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(54) **Cable assembly with adjustable cable outlet**

(57) A cable assembly in accordance with the present invention comprises an insulative housing defining a base portion and a sleeve protruding from the base portion and arranged angular with the base portion, the base portion defining a front face and a receiving space therein, the sleeve defining a passageway communicated with the receiving space; a printed circuit board received in the receiving space of the insulative housing and defining a mating portion accessible from the front face of the insulative housing and a termination portion opposite to the mating portion; and a cable attached to the termination portion of the printed circuit board and extending out of the insulative housing through the passageway of the sleeve.

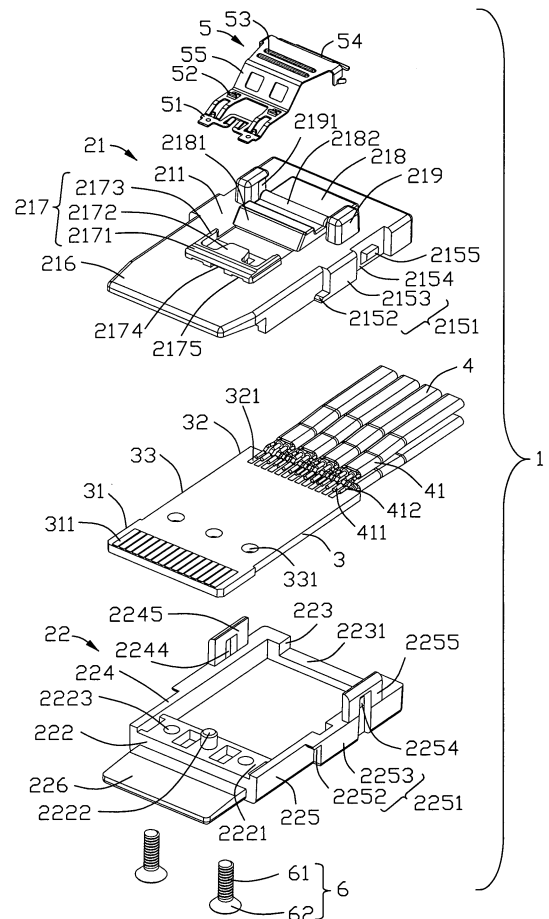


FIG. 2

Description

[0001] The present invention relates to a cable assembly, and more particularly to a cable assembly can be easily assembled and with an insulative housing for adjusting the cable outlet.

Description of Prior Art

[0002] U.S. Pat. No. 7,303,438 B2 issued to Dawiedczyk etc. (hereinafter referred to as Dawiedczyk '438 patents) on Dec. 4, 2007 discloses a cable assembly (not labeled) defining a plug connector 300 and a cable 101 coupled to the plug connector 300, please referring to FIGS. 14 & 16 in the Dawiedczyk '438 patent. As shown, the plug connector 300 includes an insulative housing 301 defining a forward mating face 302, a circuit card 305 disposed in the insulative housing 301 with a projecting mating blade 304 forwardly extending from the forward mating face 302 and a trailing edge (not shown) opposite to the mating blade 304. Further, a cable 101 electrically connects to the circuit card 305 and rearward extends out of the plug connector 300 in a horizontal direction. In addition, the insulative housing 301 is integrative molding around a middle and rear section of the circuit card 305 and a front portion of the cable 101 processed by the machine. And U.S. Pat. No. 7,448,897 B2 issued to Dawiedczyk etc. on Nov. 11, 2008 also discloses a plug connector 100 with an insulative housing (not labeled) over-molding around the edge card 120, please referring to FIGS. 1. Thus, the insulative housing 301 can not be enclosed the circuit card 305 and the cable 101 through the manual operation which is at lower cost and with higher productivity efficiency.

[0003] U.S. Pat. No. 7,175,444 B2 issued to Lang etc. (hereinafter referred to as Lang '444 patent) on Feb. 13, 2007 discloses a plug connector 400 defining an insulative housing (not labeled) assembled by a pre-molded frame 402 and a pre-formed body portion 470 in a front-to-rear direction, and a circuit card 450 disposed in the insulative housing, please referring to FIGS. 21 to 23 in the Lang '444 patent. As mentioned in the above, the insulative housing encloses the circuit board 450 through manual operation, however, the insulative housing of the plug connector 400 can not adjust the cable (not shown) outlet in different direction.

[0004] Please referring to FIGS. 1 to 8 and 14 to 16 in the Dawiedczyk '438 patent, the cables 101 all rearwardly exit out of the insulative 301 in a horizontal direction. It should be noted that the cable assembly is widely used in the server as an internal cable, whereas the internal space of the server will be limited due to the sever developed in a miniaturization trend increasingly. So the horizontal outlet direction of the cable may be not meet the practical applications in the server at sometime.

[0005] As discussed above, an improved cable assembly overcoming the shortages of existing technology is needed.

Summary of the Invention

[0006] Accordingly, an object of the present invention is to provide a cable assembly can be easily assembled by the manual operation to reduce the cost thereof and improve the assembling efficiency thereof.

[0007] Accordingly, an another object of the present invention is to provide a cable assembly with the cable outlets can be adjusted.

[0008] In order to achieve the object set forth, a cable assembly in accordance with the present invention comprises a lower cover defining a body portion with a front face and having a receiving space therein; a printed circuit board received in the receiving space of the lower cover, defining a mating portion forwardly extending from the front face of the body portion and with a plurality of conductive pads thereon, and a rear portion opposite to the mating portion with a plurality of conductive pads thereon; a plurality of cables, each cable with a plurality of conductors therein electrically terminated to the corresponding conductive pads of the rear portion of the printed circuit board; an upper cover defining a body portion with a front face and engaged with the lower cover, and substantially enclosing the rear portion of the printed circuit board; and engaging means interlocking with the lower cover, the printed circuit board and the upper cover together.

[0009] In order to achieve another object set forth, a cable assembly in accordance with the present invention comprises an insulative housing defining a base portion and a sleeve protruding from the base portion and arranged angular with the base portion, the base portion defining a front face and a receiving space therein, the sleeve defining a passageway communicated with the receiving space; a printed circuit board received in the receiving space of the insulative housing and defining a mating portion accessible from the front face of the insulative housing and a termination portion opposite to the mating portion; and a cable attached to the termination portion of the printed circuit board and extending out of the insulative housing through the passageway of the sleeve.

[0010] Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

Brief Description of The Drawings

[0011] Fig. 1 is a perspective view of a cable assembly of a first embodiment in accordance with the present invention;

[0012] Fig. 2 is an exploded, perspective view of the cable assembly of Fig. 1;

[0013] Fig. 3 is an another exploded, perspective view of the cable assembly of Fig. 2;

[0014] Fig. 4 is a cross section view of the cable assembly of Fig. 1 taken along line 4-4;

[0015] Fig. 5 is a cross section view of the cable assembly of Fig. 1 taken along line 5-5;

[0016] Fig. 6 is a cross section view of the cable assembly of Fig. 1 taken along line 6-6;

[0017] Fig. 7 is an enlarged view of a latch member of the cable assembly;

[0018] Fig. 8 is a perspective view of a cable assembly of a second embodiment in accordance with the present invention;

[0019] Fig. 9 is an exploded, perspective view of the cable assembly of Fig. 8;

[0020] Fig. 10 is an another exploded, perspective view of the cable assembly of Fig. 9;

[0021] Fig. 11 is a cross section view of the cable assembly of Fig. 8 taken along line 11-11;

[0022] Fig. 12 is a cross section view of the cable assembly of Fig. 8 taken along line 12-12;

[0023] Fig. 13 is a cross section view of the cable assembly of Fig. 8 taken along line 6-6;

[0024] Fig. 14 is a perspective view of a cable assembly of a third embodiment in accordance with the present invention;

[0025] Fig. 15 is an exploded, perspective view of the cable assembly of Fig. 14;

[0026] Fig. 16 is a cross section view of the cable assembly of Fig. 14 taken along line 16-16.

Detailed Description of Preferred Embodiments

[0027] Reference will now be made to the drawing figures to describe the present invention in detail.

[0028] Referring to FIGS. 1 to 3, a cable assembly 1 of the first embodiment made in accordance with the present invention includes an insulative housing 2, a printed circuit board 3 enclosed by the insulative housing 2, a number of cables 4 terminated to the printed circuit board 3 and extending out of the insulative housing 2, a latch member 5 assembled to the insulative housing 2 and a pair of screws 6 locking with the insulative housing 2 and the printed circuit board 3.

[0029] The insulative housing 2 is configured by assembling of an upper cover 21 and a lower cover 22 which are all formed in advance. The insulative housing 2 is made of plastic materials or other materials.

[0030] Referring to FIGS. 1 to 3, the upper cover 21 includes a body portion (not labeled) defining a forward face (not labeled) and a top flange 216 extending forwardly for a pre-selected length therefrom. The body portion defines a top wall 211, a front wall 212, a rear wall 213 and a pair of left and right side walls 214, 215 connected with the front and rear walls 212, 213. The walls 212, 213, 214, 215 defines a groove (not labeled) therebetween extending downwardly from peripheral sides of a bottom surface of the top wall 211. The top flange 216 is preferably angled along its side edges (not labeled).

[0031] The front wall 212 defines a channel 2121 for the printed circuit board 3 to pass through and three cir-

cular holes 2122 arranged along widthwise direction and spaced with each other. The rear wall 213 also defines a channel 2131 for the cable 4 to pass through. The left and right side walls 214, 215 each defines an expansive portion 2141, 2151 outwardly protruding from an outer surface thereof. Each expansive portion 2141, 2151 includes an upper guide portion 2142, 2152 and an upper main portion 2143, 2153. Each upper main portion 2143, 2153 defines a receiving slot 2144, 2154 and a wedge-shape block 2145, 2155 disposed in the receiving slot 2144, 2154.

[0032] The top wall 211 of the upper cover 21 defines a generally M-shape engaging portion 217 on a top surface thereof. The engaging portion 217 comprises a transverse main section 2171, a protruding section 2172 and a pair of arms 2173 located at opposite sides of the protruding section 2172, all extending rearward from the transverse main section 2171. A slit (not labeled) is formed between the protruding section 2172 and the top surface of the top wall 211. A first slot 2174 is recessed from a front surface of the main section 2171 and in communication with the slit. A pair of second slots 2175 located at two sides of the first slot 2174 are recessed from a front surface of the main section 2171 to communicate with the slit, respectively. The upper cover 21 defines a platform portion 218 protruding upward from a bottom surface of the top wall 211. The platform portion 218 defines an inclined front surface 2181 and a transverse bar-shape pivot section 2110 on middle thereof. The upper cover 21 further defines a pair of ear sections 219 disposed at two sides of the platform portion 218. Each of ear sections 219 has a recess 2191 communicated to the top surface of the top wall 211 and toward with each other.

[0033] The lower cover 22 includes a body portion (not labeled) defining a forward face (not labeled) and a bottom flange 226 forwardly extending for a preselected length from the forward face. The body portion defines a bottom wall 221, a front wall 222, a rear wall 223 and a pair of left and right side walls 224, 225 connected with the front and rear walls 222, 223. The walls 222, 223, 224, 225 extend upwardly from peripheral sides of a top surface of the bottom wall 221 and defines a groove (not labeled) therebetween.

[0034] The front wall 222 defines a channel 2221 for the printed circuit board 3 to pass through and a positioning post 2222 disposed in the channel 2221 for positioning the printed circuit board 3. A pair of holes 2223 disposed at two sides of the positioning post 2222 pass through the front wall 222 and the bottom wall 221 in a vertical direction corresponding to a pair of circular holes 2122 of the upper cover 21. The rear wall 223 also defines a channel 2231 for the cable 4 to pass through. The left and right side walls 224, 225 each defines an expansive portion 2241, 2251 outwardly protruding from an outer surface thereof. Each expansive portion 2241, 2251 includes a lower guide portion 2242, 2252 and a lower main portion 2243, 2253. Each lower main portion 2243, 2253

defines a locking member 2245, 2255 with an aperture 2244, 2254 thereof.

[0035] The print circuit board 3 defines a mating portion 31 with a plurality of conductive pads 311 for mating with a mating connector (not shown in FIGS.), a rear portion 32 opposite to the mating portion 31 with a plurality of conductive pads 321 for termination to a plurality of cables 4 and a middle portion 33 connected with the mating portion 31 and the rear portion 32. The conductive pads 311, 321 are arranged on opposite upper and lower surfaces of the printed circuit board 3. The print circuit board 3 further defines three through holes 331 arranged in a widthwise direction. A middle through hole 331 of the three through holes 331 is arranged for receiving the positioning post 2122 of the lower cover 21. The mating portion 31 is wider than middle portion 33 and the rear portion 32 so that the mating portion 31 will be stopped by a forward face of the insulative housing 2.

[0036] The cable 4 comprises two sets of sub-assemblies in a stacked relationship. Each sub-assembly comprises four serial Attached Technology Attachment (ATA) standard cables 41 for high speed signal transmission. Each Serial ATA standard cable 41 comprises a pair of signal conductors 411 respectively transmitting positive signal and negative signal, and a pair of grounding conductors 412 arranged at opposite outer sides of the pair of signal conductors 411 for providing grounding to the signal transmission.

[0037] Referring to FIGS. 2, 3 and 7, the latch member 5 is stamped and formed from a metallic plate and comprises a retaining portion 51, a pair of generally L-shape locking portions 52 extending upwardly and rearwardly from the retaining portion 51, a N-shape pressing portion 53 formed at a rear position of the pair of locking portions 52, and an inclined supporting portion 54 slantwise extending from the pressing portion 53. The latch member 5 further defines an inclined intermediate portion 55 connecting the pressing portion 53 with the locking portions 52.

[0038] The retaining portion 51 has a pair of transverse bar sections 511 respectively connecting with front edges of the locking portions 52, an engaging section 512 connecting with opposite inner ends of the pair of bar sections 511 and extending rearward from the bar sections 511, and a pair of positioning sections 513 respectively extending forwardly from front edges of the pair of bar sections 511. The engaging section 512 is located between the pair of locking portions 52 and comprises a rectangular frame 5121 located in a horizontal surface and a pair of elastic snapping sections 5122 extending into the space circumscribed by the frame 5121 with distal ends bending upwardly. Each locking portion 52 comprises an inclined first section 521 extending rearward and upwardly from the retaining portion 51 and a flat second section 522 extending rearward from the first section 521 to connect with the intermediate portion 55. Each locking portion 52 defines two cutouts (not labeled) therein for increasing flexibility thereof. The second section 522 de-

finer a pair of latch sections 5221 extending upwardly from a middle portion thereof. A pair of stop sections 514 are respectively formed with the bar sections 51 and extend into the cutout (not labeled) of the locking portion 52 and curve upwardly. The pressing portion 53 comprises a body section 531 and a pair of side beams 532 extending downwardly from opposite lateral ends of the body section 531. Each side beam 531 defines a spring tab 5321 extending outwardly therefrom. The body section 531 defines a plurality of ribs 5331 for facilitating handling. The supporting portion 54 defines a pair of rectangular openings 541 and forms a curved edge 542 at a free end thereof. The openings 541 and the cutouts respectively formed in the the locking portion 52 and the intermediate portion 55 are defined for perfect deformation of the locking portion 52 and the supporting portion 54.

[0039] Referring to FIGS. 2, 3 and 6, a pair of engaging means 6, such as screws, are used for locking with the upper cover 21, the printed circuit board 3 and the lower cover 22. Each screw 6 defines a cylindrical thread portion 61 and an operating portion 62.

[0040] Referring to FIGS. 8 to 13, a cable assembly 1' of the second embodiment made in accordance with the present invention comprises a printed circuit board 3, a number of cables 4 terminated to the printed circuit board 3, a latch member 5 and a pair of screws 6 corresponding to the element members in the first embodiment and an insulative housing 2' with a structure different from the insulative housing 2 shown in the first embodiment. The insulative housing 2' is also assembled by an upper cover 21' and a lower cover 22' which are all pre-formed. The upper cover 21' has a similar structure to the upper cover 21 of the insulative housing 2. The lower cover 22' is also similar to the lower cover 22 of the insulative housing 2, but further defines a sleeve 2211' downward protruding from a bottom wall 221' thereof, the sleeve 2211' defines a passageway therein (not labeled) communicated with a receiving space (not labeled) of the lower cover 22'. So the cables 4 extend out of the insulative housing 21' through the passageway of the sleeve 2211' in a downward direction.

[0041] Referring to FIGS. 14 to 16, a cable assembly 1" of the third embodiment made in accordance with the present invention comprises a printed circuit board 3, a number of cables 4 terminated to the printed circuit board 3, a latch member 5 and a pair of screws 6 corresponding to the element members in the first and second embodiments and an insulative housing 2" with a structure different from the insulative housing 2, 2' shown in the first and second embodiments. The insulative housing 2" is also assembled by an upper cover 21" and a lower cover 22" which are all pre-formed. The upper cover 21" has a similar structure to the upper cover 21 of the insulative housing 2, but further defines a sleeve 2211" upward protruding from a top wall 221" thereof. The sleeve 2211" defines a passageway (not labeled) therein communicated with a receiving space (not labeled) of the upper

cover 21 ". The cables 4 extend out of the insulative housing 21 " through the passageway of the sleeve 2211 " in an upward direction. The lower cover 22" is also similar to the lower cover 22 of the insulative housing 2.

[0042] Referring to FIGS. 1 to 7, the assembling process of the cable assembly 1 of the first embodiment made in according to the present invention starts from arranging the cables 4 into two levels and soldering the signal conductors 411 and the grounding conductors 412 of the Serial ATA standard cable 41 to the conductive pads 311, 321 of the printed circuit board 3.

[0043] After the cables 4 are soldered to the printed circuit board 3, then assembling the cables 4 and the printed circuit board 3 together to the lower cover 22. The middle portion 33 of the printed circuit board 3 is disposed in the channel 2221 and the positioning post 2222 disposed in the channel 2221 passes through the holes 331 of printed circuit board 3. And, as the mating portion 31 is wider than the middle portion 33, so that the mating portion 31 is stopped by the front wall 222 of the lower cover 22 in a front-to-rear direction. The cables 4 extend rearwardly out of the lower cover 22 through the rear opening of the insulative housing 2 in a horizontal direction.

[0044] Referring to FIGS. 8 to 16, in the second embodiment of the present invention, the cables 4 are firstly bent downwardly and then assembling the printed circuit board 3 and the cables 4 to the lower cover 22' and making the cables 4 extending out of the lower cover 22' through a passageway of the sleeve 2211' of thereof. In the third embodiment of the present invention, the cables 4 are firstly bent upwardly and then assembling the printed circuit board 3 and the cables 4 to the lower cover 22".

[0045] After the printed circuit board 3 and the cables 4 are together assembled to the lower cover 22, then assembling the upper cover 21 to the lower cover 22. The locking members 2245, 2255 of the lower cover 22 are respectively received into the receiving slot 2144, 2154. At this moment, the wedge-shape blocks 2145, 2155 disposed in the receiving slot 2144, 2154 are respectively received into the apertures 2244, 2254 of the locking members 2245, 2255 so that the upper cover 21 and the lower cover 22 are latched with each other. The top end of the positioning post 2222 of the lower cover 22 is attached to the opening of circular holes 2122. The insulative housing 2 is formed after the upper cover 21 and the lower cover 22 latched with each other. The insulative housing 2 defines a body portion (not labeled) formed by the body portions of the upper and lower cover 21, 22, a top flange 216 and a bottom flange 226 respectively extending forwardly from the upper and lower side of the forward face of the body portion thereof. The insulative housing 2 defines a receiving space (not labeled) formed by a pair of grooves (not labeled) respectively defined in the upper cover 21 and lower cover 22. The insulative housing 2 further defines a pair of guide portion (not labeled) formed by the upper guide portions 2142, 2152 and lower guide portions 2242, 2252. The middle

portion 33 of the printed circuit board 3 is received into a front opening (not labeled) formed by a pair of channels 2121, 2221 respectively defined in the upper cover 21 and lower cover 22. The mating portion 31 of the printed circuit board 3 is extending forwardly from the forward face of the insulative housing 2 and disposed between the top and bottom flanges 216, 226. The mating portion 31 is paralleled and spaced with the top and bottom flanges 216, 226. The mating portion 31 of the printed circuit board 3 and the top and bottom flange 216, 226 all have respective width, the width of the mating portion 31 is less than the width of the top flange 2116 but greater than the width of the bottom flange 226. The cables 4 exit out of the insulative housing 2 through a rear opening (not labeled) formed by a pair of channels 2231, 2232 respectively defined in the upper and lower cover 21, 22. The soldering points of the print circuit board 3 and the cables 4 are disposed in the receiving space of the insulative housing 2.

[0046] Referring to FIGS. 8 to 16, in the second and third embodiments of the present invention, the upper covers 21', 21 " are both assembled to the lower covers 22', 22" in a up-to-down direction.

[0047] After the upper cover 21 is assembled to the lower cover 22, then assembling a pair of screws 6 to the insulative housing 2. The thread portions 61 of a pair of screws 6 pass through a pair of holes 2223 defined in the lower cover 22 and a pair of through holes 331 defined in the printed circuit board 3 in a spiral movement, at last a pair of distal ends of the screws 6 are received into a pair of circular holes 2122 defined in the upper cover 21. Thus, the upper cover 21, the lower cover 22 and the printed circuit board 3 are engaged with each other by the pair of screws 6.

[0048] Finally, assembling the latch member 5 to the top wall 211 of upper cover 21 of the insulative housing 2. A forward pressing force is exerted on the latch member 5. The spring tabs 5321 of the pressing portion 53 respectively slide along the recesses 2191 of the ear sections 219 of the upper cover 21. At the same time, with the guidance of the outmost ends of the retaining portion 51 sliding along the arms 2173 of the engaging portion 217 of the upper cover 21, the bar section 511 and the engaging section 512 are received in the slit with the snapping sections 5122 and the positioning sections 513 respectively locked into the first and the second slots 2174, 2175 to prevent the latch member 5 from moving rearwardly when the cable assembly 1 mates with the complementary connector. The pair of stop sections 514 locate at the back of transverse main section 2171 of the engaging portion 217 for preventing excessive forward movement of the latch member 5. The supporting portion 54 is located above the a platform 218 abutting against a surface of the platform. The spring tabs 5321 of the pressing portion 53 elastically engage with inner surfaces of the recesses 2191 of the ear sections 219 for preventing the latch member 5 from escaping the recesses 2191 of the upper cover 21. The pressing portion 53 is down-

wardly movable relative to the insulative housing 2 to deflect the locking portion 52 toward the insulative housing 2.

[0049] Referring to FIGS. 8 to 16, in the second and third embodiments of the present invention, the latch member 5 and the pair of screws 6 are assembled to the insulative housing 2', 2" using the same manners and steps description in the first embodiment of the present invention.

[0050] After the above assembling steps, the entire process of assembling the cable assembly 1, 1', 1" is finished.

[0051] It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

Claims

1. A cable assembly for mating with a complementary connector, comprising:

a lower cover defining a body portion with a front face and having a receiving space therein;
a printed circuit board received in the receiving space of the lower cover, defining a mating portion forwardly extending from the front face of the body portion and with a plurality of conductive pads thereon, and a rear portion opposite to the mating portion with a plurality of conductive pads thereon;
a plurality of cables, each cable with a plurality of conductors therein electrically terminated to the corresponding conductive pads of the rear portion of the printed circuit board;
an upper cover defining a body portion with a front face and engaged with the lower cover, and substantially enclosing the rear portion of the printed circuit board; and
engaging means interlocking with the lower cover, the printed circuit board and the upper cover together.

2. The cable assembly as claimed in claim 1, wherein the upper cover and lower cover respectively defines a top flange and a bottom flange forwardly extending from the forward face of the body portion thereof.
3. The cable assembly as claimed in claim 2, wherein the top flange and bottom flange are disposed on opposite sides of the mating portion of the printed circuit board, spaced apart and paralleled with the mating portion of the print circuit board respectively.
4. The cable assembly as claimed in claim 2, wherein

engaging means is a screw, each of the upper and lower cover and the printed circuit board comprises a hole for allowing the screw extending through.

5. The cable assembly as claimed in claim 1, wherein the printed circuited board further defines a middle portion connected with the mating portion and having a plurality of holes therein.
6. The cable assembly as claimed in claim 5, wherein the lower cover defines a positioning post thereof extending through one hole of the printed circuit board.
7. The cable assembly as claimed in claim 1, wherein the cable assembly further comprises a latch member assembled to a top face of the upper cover.
8. The cable assembly as claimed in claim 1, wherein the upper cover or the lower cover further defines a sleeve angled with the body portion thereof and defining a passageway for the cable pass through.
9. A cable assembly, comprising:
an insulative housing defining a base portion and a sleeve protruding from the base portion and arranged angular with the base portion, the base portion defining a front face and a receiving space therein, the sleeve defining a passageway communicated with the receiving space;
a printed circuit board received in the receiving space of the insulative housing and defining a mating portion accessible from the front face of the insulative housing and a termination portion opposite to the mating portion; and
a cable attached to the termination portion of the printed circuit board and extending out of the insulative housing through the passageway of the sleeve.
10. The cable assembly as claimed in claim 9, wherein the insulative housing is defined by an upper cover having a body portion and a lower cover having a body portion corresponding to the upper cover.
11. The cable assembly as claimed in claim 10, wherein the upper cover and the lower cover respective has a top flange and a bottom flange extending from a front surface of the body portion thereof and spaced apart with the mating portion of the printed circuit board.
12. The cable assembly as claimed in claim 11, wherein the cable assembly further comprises a latch member assembled to a top surface of the insulative housing.

- 13.** The cable assembly as claimed in claim 12, wherein the mating portion of the printed circuit board and the top and bottom flange all have respective width, the width of the mating portion being less than the width of the top flange but greater than the width of the bottom flange. 5
- 14.** The cable assembly as claimed in claim 11, wherein the sleeve is integrated formed on the upper cover or lower cover. 10
- 15.** The cable assembly as claimed in claim 9, wherein the insulative housing defines a pair of guide portions formed on the opposites sides thereof. 15
- 16.** The cable assembly as claimed in claim 9, wherein the cable assembly further defines engaging means assembled to the housing for locking the printed circuit board toward the insulative housing reliable. 20

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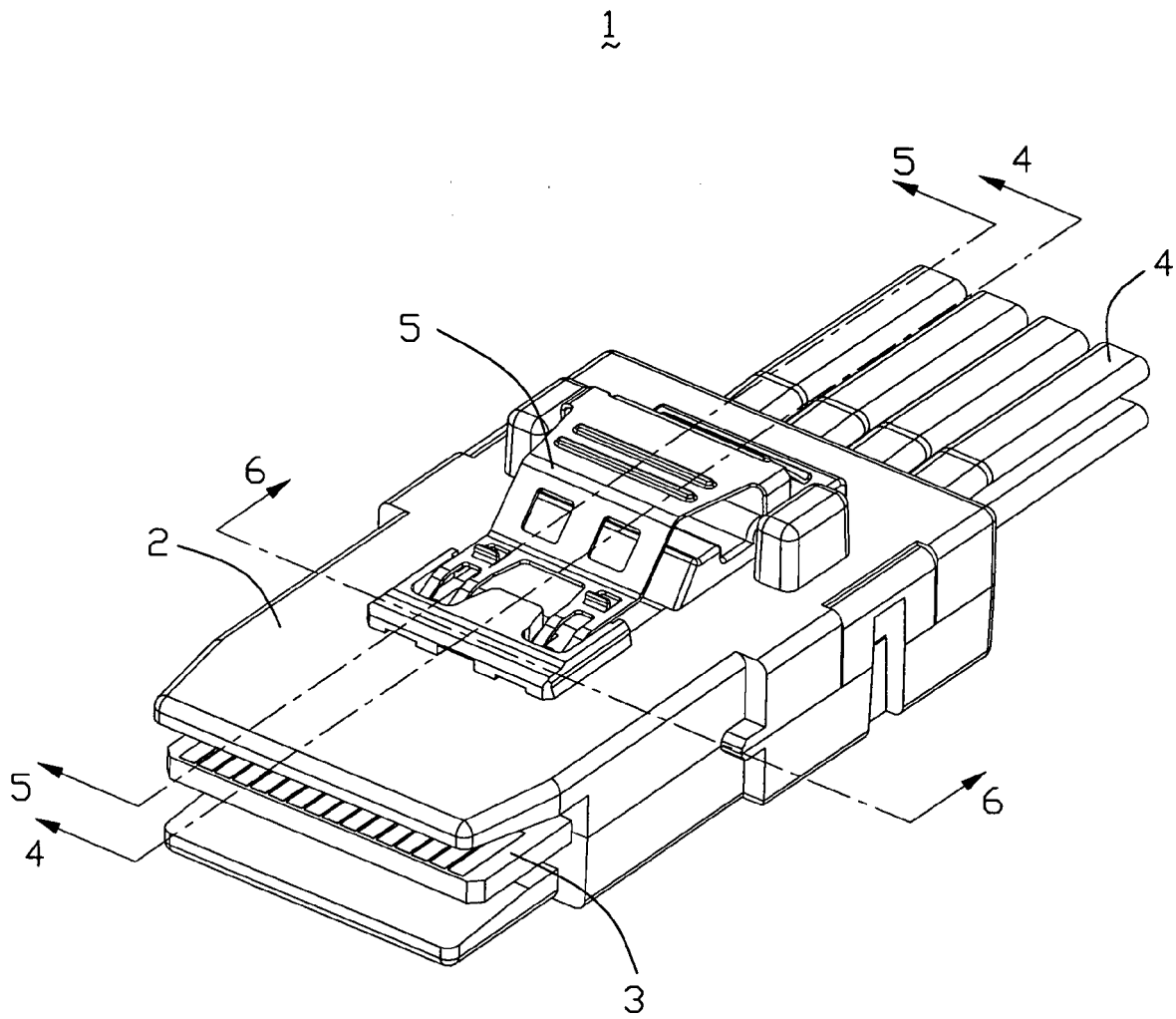


FIG. 1

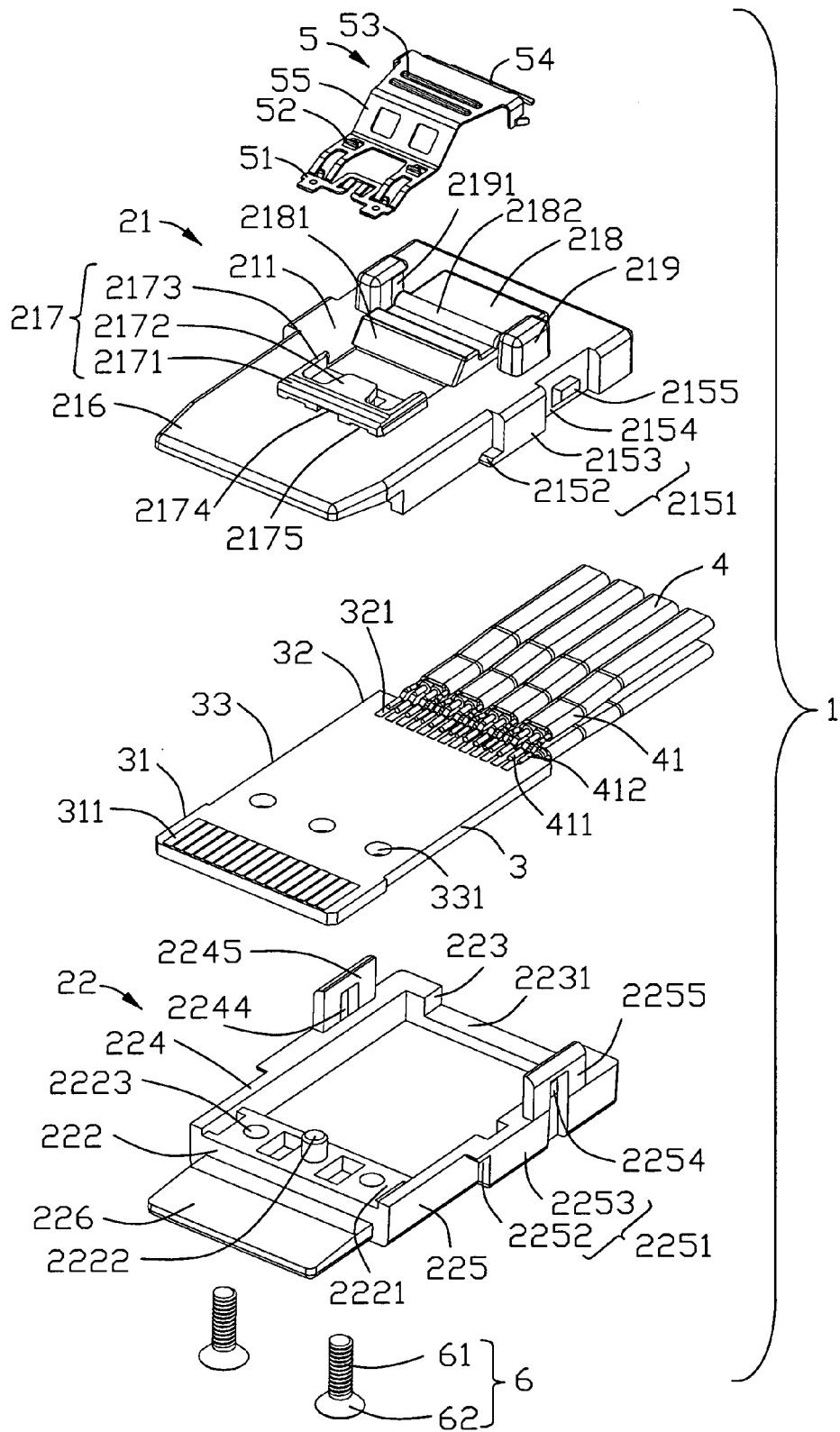


FIG. 2

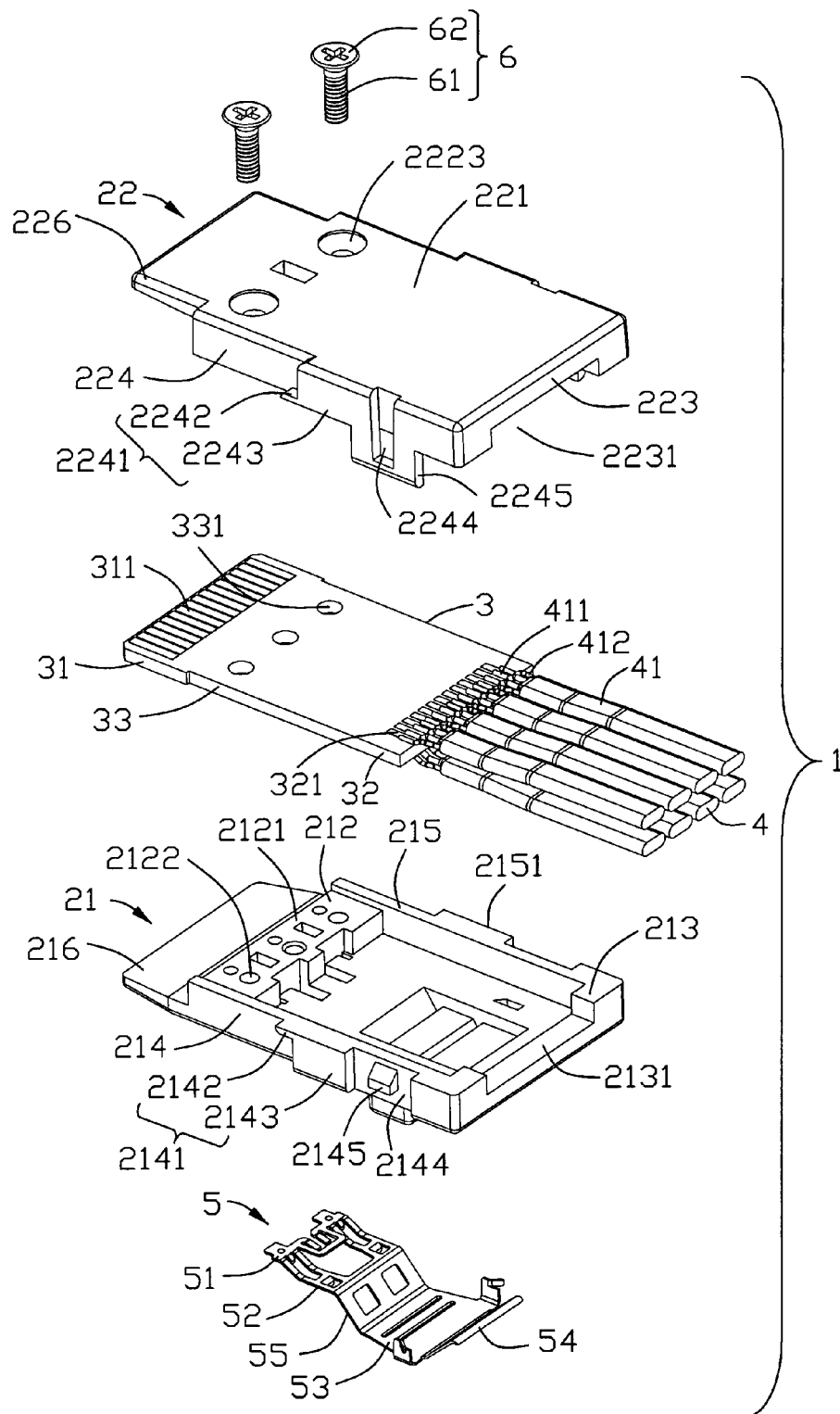


FIG. 3

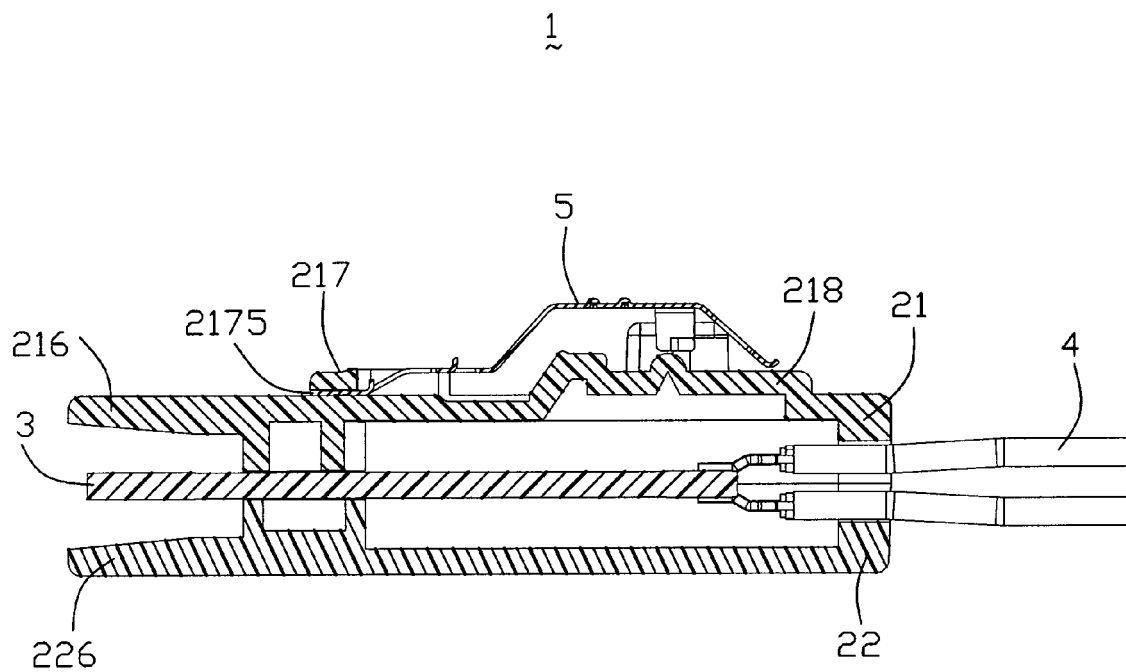


FIG. 4

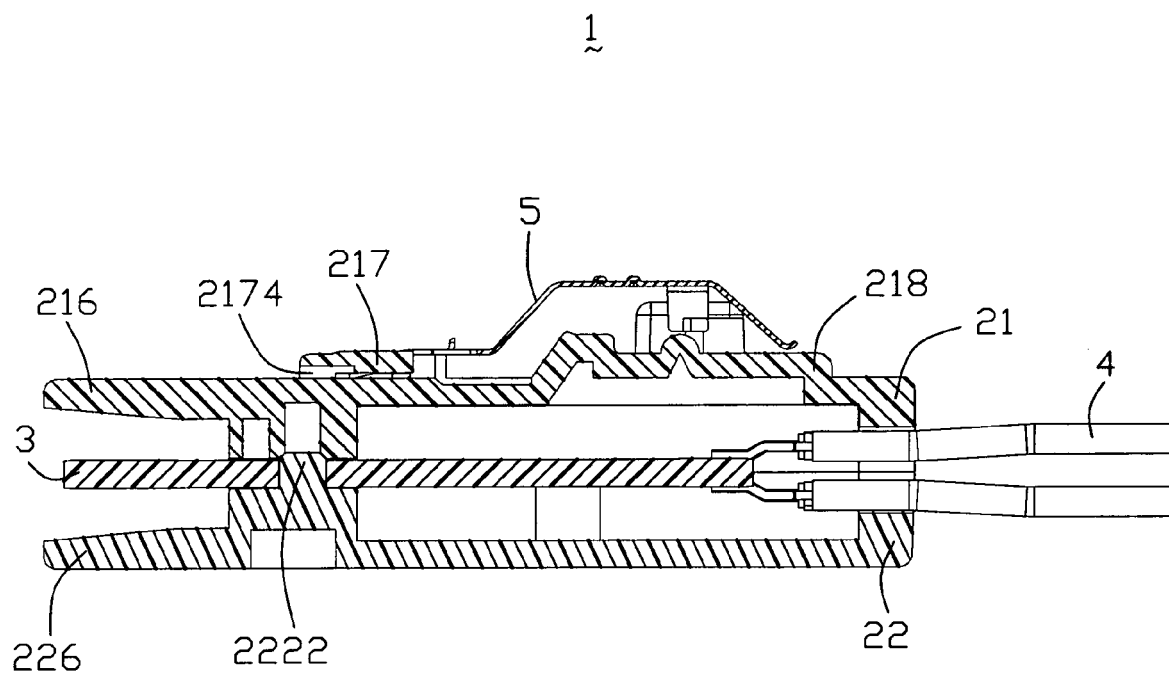


FIG. 5

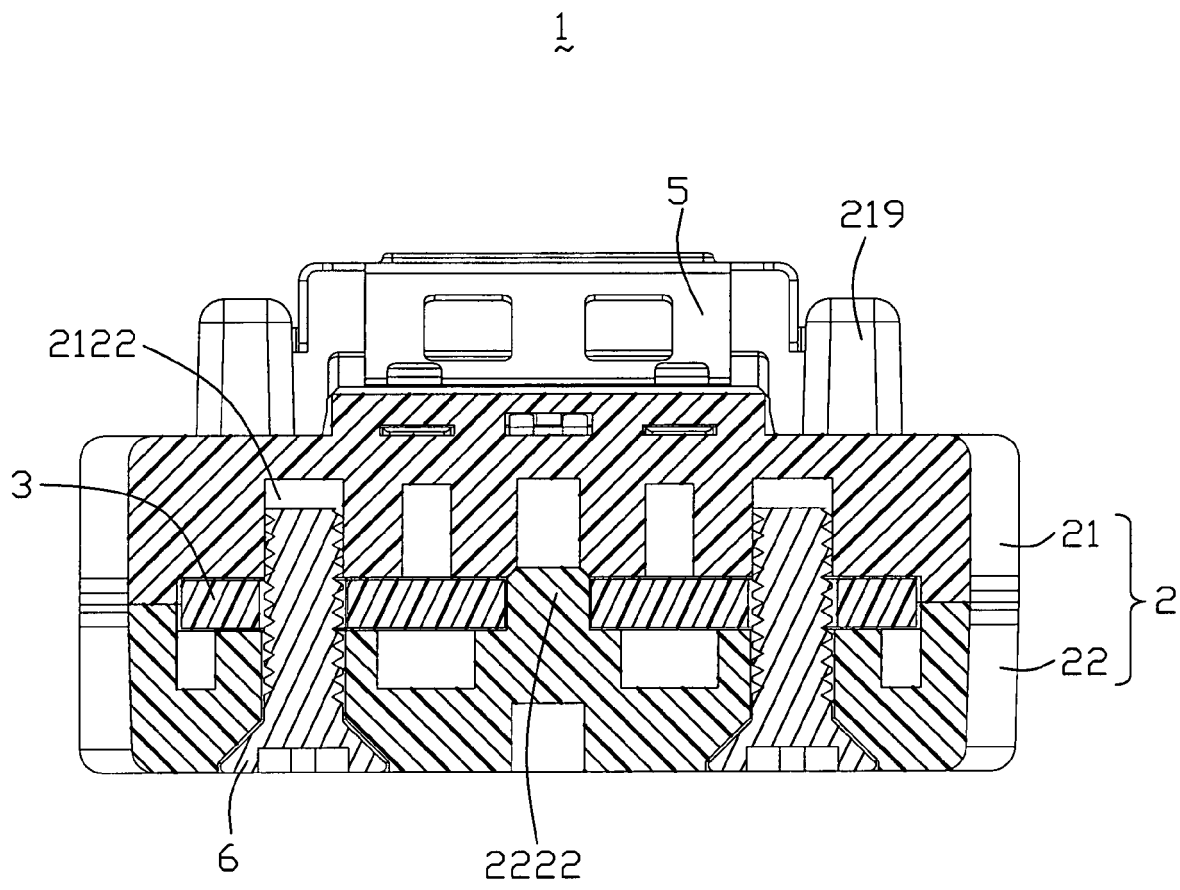


FIG. 6

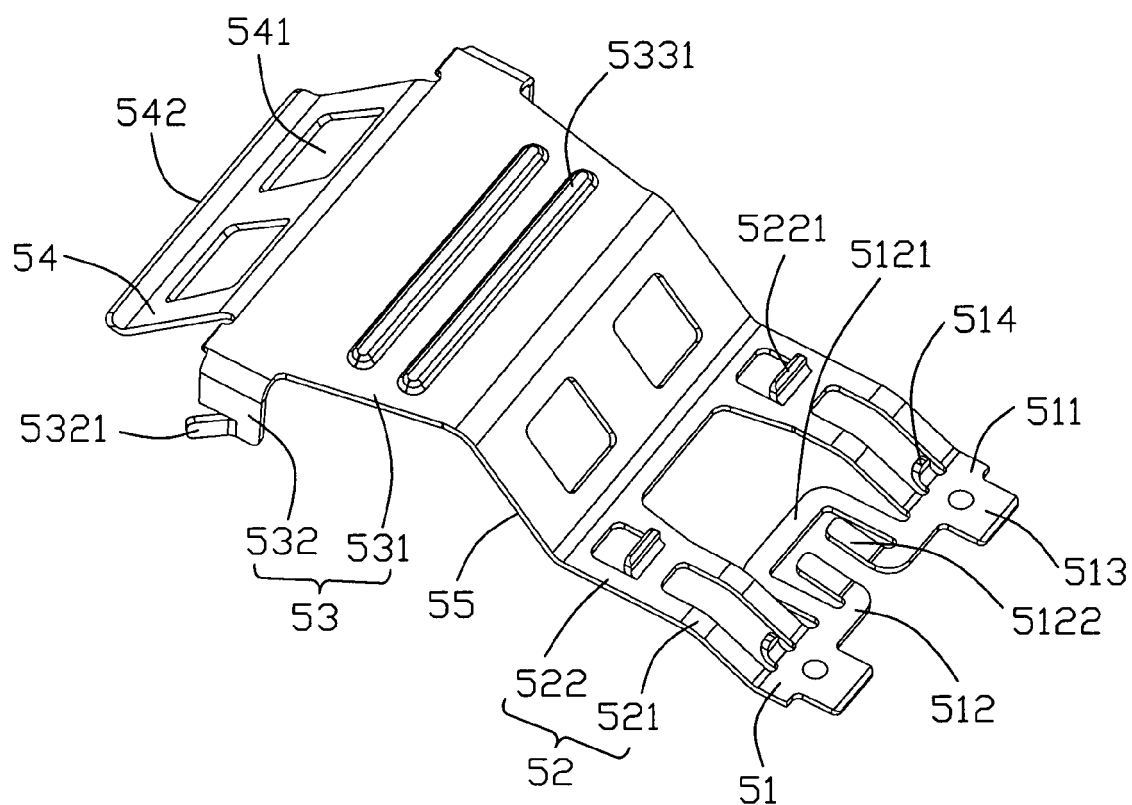


FIG. 7

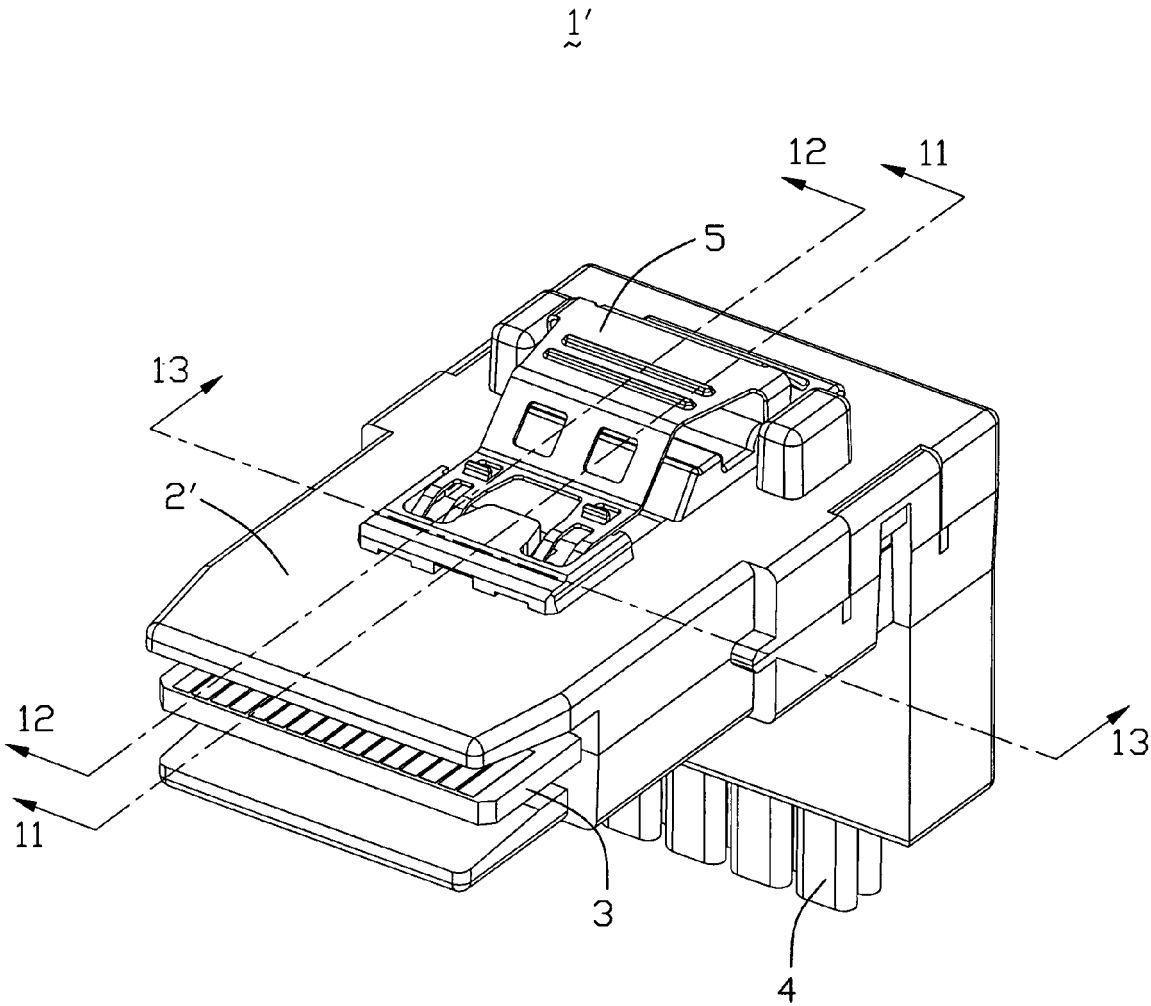


FIG. 8

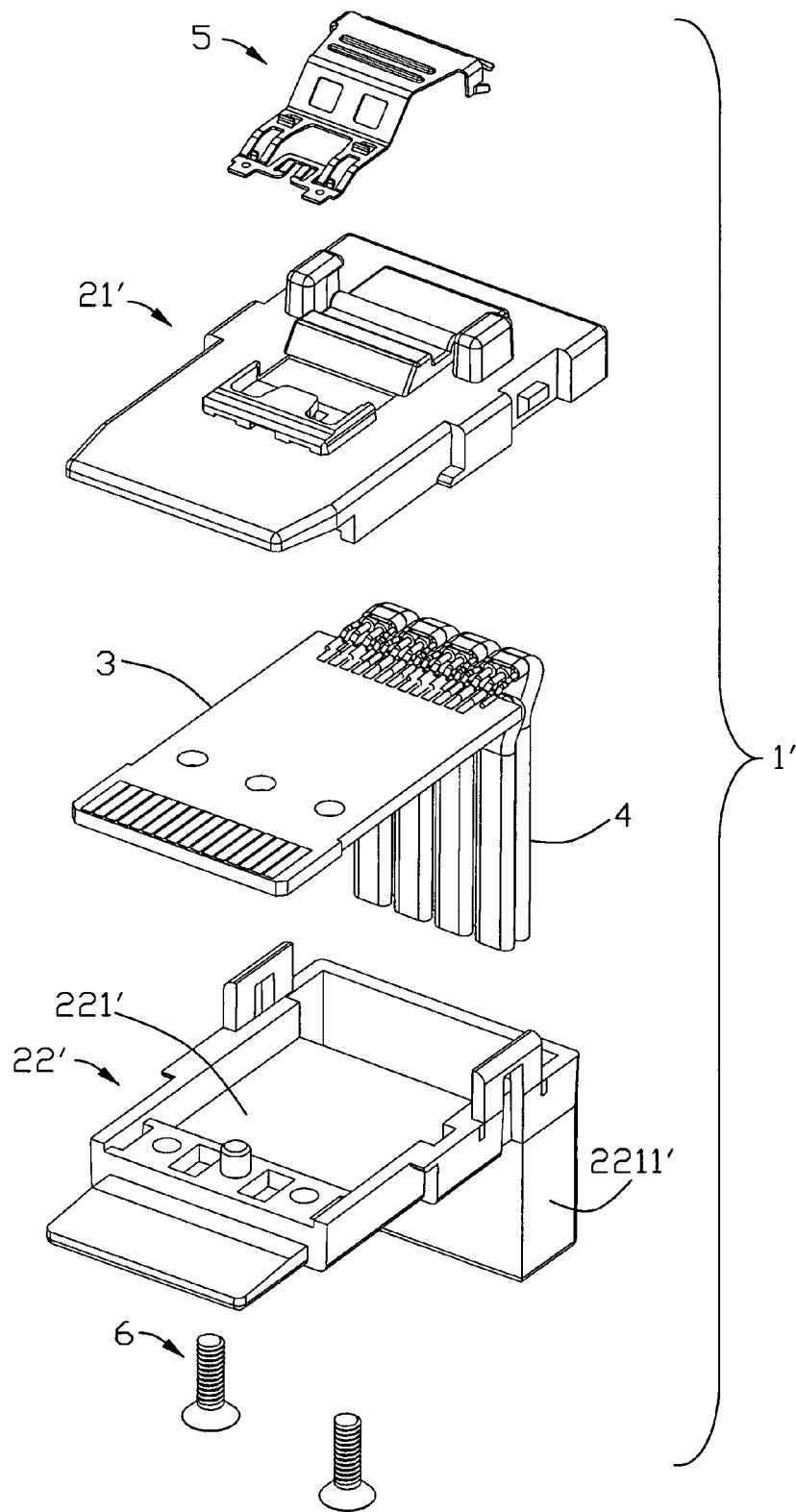


FIG. 9

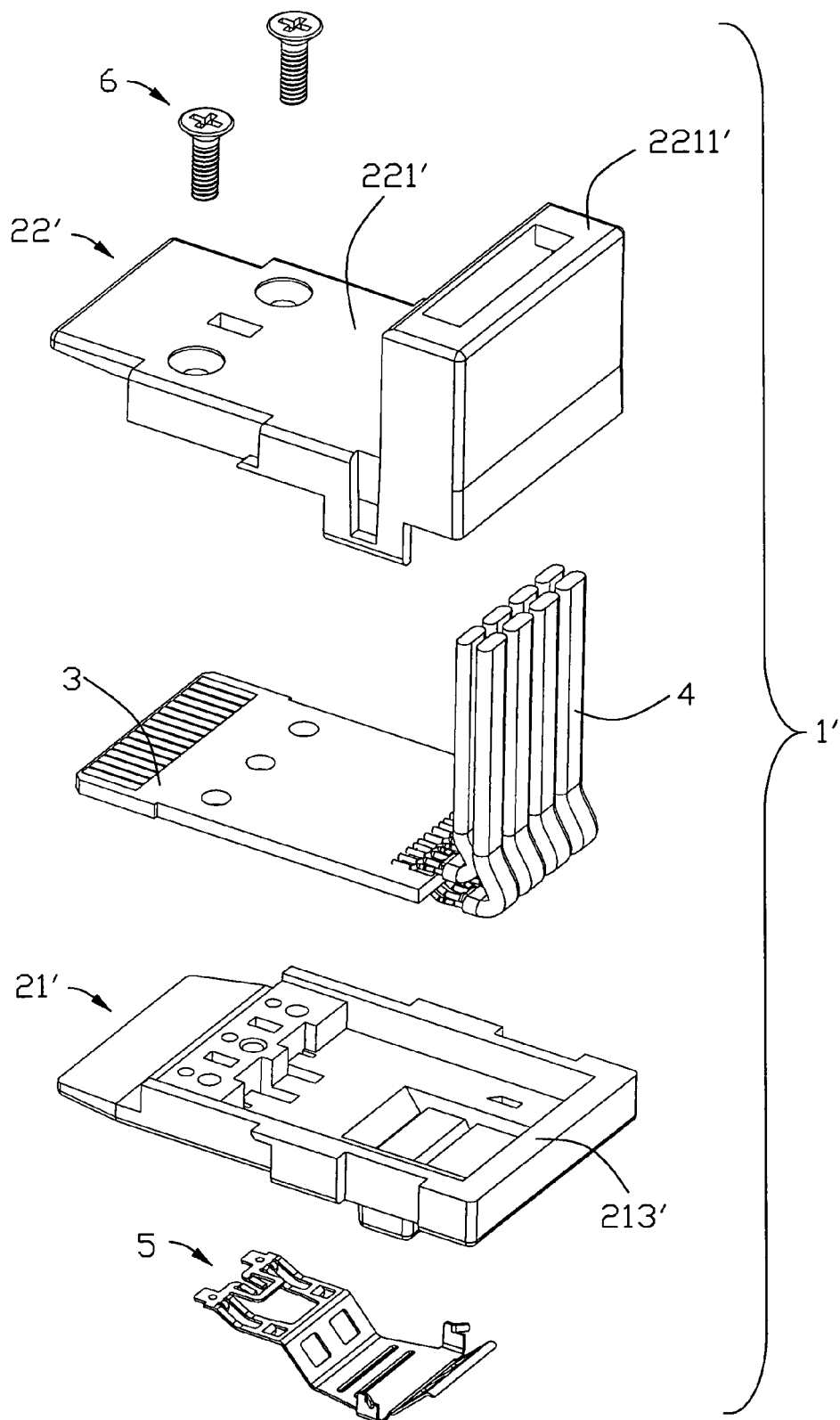


FIG. 10

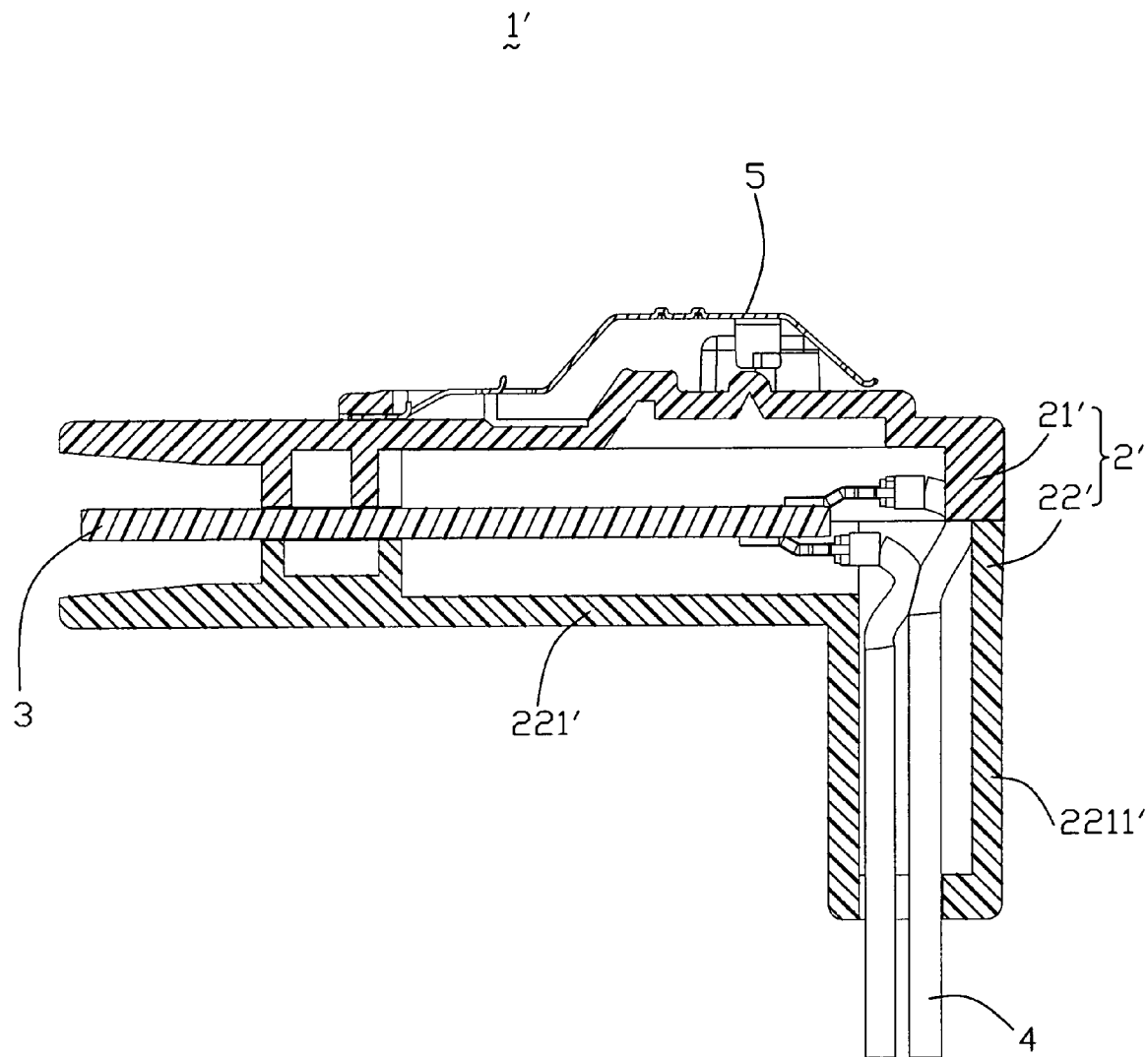


FIG. 11

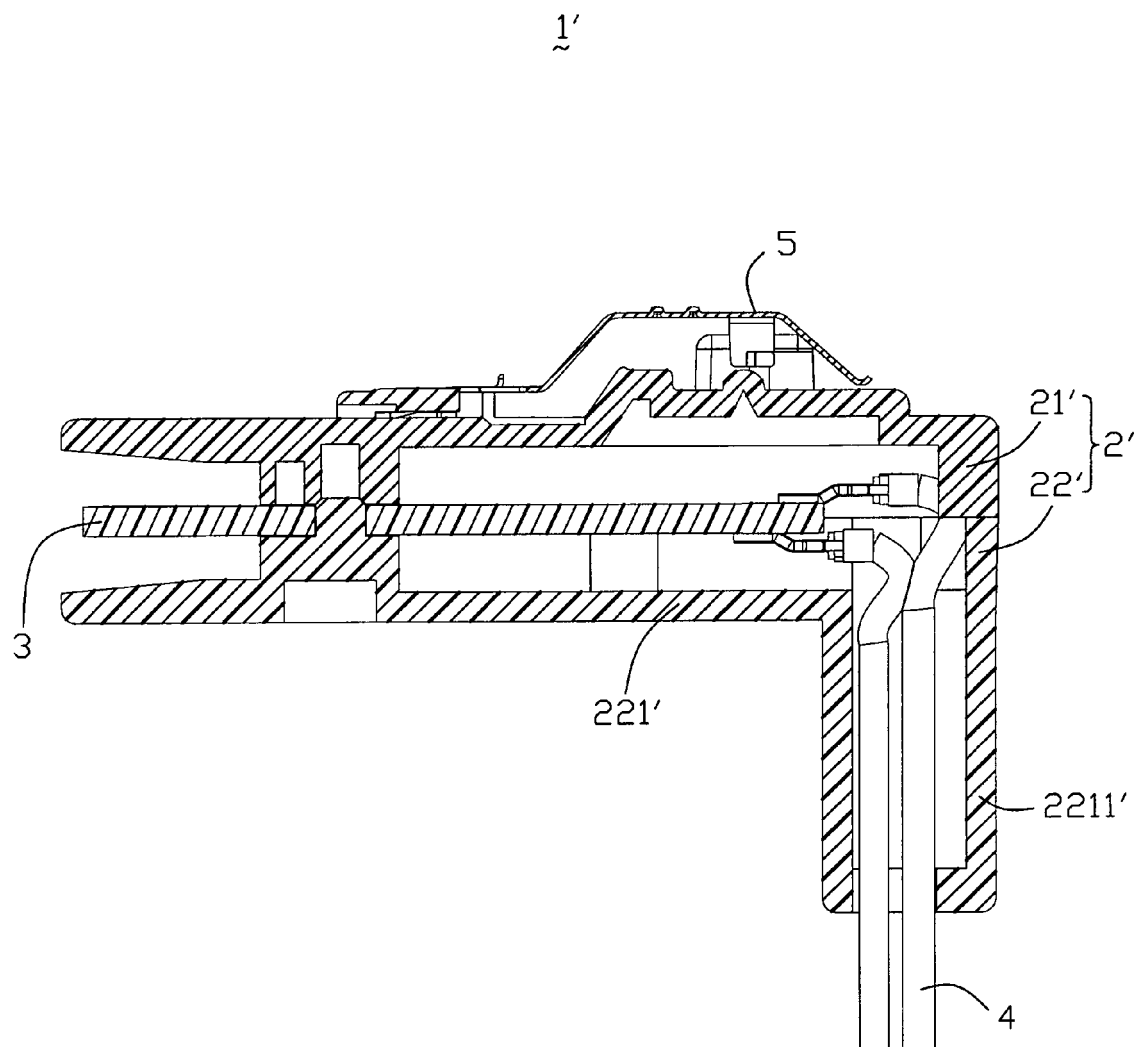


FIG. 12

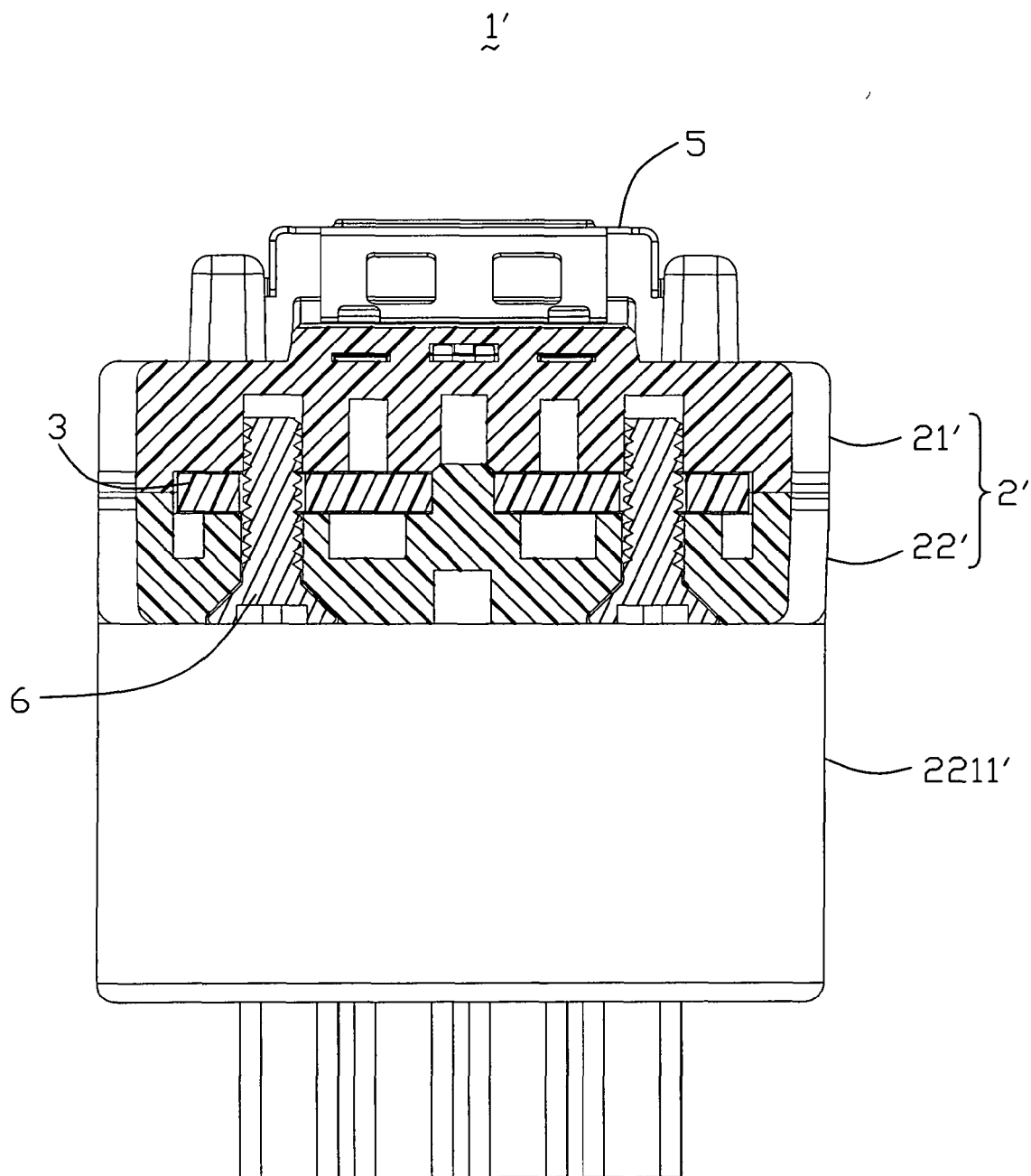


FIG. 13

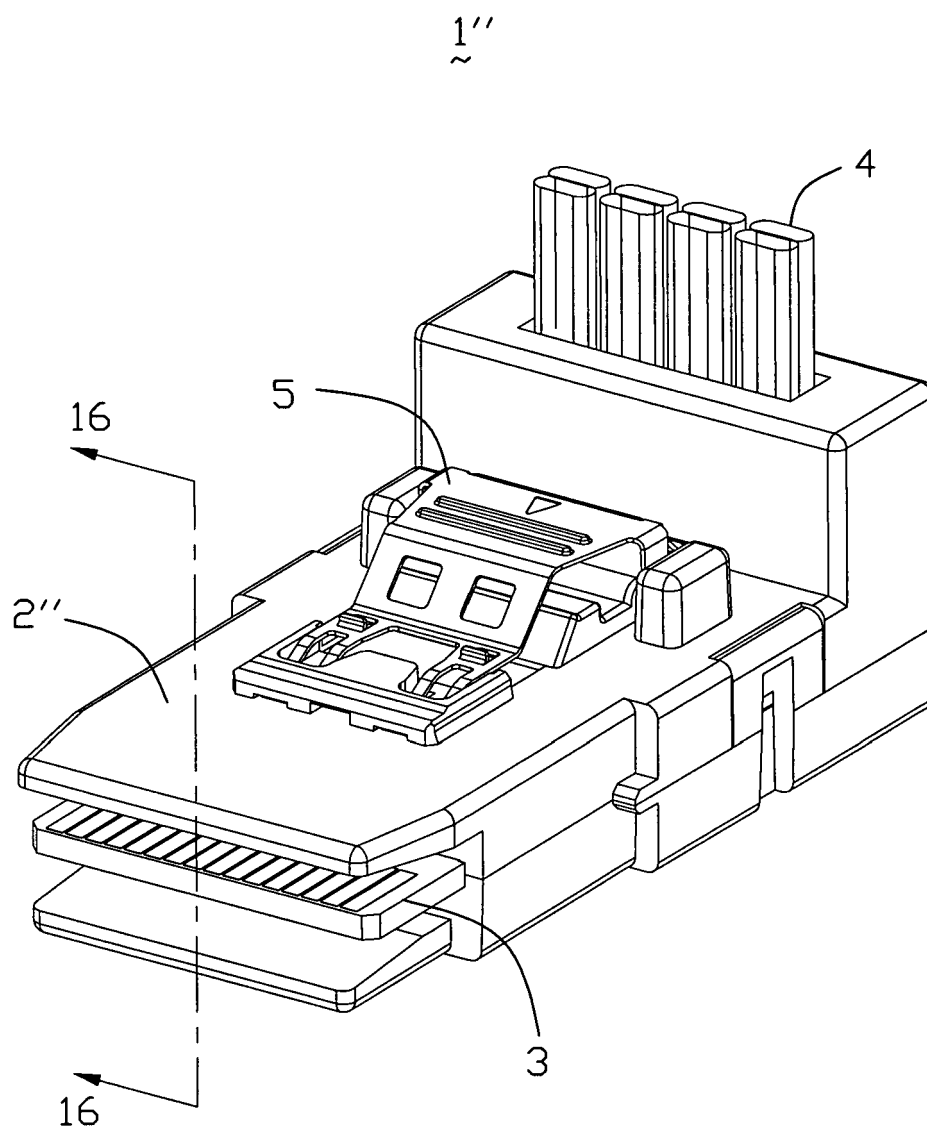


FIG. 14

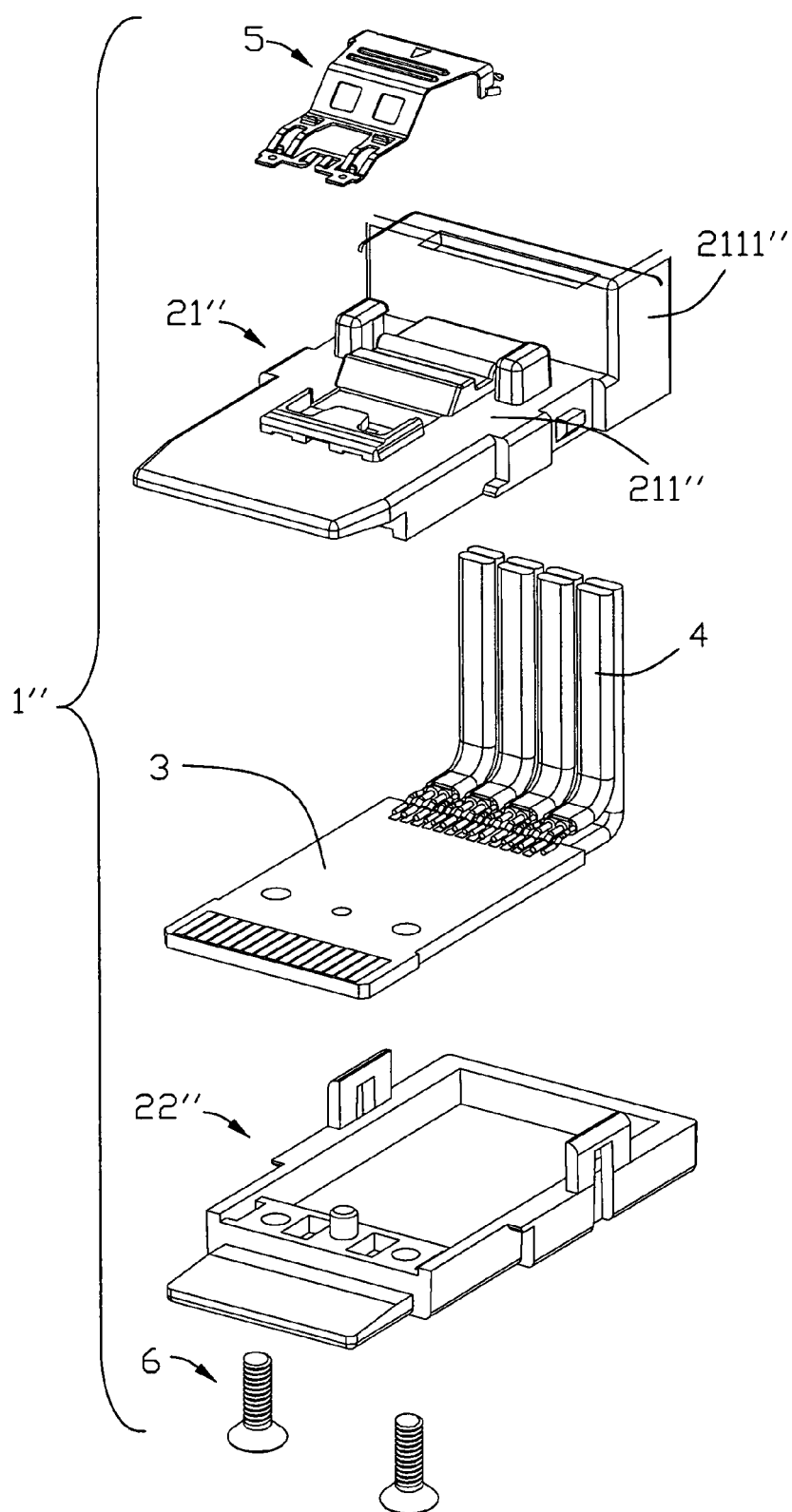


FIG. 15

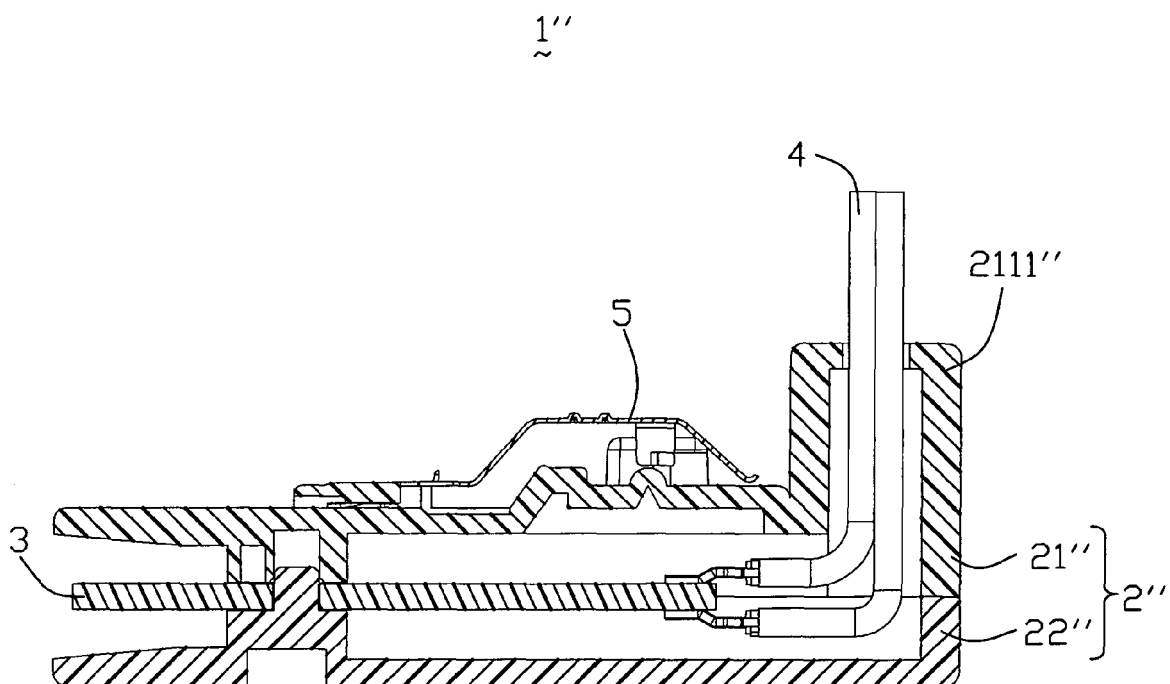


FIG. 16

REFERENCES CITED IN THE DESCRIPTION

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