and second side portions **645**, **647** to flex inward/outward as needed during assembly of the free connector **600**. In certain embodiments the forward portion **643**F of the metal frame **604** comprises a component distinct from the rear portion **643**R, e.g., the metal frame **604** comprises two or more discrete pieces.

[0044] The first side arm **645** of the metal frame **604** includes an upper face **651** that transitions to a first side **653** and to a first lower face **661**. The second side arm **647** of the metal frame **605** includes a recessed side **663**, conformed to a keying notch **664**, that transitions to a second side **665** and a second lower face **667**. Each of the first side arm **645** and the second side arm **647** includes a cut-out **669***a*, **669***b* to interface with projections **641***a*, **641***b* of the forward connector body **602**, Each of the first side arm **645** and the second side arm **647** of the metal frame **604** additionally includes an interfacing tab **644** to interface with a corresponding recessed notch **629** of the forward connector body **602**. The interfacing tabs **644** include edge tangs **669** to assist in retaining the interfacing tabs **644** within the respective recessed notches **629**, Most, or all, of the forward facing edges of the metal frame **605**, such as edges **670**, **671**, **672**, are beveled as an anti-snag feature to enable smooth insertion of the free connector **600** into a fixed connector.

[0045] The rear connector body **608** of the free connector **600** generally corresponds to the rear connector body **208** of the free connector **200**. However, modifications made to the rear connector body **208**, now evident in rear connector body **602**, can be appreciated with respect to FIGS. **11**A-**11**B and **12**A-**12**B.

[0046] As shown, the rear connector body **608** of the free connector **600** includes a rear body portion **660** that defines a central cavity **672** into which is inserted a pair of conductors. Each side face is provided with an elongate opening **674**, which extends through a front face **675** of the rear connector body **608**, into which the inward directed beams **652** (see FIG. **6**) of the metal frame **604** extend wherein an electrical interface with the foil (or drain wire) of a conductor within the cavity **672** is established. The elongate open-

ing **674**, being extended through the front face **675**, provides an open access to any conductor inserted within the cavity **672**, A latch **653** on a lower face **686** of the rear body portion **660** interfaces with a cut-out **673** (see FIG. **911**) of the metal frame **604** to secure the rear connector body **608** to the metal frame **604**. A lip edge **677** of the rear body portion **660** seats against a rear face **657** of the metal frame **604**. The front face **675** of the rear connector body **608** presents a flat front surface **676**, to seat flush against the forward connector body **602**, and beveled edges **677** to ease sliding the rear connector body **608** relative to the forward connector body **602**.

[0047] The rear connector body **608** of the free connector **600** includes a contact receiving portion **680** that extends forward from the rear body portion **660**. The contact receiving portion **680** is essentially divided into a first half **682***a* to accommodate the upper positioned electrical contact **606***a* and a second half **682***b* to accommodate the lower positioned electrical contact **606***b*. The first half **682***a* of the contact receiving portion **680** includes an upward channel that is contoured to direct the end of a conductor upward (e.g., a 90 deg. bend) to extend across a contact receiving slot **683***a*, see FIG. **12**B with conductor **50**. The second half **682***b* of the contact receiving portion **680** includes a downward channel that is contoured to direct the end of a conductor downward (e.g., a 90 deg. bend) to extend through a contact receiving slot **683***b*, see FIG. **12**A, with conductor **52**. In certain embodiments, an upper face **684** of the rear connector body **608** is marked with a plus sign, e.g., "+", to indicate a positive terminal relative to the upward channel while a lower face **686** of the rear connector body **608** is marked with a minus sign, e.g., "−", to indicate a negative terminal relative to the downward channel.

[0048] It will be appreciated that aspects of the above embodiments may be combined in any way to provide numerous additional embodiments. These embodiments will not be described individually for the sake of brevity.

[0049] While the present invention has been described above primarily with reference to the accompanying drawings, it will be appreciated that the invention is not limited to the illustrated embodiments; rather, these embodiments are intended to disclose the invention to those skilled in this art. Note that features of one or more embodiments can be incorporated in other embodiments without departing from the spirit of the invention. In the drawings, like numbers refer to like elements throughout. Thicknesses and dimensions of some components may be exaggerated for clarity.

[0050] It will be understood that, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example; a first element could be termed a second element, and, similarly, a second element could be termed a first element, without departing from the scope of the present invention.

[0051] Spatially relative terms, such as "under", "below", "lower", "over", "upper", "top", "bottom" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "under" or "beneath" other elements or features would then be oriented "over" the other elements or features. Thus, the exemplary term "under" can encompass both an orientation of over and under. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0052] Well-known functions or constructions may not be described in detail for brevity and/or clarity. As used herein the expression "and/or" includes any and all combinations of one or more of the associated listed items.

[0053] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises", "comprising", "includes" and/or "including" when used in this specification, specify the presence of stated features, operations, elements, and/or components, but do not preclude the presence or addition of One or more other features, operations, elements, components, and/or groups thereof.

[0054] Herein, the terms "attached", "connected", "interconnected", "contacting", "mounted" and the like can mean either direct or indirect attachment or contact between elements, unless stated otherwise.

[0055] Although exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

1. A connector comprising:

a forward connector body, including a forward portion and a rearward portion;

a rear connector body that interfaces with the forward connector body, the rear connector body defining a central channel to receive a single pair of conductors, each of a first and second side faces of the rear connector body including an elongate opening extending through a front face of the rear connector body providing access to an upward channel and a downward channel, respectively, of a contact receiving portion of the rear connector body; and

a metal frame positioned having a rearward portion and forward portion, the rearward portion of the metal frame positioned about the rear connector body and a rearward portion of the forward connector body, the forward portion of the metal frame positioned about the forward portion of the forward connector body.

2. The connector of claim **1**, wherein the front face of the rear connector body presents a flat surface.

3. The connector of claim **2**, wherein the edges of the front face of the rear connector body are beveled.

4. The connector of claim **1**, wherein the metal frame is a unitary component.

5. The connector of claim **1**, wherein the forward portion of the metal frame includes first and second cantilevered side arms.

6. The connector of claim **5**, wherein each of the first and second cantilevered sider arms includes a cut-out that inter-

faces with a corresponding projection located on the forward portion of the forward connector body.

7. The connector of claim **5**, wherein the first cantilevered side arm is positioned about an upper face, a first side face and a lower face of the forward portion of the forward connector body.

8. The connector of claim **5**, wherein the second cantilevered side arm includes a recessed portion that is conformed to a keying notch in a second side face of the forward connector body, the second cantilevered arm positioned about the second side face and the lower face of the forward portion of the forward connector body.

9. The connector of claim **1**, wherein the metal frame includes a plurality of forward-facing edges and wherein at least a portion of the plurality of forward-facing edges are beveled.

10.-**20**. (canceled)

21. The connector of claim **1**, wherein the forward connector body includes a cantilevered latch supported by a t-mount.

22. The connector of claim **1**, further comprising exactly two contacts, each having first ends that comprise a tuning fork contact and each have second ends that comprise insulation displacement contacts (IDCs).

23. The connector of claim **22**, wherein the single pair of conductors, comprising a first conductor and a second conductor, are electrically coupled to first and second contacts of the exactly two contacts with the electrically coupled conductors and contacts transmitting both power and data.

24. A method of assembling a connector that includes a metal frame having a forward portion and a rearward portion, a rearward connector body, and a forward connector body interfacing with the rearward connector body, the method comprising:

positioning the rearward portion of the metal frame about both the rearward connector body and a portion of the forward connector body;

flexing the first cantilevered arm to place the first cantilevered arm in contact with the forward connector body including contact with an upper face, a first side face and a lower face of the forward connector body and securing the first cantilevered arm in position; and

flexing the second cantilevered to place the second cantilevered arm in contact with the forward connector body including with contact with a second side face and the lower face of the forward connector body and securing the second cantilevered arm in position.

25. The method of claim **24**, wherein positioning the rearward portion of the metal frame additionally includes positioning a portion of the metal frame beneath a cantilevered latch of the connector and immediately proximate a t-shaped mount of the cantilevered latch.

26. The method of claim **24**, wherein the second cantilevered arm is additionally placed in contact with a keying notch of the forward connector body.

27. The method of claim **26**, wherein the second cantilevered arm is conformed to a shape of the keying notch.

28. The method of claim **24**, wherein the contact of the first cantilevered arm with the upper face of the forward connector body extends from the first side face of the forward connector body to the second side face of the forward connector body.

29. The method of claim **24**, further comprising beveling at least a portion of forward facing edges of the metal frame.

30. The method of claim **24**, further comprising housing exactly two power- and data-transmitting contacts within the forward connector body.

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