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Little

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(54) **ELECTRICAL CONNECTOR ASSEMBLY HAVING A POLARIZING FEATURE AND A LATCHING FEATURE**

(71) Applicants: **FOXCONN (KUNSHAN) COMPUTER CONNECTOR CO., LTD.**, Kunshan (CN); **FOXCONN INTERCONNECT TECHNOLOGY LIMITED**, Grand Cayman (KY)

(72) Inventor: **Terrance F. Little**, Fullerton, CA (US)

(73) Assignees: **FOXCONN (KUNSHAN) COMPUTER CONNECTOR CO., LTD.**, Kunshan (CN); **FOXCONN INTERCONNECT TECHNOLOGY LIMITED**, Grand Cayman (KY)

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H01R 13/627 (2006.01)
H01R 13/447 (2006.01)

(52) **U.S. Cl.**
CPC ***H01R 13/6272*** (2013.01); ***H01R 13/447*** (2013.01)

(58) **Field of Classification Search**
CPC H01R 13/6272; H01R 13/447; H01R 13/6273; H01R 13/506
See application file for complete search history.

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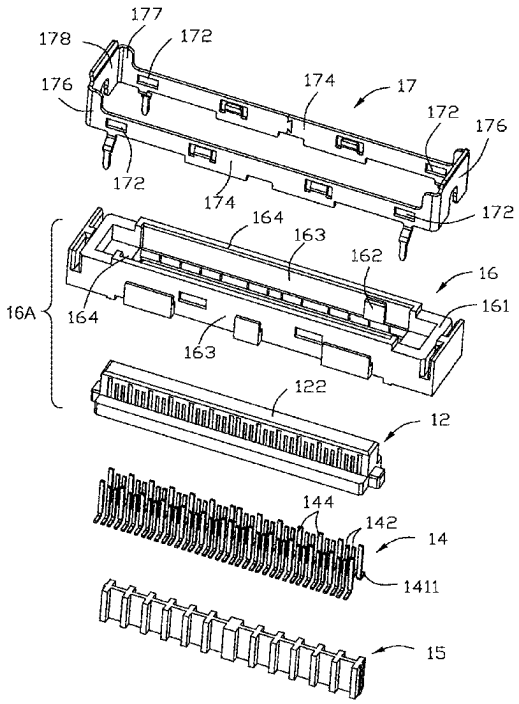
Primary Examiner — Jean F Duverne
(74) *Attorney, Agent, or Firm* — Ming Chieh Chang

(57) **ABSTRACT**

An electrical connector includes a contact assembly, a cable assembly terminated to the contact assembly, a cover receiving the contact assembly and the cable assembly, a latch disposed at a bottom of the cover for latching to a mating connector, and an un-mating assembly mounted to the cover and including a lift bar, wherein the latch is operable to unlatch from the mating connector in response to an upward movement of the lift bar while moving upward to dislodge the cover from the mating connector.

15 Claims, 15 Drawing Sheets



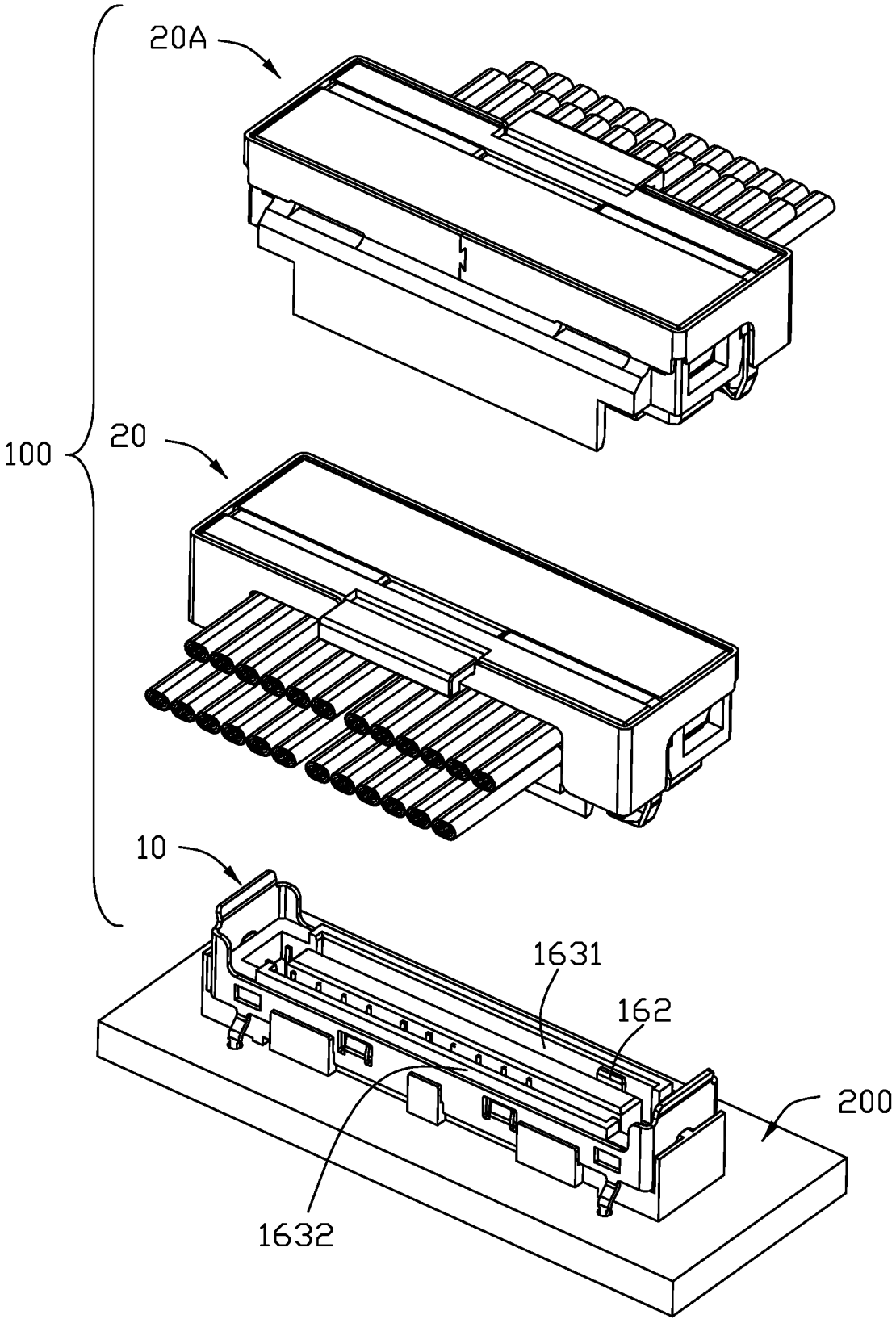


FIG. 1

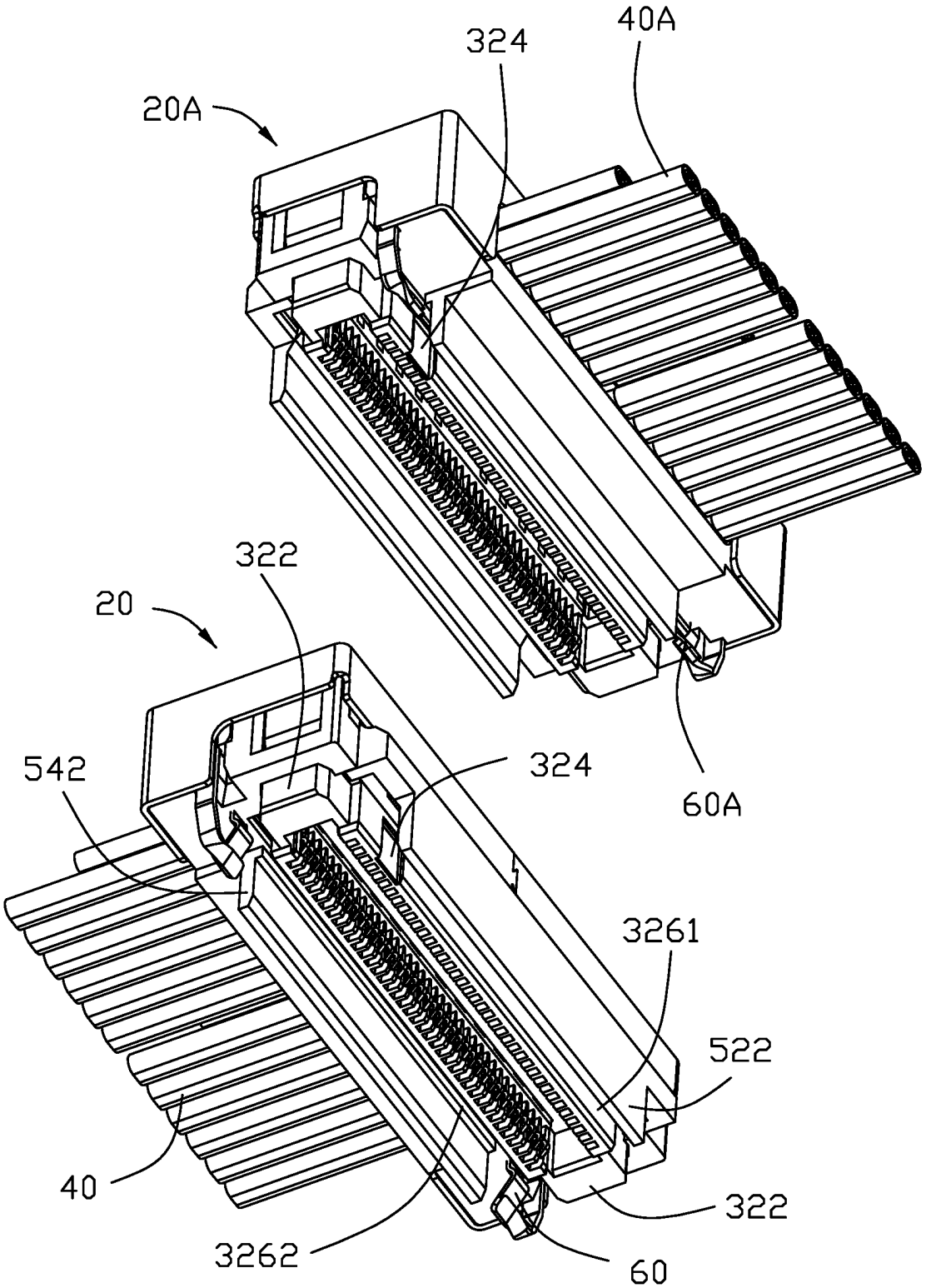


FIG. 2

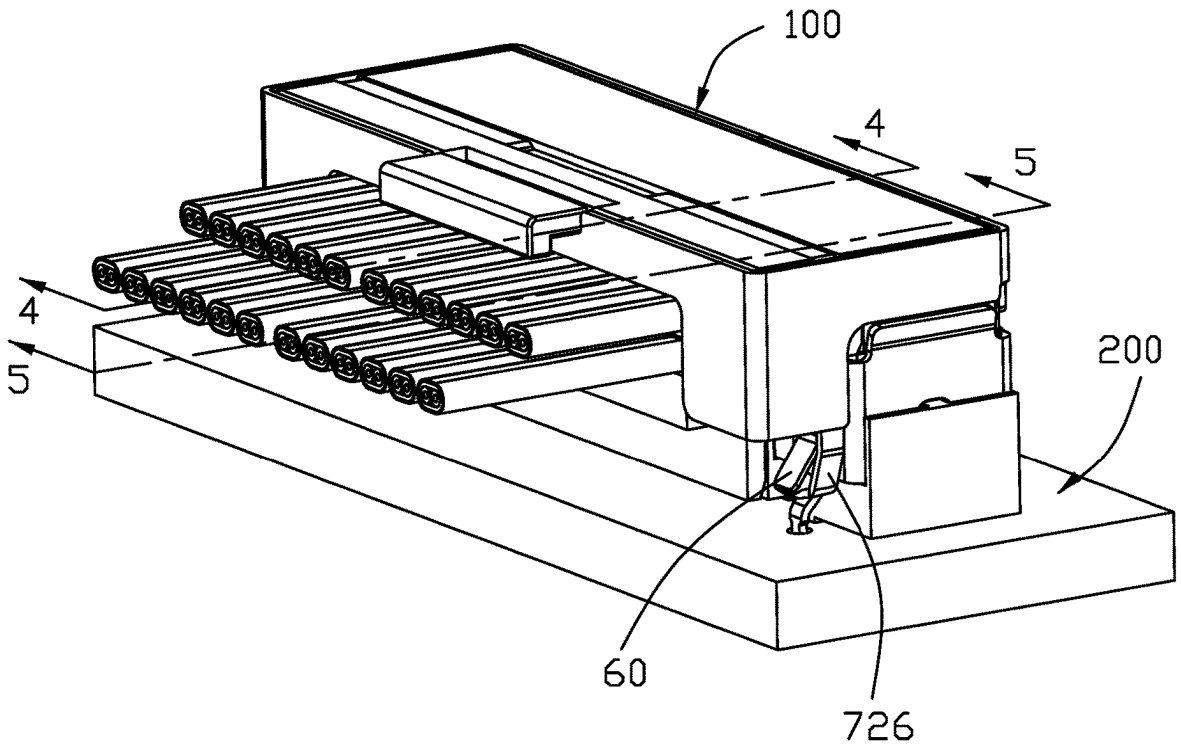


FIG. 3

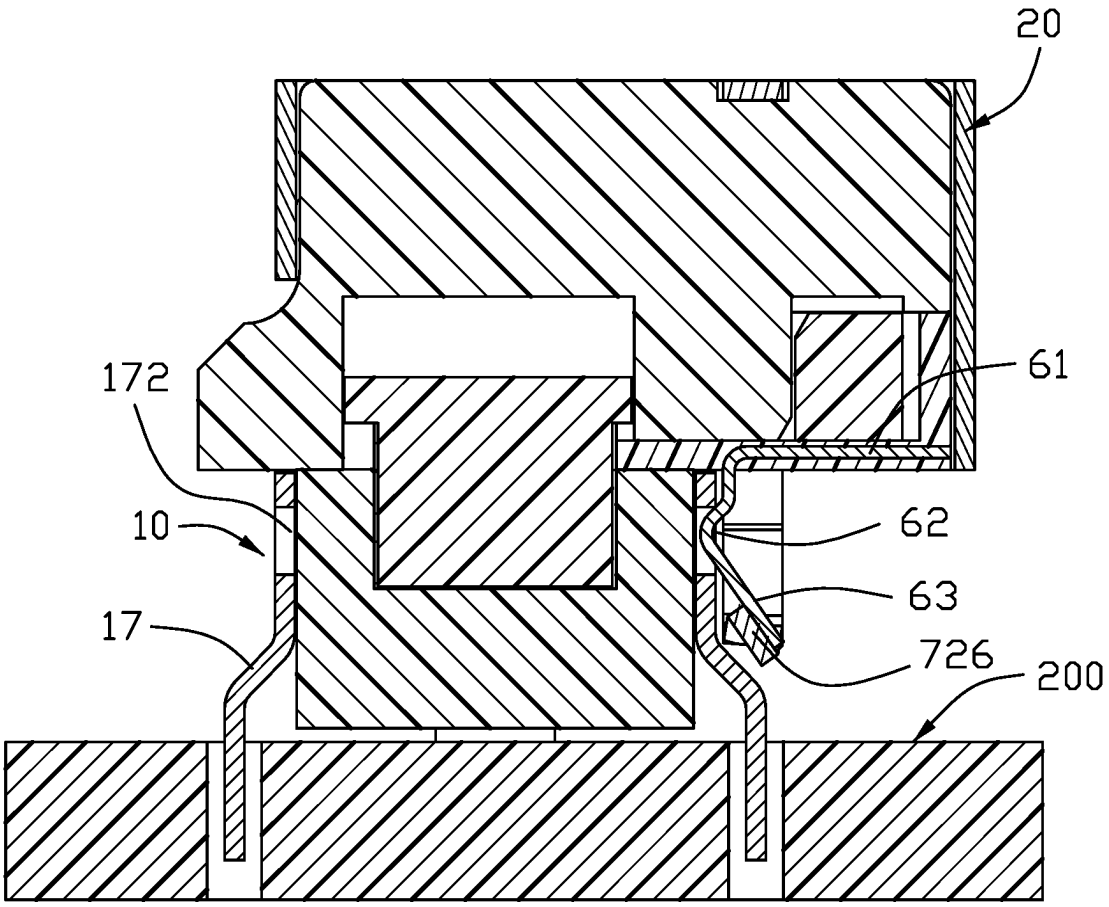


FIG. 4

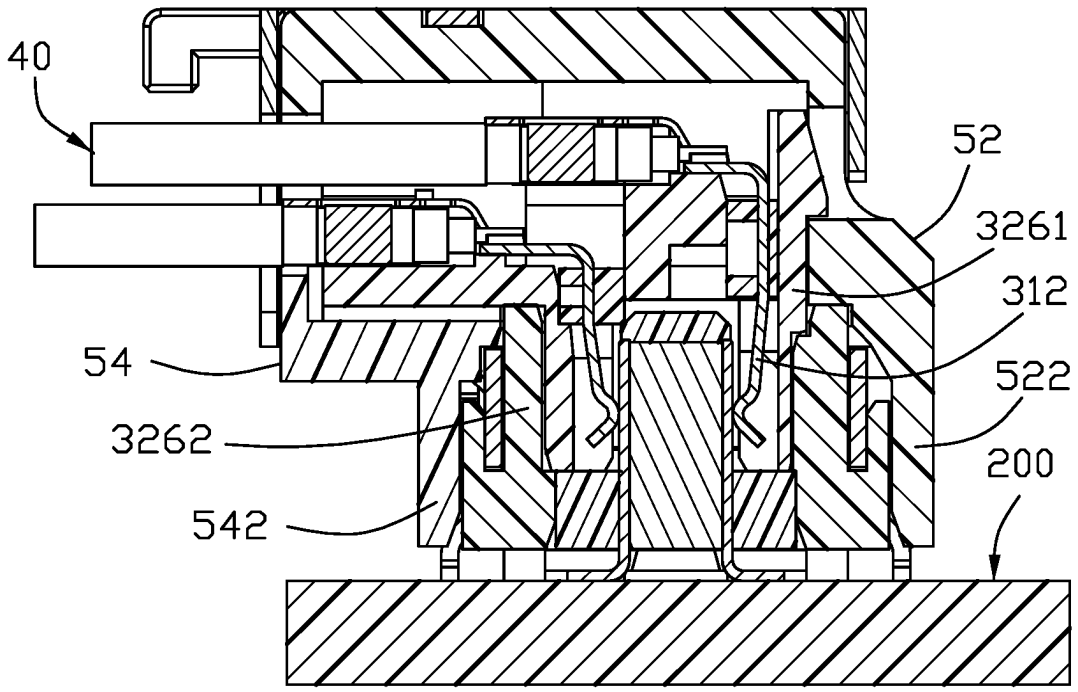


FIG. 5

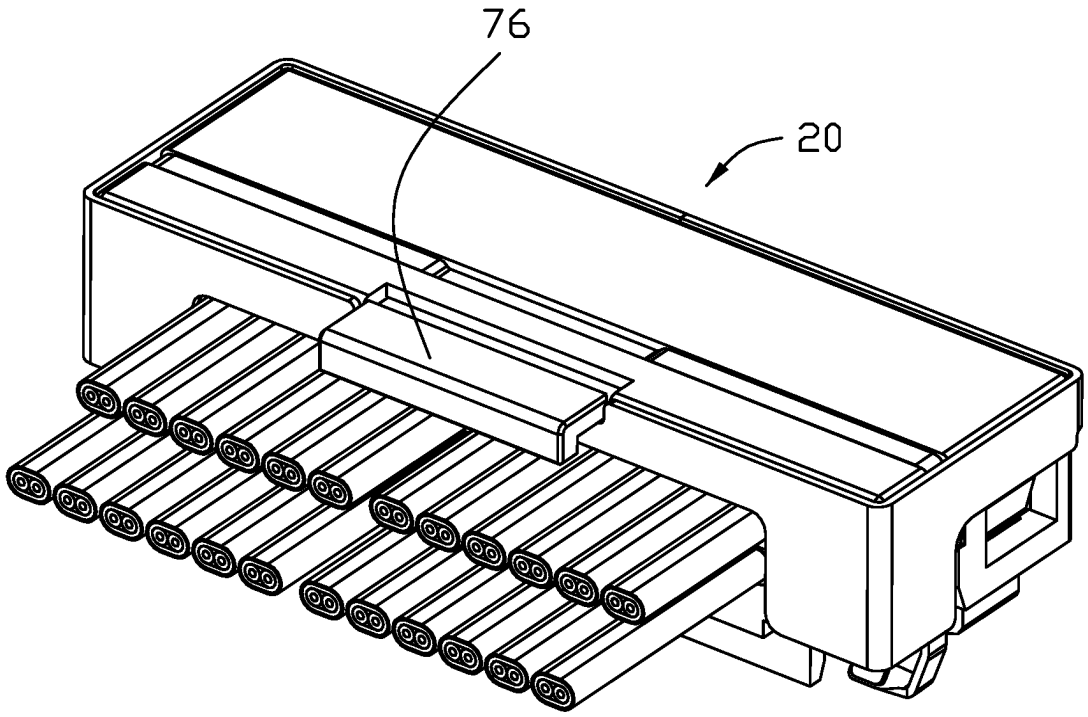


FIG. 6

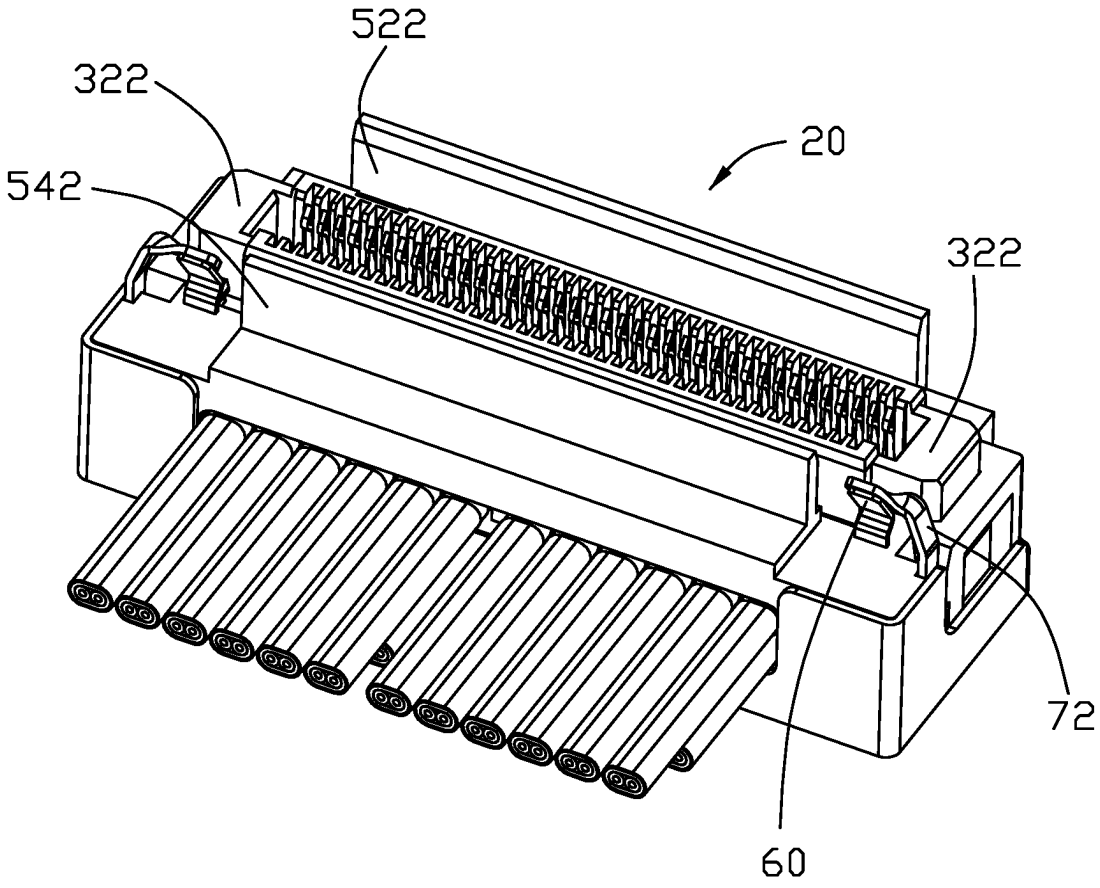


FIG. 7

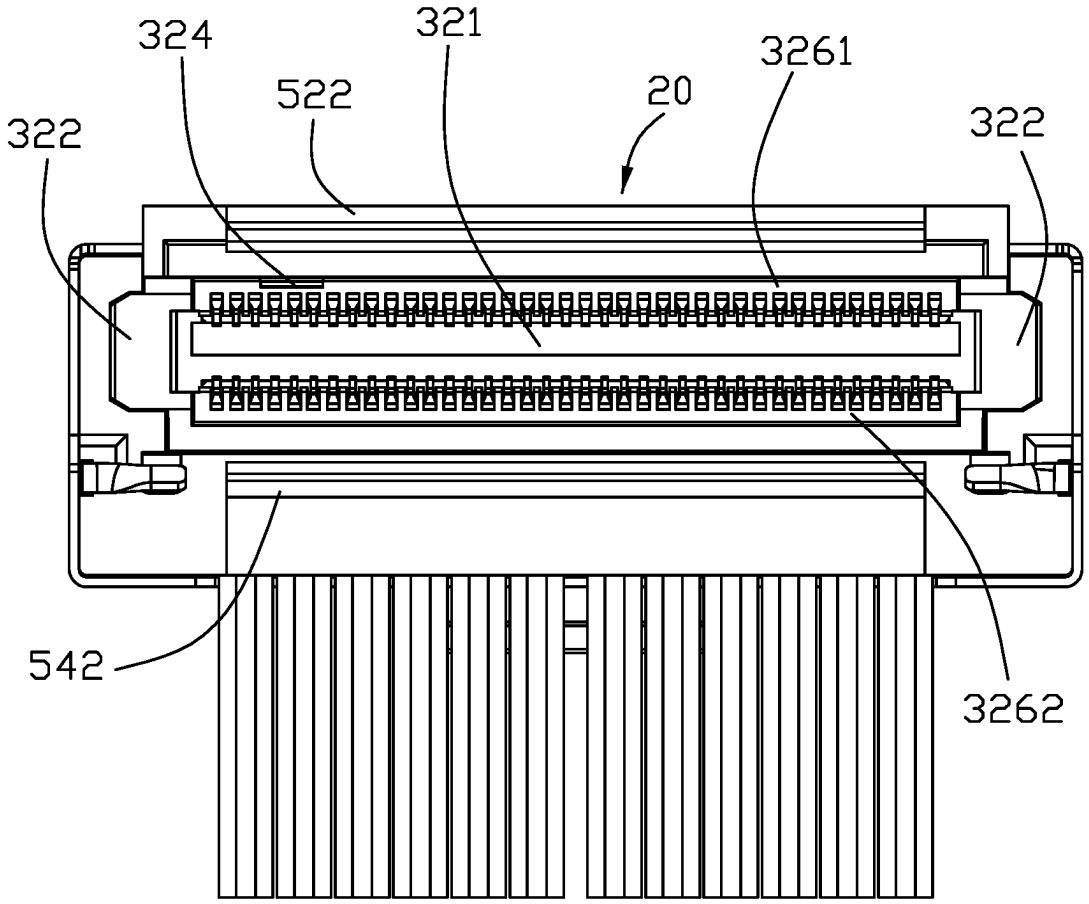


FIG. 8

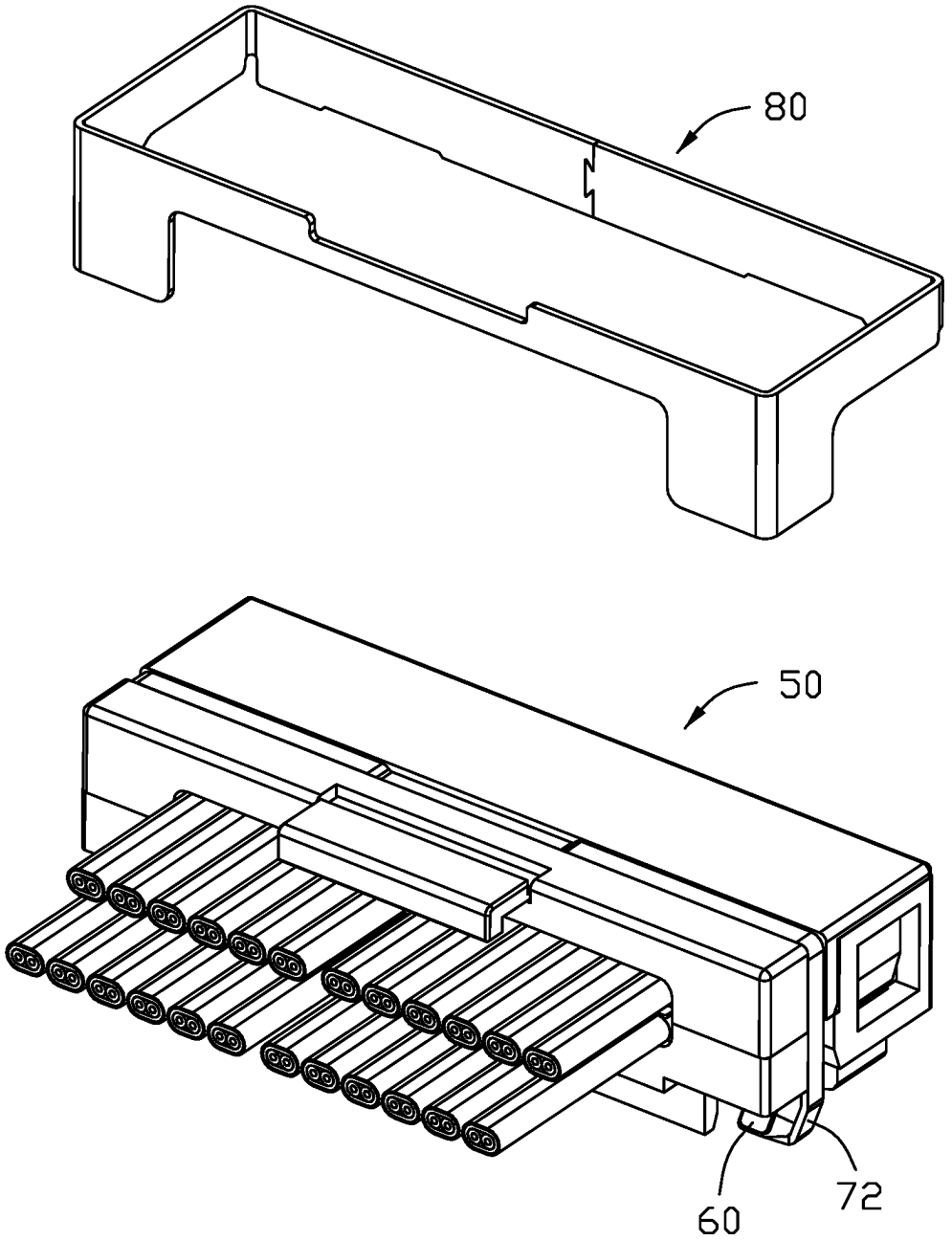


FIG. 9

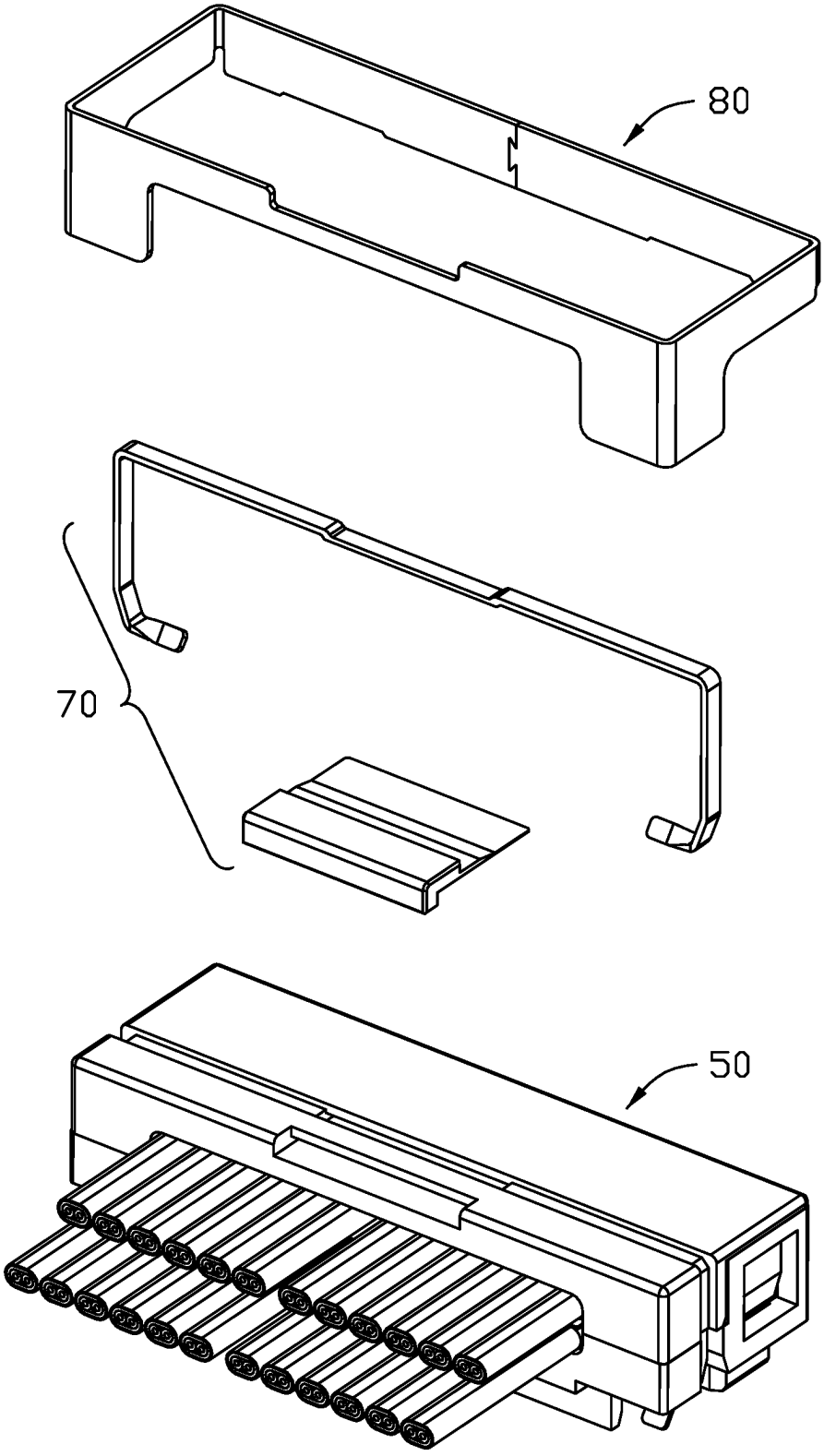


FIG. 10

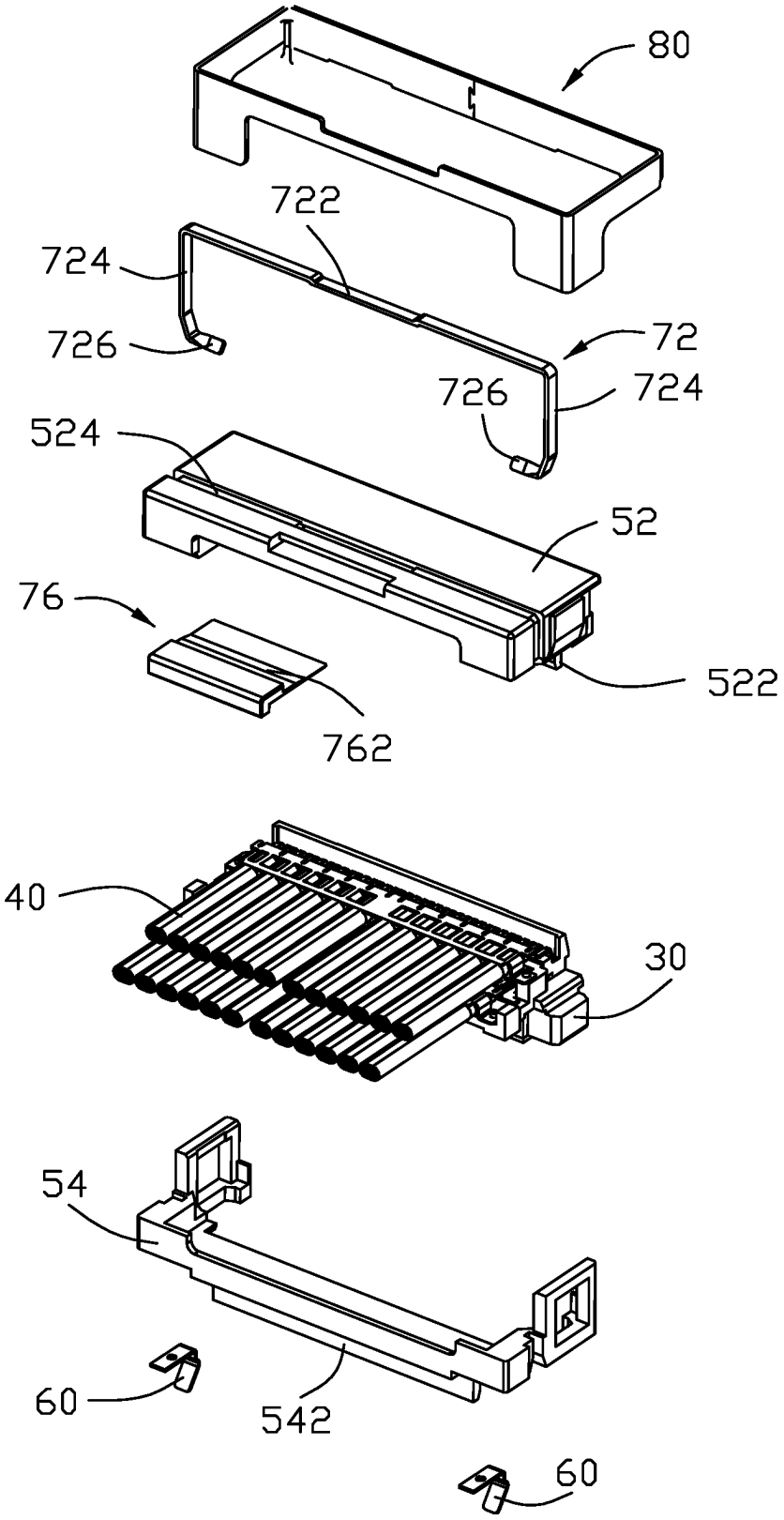


FIG. 11

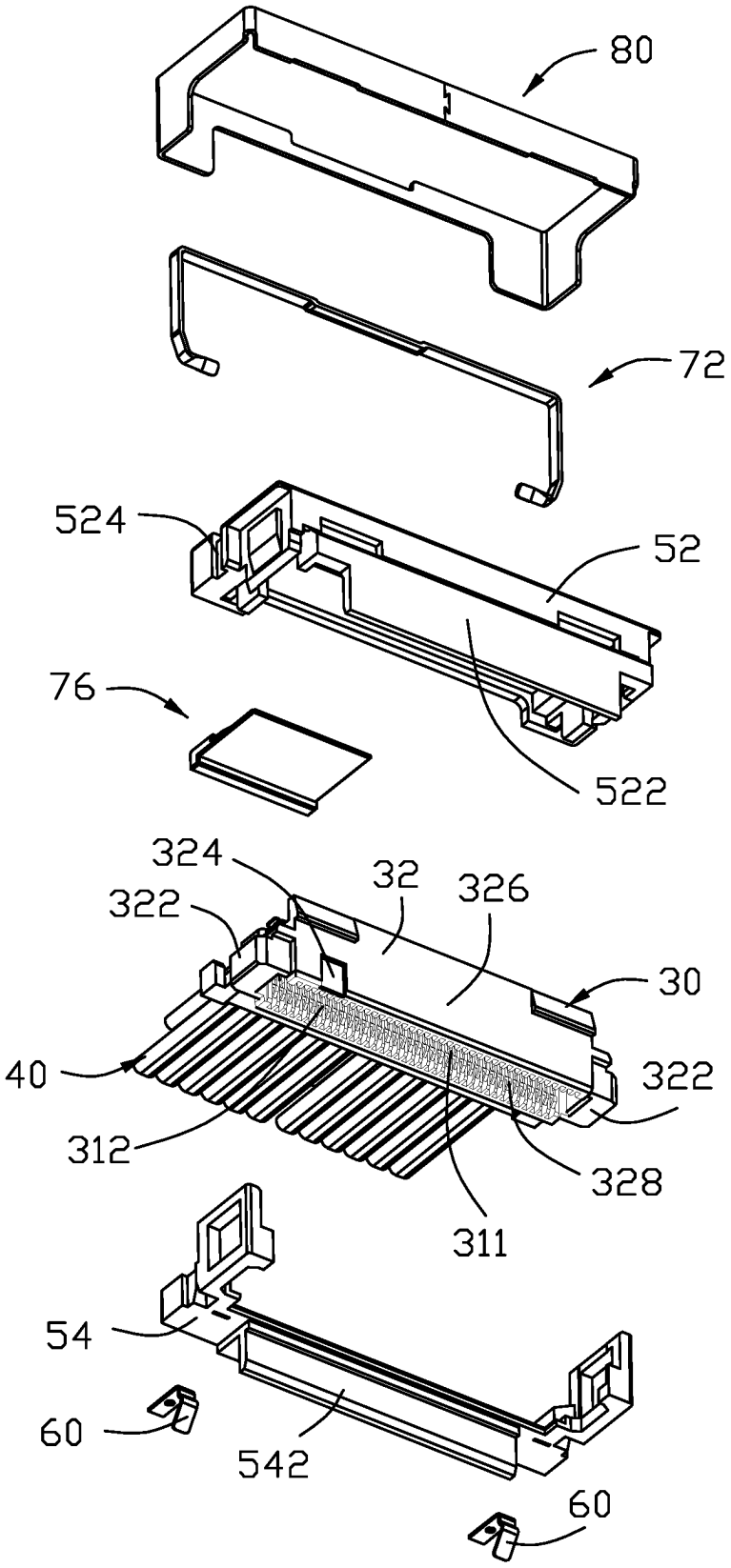

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FIG. 12

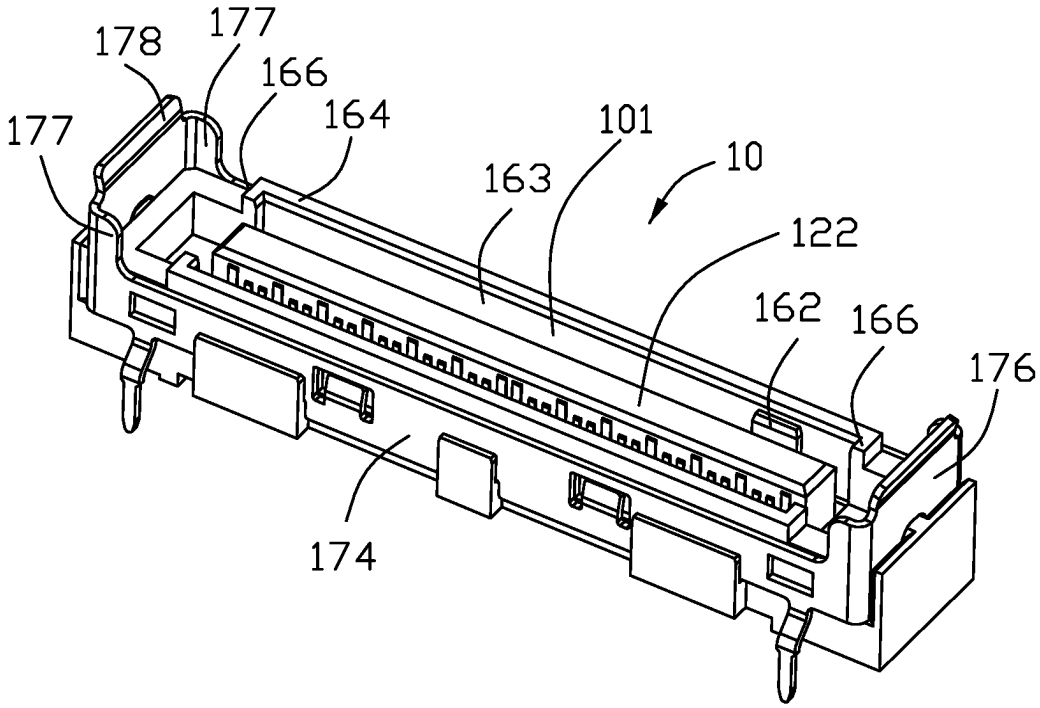

FIG. 13

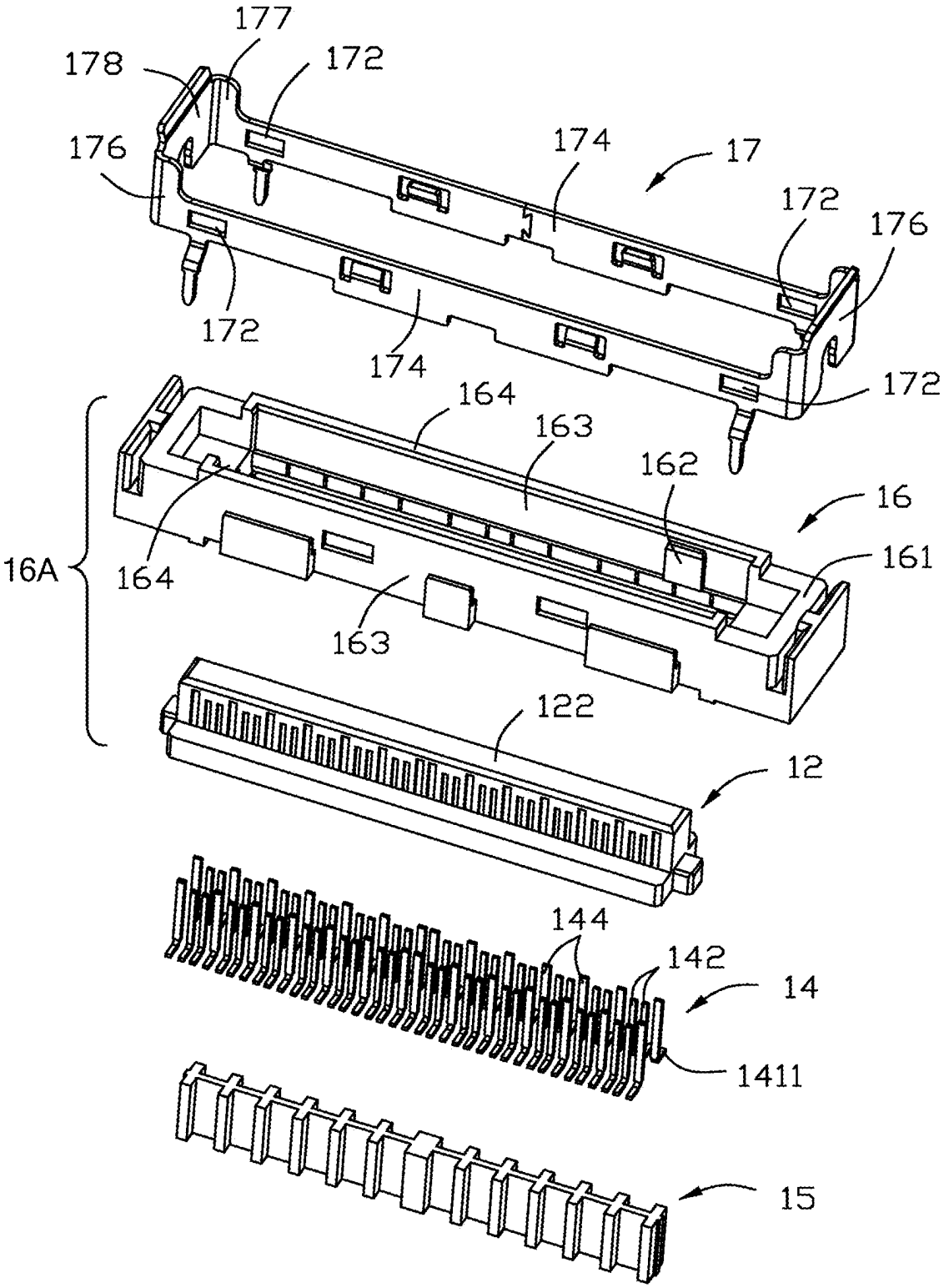
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FIG. 14

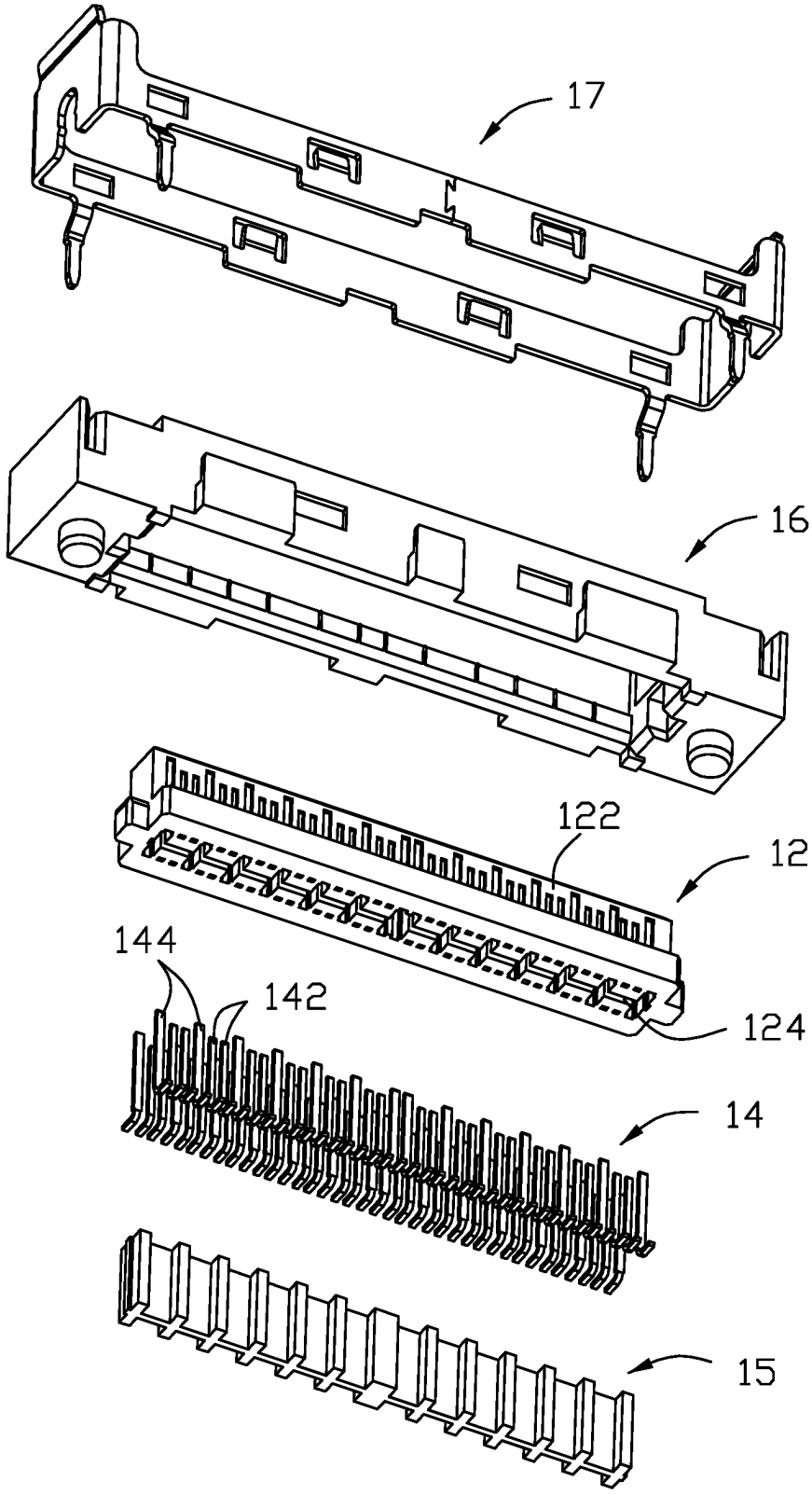

FIG. 15

ELECTRICAL CONNECTOR ASSEMBLY HAVING A POLARIZING FEATURE AND A LATCHING FEATURE

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Patent Application No. 63/260,134, filed on Aug. 10, 2021, the content of which is incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electrical connector assembly including a receptacle connector and a plug connector.

2. Description of Related Arts

U.S. Patent Application Publication No. 2020/0266584 discloses an electrical connector assembly including a plug connector and a mating receptacle connector. The plug connector includes alignment tabs at two opposite ends thereof and the receptacle connector includes notches at two opposite ends thereof configured to receive the alignment tabs. During a detachment operation, a user may operate a handle via a pull tab to urge the alignment tabs in a direction vertically away from the receptacle connector to dislodge the plug connector without applying any mis-oriented pressure on the receptacle connector and/or the plug connector. The plug connector may also include legs at one side thereof and the receptacle connector may also include spaces defined by spaced-apart portions at one side thereof configured to receive the legs to achieve a general alignment during an initial part of a mating operation.

China Patent Publication No. CN112952423A discloses a receptacle connector including a first insulator, a first electric connecting part, and a shell. The first electric connecting part is set in the first insulator, the shell surrounds the first insulator and includes a pair of end walls opposite to each other, each end walls defines a lock hole, and an inserting groove is defined between each end wall and the first insulator. Therefore, a right handed cable plug connector or a left handed cable plug connector can be mated with the receptacle connector on a printed circuit board (PCB). The receptacle connector occupies a large space on the PCB.

Therefore, an improved electrical connector is desired to overcome the disadvantages of the prior arts.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an electrical connector assembly with improved polarizing feature and/or locking feature.

In order to achieve above-mentioned object, an electrical connector includes a contact assembly, a cable assembly terminated to the contact assembly, a cover receiving the contact assembly and the cable assembly, a latch disposed at a bottom of the cover for latching to a mating connector, and an un-mating assembly mounted to the cover and including a lift bar, wherein the latch is operable to unlatch from the mating connector in response to an upward movement of the lift bar while moving upward to dislodge the cover from the mating connector.

Other objects, advantages and novel features of the present invention will become more apparent from the following detailed description of the present embodiment when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a top perspective view of an electrical connector assembly in accordance with the present invention mounted on a printed circuit board;

FIG. **2** is a bottom perspective view of plug connectors of the electrical connector assembly;

FIG. **3** is an assembled perspective view of the electrical connector assembly;

FIG. **4** is a cross-sectional view of the electrical connector assembly taken along lines **4-4** in FIG. **3**;

FIG. **5** is another cross-sectional view of the electrical connector assembly taken along lines **5-5** in FIG. **3**;

FIG. **6** is a top perspective view of the plug connector;

FIG. **7** is a bottom perspective view of the plug connector;

FIG. **8** is a bottom plan view of the plug connector;

FIG. **9** is an exploded view of the plug connector;

FIG. **10** is a further exploded view of the plug connector in FIG. **9**;

FIG. **11** is a still further exploded view of the plug contact in FIG. **10**;

FIG. **12** is a view similar to FIG. **11** but from another perspective;

FIG. **13** is a top perspective view of a receptacle connector of the electrical connector assembly;

FIG. **14** is an exploded view of the receptacle connector in FIG. **13**; and

FIG. **15** is a view similar to FIG. **14** but from another perspective.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference will now be made to the drawing figures to describe the preferred embodiment of the present invention in detail.

Referring to FIGS. **1-15**, an electrical connector assembly **100** of an embodiment of this present invention comprises a receptacle connector **10** to be mounted on a printed circuit board (PCB) **200** and a cable plug connector **20** connecting with two rows of cables. The receptacle connector **10** features a tongue in receptacle design where non-cantilever beam tongue is adopted in order to reduce overall mating height. The plug connector **20** features cantilever beam design in order to reduce overall mating height and provide adequate wiping distance.

Also shown in each of FIGS. **1** and **2**, another plug connector **20**A is shown of similar construction to the plug connector **20**. As shown, the plug connector **20** has a left-hand cable exit and the plug connector **20**A has a right-hand cable exit. The left-handed cable plug connector **20** has two rows of cables **40** extending to a left side, the right-handed cable plug connector **20**A has two rows of cables **40**A extending to a right side. Please notes, left and right is used to describe an opposite direction. The receptacle connector **10** is symmetrical in a sense that it can be placed in two orientations on the PCB **200** for mating with either one of the two plug connectors **20** and **20**A. Understandingly, when the receptacle connector **10** is mounted on the PCB **200**, the terminal assignment is definitive, the plug connector **20** must inserted in a pre-determined direction to keep the terminal assignment consistent. When the PCB **200**

is loaded with other elements, the left-handed cable plug connector **20** or the right-handed cable plug connector **20**A is selected by space limitation on the PCB **200**. If not, the cables must bend to meet space limitation. On the other hand, a polarizing feature may be designed into the electrical connector assembly **100** so that either one of the two plug connectors **20** and **20**A may only be mated to the receptacle connector **10** in only one orientation.

Referring to FIGS. **6-12** in particular, the plug connector **20** includes a contact assembly **30**, a cable assembly **40** terminated to the contact assembly **30**, an insulative cover **50** receiving the contact assembly **30** and the cable assembly **40**, a pair of latches **60** disposed at a bottom of the cover **50**, and an un-mating assembly **70** mounted to the cover **50**. The plug connector **20** may further include a metallic shroud **80** for added strength. The cable assembly **40** includes plural cables extending in a lateral direction perpendicular to a mating direction along which the plug connector **20** and the receptacle connector **10** are to be mated. In this embodiment, the mating direction is defined in an upright direction, the wires extend horizontal. The wires extend angled to the mating direction. The latches **60** and the un-mating assembly are located at a lateral outside of one side wall **326** of the insulating housing **32** from which the cables reach out.

The plural cables of the cable assembly **40** are arranged in an upper row and a lower row. The contact assembly **30** may include an insulative housing **32**, a front and a rear insert-molded contact modules (not labeled) mounted in the insulative housing **32**, and an upper and a lower ground bars retaining the upper and the lower rows of cables to the front and the rear contact modules. Further detail concerning the cable assembly and the contact assembly is provided in commonly owned corresponding U.S. Patent Application No. 63/201,807 filed on May 13, 2021, the content of which is incorporated herein by reference. The insulative housing **32** defines a mating cavity **311** opening downwards and the terminals **312** exposed to the mating cavity **311**. The longitudinal insulative housing **32** includes two side walls **326** and two end walls (not labeled) collectively defining the mating cavity **311**. The insulative housing **32** may have a pair of enlarged locating lugs **322** at two opposite longitudinal end walls thereof for purpose of blind mating to the receptacle connector **10**.

The cover **50** includes an upper cover part **52** having a first blind mating lug **522** and a lower cover part **54** having a second blind mating lug **542** opposing the first blind mating lug **522**. The upper cover part **52** and the lower cover part **54** may be secured to each other by any suitable means.

The latch **60** may be secured to the bottom of the lower cover part **54** by any suitable means. In the embodiment shown, a pair of the latches **60** is embedded, such as by insert molding, in the lower cover part **54**. If desired, the latch **60** may also be secured to the bottom of the upper cover part **52** by any suitable means. As another alternative, instead of formed separately, the latches **60** may be formed on the metallic shroud **80** to then extend to a location near the bottom of the cover **50**. In this embodiment as shown in FIG. **4**, the latch **60** includes a retained portion **61** embedded in the cover **50**, a middle arc latching portion **62** protruding towards the side wall **326** and a slant end portion **63** extending outwards from the latching portion away from the insulative housing **32**.

The un-mating assembly **70** includes a lift bar **72** and a push button **76** for moving the lift bar **72** upward. The lift bar **72** is mounted in a channel **524** of the upper cover part **52**. The lift bar **72** has an intermediate portion **722** and two end portions **724** terminating as hooks **726**. The push button **76** is disposed under the lift bar **72** and has a cam surface **762** engaging the intermediate portion **722**. The cam surface **762** is angled to apply a vertical lifting action to the intermediate portion **722**. Specifically, as the push button **76** is activated in the lateral direction, the cam surface **762** causes the lift bar **72** to translate in the vertical direction. The hook **726** is angled to apply a vertical lifting action on the latch **60**, thereby dislodging the cover **50** from the receptacle connector **10** without applying any mis-oriented pressure on the receptacle connector **10** and/or the plug connector **20**. Specifically, the latch **60** is operable to unlatch from the receptacle connector **10** in response to an upward movement of the lift bar **72** while moving upward to dislodge the cover **50** from the receptacle connector **10**.

Referring to FIGS. **13-15** in particular, the receptacle connector **10** includes an insulative housing **12** having a tongue **122** and a cavity **124**, two rows of terminals **14** molded in the insulative housing **12** while exposing respectively to two opposite surfaces of the tongue **122**, a conductive plastic member **15**, an insulative shroud **16** enclosing the insulative housing **12**, and a receptacle shell **17** enclosing the shroud **16**. The insulative shroud **16** and the insulative housing **12** are to be retained together to form a receptacle housing **16**A, as shown in FIG. **14**. The receptacle housing **16**A defines a receiving cavity **101** between two side walls **163** parallel to the tongue **122** and two end walls **161** connecting with the side walls **163**, and the longitudinal tongue **122** is in the receiving cavity **101**. Each row of terminals **14** includes a plurality of signal terminals **142** and a plurality of ground terminals **144** and the plurality of ground terminals **144** are exposed to the cavity **124**. The conductive plastic member **15** is molded in the cavity **124** to be electrically coupled to the plurality of ground terminals **144**. The shroud **16** may have features for securely retaining the insulative housing **12**. The shell **17** may have retention features for securely retaining to the shroud **16**. The shell **17** may have one or more latching holes **172** on one or both side walls **174** thereof. The signal terminals **142** are preferably arranged in pairs for differential signals transmission.

Turning now to the polarizing feature, as best seen in FIGS. **1-2** in combination with FIGS. **12-13**, the insulative housing **32** of the plug connector **20** has a keyway **324** and the shroud **16** of the receptacle connector **10** has a key **162**. Each of the keyway **324** and the key **162** generally extends in the mating direction. In this embodiment, the key **162** is defined on the receptacle housing **16**A. The side walls **163** of the receptacle housing comprise a first side wall **1631** and a second side wall **1632** opposite to the first side wall. The key **162** is defined on the first side wall **1631** and offset to one end wall, while the second side wall **1632** has no key. In the plug connector **10**, the side walls of the insulative housing **32** comprises a front side wall or a first side wall **3261** and a rear side wall or a second side wall **3262**, the keyway **324** is defined on the first side wall **3261**. As best shown in FIGS. **1-2**, in the left handed cable plug connector **20**, the keyway **324** is defined on the first side wall **3261** and the cable assembly **40** reaches out from the second side wall **3262**, while in the right handed cable plug connector **20**A, the insulative housing keep a same direction with the left handed cable plug connector **20**, the cable assembly **10**A reaches out from the first side wall **3261**, and the latch **60**A is located near to the first side wall **3261**. It is noted that the latch **60** is located at a lateral side of the contact assembly **30** of the plug connector **20** proximal to the cable assembly **40**. In the case of the plug connector **20**, as shown in FIGS. **1-2**, the latch **60** is located proximal to the second side wall **3262**, and the keyway **324** is disposed on the first side wall

3261. Understandably, in the case of the plug connector 20A, corresponding keyway 324 is disposed on first side wall 3261, assuming the cable assembly including plural cable wires extending rearward in the lateral direction.

Turning now to the blind mating feature, the first blind mating lug 522 of the upper cover part 52 extends alongside and downward beyond the front/first side wall 3261 and the second blind mating lug 542 of the lower cover part 54 extends alongside and downward beyond the rear/second side wall 3262, as seen in FIG. 5. The first and second blind mating lugs 522 and 542, together with the pair of enlarged locating lugs 322 at two opposite ends of the insulative housing 32, form an effective blind mate structure, as seen in FIG. 2, which keep an easy mating process of such small form factor plug connector into the receptacle connector. The first and second blind mating lugs 522 and 542 also prevent the plug connector 20 from rotating when the plug connector 20 and the receptacle connector 10 are mated. Moreover, as shown in FIGS. 13 and 14, corresponding to plug-side blind mating feature, the receptacle housing 16A is provided with a respective raised portion 164 at each of two side walls 163 thereof in that a top face of the raised portion 164 is leveled higher than a top face of the tongue 122. Each of the two side walls 163 is thinned so that the raised portion 164 has two angled ends 166. Similarly, the receptacle shell 17 is provided with a respective raised portion 178 at each of two end walls 176 thereof. Raised end portions 177 are also formed on the side walls 174 to continue the raised portion 178. These raised portions and ends 164, 166, 177, and 178 together define an interface beneficial for blind mating of the plug and receptacle connectors.

Although the present invention has been described with reference to particular embodiments, it is not to be construed as being limited thereto. Various alterations and modifications can be made to the embodiments without in any way departing from the scope or spirit of the present invention as defined in the appended claims.

What is claimed is:

1. A cable plug connector comprising:
- a contact assembly;
- a cable assembly terminated to the contact assembly;
- an insulative cover receiving the contact assembly and the cable assembly;
- a latch disposed at a bottom of the insulative cover for latching to a mating receptacle connector; and
- an un-mating assembly mounted to the cover and comprising a lift bar;
- wherein the latch is operable to unlatch from the mating connector in response to an upward movement of the lift bar while moving upward to dislodge the insulative cover from the mating connector.

2. The cable plug connector as claimed in claim 1, wherein the cover comprises an upper cover part having a first blind mating lug and a lower cover part having a second blind mating lug opposing the first blind mating lug.

3. The cable plug connector as claimed in claim 1, wherein the latch is separately attached to a bottom face of the cover.

4. The cable plug connector as claimed in claim 1, wherein the un-mating assembly comprises a push button for moving the lift bar upward.

5. The cable plug connector as claimed in claim 1, wherein the contact assembly comprises an insulative housing having a polarizing feature.

6. The cable plug connector as claimed in claim 1, wherein the cable assembly comprises plural cables angled from a lateral side of the contact assembly and the latch is located proximate to the lateral side of the contact assembly.

7. The cable plug connector as claimed in claim 1, wherein the contact assembly comprises an insulative housing and terminals retained in the insulative housing, the insulative housing defines a pair of enlarged locating lugs at two opposite longitudinal ends for a blind mating of the cable plug connector.

8. A receptacle connector adapted for mating with a right-handed cable plug connector or a left-handed cable plug, the receptacle connector comprising:
- a receptacle housing comprising a tongue, and a first side wall and a second side wall both parallel to the tongue;
- a plurality of terminals exposed upon the tongue;
- a shell surrounding the receptacle housing and comprising two side walls corresponding to the first side wall and the second side wall of the receptacle housing, each of the side walls defining at least one latching hole;
- wherein the first side wall of the receptacle housing defines a polarizing feature for mating with the right-handed cable plug connector or the left-handed cable plug.

9. The receptacle connector as claimed in claim 8, wherein the polarizing feature is in a form of a key in an inner side of the first side wall, the key extending in a mating direction of the receptacle connector.

10. A cable plug connector comprising:
- a contact assembly comprising an insulative housing and a plurality of terminals, the insulative housing comprising a first side wall and an opposite second side wall;
- a cable assembly terminated to the contact assembly and comprising plural cables extending in a lateral direction angled to a mating direction of the cable plug connector; and
- an insulative cover receiving the contact assembly and the cable assembly;
- wherein the first side wall defines only one recessed keyway on an outer side thereof.

11. The cable plug connector as claimed in claim 10, wherein the insulative housing defines two enlarged locating lugs at two opposite longitudinal ends thereof.

12. The cable plug connector as claimed in claim 10, wherein the cover comprises a first blind mating lug and a second blind mating lug extending alongside and downward beyond the first and second side walls, respectively.

13. The cable plug connector as claimed in claim 10, wherein the cables extend out from the second side wall, a latch is attached on the cover and located proximate to the second side wall, and an un-mating assembly is mounted to the cover and located proximate to the latch.

14. The cable plug connector as claimed in claim 10, wherein the cables extend out from the first side wall, a latch is attached on the cover and located proximate to the first side wall, and an un-mating assembly is mounted to the cover and located proximate to the latch.

15. The cable plug connector as claimed in claim 10, wherein a latch is disposed at a bottom of the cover for latching to a receptacle connector.

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