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des brevets



(11)

EP 4 164 070 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.04.2023 Bulletin 2023/15

(51) International Patent Classification (IPC):
H01R 13/66 (2006.01) **H01R 12/72** (2011.01)
H01R 12/70 (2011.01) **H01R 12/73** (2011.01)

(21) Application number: 22167112.6

(52) Cooperative Patent Classification (CPC):
H01R 13/6658; H01R 12/724; H01R 12/7088;
H01R 12/721; H01R 12/737

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

(30) Priority: 07.10.2021 TW 110137488

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(54) CONNECTOR

(57) The present invention provides a connector including a housing, an adapter plate, a plurality of first terminals, a plurality of second terminals, a plurality of third terminals, an adapter seat and a plurality of fourth terminals. The first terminals and the second terminals are electrically connected to the fourth terminals through

a circuit layout of the adapter board to perform a voltage and current transmission, and the third terminals can be directly connected to a circuit board. Compared with the first terminals, the second terminals and the fourth terminals, the third terminal performs a large voltage and current transmission.

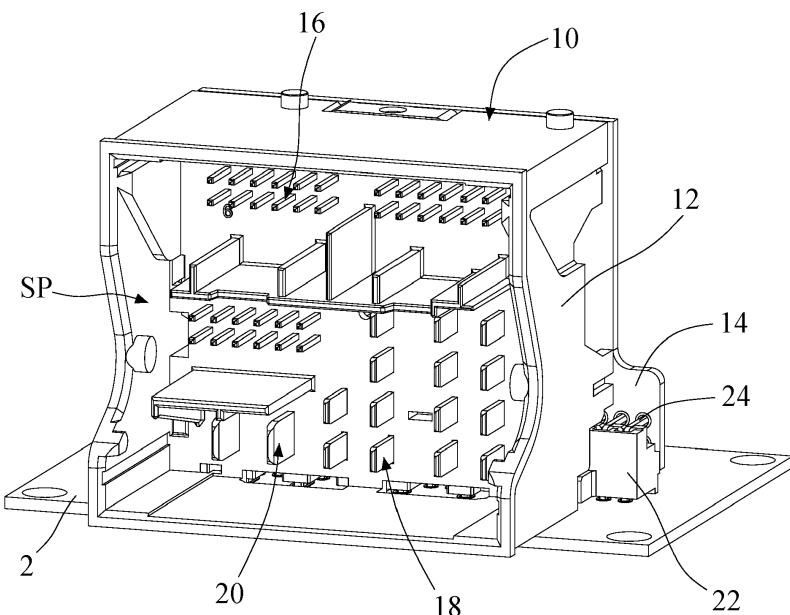


FIG.2

Description

FIELD OF THE INVENTION

[0001] The present invention relates to the technical field of connectors, particularly to one that causes low power loss or no power loss during great voltage and current transmissions.

BACKGROUND OF THE INVENTION

[0002] Conventionally, connectors transmit powers (or electricity) and signals at the same time. With reference to FIG. 1, a connector 1 is connected to a circuit board 2 and includes a housing 3, an adapter plate 5, a first terminal group 7, a second terminal group 9, a third terminal group 11, an adapter seat 13 and a fourth terminal group 15. Among which the third terminal group 11 has a greater area of the electrodes comparing to others' and that is for the purpose of power transmission.

[0003] The connector 1 as shown in FIG. 1 can be further connected to another connector (not shown), and the second terminal group 9 and the third terminal group 11 have each terminal thereof arranged as a bar without any bending structures; therefore, the adapter seat 13 has to perform the transmission to the circuit board 2 via the fourth terminal group 15. However, the power is transmitted through so many components such as the third terminal group 11, the adapter plate 5, the adapter seat 13 and the fourth terminal group 15, and such transmission will inevitably cause power loss during the process. Also, since the transmission requires the power going through so many components, there is also a possibility that the power value of the voltages and electric currents transmitted by the connector 1 would be limited due to the material characteristics of the components.

[0004] On the other hand, with an assembly by such amount of the components, the structure of the conventional connector 1 has certain thickness that cannot be effectively improved, and this leads to restrictions of applications.

[0005] Therefore, the present invention provides a connector that is able to resolve the deficiencies in the prior art.

SUMMARY OF THE INVENTION

[0006] An objective of the present invention is to provide a connector that is capable of performing great voltage and electric currents transmissions with low power loss or no power loss.

[0007] Another objective of the present invention is to provide one or multiple structures for the aforesaid connector to fix a housing, a plurality of terminals, an adapter plate and an adapter seat thereof by positioning or engaging arrangements, so as to provide a stably fixed structure.

[0008] Another objective of the present invention is to

provide one or multiple structures for the aforesaid connector to combine the adapter plate, the adapter seat and the terminals thereof for various applications in different situations.

[0009] Yet another objective of the present invention is to provide the aforesaid connector as a multimedia system application suitable for use in the cars.

[0010] To achieve the objectives mentioned above and other objectives, the present invention has a connector that is able to be connected with an external connector and a circuit board. The connector comprises a housing, an adapter plate, a plurality of first terminals, a plurality of second terminals, a plurality of third terminals, an adapter seat and a plurality of fourth terminals. The housing includes an engaging end and a half opened engaging space formed for the external connector to be disposed in the engaging space through the engaging end. The housing provides a first surface for connection with the circuit board and a second surface forming a plurality of first through holes, a plurality of third through holes and a plurality of fifth through holes thereon; the fifth through holes are arranged closer to the first surface than the first through holes. Wherein the first surface is adjacent to the second surface and the size of the fifth through holes is no smaller than the size of the third through holes, the latter being no smaller than the size of the first through holes. The adapter plate is combined with the second surface and includes a plurality of second through holes, a plurality of fourth through holes and a plurality of sixth through holes formed thereon. The second through holes are arranged corresponding to the first through holes and the fourth through holes are arranged corresponding to the third through holes; the sixth through holes are arranged closer to the first surface of the housing than the second and the fourth through holes. The adapter plate further has a wire layout for the second through holes and the fourth through holes to be electrically connected to the sixth through holes distinctly. The first terminals separately provide an eleventh terminal end arranged in the second through holes and a twelfth terminal end passing through the first through holes and protruding in the engaging space. The second terminals separately provide a twenty-first terminal end arranged in the fourth through holes and a twenty-second terminal end passing through the third through holes and protruding in the engaging space. Wherein the size of the second terminals is no smaller than the size of the first terminals. The third terminals separately provide a thirty-first terminal end to be connected with the circuit board and a thirty-second terminal end passing through the fifth through holes and protruding in the engaging space. Wherein the size of the third terminals is no smaller than the size of the second terminals. The adapter seat combines the adapter plate with the housing and includes a plurality of guiding holes formed thereon. The fourth terminals separately provide a forty-first terminal end arranged in the sixth through holes and a forty-second terminal end passing through the guiding holes and being guided for connec-

tion with the circuit board. Wherein the first and second terminals are electrically connected with the fourth terminals via a wire layout of the adapter plate for performing voltage and current transmissions, and the third terminals are utilized for a direct connection with the circuit board, performing greater transmissions of voltages and electric currents than the first, second and fourth terminals.

[0011] Alternatively, the connector of the present invention comprises a housing, an adapter plate, a plurality of first terminals, a plurality of second terminals, a plurality of third terminals, an adapter seat and a plurality of fourth terminals. The housing includes an engaging end, a half opened engaging space and a first opening for the external connector to be disposed in the engaging space through the engaging end. The housing provides a first surface for connecting the circuit board with the housing and a second surface forming a plurality of first through holes and a plurality of third through holes thereon. The first opening is formed at an intersection area of the first surface and the second surface. Wherein the first surface is adjacent to the second surface. The adapter plate is combined with the second surface and has a plurality of second through holes, a plurality of fourth through holes and a plurality of electrode terminals formed thereon. The second through holes are arranged corresponding to the first through holes and the fourth through holes are arranged corresponding to the third through holes. The electrode terminals are formed at an edge of the adapter plate, and the adapter plate further forms a layout for wires, for the second through holes and the fourth through holes to be electrically connected to the electrode terminals distinctly. The first terminals separately provide an eleventh terminal end arranged in the second through holes and a twelfth terminal end passing through the first through holes and protruding in the engaging space. The second terminals separately provide a twenty-first terminal end arranged in the fourth through holes, a twenty-second terminal end passing through the third through holes and protruding in the engaging space, a twenty-third terminal end for connection with the circuit board and a twenty-fourth terminal end passing through the third through holes and protruding in the engaging space. Wherein the size of the second terminals is no smaller than the size of the first terminals. The third terminals separately provide a thirty-first terminal end to be connected with the circuit board and a thirty-second terminal end protruding in the engaging space. Wherein the size of the third terminals is no smaller than the size of the second terminals. The adapter seat is arranged at the first opening for combining the adapter plate with the housing and further includes an inserting point formed thereon for inserting the adapter plate and a plurality of guiding holes formed thereon. The fourth terminals are arranged at the inserting point, separately providing a forty-third terminal end arranged in the inserting point corresponding to the electrode terminals and a forty-fourth terminal end passing through the inserting point for connection with the circuit board. The fourth terminals

are positioned in the inserting point via the guiding holes. Wherein the first terminals and the second terminals with the twenty-first terminal end and the twenty-second terminal end are electrically connected to the fourth terminals via a wire layout of the adapter plate for performing voltage and current transmissions, and the second terminals with the twenty-third terminal end and the twenty-fourth terminal end and the third terminals are able to be directly connected with the circuit board, performing greater transmissions of voltages and electric currents than the first, second and fourth terminals.

[0012] Alternatively, the connector of the present invention comprises a housing, an adapter plate, a plurality of first terminals, a plurality of second terminals, a plurality of third terminals, an adapter seat and a plurality of fourth terminals. The housing includes an engaging end and a half opened engaging space formed for the external connector to be disposed in the engaging space through the engaging end. The housing provides a first surface for

connection with a circuit board and a second surface forming a plurality of first through holes, a plurality of third through holes and a plurality of fifth through holes thereon. The fifth through holes are arranged closer to the first surface than the first through holes. Wherein the first

surface is adjacent to the second surface and the size of the fifth through holes is no smaller than the size of the third through holes, the latter being no smaller than the size of the first through holes. The adapter plate is combined with the second surface and has a plurality of sec-

ond through holes, a plurality of fourth through holes and a plurality of electrode terminals formed thereon. The second through holes are arranged corresponding to the first through holes and the fourth through holes are arranged corresponding to the third through holes; the elec-

trode terminals are formed at an edge of the adapter plate. The adapter plate further forms a layout for wires, for the second through holes and the fourth through holes to be electrically connected to the electrode terminals distinctly. The first terminals separately provide an ele-

venth terminal end arranged in the second through holes and a twelfth terminal end passing through the first through holes and protruding in the engaging space. The second terminals separately provide a twenty-first terminal end arranged in the fourth through holes, a twenty-

second terminal end passing through the third through holes and protruding in the engaging space, a twenty-third terminal end for connection with the circuit board and a twenty-fourth terminal end passing through the third through holes and protruding in the engaging space.

Wherein the size of the second terminals is no smaller than the size of the first terminals. The third terminals separately provide a thirty-first terminal end to be connected with the circuit board and a thirty-second terminal end passing through the fifth through holes and protruding in the engaging space. Wherein the size of the third terminals is no smaller than the size of the second terminals. The adapter seat combines the adapter plate with the housing and includes a plurality of inserting points

formed for the adapter plate to be inserted thereon. The fourth terminals are arranged at the inserting point, separately providing a forty-third terminal end arranged in the inserting point corresponding to the electrode terminals and a forty-fourth terminal end passing through the inserting point for connection with the circuit board. Wherein the first terminals and the second terminals with the twenty-first terminal end and the twenty-second terminal end are electrically connected with the fourth terminals via a wire layout of the adapter plate for performing voltage and current transmissions, and the second terminals with the twenty-third terminal end and the twenty-fourth terminal end and the third terminals are directly connected with the circuit board, performing greater transmissions of voltages and electric currents than the first, second and fourth terminals.

[0013] In comparison with the conventional connectors, the present invention provides one that is applicable in great electric currents transmissions within a limited space by physically reducing the thickness of the connector via structural designs. In addition, with multiple engaging, positioning and limiting structures among the components, the connector is fixedly and stably assembled.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is a perspective view of a conventional connector according to the prior art;
 FIG. 2 is a perspective view of the present invention connected with a circuit board in a first embodiment;
 FIG. 3(a) is a front plan view of the housing in FIG. 2;
 FIG. 3(b) is a rear plan view of the housing in FIG. 2;
 FIG. 3(c) is a bottom plan view of the housing in FIG. 2;
 FIG. 3(d) is a side plan view of the housing in FIG. 2;
 FIG. 4(a) is a front plan view of an adapter plate mounted on an adapter seat according to the present invention as shown in FIG. 2;
 FIG. 4(b) is a rear plan view of the adapter plate mounted on the adapter seat according to the present invention as shown in FIG. 2;
 FIG. 4(c) is a side plan view of the adapter plate mounted on the adapter seat according to the present invention as shown in FIG. 2;
 FIG. 5(a) is a perspective view of the adapter seat and a plurality of second terminals engaged with a plurality of third terminals according to the present invention as shown in FIG. 2;
 FIG. 5(b) is a bottom plan view of FIG. 5(a);
 FIG. 6 is a bottom plan view of the present invention as shown in FIG. 2;
 FIG. 7 is a perspective view of the present invention connected with a circuit board in a second embodiment;
 FIG. 8(a) is a front plan view of the housing in FIG. 7;

FIG. 8(b) is a rear plan view of the housing in FIG. 7;
 FIG. 8(c) is a bottom plan view of the housing in FIG. 7;
 FIG. 8(d) is a side plan view of the housing in FIG. 7;
 FIG. 9(a) is a perspective view of an adapter plate, a plurality of first terminals, a plurality of second terminals and a plurality of third terminals engaged with a plurality of fourth terminals according to the present invention as shown in FIG. 7;
 FIG. 9(b) is a perspective view of the adapter plate, an adapter seat, the first terminals, the second terminals and the third terminals engaged with the fourth terminals according to the present invention as shown in FIG. 7;
 FIG. 9(c) is a top plan view of FIG. 9(b);
 FIG. 10 is a perspective view of the present invention connected with a circuit board in a third embodiment;
 FIG. 11(a) is a front plan view of the housing in FIG. 10;
 FIG. 11(b) is a rear plan view of the housing in FIG. 10;
 FIG. 11(c) is a bottom plan view of the housing in FIG. 10;
 FIG. 11(d) is a side plan view of the housing in FIG. 10;
 FIG. 12(a) is a perspective view of an adapter according to the present invention as shown in FIG. 10; and
 FIG. 12(b) is a perspective view of the adapter, a plurality of second terminals engaged with a plurality of third terminals according to the present invention as shown in FIG. 10.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] In order to fully comprehend the objectives, features and efficacy of the present invention, a detailed description is described by the following substantial embodiments in conjunction with the accompanying drawings. The description is as below.

[0016] The description of unit, element and component in the present invention uses "one", "a", or "an". The way mentioned above is for convenience, and for general meaning of the category of the present invention. Therefore, the description should be understood as "include one", "at least one", and include the singular and plural forms at the same time unless obvious meaning.

[0017] The description of comprise, have, include, contain, or another similar semantics has the non-exclusive meaning. For example, an element, structure, product, or device contain multi requirements are not limited in the list of the content, but include another inherent requirement of element, structure, product or device not explicitly listed in the content. In addition, the term "or" is inclusive meaning, and not exclusive meaning.

[0018] Referring to FIG. 2, it is a perspective view of the present invention, a connector 10 connected with a

circuit board 2 in the first embodiment. In FIG. 2, the connector 10 can be connected with an external connector (not shown) and the circuit board 2. In view of different applications, the external connector can be one for use in the cars.

[0019] The connector 10 comprises a housing 12, an adapter plate 14, a first terminal group 16 consisted of a plurality of first terminals 162, a second terminal group 18 consisted of a plurality of second terminals 182, a third terminal group 20 consisted of a plurality of third terminals 202, an adapter seat 22 and a fourth terminal group 24 consisted of a plurality of fourth terminals 242.

[0020] With reference to FIGS. 3(a) to 3(d), there are plan views of the housing 12 illustrated in FIG. 2, among which FIG. 3(a) being a front plan view thereof, FIG. 3(b) being a rear plan view thereof, FIG. 3(c) being a bottom plan view thereof, and FIG. 3(d) being a side plan view thereof.

[0021] The housing 12 includes an engaging end 1218 and a half opened engaging space **SP** formed for the external connector (not shown) to be disposed in the engaging space **SP** through the engaging end 1218. The housing 12 provides a first surface **SF1** for connection with the circuit board 2 and a second surface **SF2** forming a plurality of first through holes 122, a plurality of third through holes 124 and a plurality of fifth through holes 126 thereon. The fifth through holes 126 are arranged closer to the first surface **SF1** than the first through holes 122. Wherein the first surface **SF1** is adjacent to the second surface **SF2**; in this embodiment, the first surface **SF1** and the second surface **SF2** are arranged adjacently in an approximately 90° angle. The size of the fifth through holes 126 is larger than or equals to the size of the third through holes 124, and the size of the third through holes 124 is larger than or equals to the size of the first through holes 122.

[0022] In another embodiment, the housing 12 further has a plurality of first engaging sections 1212 formed on the second surface **SF2**. Here we have two first engaging sections 1212 for exemplariness; in other embodiments it can be single or multiple. Also, the first engaging sections 1212 are exemplarily arranged as through holes herein.

[0023] In another embodiment, the housing 12 further includes a plurality of third positioning sections 1214 formed on the second surface **SF2**. Here we have two third engaging sections 1214 for exemplariness; in other embodiments it can be single or multiple. Also, the third engaging sections 1214 are exemplarily arranged as through holes herein.

[0024] In another embodiment, the housing 12 further includes a first positioning section 1210 formed on the second surface **SF2**. The first positioning section 1210 is exemplarily arranged as a positioning pin herein.

[0025] In another embodiment, the housing 12 further includes a plurality of third engaging sections 1216 formed in a space between the first and second surfaces **SF1**, **SF2**. Here the amount of the third engaging sections

1216 is two for exemplariness, each forming at one side of the space, and the free ends of the third engaging sections 1216 are arranged in a hook structure.

[0026] In another embodiment, the housing 12 further includes a plurality of first positioning elements 128 formed on the first surface **SF1** for fixing the housing 12 on the circuit board 2.

[0027] With reference to FIGS. 4(a) - 4(c), there are plan views illustrating the adapter plate 14 mounted on the adapter seat 22 as shown in FIG. 2, among which FIG. 4(a) being a front plan view thereof, FIG. 4(b) being a rear plan view thereof, and FIG. 4(c) being a side plan view thereof.

[0028] The adapter plate 14 is combined with the second surface **SF2** and has a plurality of second through holes 142, a plurality of fourth through holes 144 and a plurality of sixth through holes 146 formed thereon. The second through holes 142 are arranged corresponding to the first through holes 122 and the fourth through holes 144 are arranged corresponding to the third through holes 124. The sixth through holes 146 are arranged closer to the first surface **SF1** of the housing 12 than the second through holes 142 and the fourth through holes 144. The adapter plate 14 further forms a layout for wires (not shown) thereon; for example, it can be a cooper foil layout manufactured by means of printed circuits, so that the second through holes 142 and the fourth through holes 144 are electrically connected to the sixth through holes 146 distinctly.

[0029] The first terminals 162 are separately providing an eleventh terminal end 1622 arranged in the second through holes 142 and a twelfth terminal end 1624 passing through the first through holes 122 and protruding in the engaging space **SP**. The second terminals 182 are separately providing a twenty-first terminal end 1822 arranged in the fourth through holes 144 and a twenty-second terminal end 1824 passing through the third through holes 124 and protruding in the engaging space **SP**. Herein the size of the second terminals 182 is larger than the size of the first terminals 162. The third terminals 202 are separately providing a thirty-first terminal end 2022 connected with the circuit board 2 and a thirty-second terminal end 2024 passing through the fifth through holes 126 and protruding in the engaging space **SP**.

Herein the size of the third terminals 202 is larger than the size of the second terminals 182 for exemplariness. What is worth attention is that these are the factors for the amount of voltages and currents the terminals can handle, such as areas, thickness and length for transmission. The sizes of the terminals in the present invention represent the aforesaid factors. Therefore, the larger the sizes are, the greater the amount of voltages and currents they can handle. Additionally, after the third terminals 202 is electrically connected with the external connector (not shown), it doesn't have to be connected to the circuit board 2 via the adapter plate 14; rather, it is directly connected with the circuit board 2, thereby reducing the power loss during the voltage and current

transmissions.

[0030] In another embodiment, the adapter plate **14** further includes a second positioning section **148** arranged corresponding to the first positioning section **1210**. By having the first positioning section **1210** engaging and combined with the second positioning section **148**, the adapter plate **14** is fixed in the housing **12**. The second positioning section **148** is exemplarily arranged as a positioning hole herein.

[0031] In another embodiment, the adapter seat **22** further includes a plurality of first terminal grooves **222** connecting to the guiding holes **2212**, thereby the thirty-second terminal ends **2024** are arranged in the first terminal grooves **222** and the thirty-first terminal ends **2022** are arranged in the guiding holes **2212**.

[0032] In another embodiment, the adapter seat **22** further includes a plurality of second terminal grooves **224** and partial of the second terminals **182** are arranged in the second terminal grooves **224**. The second terminal grooves **224** are connecting to the guiding holes **2212**. Partial of the second terminals **182** are separately providing a twenty-third terminal end **1826** for connection with the circuit board **2** and a twenty-fourth terminal end **1828** passing through the third through holes **124** and protruding in the engaging space **SP**. The twenty-fourth terminal ends **1828** are arranged in the second terminal grooves **224** and the twenty-third terminal ends **1826** are arranged in the guiding holes **2212**.

[0033] With reference to FIGS. 5(a) - 5(b), there are plan views illustrating the adapter seat **22** and the second terminals **181** engaged with the third terminals **202** as shown in FIG. 2, among which FIG. 5(a) being a perspective view thereof and FIG. 5(b) being a bottom plan view thereof.

[0034] The adapter seat **22** combines the adapter plate **14** and the housing **12** and includes a plurality of guiding holes **2212** formed thereon. The fourth terminals **242** are separately providing a forty-first terminal end **2422** arranged in the sixth through holes **146** and a forty-second terminal end **2424** passing through the guiding holes **2212** and being guided for connection with the circuit board **2**.

[0035] Referring to FIG. 6, a bottom plan view of the present invention as shown in FIG. 2, in another embodiment, the adapter seat **22** further includes a plurality of fourth engaging sections **228** arranged corresponding to the third engaging sections **1216**. By having the third engaging sections **1216** engaging and combining with the fourth engaging sections **228**, the adapter seat **22** is fixed in the housing **12** as shown in FIG. 6. In this embodiment, the fourth engaging sections **228** have free ends thereof exemplarily arranged as a hook structure; as the hook structure of the fourth engaging sections **228** engaging the one of the third engaging sections **1216**, the purpose of combining and assembling is thereby achieved.

[0036] In another embodiment, the adapter seat **22** further forms a plurality of second engaging sections **226** arranged corresponding to the first engaging sections

1212 for combination therewith, thereby fixing the adapter seat **22** in the housing **12**. In this embodiment, the second engaging sections **226** are exemplarily arranged as a hook structure.

[0037] In another embodiment, the adapter seat **22** further includes a plurality of fourth positioning sections **2210** formed thereon and arranged corresponding to the third positioning sections **1214** for combination therewith, thereby fixing the adapter seat **22** in the housing **12**. In this embodiment, the fourth positioning sections **2210** are exemplarily arranged as positioning blocks.

[0038] With assembly of the aforesaid components, the first and second terminals **162**, **182** are electrically connected with the fourth terminals **242** via a wire layout of the adapter plate **14** for performing voltage and current transmission, and the third terminals **202** are able to be directly connected with the circuit board **2**, performing a greater transmission of voltages and currents than the first, second and fourth terminals **162**, **182**, **242**. For instance, the third terminals **202** can transmit several amperes of electric currents.

[0039] FIG. 7 is the perspective view of the present invention connected with a circuit board **2** in the second embodiment. In FIG. 7, the connector **10'** can be connected with an external connector and the circuit board **2**. The connector **10'** comprises a housing **12'**, an adapter plate **14'**, a first terminal group **16'** consisted of a plurality of first terminals **162'**, a second terminal group **18'** consisted of a plurality of second terminals **182'**, a third terminal group **20'** consisted of a plurality of third terminals **202'**, an adapter seat **22'** and a fourth terminal group obscurely disposed in the adapter seat **22'** and consisted of a plurality of fourth terminals **242'**.

[0040] Further with reference to FIGS. 8(a) to 8(d), there are plan views of the housing **12'** illustrated in FIG. 7, among which FIG. 8(a) being a front plan view thereof, FIG. 8(b) being a rear plan view thereof, FIG. 8(c) being a bottom plan view thereof, and FIG. 8(d) being a side plan view thereof.

[0041] The housing **12'** includes an engaging end **1218'**, a halfopened engaging space **SP** and a first opening **1220** formed for the external connector (not shown) to be disposed in the engaging space **SP** through the engaging end **1218'**. The housing **12'** further provides a first surface **SF1** to be connected with the circuit board **2** and the housing **12'** and a second surface **SF2** forming a plurality of first through holes **122'** and a plurality of third through holes **124'** thereon. The first opening **1220** is formed at an intersection of the first surface **SF1** and the second surface **SF2**. Wherein the first surface **SF1** is adjacent to the second surface **SF2**.

[0042] With reference to FIGS. 9(a) - 9(c), there are plan views illustrating the adapter plate **14'**, the first terminals **162'**, the second terminals **182'** and the third terminals **202'** engaged with the fourth terminals **242'** as shown in FIG. 7. FIG. 9(a) is a perspective view thereof. FIG. 9(b) is a perspective view illustrating the adapter plate **14'**, the adapter seat **22'**, the first terminals **162'**,

the second terminals **182'** and the third terminals **202'** engaged with the fourth terminals **242'** as shown in FIG. 7, and FIG. 9(c) is a top plan view thereof.

[0043] The adapter plate **14'** is combined with the second surface **SF2** and has a plurality of second through holes **142'**, a plurality of fourth through holes **144'** and a plurality of electrode terminals **1410** formed thereon. The second through holes **142'** are arranged corresponding to the first through holes **122'** and the fourth through holes **144'** are arranged corresponding to the third through holes **124'**; the electrode terminals **1410** are formed at an edge (herein, the lower edge) of the adapter plate **14'**. The adapter plate **14'** further forms a layout for wires for the second through holes **142'** and the fourth through holes **144'** to be electrically connected to the electrode terminals **1410** distinctly.

[0044] The first terminals **162'** are, same as in the first embodiment, separately providing an eleventh terminal end arranged in the second through holes **142'** and a twelfth terminal end passing through the first through holes **122'** and protruding in the engaging space **SP**.

[0045] The second terminals **182'** are, same as in the first embodiment, providing a twenty-first terminal end arranged in the fourth through holes **144'**, a twenty-second terminal end passing through the third through holes **124'** and protruding in the engaging space **SP**, a twenty-third terminal end **1826'** for connection with the circuit board **2** and a twenty-fourth terminal end **1828'** passing through the third through holes **124'** and protruding in the engaging space **SP**. Wherein the size of the second terminals **182'** is larger than the size of the first terminals **162'**.

[0046] The third terminals **202'** are separately providing a thirty-first terminal end **2022'** for connection with the circuit board **2** and a thirty-second terminal end **2024'** protruding in the engaging space **SP**. Wherein the size of the third terminals **202'** is larger than the size of the second terminals **182'** so that a great volume of voltage and current transmissions can be performed.

[0047] The adapter seat **22'** is arranged at the first opening **1220** for combining the adapter plate **14'** with the housing **12'**. Wherein the adapter seat **22'** further includes an inserting point **2214** formed thereon for inserting the adapter plate **14'**; in another embodiment, the adapter seat **22'** has a plurality of guiding holes as the ones in the first embodiment formed in the inserting point **2214**.

[0048] The fourth terminals **242'** are arranged at the inserting point **2214**, separately providing a forty-third terminal end **2426** arranged in the inserting point **2214** corresponding to the electrode terminals **1410** and a forty-fourth terminal end **2428** passing through the inserting point **2214** for connection with the circuit board **2**. The fourth terminals **242'** are positioned in the inserting point **2214** - for example, by the guiding holes. (The insertion of the fourth terminals **242'** is not shown in the figures.)

[0049] With assembly of the aforesaid components, the first terminals **162'** and the second terminals **182'**

with the twenty-first terminal end (with reference to FIG. 4(c) in the first embodiment) and the twenty-second terminal end (with reference to FIG. 4(c) in the first embodiment) are electrically connected with the fourth terminals **242'** via a wire layout of the adapter plate **14'** for performing voltage and current transmission. And the second terminals **182'** with the twenty-third terminal end **1826'** and the twenty-fourth terminal end **1828'** and the third terminals **202'** are able to be directly connected with the circuit board **2**, performing a greater transmission of voltages and currents than the first, second and fourth terminals **162', 182', 242'**.

[0050] Referring to FIG. 9(c), in another embodiment, the adapter seat **22'** further includes a covering piece **2216** extended therefrom and arranged corresponding to the first opening **1220** for covering and closing the first opening **1220** when assembling the adapter seat **22'** and the housing **12'**.

[0051] On the other hand, it is also applicable to include a first positioning section **1210'**, a second positioning section **148'**, a plurality of third engaging sections **1216'**, a plurality of fourth engaging sections **228'**, a plurality of first terminal grooves **222'**, a plurality of second terminal grooves **224'**, a plurality of first positioning elements and a plurality of guiding holes as described in the first embodiment of the present invention.

[0052] FIG. 10 is the perspective view of the present invention connected with a circuit board **2** in the third embodiment. In FIG. 10, the connector **10"** can be connected with an external connector and the circuit board **2**. The connector **10"** comprises a housing **12"**, an adapter plate **14"**, a first terminal group **16"** consisted of a plurality of first terminals, a second terminal group **18"** consisted of a plurality of second terminals, a third terminal group **20"** consisted of a plurality of third terminals, an adapter seat **22"** and a fourth terminal group obscurely disposed in the adapter seat **22"** and consisted of a plurality of fourth terminals, same as in the previous embodiment.

[0053] With reference to FIGS. 11(a) to 11(d), there are plan views of the housing **12"** illustrated in FIG. 10, among which FIG. 11(a) being a front plan view thereof, FIG. 11(b) being a rear plan view thereof, FIG. 11(c) being a bottom plan view thereof, and FIG. 11(d) being a side plan view thereof.

[0054] The housing **12"** includes an engaging end **1218"** and a half opened engaging space **SP** formed for the external connector (not shown) to be disposed in the engaging space **SP** through the engaging end **1218"**. The housing **12"** provides a first surface **SF1** for connection with the circuit board **2** and a second surface **SF2** forming a plurality of first through holes **122"**, a plurality of third through holes **124"** and a plurality of fifth through holes **126"** thereon. The fifth through holes **126"** are arranged closer to the first surface **SF1** than the first through holes **122"**. Wherein the first surface **SF1** is adjacent to the second surface **SF2**. The size of the fifth through holes **126"** is larger than the size of the third

through holes **124"**, and the size of the third through holes **124"** is larger than the size of the first through holes **122"**.

[0055] The adapter plate **14"** is combined with the second surface **SF2** and has a plurality of second through holes, a plurality of fourth through holes and a plurality of electrode terminals formed thereon; such structure is the same as the one in the second embodiment.

[0056] The first terminals of the first terminal group **16"** are, same as in the second embodiment, separately providing an eleventh terminal end arranged in the second through holes and a twelfth terminal end passing through the first through holes **122"** and protruding in the engaging space **SP**; such structure is the same as the one in the second embodiment.

[0057] Further referring to FIG. 12(a), a perspective view of the adapter seat **22"** as shown in FIG. 10, and FIG. 12(b), a perspective view of the adapter **22"** and the second terminals engaged with the third terminals as shown in FIG. 10, the second terminals of the second terminal group **18"** are, same as in the second embodiment, separately providing a twenty-first terminal end arranged in the fourth through holes, a twenty-second terminal end passing through the third through holes **124"** and protruding in the engaging space **SP**, a twenty-third terminal end **1826'** for connection with the circuit board **2** and a twenty-fourth terminal end **1828'** passing through the third through holes **124"** and protruding in the engaging space **SP**.

[0058] The third terminals of the third terminal group **20"** are, same as in the second embodiment, separately providing a thirty-first terminal end **2022"** connected with the circuit board **2** and a thirty-second terminal end **2024"** passing through the fifth through holes **126"** and protruding in the engaging space **SP**.

[0059] The adapter seat **22"** combines the adapter plate **14"** and the housing **12"** and includes an inserting point **2214'** formed thereon for inserting the adapter plate **14"**. The fourth terminals of the fourth terminal group are arranged at the inserting point **2214**; such structure is the same as the one illustrated in FIGS. 9(a) - 9(c).

[0060] With assembly of the aforesaid components, the first terminals of the first terminal group **16"** and the second terminals of the second terminal group **18"** with the twenty-first terminal end and the twenty-second terminal end are electrically connected with the fourth terminals via a wire layout of the adapter plate **14"** for performing voltage and current transmission. And the second terminals with the twenty-third terminal end **1826"** and the twenty-fourth terminal end **1828"** and the third terminals are able to be directly connected with the circuit board **2**, performing a greater transmission of voltages and currents than the first, second and fourth terminals.

[0061] In another embodiment, the second surface **SF2** of the housing **12"** further includes a plurality of seven through holes **1222** and a plurality of ninth through holes **1224** formed thereon. Partial of the second terminals separately includes a second positioning element **18210**, and the third terminals separately includes a third

positioning element **2026**. The second positioning elements **18210** are arranged corresponding to the seventh through holes **1222** and the third positioning elements **2026** are arranged corresponding to the ninth through holes **1224**, thereby the third terminals and partial of the second terminals are fixed in the housing **12"**.

[0062] In another embodiment, the housing **12"** further includes a plurality of fifth engaging sections **1226** formed at an intersection of the first and second surfaces **SF1**, **SF2** and the adapter seat **22"** further includes a plurality of sixth engaging sections **2218** arranged corresponding to the fifth engaging sections **1226**, thereby the sixth engaging sections **2218** move toward the fifth engaging sections **1226** in a perpendicular direction to the first surface **SF1** for engaging and fastening therewith.

[0063] In another embodiment, the housing **12"** further includes a plurality of notch holes **1228** formed at an intersection of the first and second surfaces **SF1**, **SF2** and arranged corresponding to the thirty-first terminal ends **2022"** and the twenty-third terminal ends **1826"** for guiding the thirty-first terminal ends **2022"** and the twenty-third terminal ends **1826"** to the circuit board **2**.

[0064] On the other hand, it is also applicable to include a first positioning section **1210"**, a second positioning section **148"**, a plurality of third engaging sections **1216"**, a plurality of fourth engaging sections **228"**, a plurality of first terminal grooves **222"**, a plurality of second terminal grooves **224"**, a plurality of first positioning elements **128"** and a plurality of guiding holes as described in the first embodiment of the present invention.

[0065] The present invention is disclosed by the preferred embodiment in the aforementioned description; however, it is contemplated for one skilled at the art that the embodiments are applied only for an illustration of the present invention rather than are interpreted as a limitation for the scope of the present invention. It should be noted that the various substantial alternation or replacement equivalent to these embodiments shall be considered as being covered within the scope of the present invention. Therefore, the protection scope of the present invention shall be defined by the claims.

Claims

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1. A connector (10) for connecting with an external connector and a circuit board (2), comprising:

50 a housing (12) including an engaging end (1218) and a half opened engaging space (SP) formed for the external connector to be disposed in said engaging space (SP) through said engaging end (1218), the housing (12) providing a first surface (SF1) for connection with the circuit board (2) and a second surface (SF2) forming a plurality of first through holes (122), a plurality of third through holes (124) and a plurality of fifth through holes (126) thereon, said fifth through

holes (126) arranged closer to the first surface (SF1) than said first through holes (122), wherein the first surface (SF1) is adjacent to the second surface (SF2) and a size of the fifth through holes (126) is no smaller than a size of the third through holes (124), the latter being no smaller than a size of the first through holes (122); an adapter plate (14) combined with the second surface (SF2) and having a plurality of second through holes (142), a plurality of fourth through holes (144) and a plurality of sixth through holes (146) formed thereon, the second through holes (142) arranged corresponding to the first through holes (122), the fourth through holes (144) arranged corresponding to the third through holes (124), the sixth through holes (146) arranged closer to the first surface (SF1) of the housing (12) than the second through holes (142) and the fourth through holes (144); said adapter plate (14) further forming a layout for wires for the second through holes (142) and the fourth through holes (144) to be electrically connected to the sixth through holes (146) distinctly; a plurality of first terminals (162) separately providing an eleventh terminal end (1622) arranged in the second through holes (142) and a twelfth terminal end (1624) passing through the first through holes (122) and protruding in the engaging space (SP); a plurality of second terminals (182) separately providing a twenty-first terminal end (1822) arranged in the fourth through holes (144) and a twenty-second terminal end (1824) passing through the third through holes (124) and protruding in the engaging space (SP), wherein a size of the second terminals (182) is no smaller than a size of the first terminals (162); a plurality of third terminals (202) separately providing a thirty-first terminal end (2022) connected with the circuit board (2) and a thirty-second terminal end (2024) passing through the fifth through holes (126) and protruding in the engaging space (SP), wherein a size of the third terminals (202) is no smaller than a size of the second terminals (182); an adapter seat (22) combining the adapter plate (14) with the housing (12) and including a plurality of guiding holes (2212) formed thereon; and a plurality of fourth terminals (242) separately providing a forty-first terminal end (2422) arranged in the sixth through holes (146) and a forty-second terminal end (2424) passing through the guiding holes (2212) and being guided for connection with the circuit board (2); wherein the first and second terminals (162), (182) are electrically connected with the fourth

5 terminals (242) via a wire layout of the adapter plate (14) for performing voltage and electric current transmissions, and the third terminals (202) are utilized in direct connection with the circuit board (2), performing transmissions of greater voltages and electric currents than the first, second and fourth terminals (162), (182), (242).

10 2. The connector (10) defined in claim 1, wherein the housing (12) further includes a plurality of first engaging sections (1212) formed on the second surface (SF2) and the adapter seat (22) further forms a plurality of second engaging sections (226), the first engaging sections (1212) arranged corresponding to the second engaging sections (226) for combination therewith, thereby fixing the adapter seat (22) in the housing (12).

15 3. The connector (10) defined in claim 1, wherein the housing (12) further includes a plurality of third positioning sections (1214) formed on the second surface (SF2) and the adapter seat (22) further includes a plurality of fourth positioning sections (2210) formed thereon, the third positioning sections (1214) arranged corresponding to the fourth engaging sections (2210) for combination therewith, thereby fixing the adapter seat (22) in the housing (12).

20 4. A connector (10') for connecting with an external connector and a circuit board (2), comprising:
25 a housing (12') including an engaging end (1218'), a half opened engaging space (SP) and a first opening (1220) for the external connector to be disposed in said engaging space (SP) through said engaging end (1218'), the housing (12') providing a first surface (SF1) for connecting the circuit board (2) with the housing (12') and a second surface (SF2) forming a plurality of first through holes (122') and a plurality of third through holes (124') thereon, said first opening (1220) forming at an intersection area of the first surface (SF1) and the second surface (SF2), wherein the first surface (SF1) is adjacent to the second surface (SF2);
30 an adapter plate (14') combined with the second surface (SF2) and having a plurality of second through holes (142'), a plurality of fourth through holes (144') and a plurality of electrode terminals (1410) formed thereon, the second through holes (142') arranged corresponding to the first through holes (122'), the fourth through holes (144') arranged corresponding to the third through holes (124'), the electrode terminals (1410) formed at an edge of the adapter plate (14'), said adapter plate (14') further forming a layout for wires for the second through holes (142') and the fourth through holes (144') to be

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electrically connected to the electrode terminals (1410) distinctly; a plurality of first terminals (162') separately providing an eleventh terminal end arranged in the second through holes (142') and a twelfth terminal end passing through the first through holes (122') and protruding in the engaging space (SP); a plurality of second terminals (182') separately providing a twenty-first terminal end arranged in the fourth through holes (144'), a twenty-second terminal end passing through the third through holes (124') and protruding in the engaging space (SP), a twenty-third terminal end (1826') for connection with the circuit board (2) and a twenty-fourth terminal end (1828') passing through the third through holes (124') and protruding in the engaging space (SP), wherein a size of the second terminals (182') is no smaller than a size of the first terminals (162'); a plurality of third terminals (202') separately providing a thirty-first terminal end (2022') connected with the circuit board (2) and a thirty-second terminal end (2024') protruding in the engaging space (SP), wherein a size of the third terminals (202') is no smaller than a size of the second terminals (182'); an adapter seat (22') arranged at the first opening (1220) for combining the adapter plate (14') with the housing (12'), the adapter seat (22') further including an inserting point (2214) formed thereon for inserting the adapter plate (14') and a plurality of guiding holes formed thereon; and a plurality of fourth terminals (242') arranged at the inserting point (2214), separately providing a forty-third terminal end (2426) arranged in the inserting point (2214) corresponding to the electrode terminals (1410) and a forty-fourth terminal end (2428) passing through the inserting point (2214) for connection with the circuit board (2), said fourth terminals (242') being positioned in the inserting point (2214) via the guiding holes; wherein the first terminals (162') and the second terminals (182') with the twenty-first terminal end and the twenty-second terminal end are electrically connected with the fourth terminals (242') via a wire layout of the adapter plate (14') for performing voltage and electric current transmissions, and the second terminals (182') with the twenty-third terminal end (1826') and the twenty-fourth terminal end (1828') and the third terminals (202') are directly connected with the circuit board (2), performing transmissions of greater voltages and electric currents than the first, second and fourth terminals (162'), (182'), (242').

5. The connector (10') defined in claim 4, wherein the adapter seat (22') further includes a covering piece (2216) extended therefrom, said covering piece (2216) being arranged corresponding to the first opening (1220) for covering and closing the first opening (1220).

6. A connector (10") for connecting with an external connector and a circuit board (2), comprising:
 10 a housing (12") including an engaging end (1218") and a half opened engaging space (SP) formed for the external connector to be disposed in said engaging space (SP) through said engaging end (1218"), the housing (12") providing a first surface (SF1) for connection with the circuit board (2) and a second surface (SF2) forming a plurality of first through holes (122"), a plurality of third through holes (124") and a plurality of fifth through holes (126") thereon, said fifth through holes (126") arranged closer to the first surface (SF1) than said first through holes (122"), wherein the first surface (SF1) is adjacent to the second surface (SF2) and a size of the fifth through holes (126") is no smaller than a size of the third through holes (124"), the latter being no smaller than a size of the first through holes (122");
 15 an adapter plate (14") combined with the second surface (SF2) and having a plurality of second through holes, a plurality of fourth through holes and a plurality of electrode terminals formed thereon, the second through holes arranged corresponding to the first through holes (122"), the fourth through holes arranged corresponding to the third through holes (124"), the electrode terminals formed at an edge of the adapter plate (14"), said adapter plate (14") further forming a layout for wires for the second through holes and the fourth through holes to be electrically connected to the electrode terminals distinctly;
 20 a plurality of first terminals separately providing an eleventh terminal end arranged in the second through holes and a twelfth terminal end passing through the first through holes (122") and protruding in the engaging space (SP);
 25 a plurality of second terminals separately providing a twenty-first terminal end arranged in the fourth through holes, a twenty-second terminal end passing through the third through holes and protruding in the engaging space (SP), a twenty-third terminal end (1826") for connection with the circuit board (2) and a twenty-fourth terminal end (1828") passing through the third through holes (124") and protruding in the engaging space (SP), wherein a size of the second terminals is no smaller than a size of the first terminals;

a plurality of third terminals separately providing a thirty-first terminal end (2022") connected with the circuit board (2) and a thirty-second terminal end (2024") passing through the fifth through holes (126") and protruding in the engaging space (SP), wherein a size of the third terminals is no smaller than a size of the second terminals; an adapter seat (22") combining the adapter plate (14") with the housing (12") and including a plurality of inserting points (2214') formed thereon for the adapter plate (14") to be inserted thereon; and

a plurality of fourth terminals arranged at the inserting point (2214'), separately providing a forty-third terminal end arranged in the inserting point (2214') corresponding to the electrode terminals and a forty-fourth terminal end passing through the inserting point (2214') for connection with the circuit board (2);

wherein the first terminals and the second terminals with the twenty-first terminal end and the twenty-second terminal end are electrically connected with the fourth terminals via a wire layout of the adapter plate (14") for performing voltage and current transmissions, and the second terminals with the twenty-third terminal end (1826") and the twenty-fourth terminal end (1828") and the third terminals are directly connected with the circuit board (2), performing transmissions of greater voltages and currents than the first, second and fourth terminals.

7. The connector (10") defined in claim 6, wherein the second surface (SF2) of the housing (12") further includes a plurality of seven through holes (1222) and a plurality of ninth through holes (1224) formed thereon, partial of the second terminals separately includes a second positioning element (18210), and the third terminals separately includes a third positioning element (2026), said second positioning elements (18210) arranged corresponding to the seventh through holes (1222) and the third positioning elements (2026) arranged corresponding to the ninth through holes (1224), thereby the third terminals and partial of the second terminals are fixed in the housing (12").

8. The connector (10") defined in claim 6, wherein the housing (12") further includes a plurality of fifth engaging sections (1226) formed at an intersection of the first and second surfaces (SF1), (SF2) and the adapter seat (22") further includes a plurality of sixth engaging sections (2218) arranged corresponding to the fifth engaging sections (1226), thereby the sixth engaging sections (2218) move toward the fifth engaging sections (1226) in a perpendicular direction to the first surface (SF1) for engaging and fastening therewith.

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10. The connector (10") defined in claim 6, wherein the housing (12") further includes a plurality of notch holes (1228) formed at an intersection of the first and second surfaces (SF1), (SF2) and arranged corresponding to the thirty-first terminal ends (2022") and the twenty-third terminal ends (1826") for guiding the thirty-first terminal ends (2022") and the twenty-third terminal ends (1826") to the circuit board (2).

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10. The connector defined in claims 1, 4 or 6, wherein the housing (12), (12'), (12") further includes a first positioning section (1210), (1210'), (1210") formed thereon and the adapter plate (14), (14'), (14") further includes a second positioning section (148), (148') arranged corresponding to said first positioning section (1210), (1210'), (1210"); by having the first positioning section (1210), (1210'), (1210") engaging and combined with the second positioning section (148), (148'), the adapter plate (14), (14'), (14") is fixed in the housing (12), (12'), (12").

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11. The connector defined in claims 1, 4 or 6, wherein the housing (12), (12'), (12") further includes a plurality of third engaging sections (1216), (1216'), (1216") formed in a space between the first and second surfaces (SF1), (SF2) and the adapter seat (22), (22'), (22") further includes a plurality of fourth engaging sections (228), (228'), (228"), the third engaging sections (1216), (1216'), (1216") arranged corresponding to the fourth engaging sections (228), (228'), (228"); by having the third engaging sections (1216), (1216'), (1216") engaging and combining with the fourth engaging sections (228), (228'), (228"), the adapter seat (22), (22'), (22") is fixed in the housing (12), (12'), (12").

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12. The connector defined in claims 1, 4 or 6, wherein the adapter seat (22), (22'), (22") further includes a plurality of first terminal grooves (222), (222') connecting to the guiding holes (2212), thereby the thirty-second terminal ends (2024), (2024'), (2024") are arranged in the first terminal grooves (222), (222') and the thirty-first terminal ends (2022), (2022'), (2022") are arranged in the guiding holes (2212).

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13. The connector defined in claim 12, wherein the adapter seat (22), (22'), (22") further includes a plurality of second terminal grooves (224), (224') and partial of the second terminals (182), (182') are arranged in said second terminal grooves (224), (224'), the second terminal grooves (224), (224') connecting to the guiding holes (2212) and partial of the second terminals (182), (182') separately providing a twenty-third terminal end (1826), (1826'), (1826") for connection with the circuit board (2) and a twenty-fourth terminal end (1828), (1828'), (1828") passing through the third through holes (124), (124'), (124") and protruding in the engaging space (SP), the twenty-

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ty-fourth terminal ends (1828), (1828'), (1828'') ar-
ranged in the second terminal grooves (224), (224')
and the twenty-third terminal ends (1826), (1826'),
(1826'') arranged in the guiding holes (2212).

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14. The connector defined in claims 1, 4 or 6, wherein
the housing (12), (12'), (12'') further includes a plu-
rality of first positioning elements (128), (128')
formed on the first surface (SF1) for fixing the hous-
ing (12), (12'), (12'') on the circuit board (2). 10

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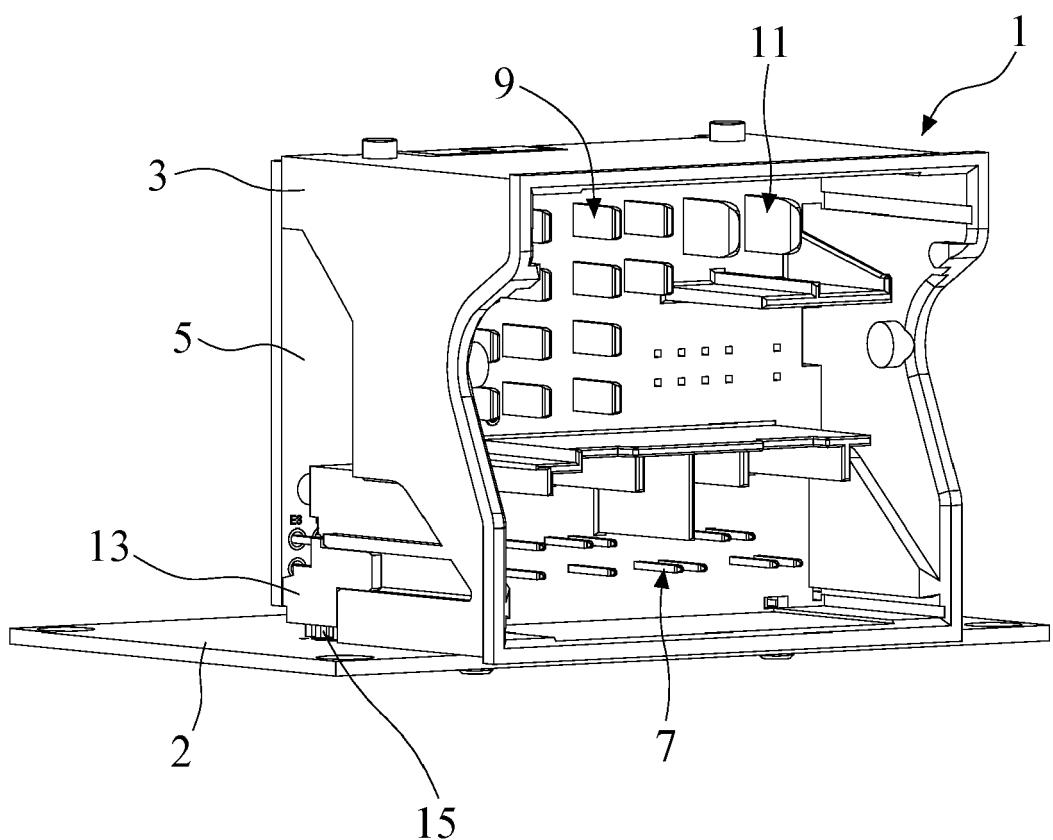


FIG. 1

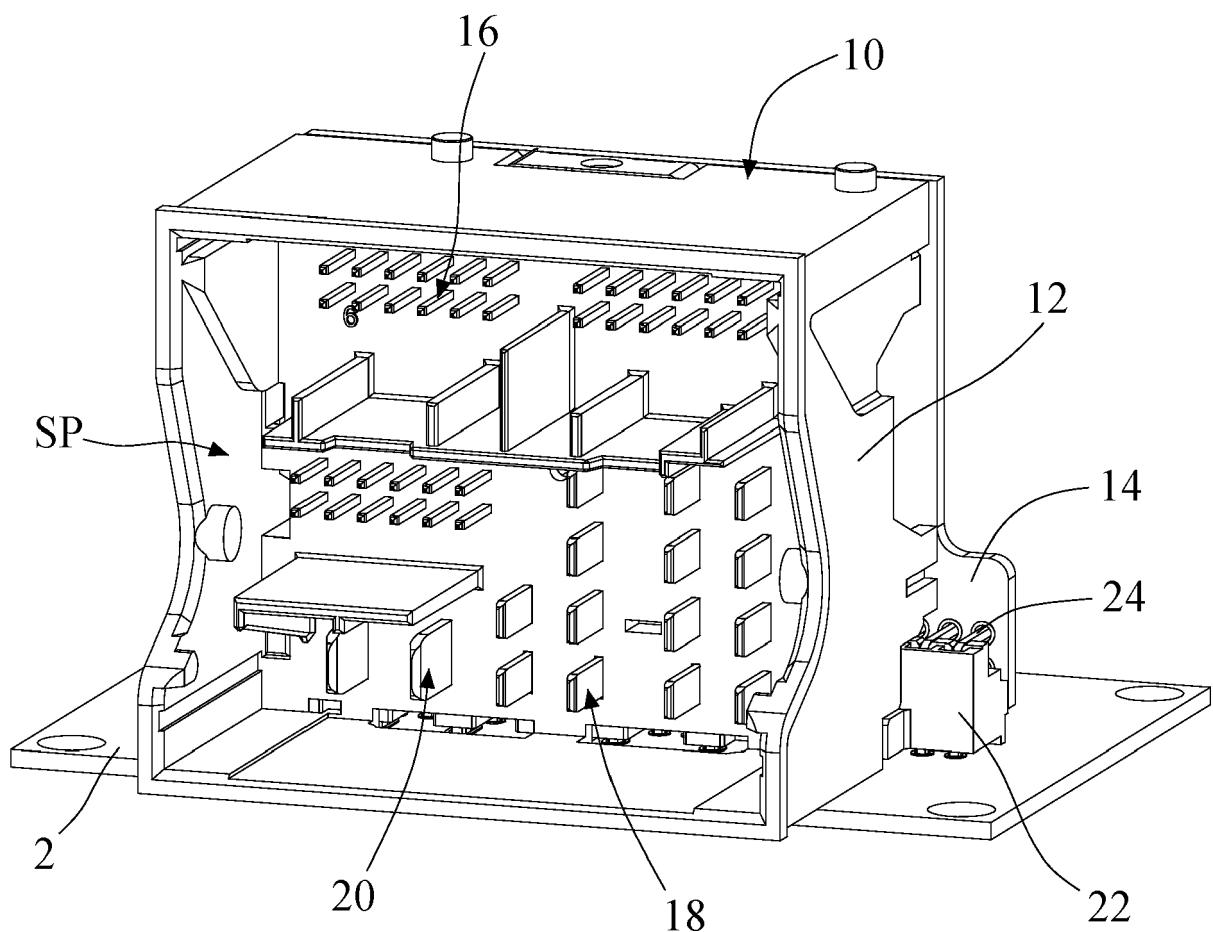
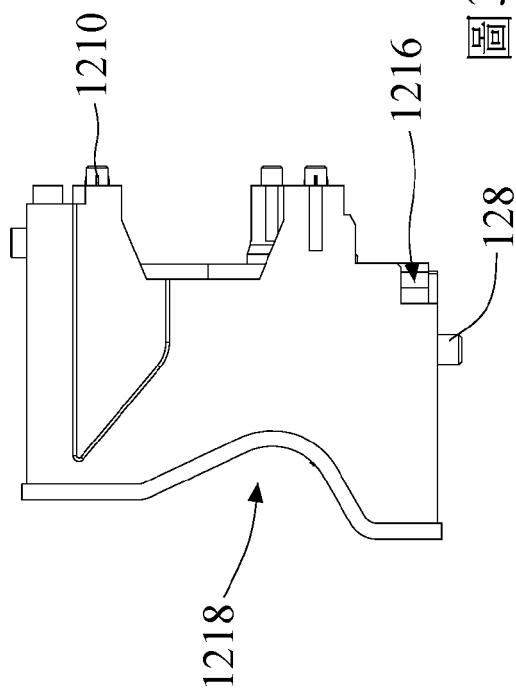
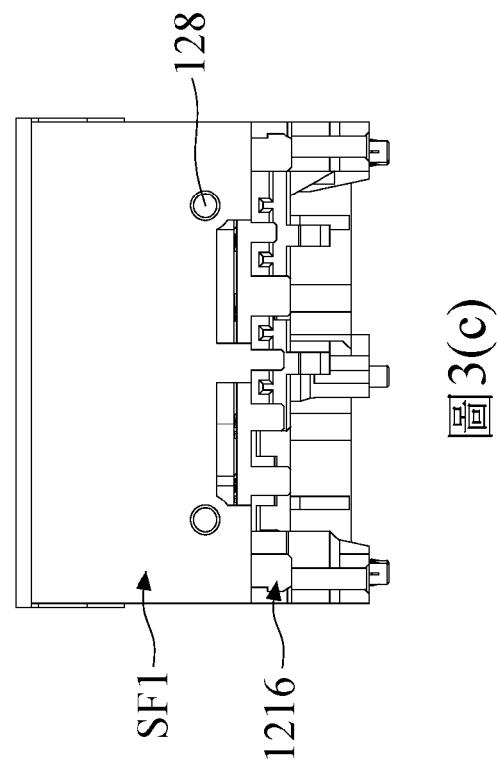
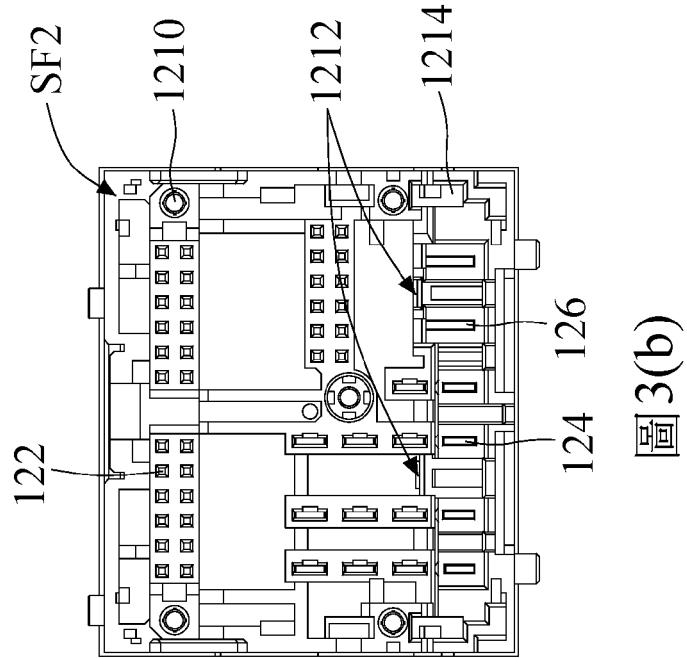
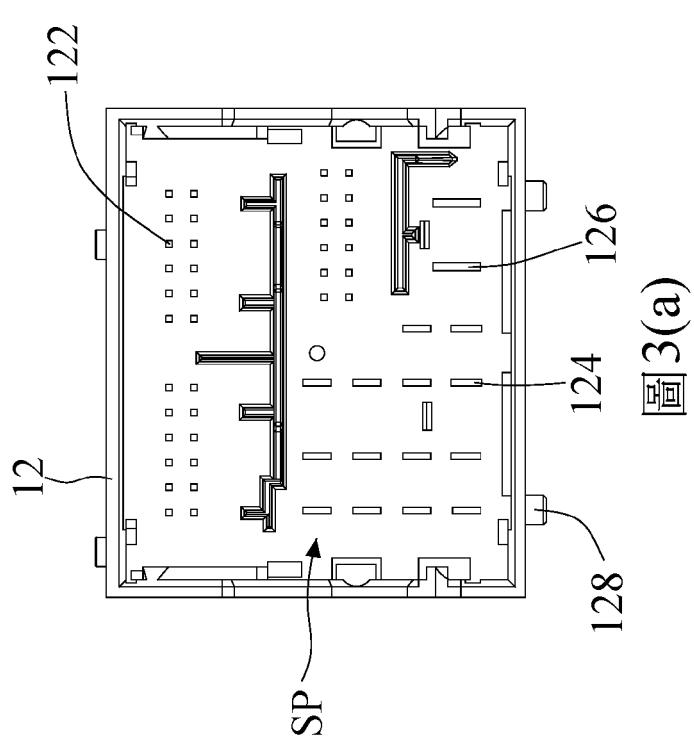


FIG.2



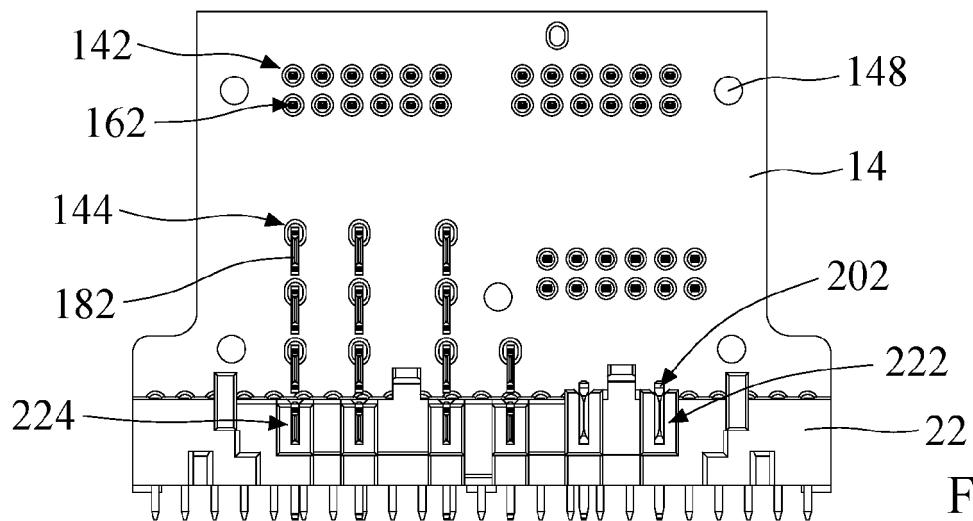


FIG.4(a)

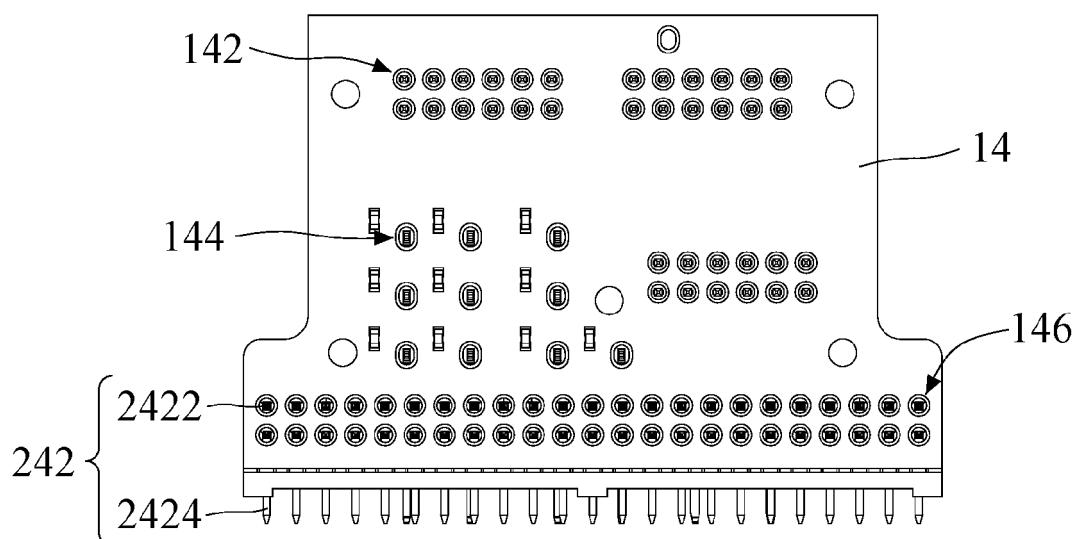


FIG.4(b)

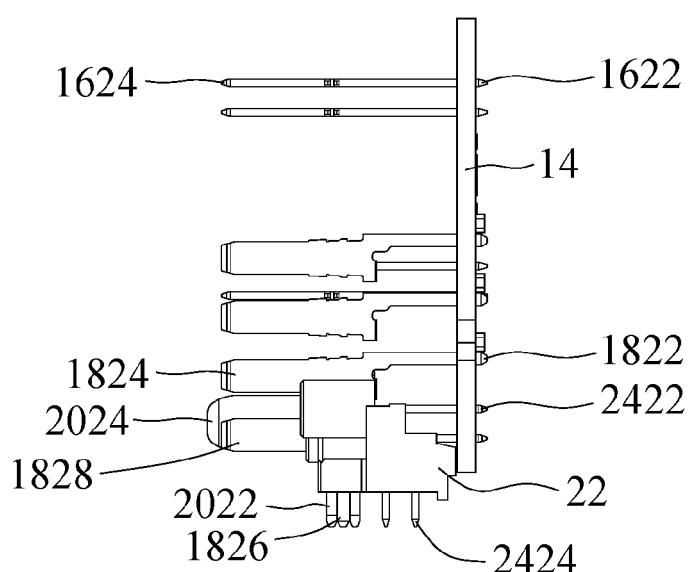


FIG.4(c)

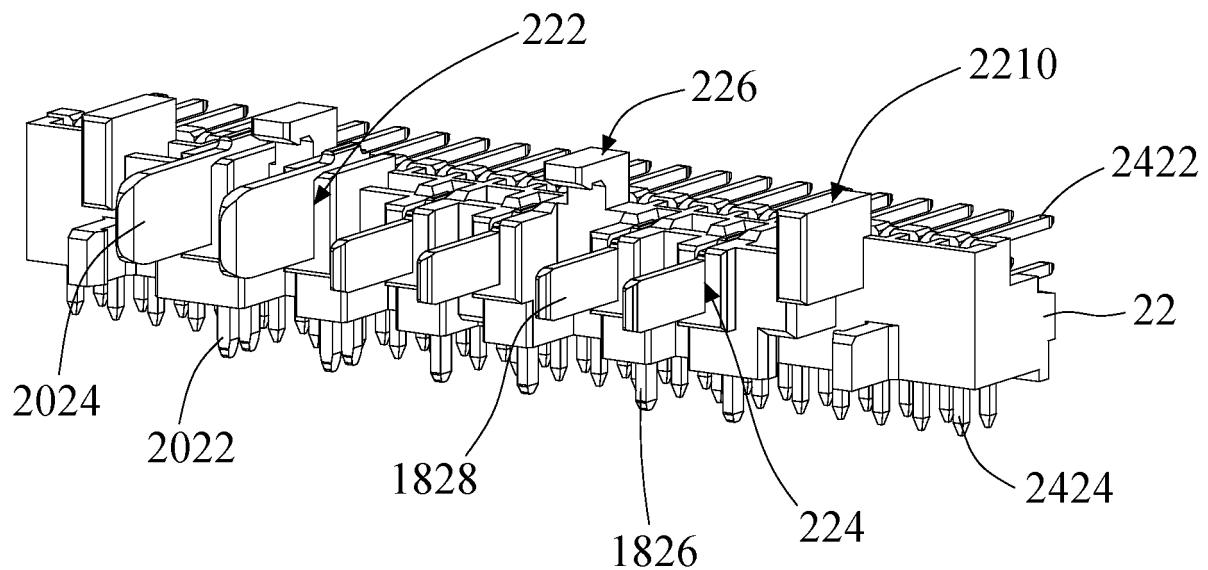


FIG.5(a)

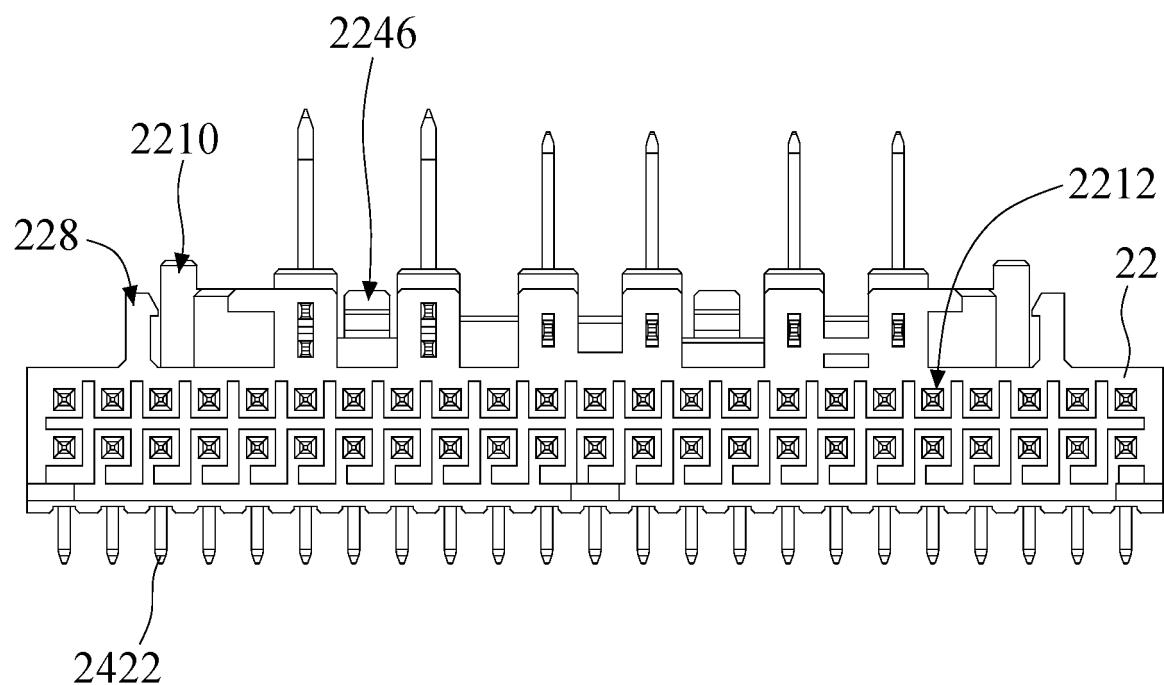


FIG.5(b)

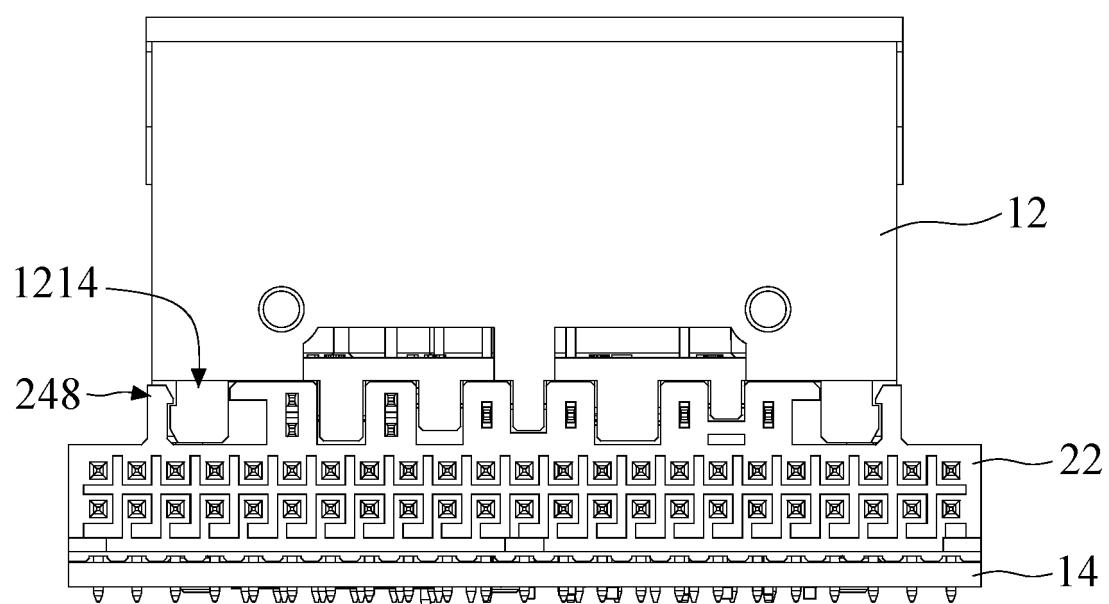


FIG.6

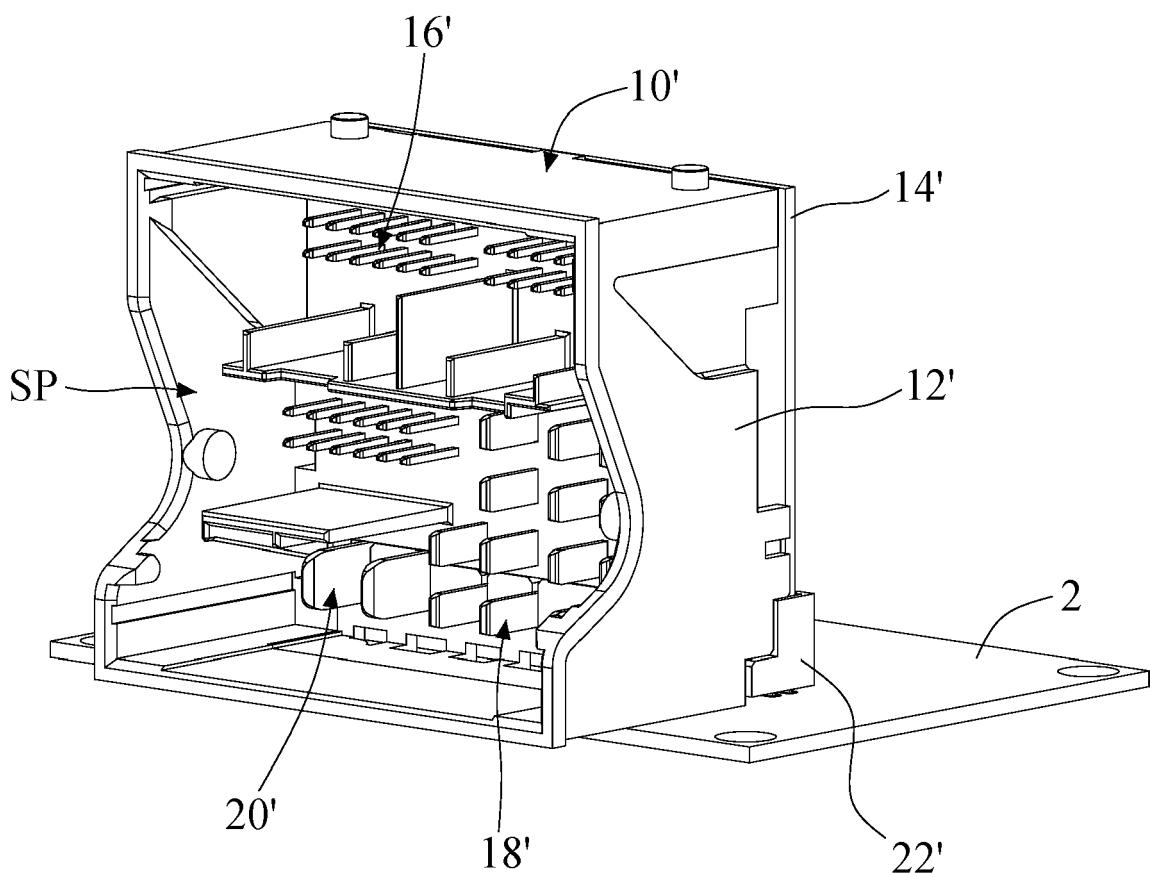


FIG.7

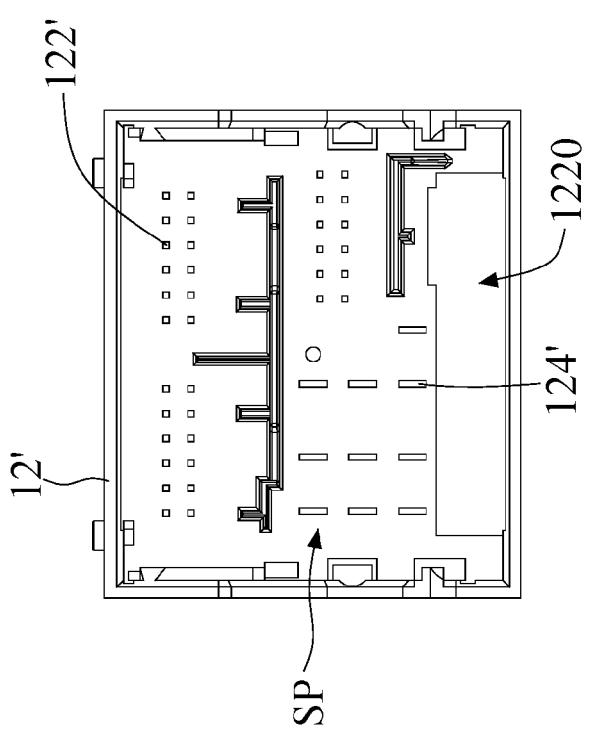


FIG. 8(a)

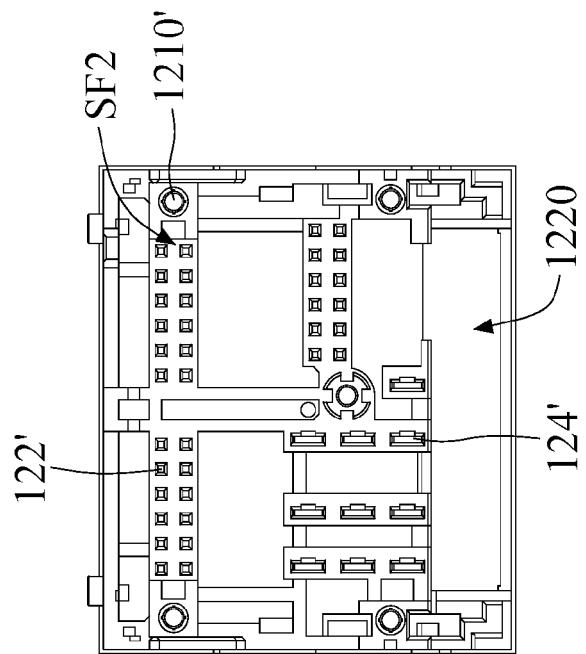


FIG. 8(b)

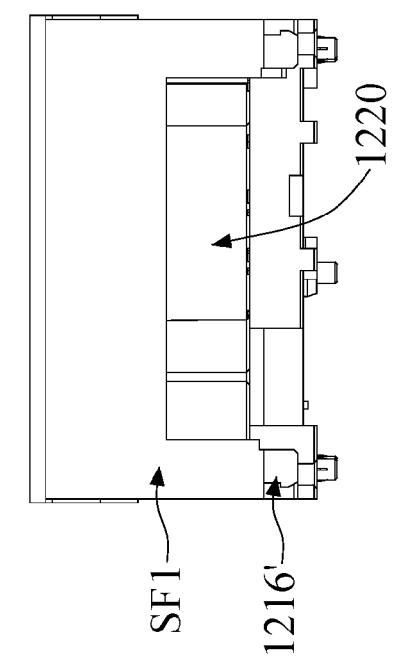


FIG. 8(c)

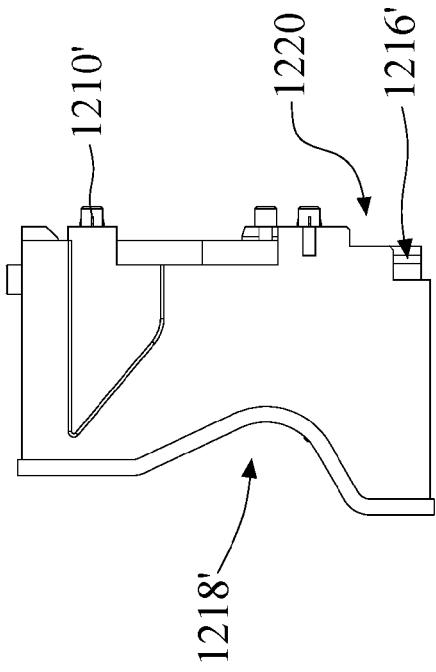


FIG. 8(d)

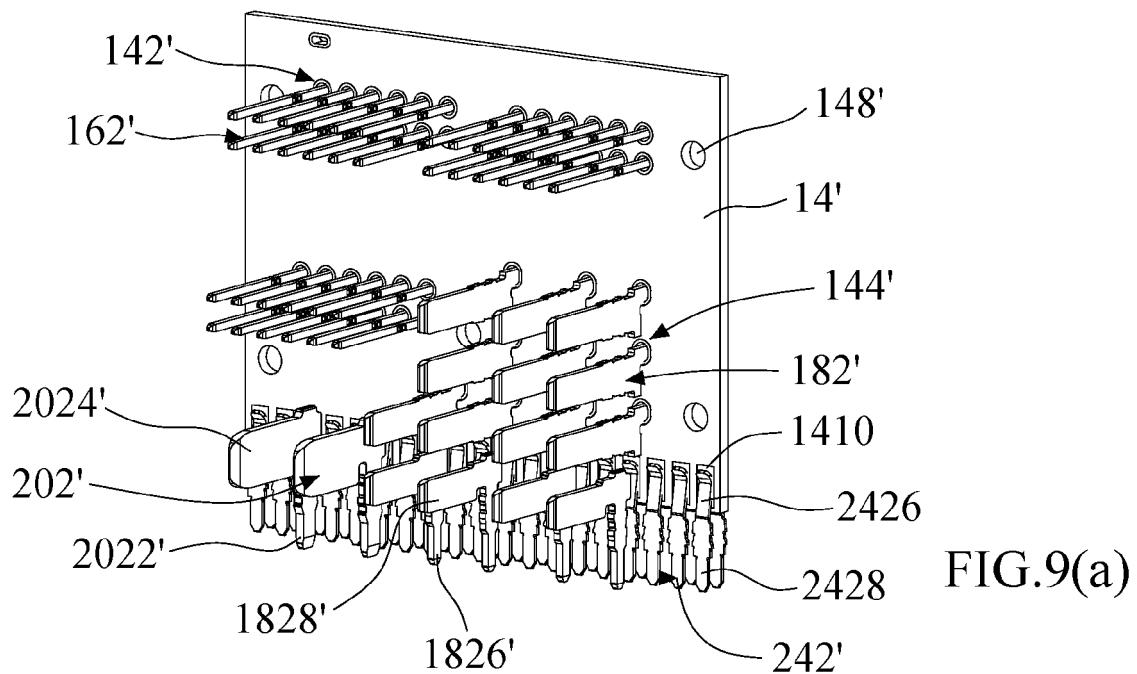


FIG.9(a)

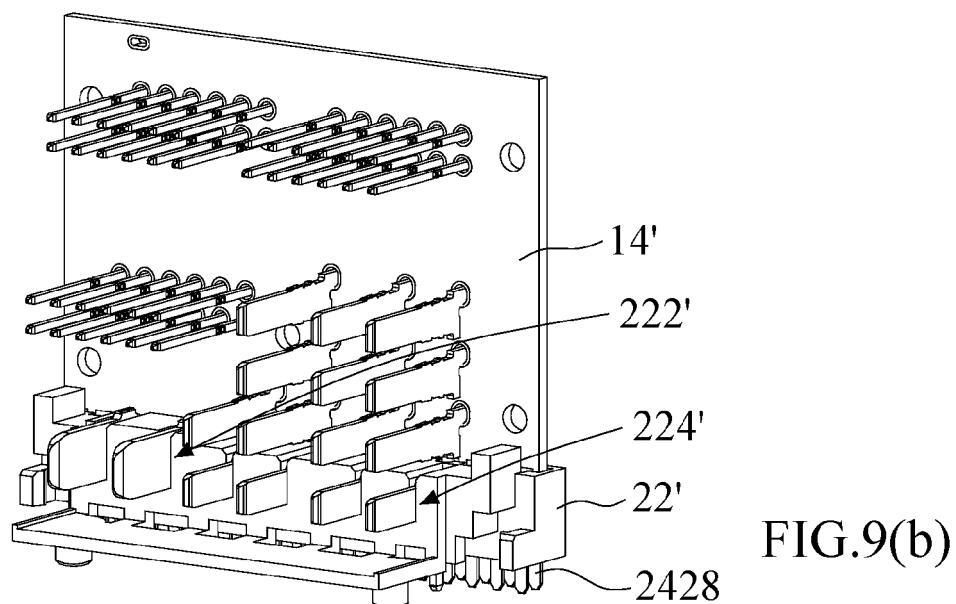


FIG.9(b)

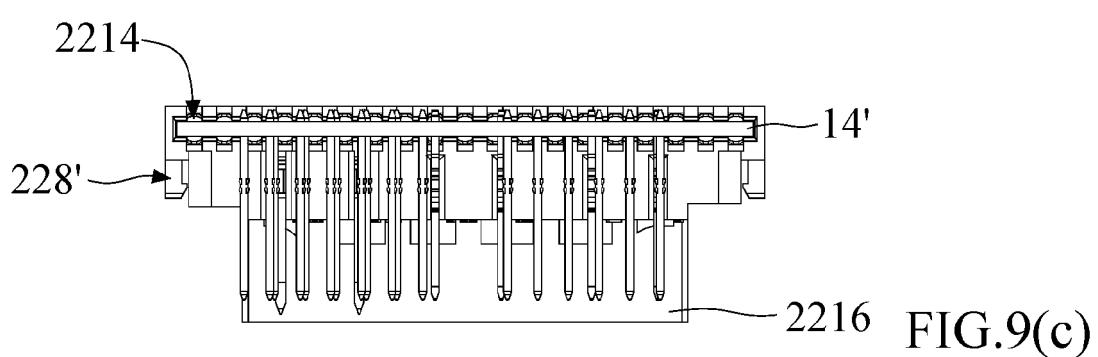


FIG.9(c)

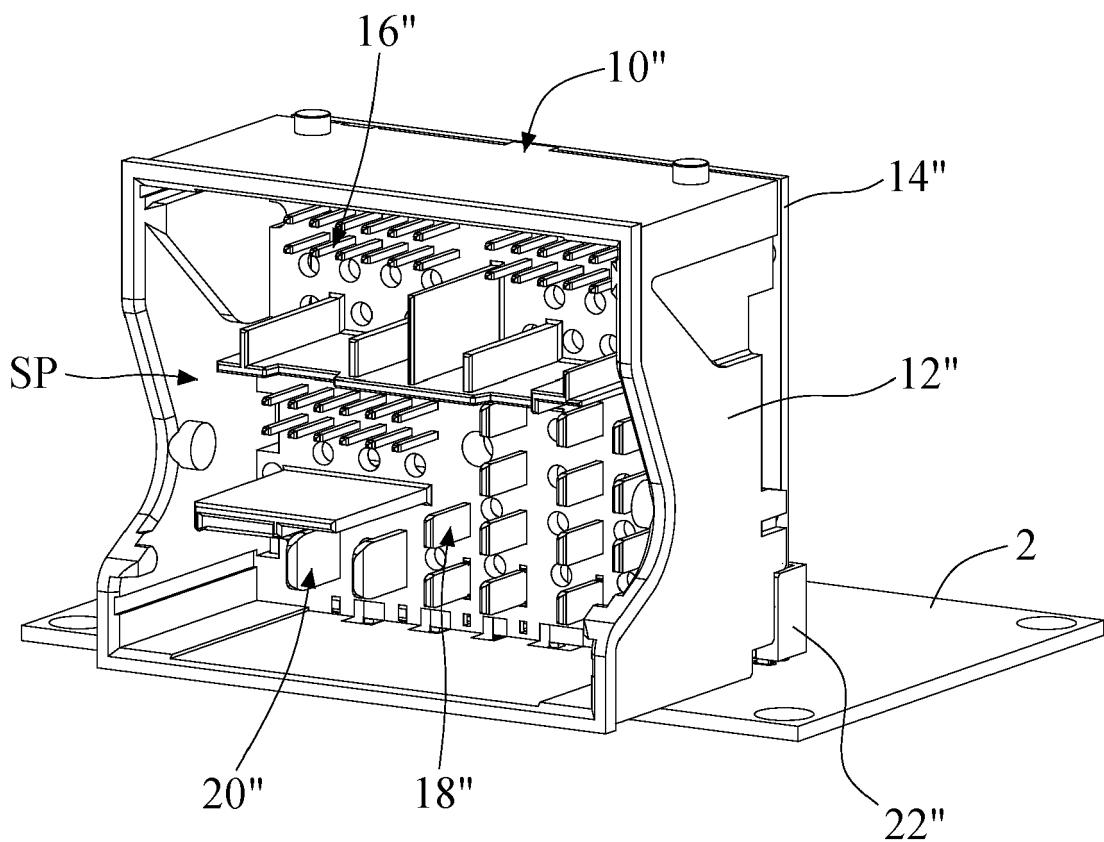


FIG.10

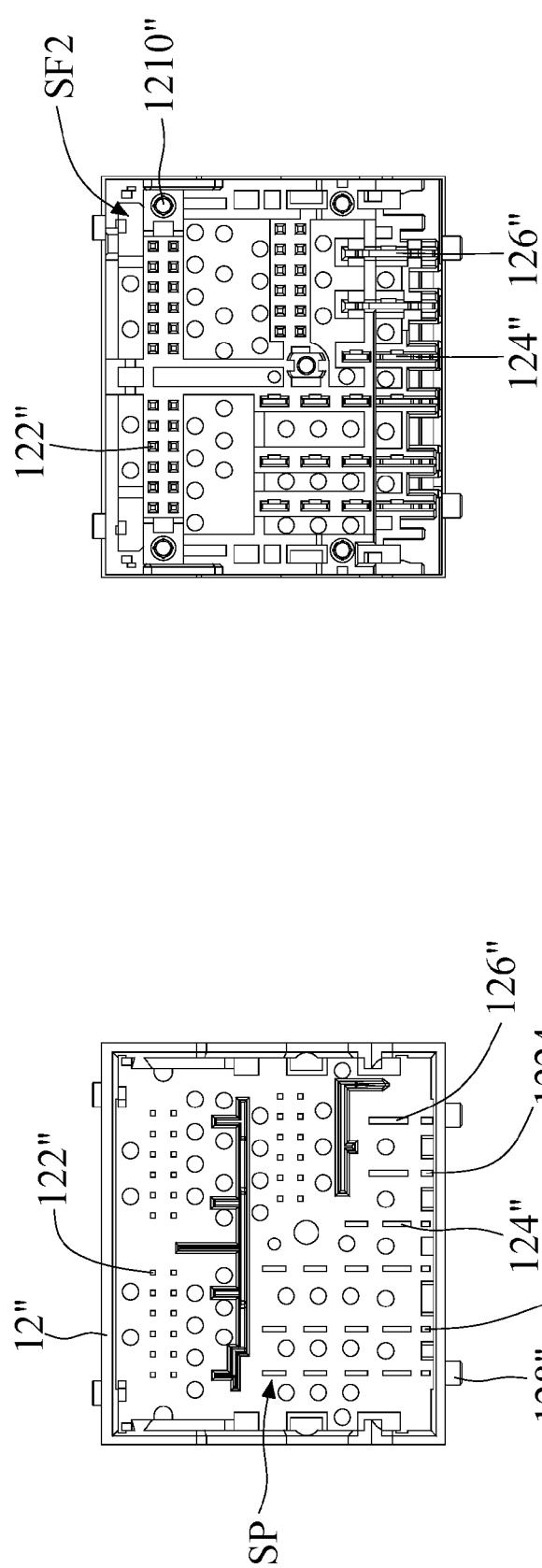


FIG. 11(a)
FIG. 11(b)

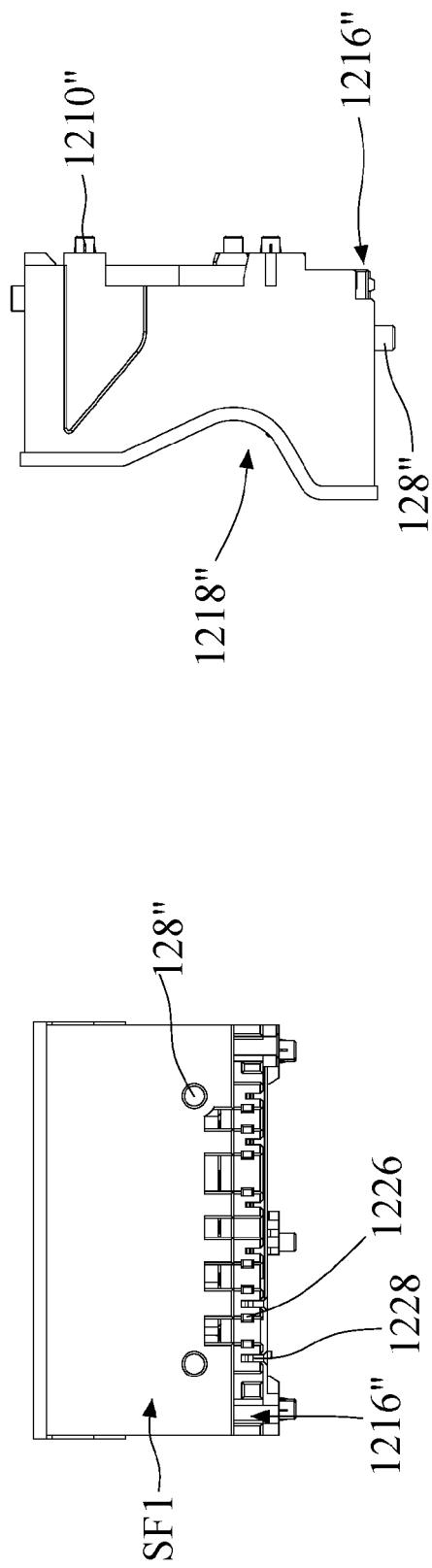


FIG. 11(c)
FIG. 11(d)

22"

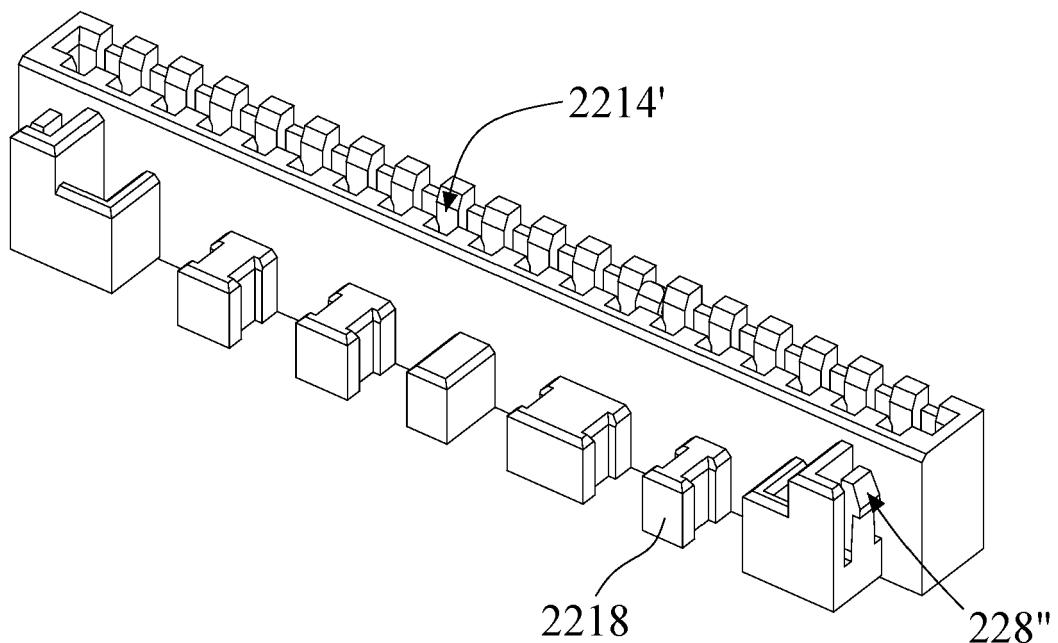


FIG.12(a)

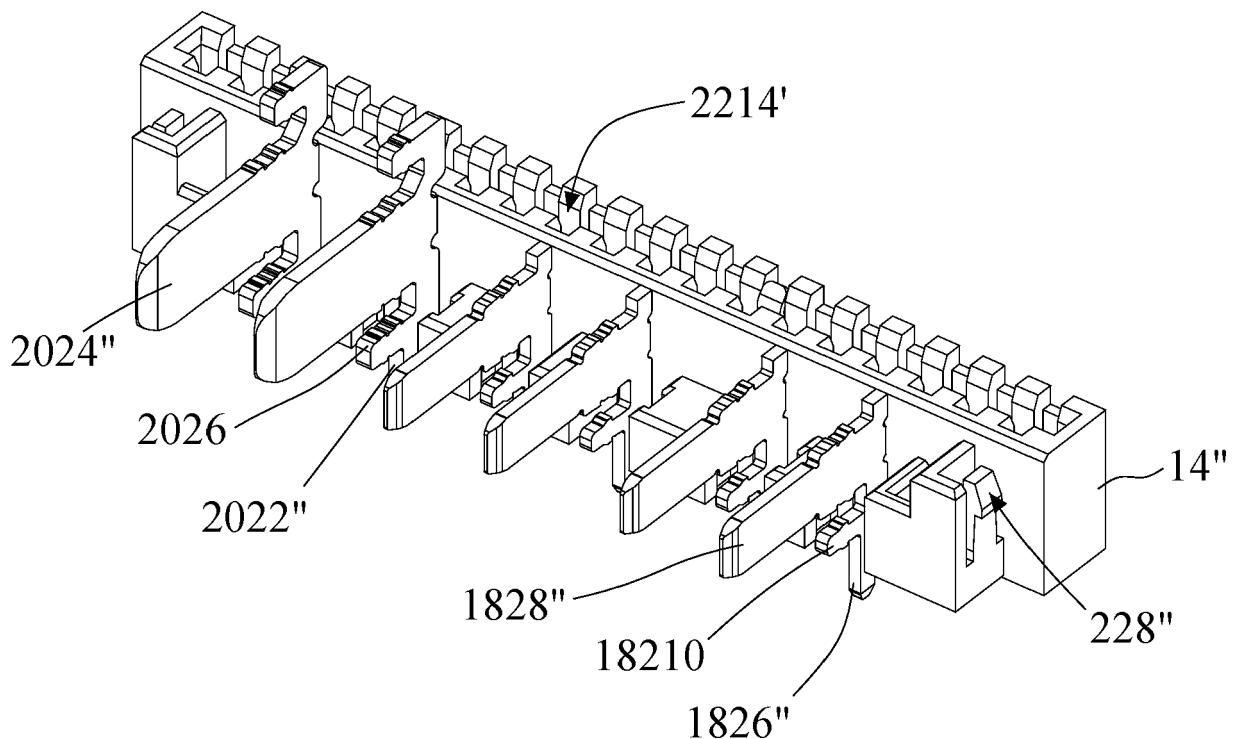


FIG.12(b)



EUROPEAN SEARCH REPORT

Application Number

EP 22 16 7112

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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55	<p>Place of search The Hague</p> <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p>	<p>Date of completion of the search 16 September 2022</p> <p>Examiner Hugueny, Bertrand</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>	<p>EPO FORM 1503 03/82 (P04C01)</p>

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