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(54) Title: CONNECTOR HAVING SECURED LOCKING MECHANISM

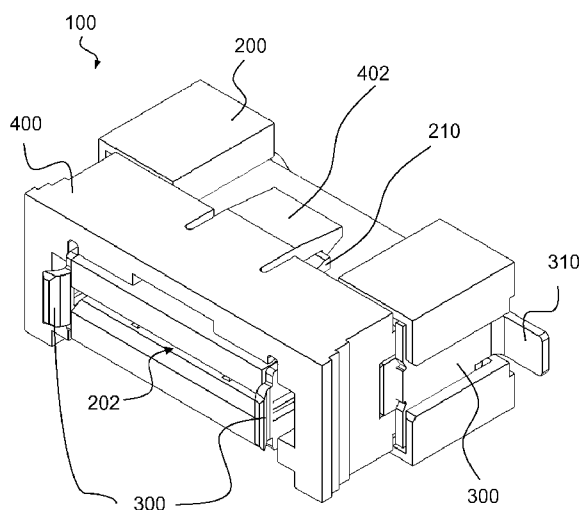


Figure 1

(57) Abstract: The present invention provides an electrical connector (100) for connecting to a flexible printed circuit (FPC) board or an FPC cable (600). The connector has a housing (200) with a slot (202) into which an FPC cable can be inserted to make electrical contacts with the contact terminals (500). A pair of locking members (300) is fixed to the housing, each has a locking portion (312) extending towards the front end of the housing. The FPC cable has a pair of lugs (604) protruding laterally from side edges thereof. When the FPC cable is inserted into the slot, the pair of lugs deforms the locking member resiliently away from the FPC cable to allow the lugs to pass by. Thereafter the locking members resume to the original position to engage the lugs by which the FPC cable is locked to the housing such that removal of the FPC cable from the slot is prevented.



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- 1 -

## CONNECTOR HAVING SECURED LOCKING MECHANISM

### Field of the Invention

5           This invention relates to an electrical connector for a FPC (flexible printed circuit) cable. More particularly, this invention relates to a FPC connector that provides a secure locking mechanism.

### Background of the Invention

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          A FPC connector is a device that facilitates electrical connections between a FPC and another device or component. A FPC connector is often mounted on a substrate such as a circuit board and electrically connected to the FPC cable. In general, a FPC cable has properties of lightness, smallness, compactness, and flexibility. Therefore, electrical connectors for FPC are widely used in small portable electronic products having movable parts, such as notebook, mobile phone, digital camera, hard disk drive, etc.

          A typical FPC connector includes an insulating housing, conductive contacts for electrical connections, and locking members for engagement of the connector with a FPC cable. Therefore, a secure locking mechanism and compactness of the FPC connector are factors to be considered when designing a FPC connector. For this reason, effective solutions for a secure locking mechanism for a FPC connector are constantly sought, and at the same time compactness and easy to use are also desirable. A secure locking mechanism should be able to hold a FPC cable in place firmly and prevent detachment from the connector. Thus, various configurations of FPC connectors have been devised and accordingly various forms of locking members have been proposed.

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## SUMMARY OF THE INVENTION

In this invention, a FPC connector that provides a secure and convenient locking mechanism is proposed. The proposed FPC connector is simple in structure and easy to use, in which the insertion of a FPC cable into the FPC connector and locking of the FPC cable to the connector can be operated with one hand. Further, only a low insertion force is required to lock the cable.

### Brief Description of the Drawings

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Figure 1 is a perspective front view of a FPC connector in accordance with an embodiment of this invention;

15

Figure 2 is a perspective rear view of the FPC connector shown in Figure 1;

Figure 3 is an exploded view of Figure 1;

20

Figure 4 is a perspective view of the FPC connector shown in Figure 1 with a FPC cable inserted;

Figure 5A is a perspective front view showing the housing of the FPC connector shown in Figure 1;

25

Figure 5B is an enlarged perspective view of Figure 1 without retaining device.

Figure 6 is a perspective rear view of the housing shown in Figure 5A;

30

Figure 7 is a perspective view of a conducting terminal of the FPC connector shown in Figure 1;

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Figure 8 is a perspective view showing the conducting terminal of Figure 7 in contact with a contact portion of a cable;

Figure 9 is a perspective view of a locking member of the FPC connector  
5 shown in Figure 1;

Figure 10 is a side view of the locking member of the the FPC connector shown in Figure 9;

10 Figure 11 is a perspective view of the retaining member of the FPC connector shown in Figure 1;

Figure 12 is a perspective rear view of the retaining member shown in Figure 11;

15

Figure 13 is a cross sectional top view of the FPC connector shown in Figure 1 with a cable inserted into the FPC connector; and

20 Figure 14 is a perspective view of a FPC connector in accordance with another embodiment of this invention.

## Detailed Description of preferred embodiments

Figure 1 illustrates an embodiment of an electrical connector 100 for connecting a FPC cable to a circuit board. As shown in Figure 1, connector 100 comprises a housing 200 to which locking members 300 and a retaining device 400 are attached. Housing 200 has a front opening or slot 202 at the front side that receives an end portion of a FPC cable. The end portion of the FPC cable has a contact portion in contact with conducting terminals 500 (Figure 2) that extend through the rear surface of housing 200, when the contact portion of the FPC cable is inserted into front opening 202. Locking members 300 are attached to respective opposing sides of housing 200 to hold and lock a FPC cable to connector 100. Retaining device 400 fits over the attached FPC cable and attaches to housing 200 to secure the engagement between locking members 300 and the contact portion of the FPC cable.

A rear side of connector 100 is shown in Figure 2. The rear side of connector 100 has rear openings 204. Conducting terminals 500 are disposed in housing 200 through rear openings 204. Conducting terminal 500 has tail 506 protrudes out from rear opening 204 to connect conducting terminal 500 to the circuitry of the underlying circuit board. As shown in Figure 2, locking members 300 are attached to opposing sides of housing 200. Each locking member 300 includes a mounting plate 310 that extends outward from housing 200 for mounting connector 100 to the underlying circuit board.

An exploded view of connector 100 is shown in Figure 3. Connector 100 comprises housing 200, locking members 300, retaining device 400, and conducting terminals 500. Figure 4 illustrates an assembled connector 100 with contact portion 602 inserted into connector 100 via front opening 202. Cable 600, as shown in Figure 5A, comprises a thin flat body 606 with a planar contact portion 602 at an end of cable 600. Locking tabs 604 project laterally and outwardly from the edge on opposing sides of contact portion 602. When contact portion 602 is inserted into housing 200, locking tabs 604 engage with

– 5 –

locking members 300 such that FPC cable 600 can be hold and locked to connector 100.

Figure 6 shows a rear side of housing 200, having rear openings 204 at  
5 the rear surface of the housing 200 through which conducting terminals 500 are  
disposed. Front opening 202 extends across through the front side of housing  
200. When in use, contact portion 602 of FPC cable 600 is inserted into front  
opening 202 to contact conducting terminals 500. Housing 200 includes  
mounting structures 214 at opposing ends of opening 202. Each mounting  
10 structure 214 comprises guiding channels 206, 208 to receive and hold locking  
member 300 therein; and locking channels 212 to partially receive retaining  
device 400. Locking members 300 are partially inserted into mounting  
structure 214 as described below. A wedge 210 protrudes from a top surface  
of housing 200 and is used to lock retaining device 400 together with housing  
15 200. Retaining device 400 fits over cable 600 and is attached to housing 200  
as described below.

An enlarged view of conducting terminal 500 is shown in Figure 7.  
Conducting terminal 500 is made of conductive material and comprises two  
20 substantially parallel horizontally elongated arms 502. Arms 502 are joined to  
form a U-shaped planar with an extended base 504. Tail 506 extends  
downwards from base 504 to make conducting terminal 500 in L-shape. Tail  
506 makes electrical connections with the circuitry of an underlying circuit  
board.

25

The ends of both elongated arms 502 are tapered to form tab 508. As  
shown in Figure 7, tab 508 has a triangular-like shape. However, one skilled in  
the art will recognize that tab 508 may have other shapes without departing  
from this invention. Tabs 508 extend outward from the end of each elongated  
30 arm 502 and toward each other to allow tabs 502 to press against top and  
bottom surfaces of contact portion 602 of cable 600. Therefore, when contact  
portion 602 is inserted into opening 202, contact portion 602 fits between two

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elongated arms 502 and comes into contact with tabs 508 which causes elongated arms 502 to flex outward. Elongated arms 502 are then held in tension causing tabs 508 to grip contact portion 602 to secure connection between conducting terminals 500 and contact portion 602, as shown in Figure 8. Thus, the circuitry of the underlying circuit board is interconnected with the circuitry of a cable 600.

Figures 9 and 10 illustrate locking member 300 shown in Figure 3. Locking members 300 secure cable 600 to housing 200 and maintain electrical connections between conducting terminals 500 and contact portion 602 of cable 600. In this embodiment, locking members 300 are provided in pair and are independent of one another to allow each locking member to at least partially engage cable 600 if the other locking member 300 fails to function. Each locking member 300 is preferably made of a pliable material such as metal that is resiliently deformable.

Locking member 300 comprises a first arm 302 and a second arm 304, connected together via a joint portion 303, to form a U-shaped structure. Second arm 304 is stationary relative to housing 200 after locking member 300 is inserted into housing 200. First arm 302 is preferably longer than second arm 304 and includes a locking portion 312 and a link portion 314. Locking portion 312 is resiliently bent during insertion and removal of cable 600 into and out from housing 200. Slot 308 is formed in locking portion 312 of first arm 302. The size of slot 308 is configured to receive and engage with locking tab 604 to provide an engagement, to prevent attached cable 600 from moving or slipping-off. Link portion 314 of first arm 302 holds locking member 300 firmly in housing 200. Further, an opening 316 is formed through the center part of link portion 314. As shown in Figure 9, opening 316 is preferably rectangular in shape. However, opening 316 may be formed in other shapes without departing from this invention, as long as opening 316 can fit with the shape of block 213 of mounting structure 214 as shown in Figure 5A.

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As shown in Figure. 5B, when locking member 300 is fixed to housing 200, a step 317 of opening 316 is positioned adjacent to and facing block 213. The space between step 317 and block 213 are configured such that when FPC cable 600 is inserted into housing 200, first arm 302 will not be over bent.

5 In addition, block 213 is also in contact with second arm 304 to improve the fixing stability of second arm 304 in guiding channel 208. In this regard, block 213 serves to fix second arm 304 in guiding channel 208 and to limit a deforming range of first arm 302 to prevent over bending of first arm 302.

10 When attaching locking member 300 to housing 200, link portion 314 of first arm 302 is pressed into guiding channel 206 of mounting structure 214, and second arm 304 is pressed into guiding channel 208 of mounting structure 214. After locking member 300 is inserted into housing 200, second arm 304 is fixed in guiding channel 208 of housing 200 without relative movement, and the

15 movement of link portion 314 of first arm 302 is restricted within channel 206 by block 213.

Referring to Figure 10, locking portion 312 of first arm 302 is curved and integral to link portion 314. When contact portion 602 is inserted into opening

20 202, locking tabs 604 of contact portion 602 come into contact with curved locking portions 312. Locking tabs 604 then push first arms 302 outwardly. Advancing cable 600 further will bring locking tabs 604 into slots 308, and thereafter first arms 302 springs back to their original position. This secure locking means prevents cable 600 from slipping-off or backward movement

25 away from connector 100 by, e.g. forces exerted on cable 600 or by other extrinsic forces. As first arms 302 are deformed outwardly during insertion of cable 600 into housing 200 and spring back after locking tabs 604 are received in slots 308, cable 600 can be locked to housing 200 without additional steps. As such, this invention provides an electrical connector in which connection

30 and locking of an FPC cable can be achieved in one step and with one hand.

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Removal of cable 600 from connector 100 is effected by applying pressure to flex first arms 302 laterally away from each other, thus retrieving locking tabs 604 from slots 308 and allow cable 600 to release from connector 100. In this invention, locking members 300 provides sufficient strength to  
5 withstand pressure and force applied to first arm 312; and sufficient elasticity for locking and unlocking the FPC cable.

Figure 11 is an enlarged view of retaining device 400 shown in Figure 3. A rear view of retaining device 400 is shown in Figure 12. Retaining device  
10 400 comprises a beam 412 and a pair of support members 414 that extends outward vertically from the opposing ends of beam 412. Latch member 402 extends outward from an edge of beam 412 of retaining device 400. When retaining device 400 is attached to housing 200, latch member 402 engages with wedge 210 on the top surface of housing 200 to lock retaining device 400  
15 to housing 200.

Projection blocks e.g. in the form of two legs 404 extend outward from an edge of each vertical side 414 of retaining device 400. Although a total of four legs 404 are shown in this embodiment, one skilled in the art will recognise  
20 that any number of legs may be formed on retaining device 400 without departing from this invention. When retaining device is attached to housing 200, legs 404 fit into locking channels 212 of mounting structure 214 on opposing sides of housing 200, as illustrated in Figure 13. When inserted into locking channels 212, legs 404 are also positioned between first and second  
25 arms 302 and 304, hence to prevent first arm 302 from flexing towards second arm 304 and thus prevent locking member 300 from releasing the engagement with locking tabs 604 of cable 600. Further, grooves 406 may be formed at the bottom surface of beam 412 and guideways 408 may be formed at the inner surface of support members 414. When retaining device 400 is attached to  
30 housing 200, locking portion 312 of first arm 302 fits into groove 406 by which, first arm 302 is prevented from bending, hence to further ensure the engagement between locking tabs 604 and locking member 300.

Referring to Figures 9 and 10, locking member 300 further comprises a mounting plate 310 which is integral to second arm 304. Mounting plate 310 can be connected on a circuit board (not shown) or any substrate by way of soldering or other means so that connector 100 can be mounted vertically on the circuit board. Alternatively, Figure 14 illustrates a FPC connector 700 with a horizontal mounting plate 702 formed at first arm 704 in accordance with another embodiment of this invention. In this embodiment, FPC connector 700 is mounted horizontally on an underlying circuit board. Apart from horizontal mounting plate 702, other components and parts of FPC connector 700 are similar to FPC connector 100.

While preferred embodiments of the present invention have been described and illustrated above, it is to be understood that they are exemplary of the invention and are not to be considered to be limiting. It is expected that those skilled in the art can and will design alternatives within the scope of this invention as set forth in the following claims.

**Claims:**

1. An electrical connector comprising:
  - a housing with an opening defined through a front side of said
  - 5 housing for receiving a contact portion of a cable;
  - conducting terminals disposed in said housing for electrically
  - connecting to the contact portion of said cable;
  - a first locking member on a first side of said housing configured to
  - engage a first locking tab on a first side of said cable; and
  - 10 a second locking member on a second side of said housing
  - configured to engage a second locking tab on a second side of
  - said cable,
  - wherein said second locking member is independent from said first
  - locking member.
  - 15
2. The electrical connector of claim 1, wherein each of the first and the
- second locking members comprises a first arm and second arm joint
- together at one end, the housing comprises a pair of guiding channels
- each receives the first arm and second arm of one locking member,
- 20 wherein the first arm is deformable in a respective guiding channel.
3. The electrical connector of claim 2, wherein the first arm further
- comprises a slot for engaging with the locking tab of said cable.
- 25 4. The electrical connector of claim 2, further comprising a block formed in
- the locking channel, wherein the block is to fix the second arm in the
- guiding channel and to limit a deforming range of the first arm to prevent
- over bending of the first arm.
- 30 5. The electrical connector of claim 4, wherein the first arm comprises an
- opening to receive the block.

6. The electrical connector of claim 2 further comprising:  
a retaining device having a beam and a pair of support members  
extending from the beam to fit over said cable and affix into said  
housing to secure said first and second locking tabs into said first  
and second locking members.
- 5
7. The electrical connector of claim 6, wherein the retaining device further  
comprises projection blocks extending rearwardly from each support  
member, and when the retaining device is affixed to the housing, the  
projection blocks are positioned between the first and the second arms  
to prevent the first arm from flexing towards the second arm.
- 10
8. The electrical connector of claim 6, wherein the retaining device further  
comprises a pair of grooves formed on the beam, wherein when the  
retaining device is affixed to the housing, each groove receives a portion  
of a corresponding first arm to prevent the first arm from flexing towards  
the second arm.
- 15
9. The electrical connector of claim 6, wherein the housing further  
comprises a wedge and the retaining device further comprises a latch  
engageable with the wedge to lock the retaining device to the housing.
- 20

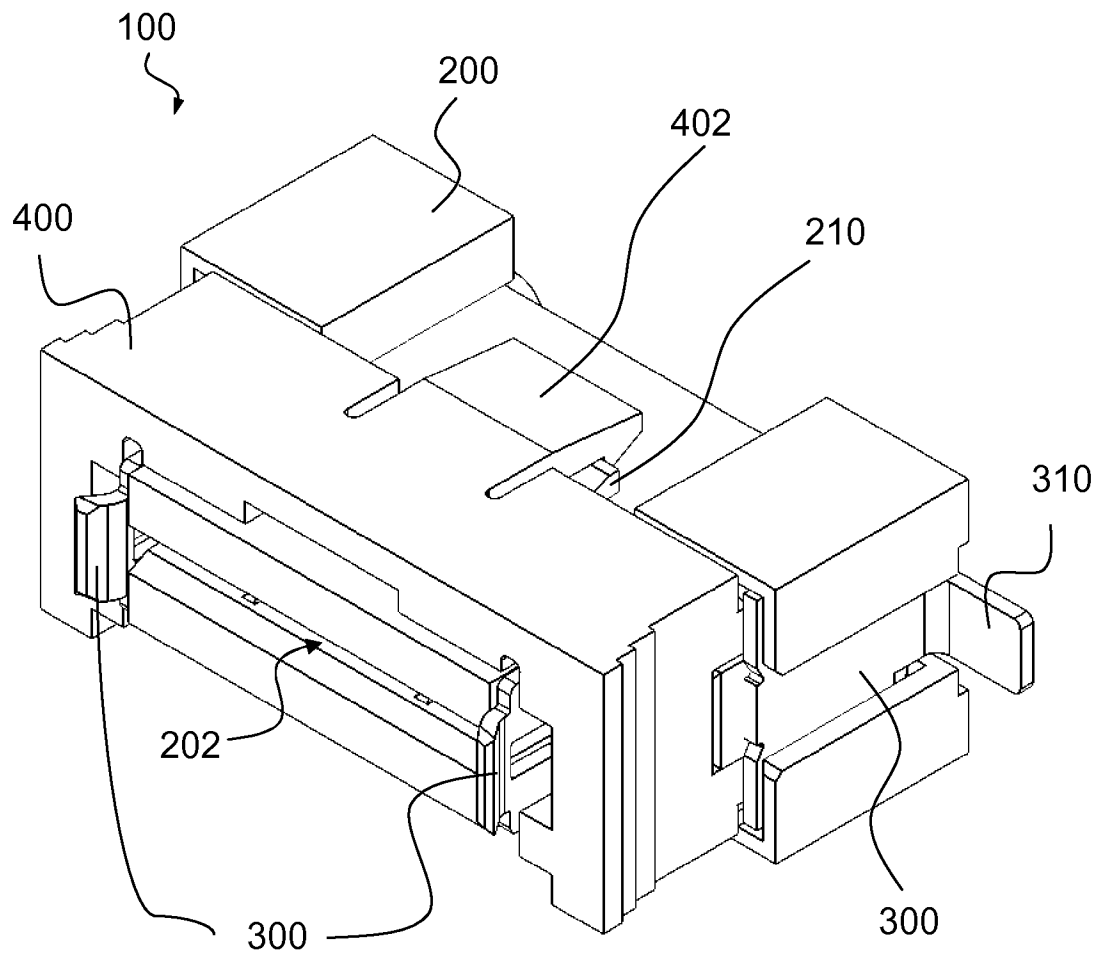


Figure 1

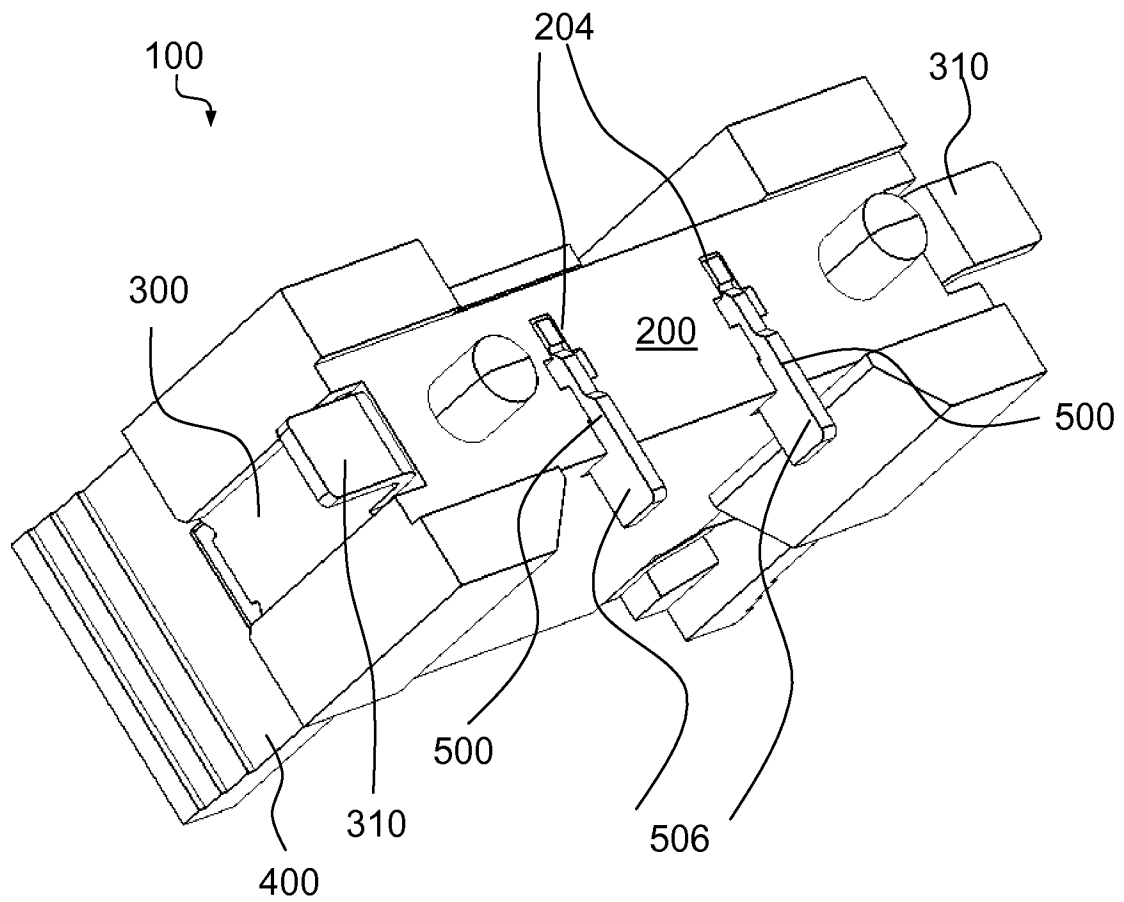


Figure 2

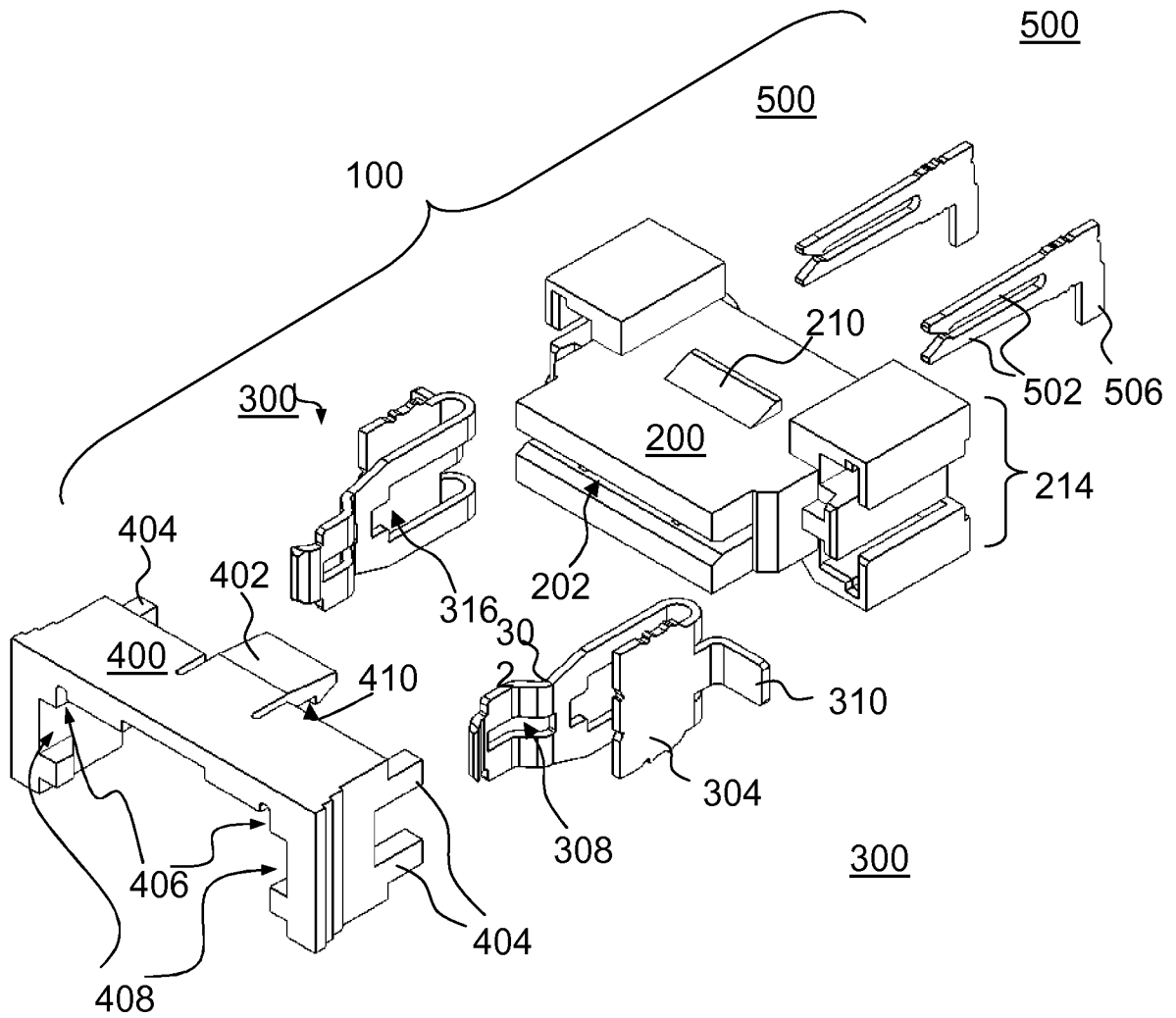


Figure 3

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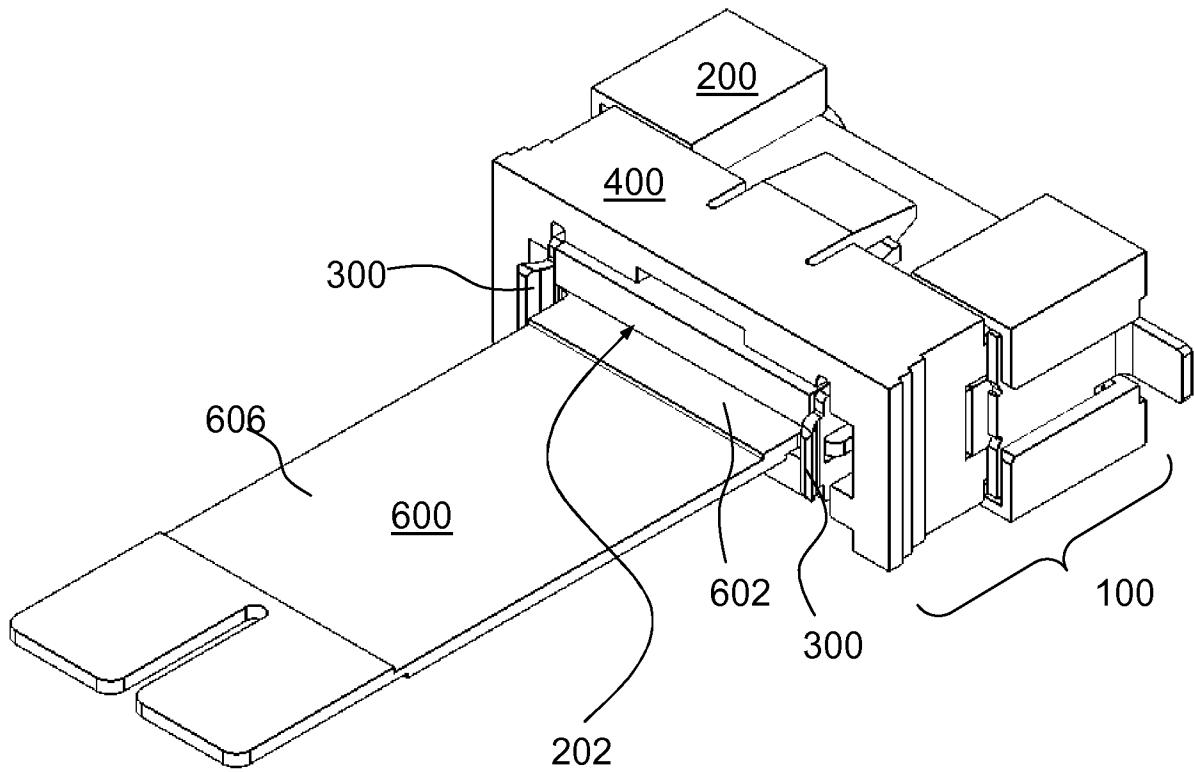


Figure 4

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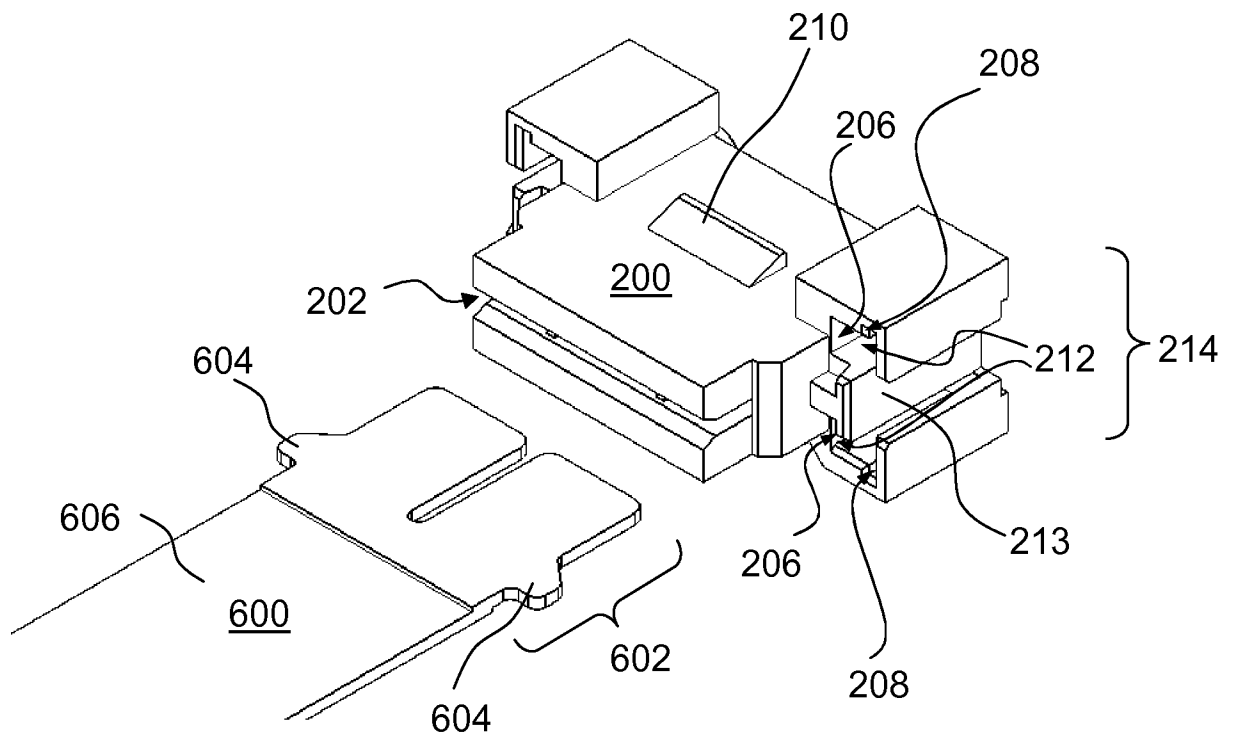


Figure 5A

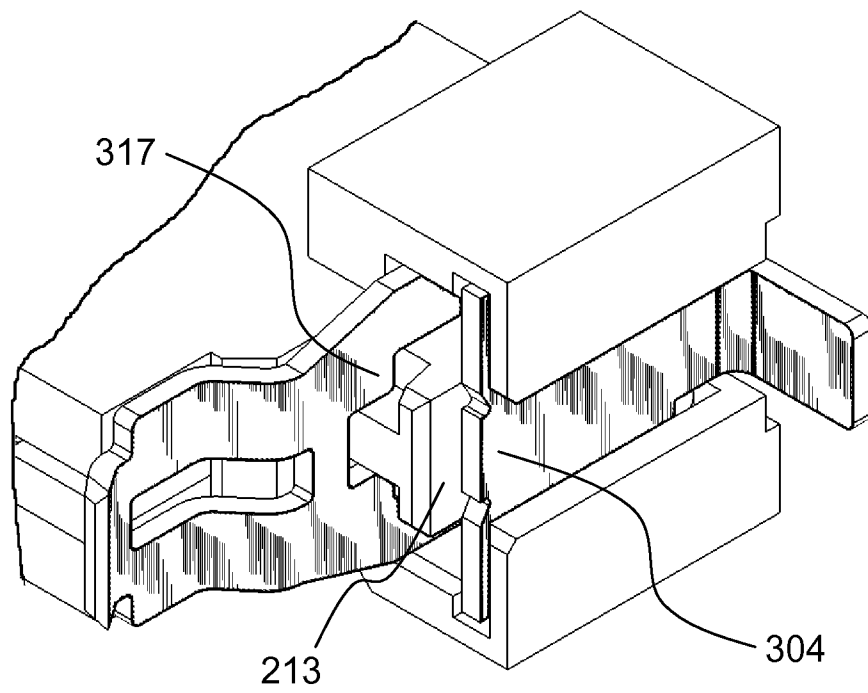


Figure 5B

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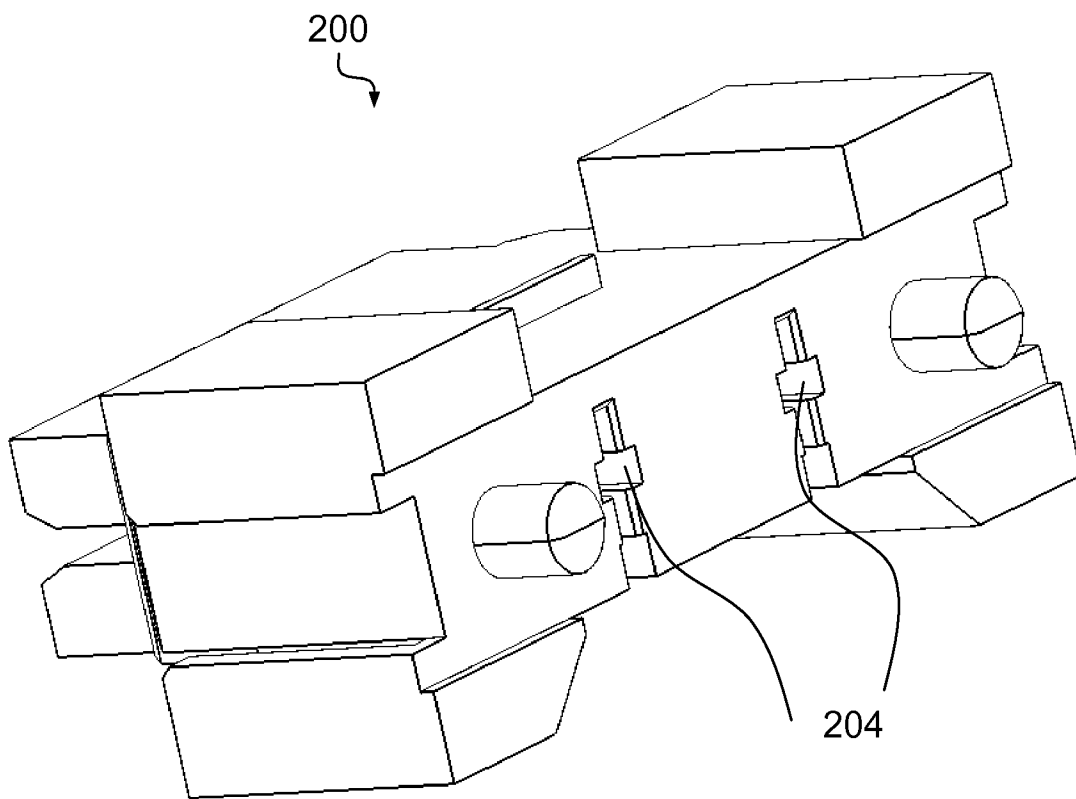


Figure 6

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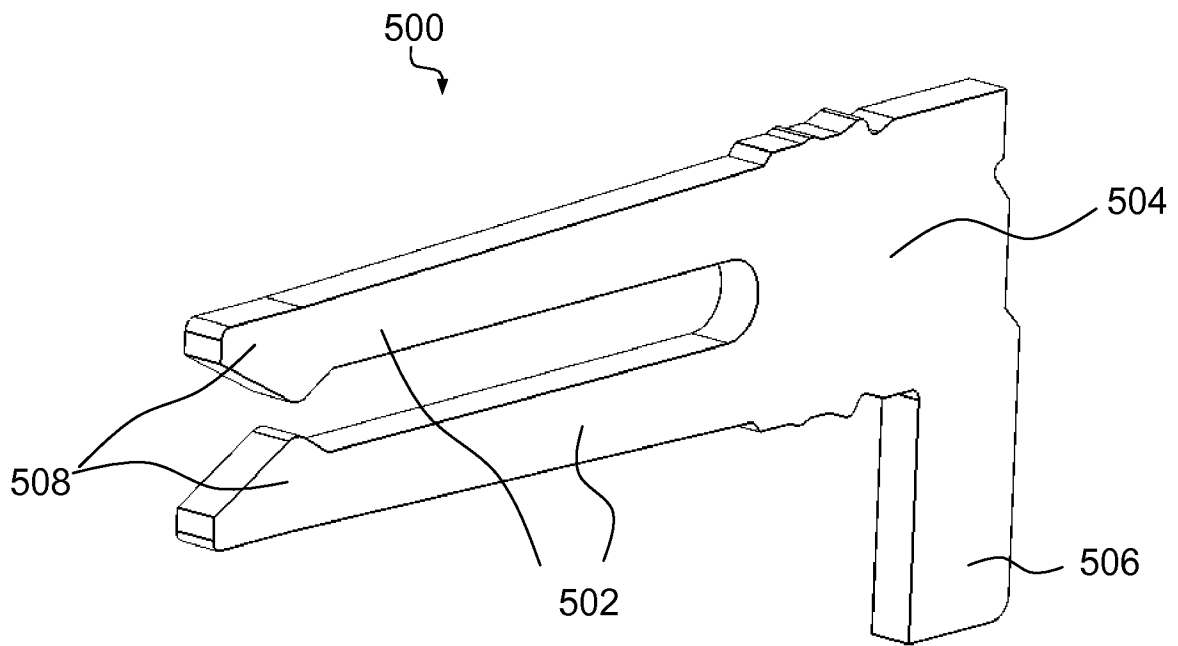


Figure 7

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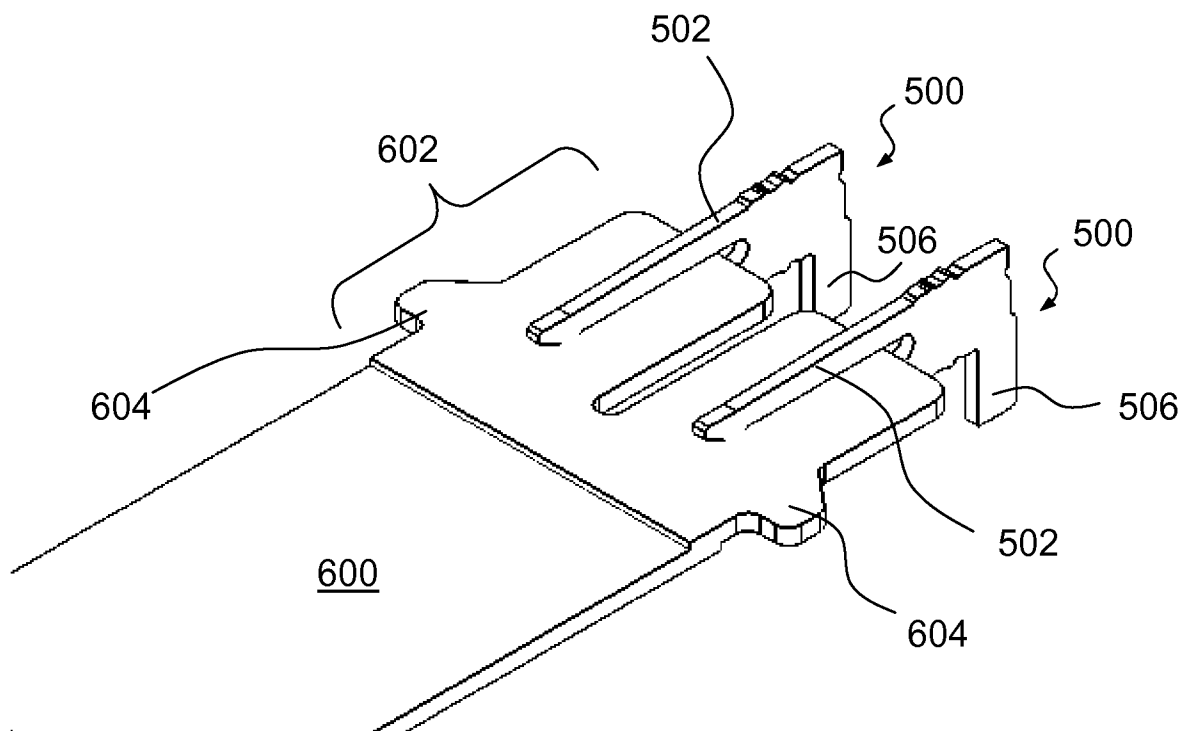


Figure 8

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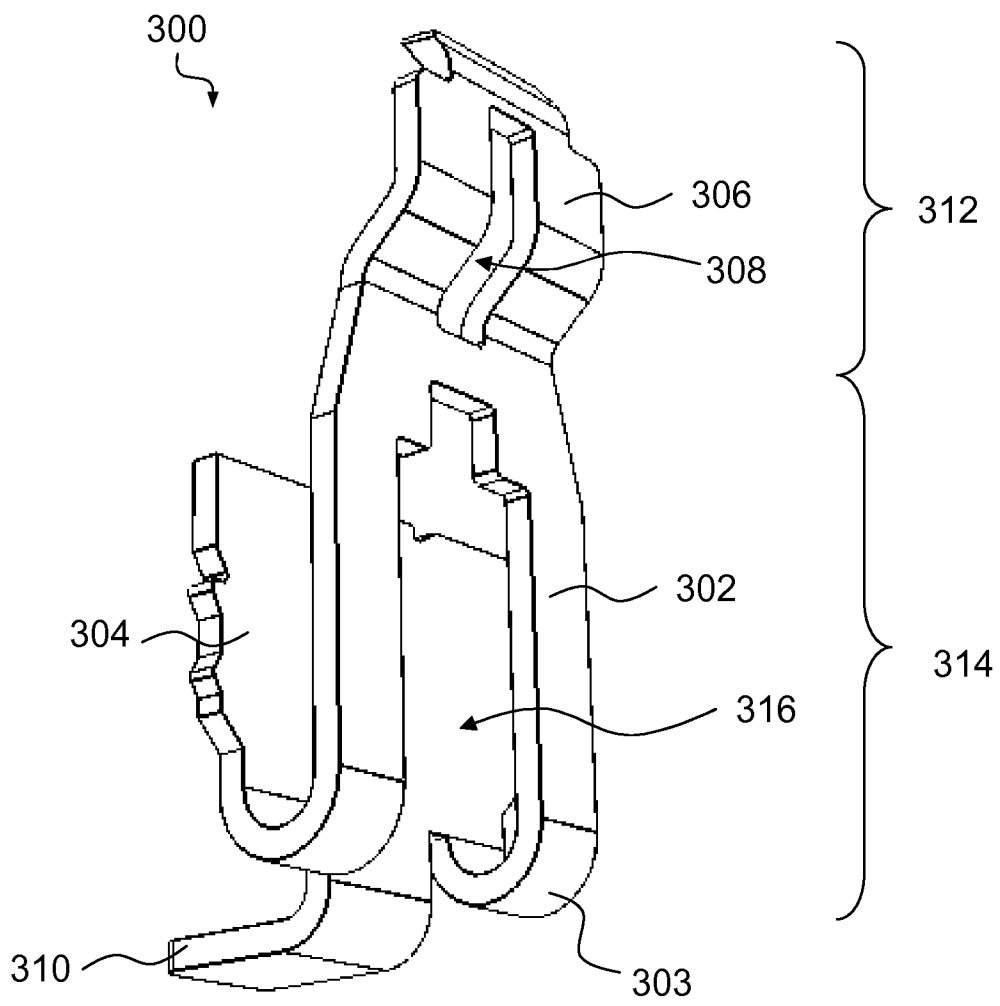


Figure 9

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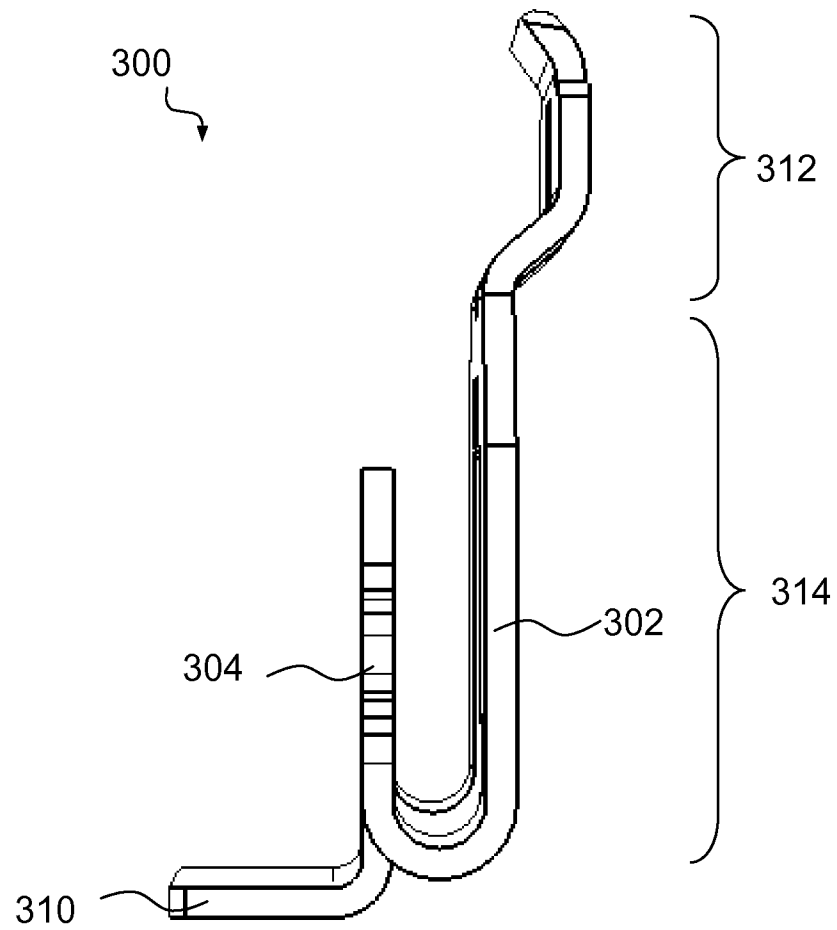


Figure 10

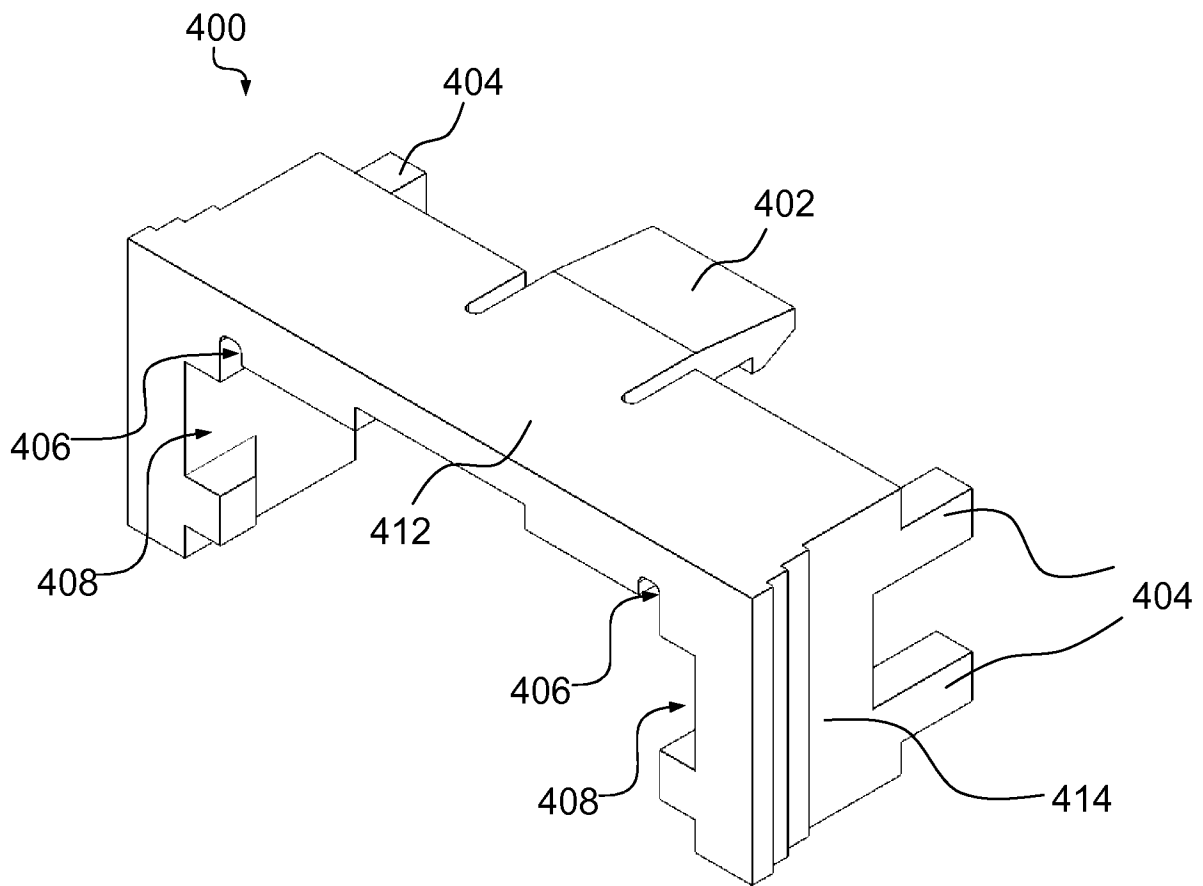


Figure 11

12/14

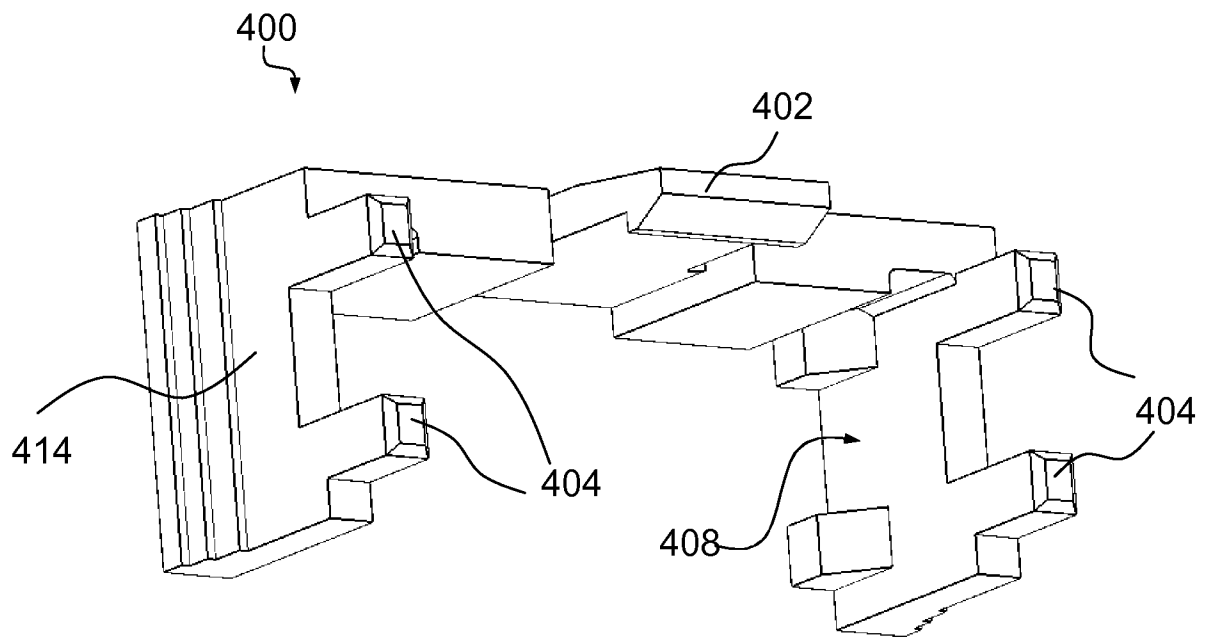


Figure 12

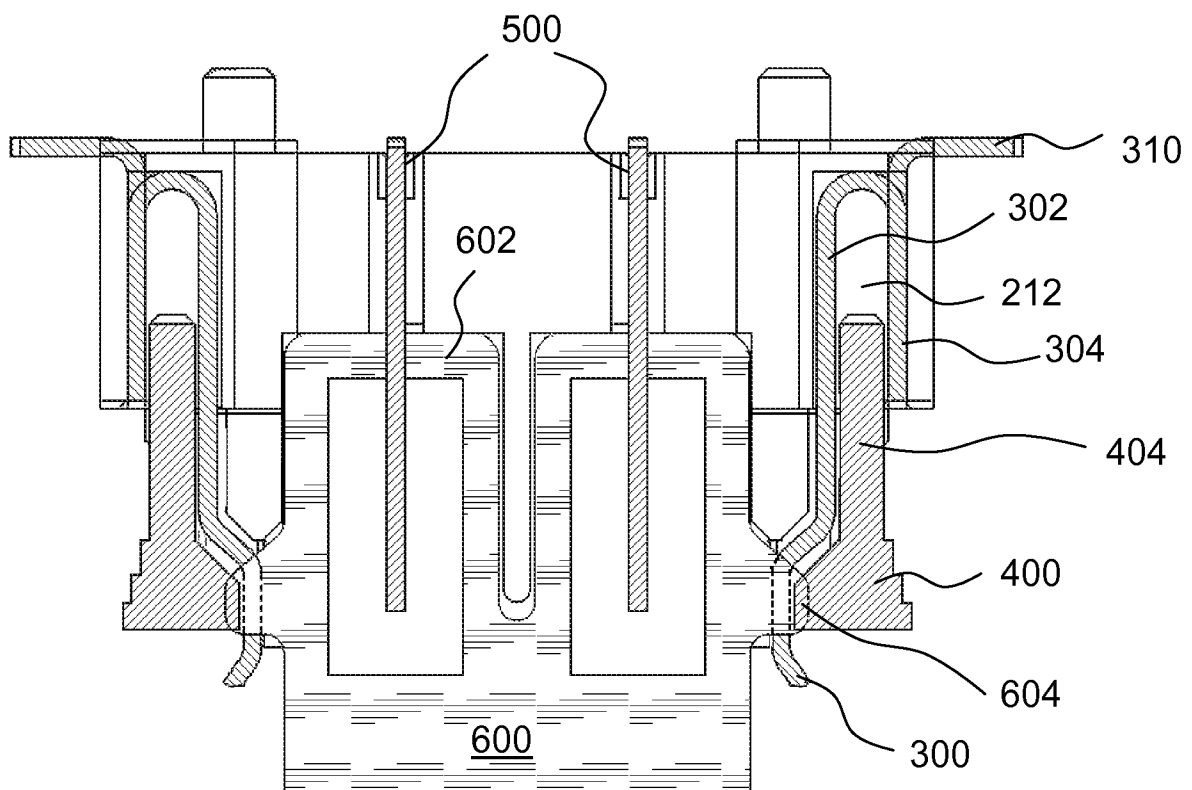


Figure 13

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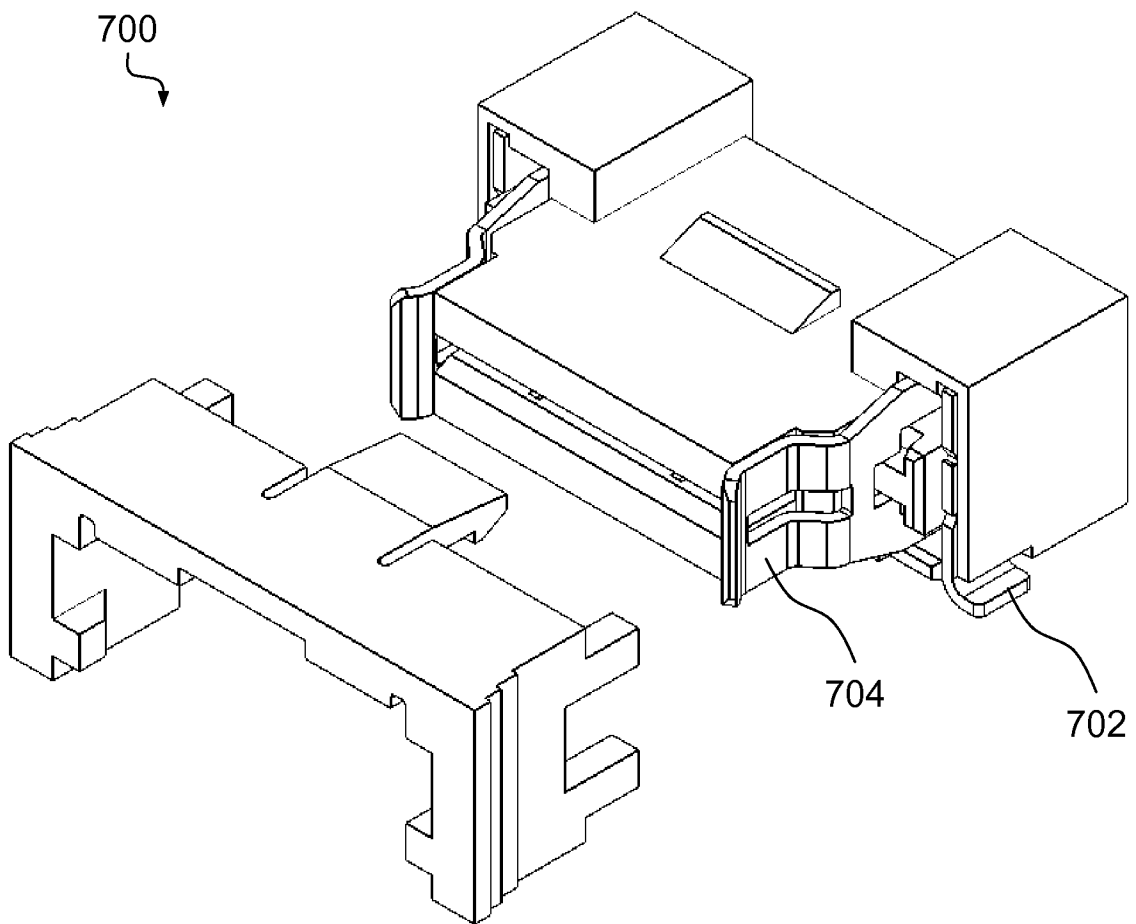


Figure 14

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB2011/000933

A. CLASSIFICATION OF SUBJECT MATTER  
INV. H01R13/627 H01R13/639 H01R12/70  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
H01R

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

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

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                            | Relevant to claim No. |
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| Y         | figures 1,3,5                                                                                                                                 | 3                     |
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| Y         | figures 1,2a-c                                                                                                                                | 9                     |
| Y         | JP 2001 257019 A (AUTO NETWORK GIJUTSU<br>KENKYUSHO; SUMITOMO WIRING SYSTEMS;<br>SUMITOMO ELEC)<br>21 September 2001 (2001-09-21)<br>figure 9 | 9                     |
|           | -/--                                                                                                                                          |                       |

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

☒ See patent family annex.

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Date of the actual completion of the international search

20 July 2011

Date of mailing of the international search report

27/07/2011

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Authorized officer

Esmiol, Marc-Olivier

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB2011/000933

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                | Relevant to claim No. |
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Information on patent family members

International application No

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