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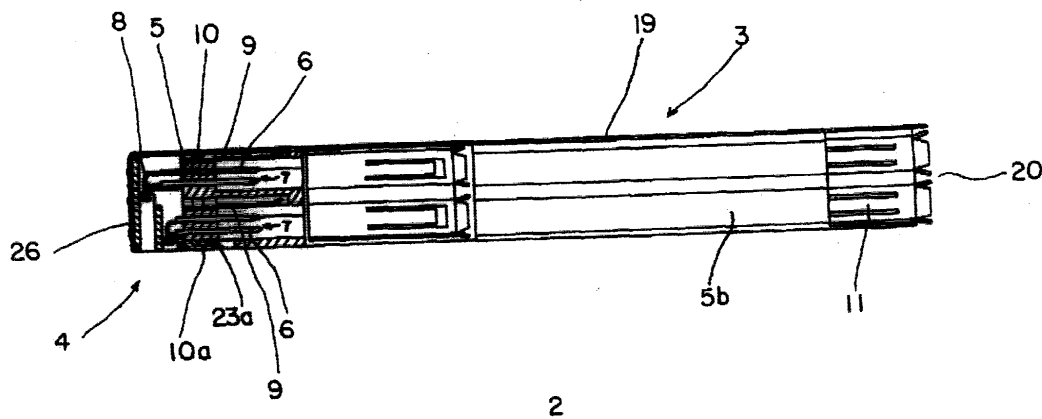
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(54) **Card connector for receiving a PC card**

(57) Disclosed is an improved card connector (2) for receiving at least one PC card (1). The card connector includes a card connector section (3) and a substrate connector section (4) wherein the card connector section (3) includes an insulating housing (5) having a lateral array (7) of pin terminals (6) to mate with corresponding receptacles of the card and grounding terminals (9) to contact the outer casing of the card. The insulating housing further includes a rearwardly extending alignment extension (28) having a leg portion (29) ex-

tending downwardly therefrom. The pin terminals include connections tails (8) arranged in a single row along the leg portion (29) of the alignment section (28). The substrate connector section (4) includes signal terminals (22) having engagement tails (22a) with a "C"-shaped contact section for receiving a respective connection tail of the pin terminal of the card connector section along with an adjacent leg portion (29) of the alignment section (28). This arrangement permits the significant reduction of the longitudinal size of the card connector.

FIG. 1



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Description

Field of the Invention:

[0001] The present invention relates to electrical connectors and specifically to a card connector for receiving one or more PC cards.

Background of the Invention

[0002] A conventional card connector has pin terminal arrays and grounding terminals arranged in parallel and adapted to receive one or more PC or other memory cards. The pin terminals are arranged in-line to mate with corresponding female receptacles of the cards which are correspondingly arranged in-line within the card (see Japanese Patent Application Laid-Open No. 9-54898), and the grounding terminals are adapted to contact the conductive outer housing of the cards. Such a card connector may be equipped with a card eject mechanism for removing the card or cards from the card connector.

[0003] In such card connectors, the grounding terminals must be connected to the grounding circuit of a given circuit board on which the card connector is mounted. To achieve this connection, in known card connectors that are adapted to receive a single card, the grounding terminals extend rearwardly from the a rear section of the terminals covering the tails of the pin terminals, and are connected to the grounding circuit of the circuit board via an extension of the ground terminal or an associated shield plate, as seen from Japanese Patent Application Laid-Open No. 9-54898.

[0004] In the case of a card connector having two or more pin terminal arrays at two or more levels, the grounding cannot be effected with recourse to a simple shield plate as in the single pin terminal array described above. Instead, it is known to place a relay circuit board on a rear side of the card connector, thereby connecting the tails of the pin terminals and grounding terminals to the corresponding conductors of the relay circuit board, and then, the relay circuit board is connected to the circuit board on which the card connector is mounted by using a board-to-board connector or card edge connector.

[0005] Use of such a relay circuit board and board-to-board connector makes it difficult to reduce the size of the card connector; since the relay circuit board and board-to-board connector extend considerably from the rear side of the card connector. Furthermore, in such prior art connectors, the number of parts and processes increases, and accordingly the manufacturing cost increases.

Summary of the Invention

[0006] An object of the present invention is to provide a card connector with a ground terminal rod whose size

is reduced to a minimum.

[0007] To attain this object, a card connector for receiving two PC cards is provided which has an insulating housing mounting two parallel lateral arrays of pin terminals adapted to mate with corresponding receptacles of the PC cards and two parallel grounding terminals extending above each array adapted to make contact with the outer casings of the cards. The card connector further includes ground terminal rods vertically traversing the lateral arrays of pin terminals to connect the grounding terminals together, thus permitting all grounding terminals to be connected to the grounding circuit of a given circuit board via the connection terminal rods.

[0008] With this arrangement, the grounding terminals are connected to the grounding circuit of a given printed circuit board via the ground terminal rods, thus eliminating the use of a relay circuit board, which, in known connectors, extends the size of the card connector on the rear side of the insulating housing. Accordingly the longitudinal size of the card connector of the present invention is reduced.

[0009] The card connector of the present invention further comprises a card connector section for accommodating the PC card and a substrate connector section to be connected to the card connector section. The card connector section comprises an insulating housing mounting two lateral arrays of pin terminals and including two rearwardly extending alignment extensions having an L-shaped leg portion extending downwardly therefrom. The pin terminals of both sets of lateral arrays are mounted in the insulating housing such that their "L"-shaped connection tails are arranged in a single row along the leg portion of the alignment extension of the housing. The substrate connector section includes signal terminals for contacting the pin terminals when the two sections are connected, that is, connection tails of the pin terminals exposed on a rear side of the insulating housing of the card connector section make contact with engagement tails of the signal terminals on the front side of the insulating housing of the substrate connector section when the card connector section is connected to the substrate connector section. The engagement tails of the signal terminals of the substrate connector section are configured such that each includes a "C"-shaped contact section for receiving a respective connection tail of the pin terminal of the card connector section along with an adjacent leg portion of the alignment extension.

[0010] With the arrangement of the engagement tails of the signal terminals on the front side of the insulating housing of the substrate connector section, the signal terminals of the substrate connector section and the pin terminals of the card connector section are confined within a reduced space, thereby further contributing to the reduction of the longitudinal size of the card connector.

[0011] Other objects and advantages of the present invention will be understood from the following description of a card connector according to the preferred em-

bodiment of the invention in conjunction with the accompanying drawings.

Brief Description of the Drawings

[0012] The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

Figure 1 is a longitudinal section of a card connector according to a first embodiment of the present invention;

Figure 2 is an enlarged longitudinal section of the essential part of the card connector of Figure 1;

Figure 3 is a plan view of the card connector partially broken away to show additional detail;

Figure 4 is a plan view of the card connector;

Figure 5 is a rear view of the card connector;

Figure 6 is a front view of the card connector;

Figure 7 is a side view of the card connector;

Figure 8 is a bottom view of the card connector;

Figure 9 is an enlarged perspective view of a portion of the card connector, illustrating how a ground terminal rod traverses pin-and- grounding terminal arrangements of different levels;

Figure 10 is a perspective view of a ground terminal rod;

Figure 11 is a plan view of a stamped and formed sheet having a plurality of grounding terminals arranged in parallel and connected to a carrier strip;

Figure 12 is an enlarged longitudinal section of the substrate connector section of the card connector;

Figure 13 is an enlarged plan view of the substrate connector section;

Figure 14 is a portion of a stamped and formed sheet of the ground connection terminal;

Figure 15 is a side view of the stamped and formed sheet of the grounding connection terminal of Figure 14;

Figure 16 is a longitudinal section of a card connector having a single lateral array of pin terminals according to a second embodiment of the invention; and

Figure 17 is an enlarged longitudinal section of the essential part of the card connector of Figure 16.

Description of the Preferred Embodiment:

[0013] Referring first to Figures 1 through 3, a card connector 2 for accommodating a PC card 1 comprises a card connector section 3 and a substrate connector section 4 to be integrally connected thereto.

[0014] Looking also to Figures 4 through 8, card con-

necter section 3 includes an insulating housing 5 mounting two lateral arrays 7 of pin terminals 6 to be mated with corresponding receptacles of two mating PC cards 1 and two rows of grounding terminals 9 adapted to contact the outer casing of each card 1. Insulating housing 5 includes two rearwardly extending alignment extensions 28 (corresponding to the two lateral arrays of terminals) having an L-shaped leg portion 29 extending downwardly therefrom. Lateral arrays 7 of pin terminals 6 are arranged vertically parallel to one another in upper and lower spaced-apart levels, and each array includes upper and lower rows of pin terminals 6 to mate to each card. Grounding terminals 9 are similarly arranged at two levels, so that each row of grounding terminals 9 extends above each upper row of pin terminals in each lateral array. Pin terminals 6 of both sets of lateral arrays are mounted in insulating housing 5 such that their "L"-shaped connection tails 8 are aligned in a single row along the respective leg portion 29 of the alignment extension 28 on the rear side of insulating housing 5 (see Figure 2). The spacing between these in-line connection tails 8 is half the distance of the interval between pin terminals 6.

[0015] Grounding terminals 9 extend above each upper row of pin terminals 6 and are aligned vertically to make contact with the outer surface of each PC casing when PC cards 1 are inserted into the card connector.

[0016] "U"-shaped ground terminal rods 10 (see Figure 10) are mounted in insulating housing 5, vertically traversing the pin-to-pin intervals of the upper and lower pin terminal arrays 7 to connect adjacent grounding terminals 9 together and connect all grounding terminals 9 to the grounding circuit of an underlying circuit board via ground terminal rods 10. As seen in Figures 3 and 9 through 11, each ground terminal rod 10 bridges two adjacent grounding terminals 9. Furthermore, as seen in Figure 8, each ground terminal rod 10 projects from a bottom 5a of insulating housing 5 to provide two grounding ends 10a.

[0017] Looking specifically at Figure 3, two card eject mechanisms 12 are provided on one longitudinal side 5b of insulating housing 5, each allotted to one of arrays 7 of pin terminals 6. Each card eject mechanism 12 comprises an eject rod 13, a push rod 14 with a push-button at one end thereof, and an intervening gear 15 between eject rod 13 and push rod 14. Eject rod 13 has a hook 18 at one end to catch and eject the front end of the respective PC card. When the button 16 is depressed, push rod 14 is pushed rearward to drive eject rod 13 forward and eject the card.

[0018] A rectangular metal shell 19 is mounted on an upper surface of insulating housing 5. At least one longitudinal sidewall of the rectangular shell has slots 11 which cooperate with longitudinal arm 5b of the housing to guide PC card 1, and rear wall 26 of rectangular shell 19 covers the rear side of substrate connector section 4. Insulating housing 5 has an opening 20 on its front side to accommodate insertion of the PC cards.

[0019] Referring to Figure 9, ground terminal rod 10 is mounted to insulating housing 5 in the direction indicated by arrow "A" and passes through both levels of grounding terminals 9. As seen in Figure 11, grounding terminals 9 are fabricated by stamping and forming an elongated thin metal sheet. Each grounding terminal has an engagement aperture 9a offset relative to its longitudinal center axis to permit one leg of ground terminal rod 10 to pass therethrough. Engagement aperture 9a has two cantilever-like contacts 9b formed therein to contact ground terminal rod 10.

[0020] Referring to Figures 12 and 13, substrate connector section 4 includes signal terminals 22 and ground connection terminals 23 mounted in its generally "L"-shaped insulating housing 21. One row of signal terminals 22 is inserted from the bottom of insulating housing 21 and extends along an upright wall 21 a of insulating housing 21. Likewise, the other row of signal terminals 22 is inserted from the bottom of insulating housing and is spaced vertically away from upright wall 21 a. Signal terminals 22 are arranged at the same interval, i.e. have the same spacing, as connection tails 8 of pin terminals 6, and engagement tails 22a of signal terminals 22 extend to the front of the card connector. As seen in Figure 12, the two rows of signal terminals 22 have different heights to permit their engagement tails 22a to be located to contact the upper and lower connection tails of terminal arrays 7. Also, signal terminals 22 include solder tails 22b extending below a lower surface of insulating housing 21, one row of terminals 22 extends forward and the other row of terminals extends rearward from the lower surface of the housing. As shown in Figure 12, and also with reference to Figure 2, engagement tails 22a of signal terminals 22 of substrate connector section 4 are configured such that each includes a generally "C"-shaped contact section for receiving a respective connection tail 8 of pin terminal 6 of the card connector section along with an adjacent leg portion 29 of the alignment extension 28.

[0021] Looking now to Figures 14 and 15, each ground connection terminal 23 has two sections integrally connected by a central engagement piece 27, and these sections each have engagement apertures 24 to conform to and make contact with the two parallel legs of ground terminal rod 10. Each engagement aperture 24 has a "U"-shaped cantilever-like contact 24a formed therein to contact one leg of the ground terminal rod. Ground connection terminals 23 are fabricated by stamping and forming an elongated thin metal sheet. The ground connection terminals are mounted in housing 21 by inserting them into the horizontal wall of the housing 21. Each ground connection terminal 23 has a solder tail 23a extending forward from a lower surface of insulating housing 21. Horizontal wall 21b of insulating housing 21 includes through holes 25 to accommodate the ends of legs 10a of ground terminal rods 10.

[0022] Substrate connector section 4 thus constructed is connected to card connector section 3 to provide

a card connector 2 with each engagement tail 22a of signal terminals 22 in contact with a corresponding connection tail 8 of a pin terminal 6, and with ground terminal rods 10 passing through adjacent upper and lower grounding terminals 9 and ground connection terminals 23.

[0023] Card connector 2 thus provided can be mounted on an underlying circuit board (not shown) by soldering solder tails 22b of signal terminals 22 to the signal conveying circuit conductors of the circuit board, and by soldering solder tails 23a of ground connection terminals 23 to the grounding circuit of the circuit board. Thus, pin terminals 6 are connected to the signal conveying circuit of the circuit board via signal terminals 22 and grounding terminals 9 are connected to the grounding circuit of the circuit board via ground terminal rods 10 and ground connection terminals 23.

[0024] As described above, the two rows of grounding terminals 9 are connected together by ground terminal rods 10, which are connected to the grounding circuit of a given circuit board via ground connection terminals 23. That is to say, ground terminal rods 10 are connected to the grounding circuit of the circuit board at the bottom of insulating housing 5. This arrangement makes it unnecessary to use a relay circuit board on the rear side of card connector 2, thus providing a substantial reduction in the longitudinal size of card connector 2, and permitting the mounting of additional electronic components on the circuit board in place of the relay circuit board and connector. Thus, additional electronic components can be mounted adjacent insulating housing 5 on the circuit board to allow for increased density of component mounting on the circuit board.

[0025] Furthermore, connection tails 8 of pin terminals 6 of card connector section 3 and engagement tails 22a of signal terminals 22 of substrate connector section 2 make contact in a minimal space at the rear side of insulating housing 5 of card connector section 3 and the front side of insulating housing 21 of substrate connector section 4, thus contributing to the reduction of the longitudinal size of the card connector.

[0026] Looking to another embodiment of the invention, and referring to Figures 16 and 17, a card connector 102 has pin terminals 106 arranged in-line at one level, thus forming a single lateral array of pin terminals 106. More specifically, card connector section 103 has a single array of upper and lower rows of pin terminals 106 mounted in its insulating housing 105, and their connection tails 108 extend to the rear side of insulating housing 105. No ground terminals are used in this embodiment.

[0027] Signal terminals 122 are arranged at the same interval as connection tails 108 of pin terminals 106, and are mounted in insulating housing 121 of substrate connector section 104 with their engagement tails 122a extending from the front of insulating housing 121 and with their solder tails 122b extending forward along a lower surface of insulating housing 121.

[0028] In this embodiment, pin terminals 106 and confronting signal terminals 122 again make contact in a minimal space, permitting the reduction of the longitudinal size of card connector 102. Also, solder tails 122b to be soldered to the signal conveying circuit of the circuit board remain within the area in which insulating housing 105 of card connector section 102 and insulating housing 121 of the substrate connector section are mated.

[0029] 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 card connector (2) for mounting on an underlying printed circuit board and for receiving at least one PC card (1), comprising:

a card connector section (3) for receiving the card including an insulative housing (5) mounting a lateral array (7) of pin terminals (6) adapted to mate with corresponding receptacles of the PC card (1) and including a rearwardly extending alignment extension (28) with a downwardly extending leg portion (29), wherein each of the pin terminals (6) includes a connection tail (8) arranged along the leg portion of the alignment extension,

a substrate connector section (4) for connecting to the card connector section (3) and including an insulative housing (21) mounting a plurality of signal terminals (22) each having an engagement tail (22a) adapted to contact a corresponding connection tail (8) of the pin terminal when the card connector section (3) is connected to the substrate connector section (4), wherein each engagement tail comprises a "C"-shaped contact section for receiving a respective connection tail (8) of the pin terminals (6) along with an adjacent leg portion (29) of the alignment extension.

2. The card connector (2) as set forth in claim 1 wherein the card connector section (3) further includes a plurality of grounding terminals (9) arranged generally parallel to and above the lateral array (7) of pin terminals (6) and adapted to contact the outer casing of the card (1),
3. The card connector (2) as set forth in claim 2 wherein the card connector section (3) further includes a plurality of U-shaped ground terminal rods (10) tra-

versing the lateral array (7) of pin terminals and adapted to connect two adjacent grounding terminals (9).

4. A card connector (2) for mounting on an underlying printed circuit board and for receiving at least two PC cards (1), comprising:

a card connector section (3) for receiving the cards including an insulative housing (5) mounting two parallel lateral arrays (7) of pin terminals (6) adapted to mate with corresponding receptacles of the PC cards (1) and including two rearwardly extending alignment extensions (28) each having a downwardly extending leg portion (29), wherein each of the pin terminals (6) includes a connection tail (8), and wherein each lateral array (7) of the pin terminals (6) is mounted in the insulating housing (5) such that each connection tail (8) is arranged along a respective leg portion of the alignment extension, and

a substrate connector section (4) for connecting to the card connector section (3) and including an insulative housing (21) mounting a plurality of signal terminals (22) each having an engagement tail (22a) adapted to contact a corresponding connection tail (8) of the pin terminals when the card connector section (3) is integrally connected to the substrate connector section (4), wherein each engagement tail comprises a "C"-shaped contact section for receiving a respective connection tail (8) of the pin terminals (6) along with an adjacent leg portion (29) of the alignment extension.

5. The card connector (2) as set forth in claim 4 wherein the card connector section (3) further includes a plurality of grounding terminals (9) arranged generally parallel to and above the lateral arrays (7) of pin terminals (6) and adapted to contact the outer casing of the cards (1), and a plurality of U-shaped ground terminal rods (10) traversing the two lateral arrays (7) of pin terminals and adapted to connect two adjacent grounding terminals (9),
6. The card connector (2) as set forth in claim 4 wherein the substrate connector section (3) mounts a plurality of ground connection terminals (23) for receiving ends (10a) of the ground terminal rods (10).
7. The card connector (2) as set forth in claim 6 wherein each ground connection terminal (23) has an engagement aperture (24) formed therein to permit insertion of the connection ends (10a) of the connection terminal rod (10), each engagement aperture (24) having a contact (24a) adapted to contact the connection end (10a).

8. The card connector (2) as set forth in claim 5 wherein each grounding terminal (9) has an engagement aperture (9a) formed therein through which ground terminal rod (10) passes, the engagement aperture (9a) having two contacts (9b) formed therein to contact the grounding terminal rod (9). 5

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FIG. 1

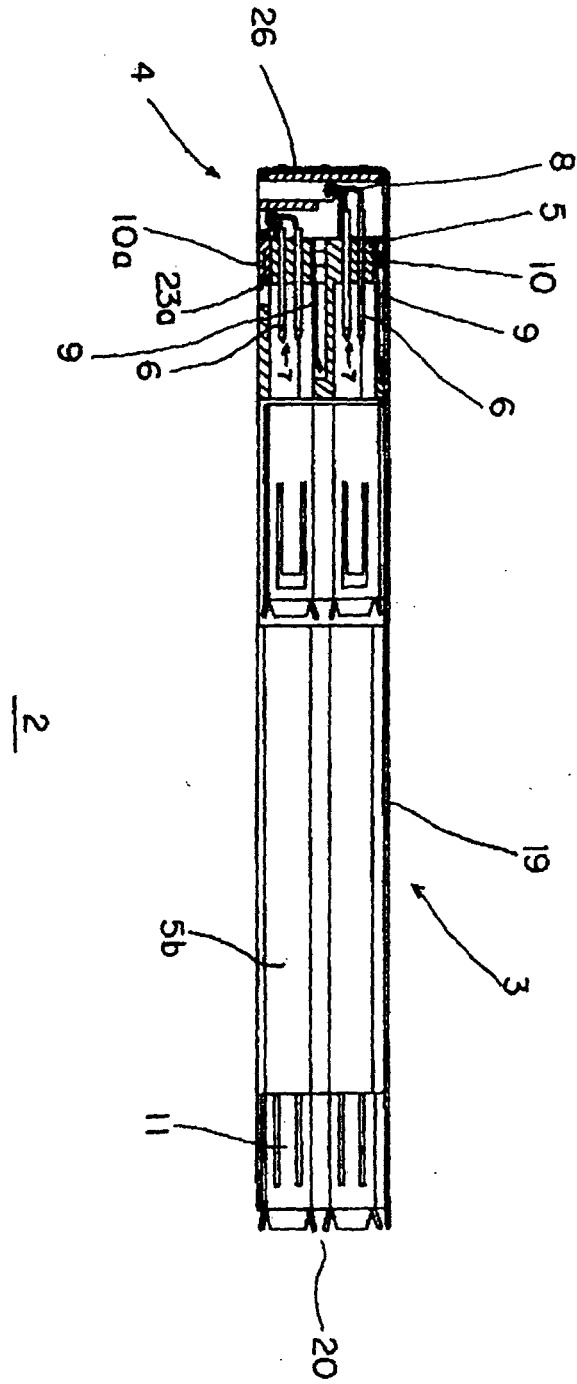


FIG. 2

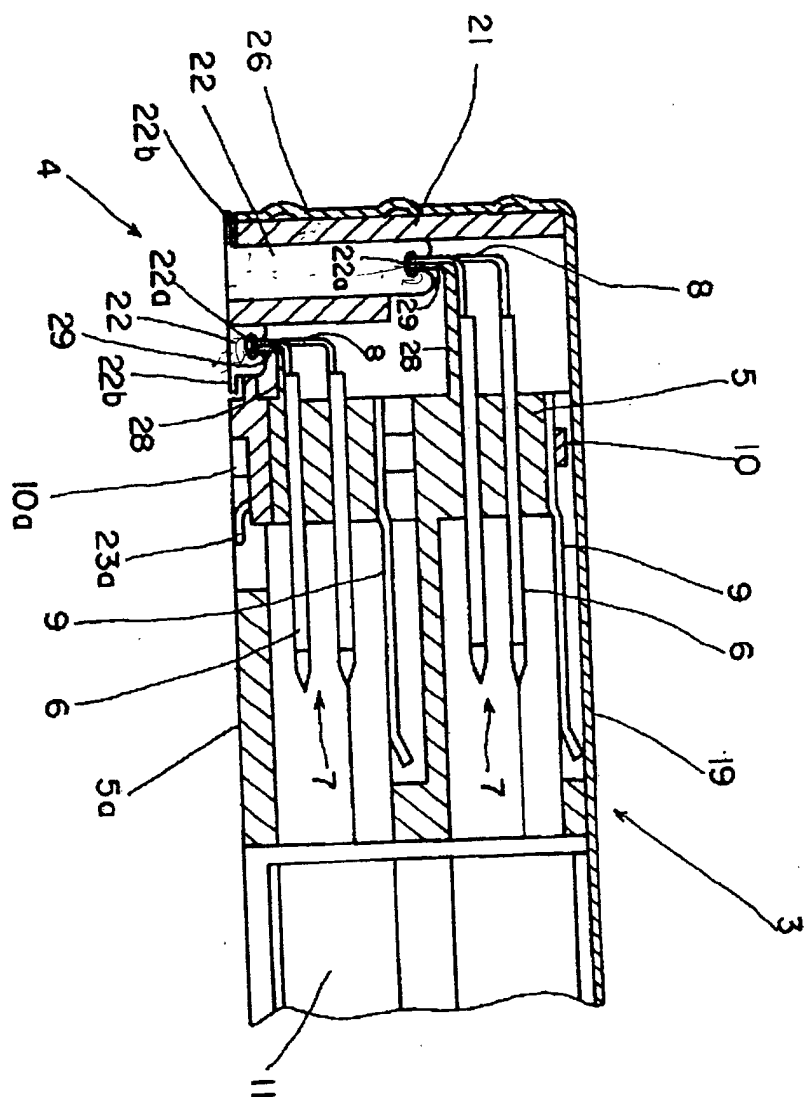


FIG. 3

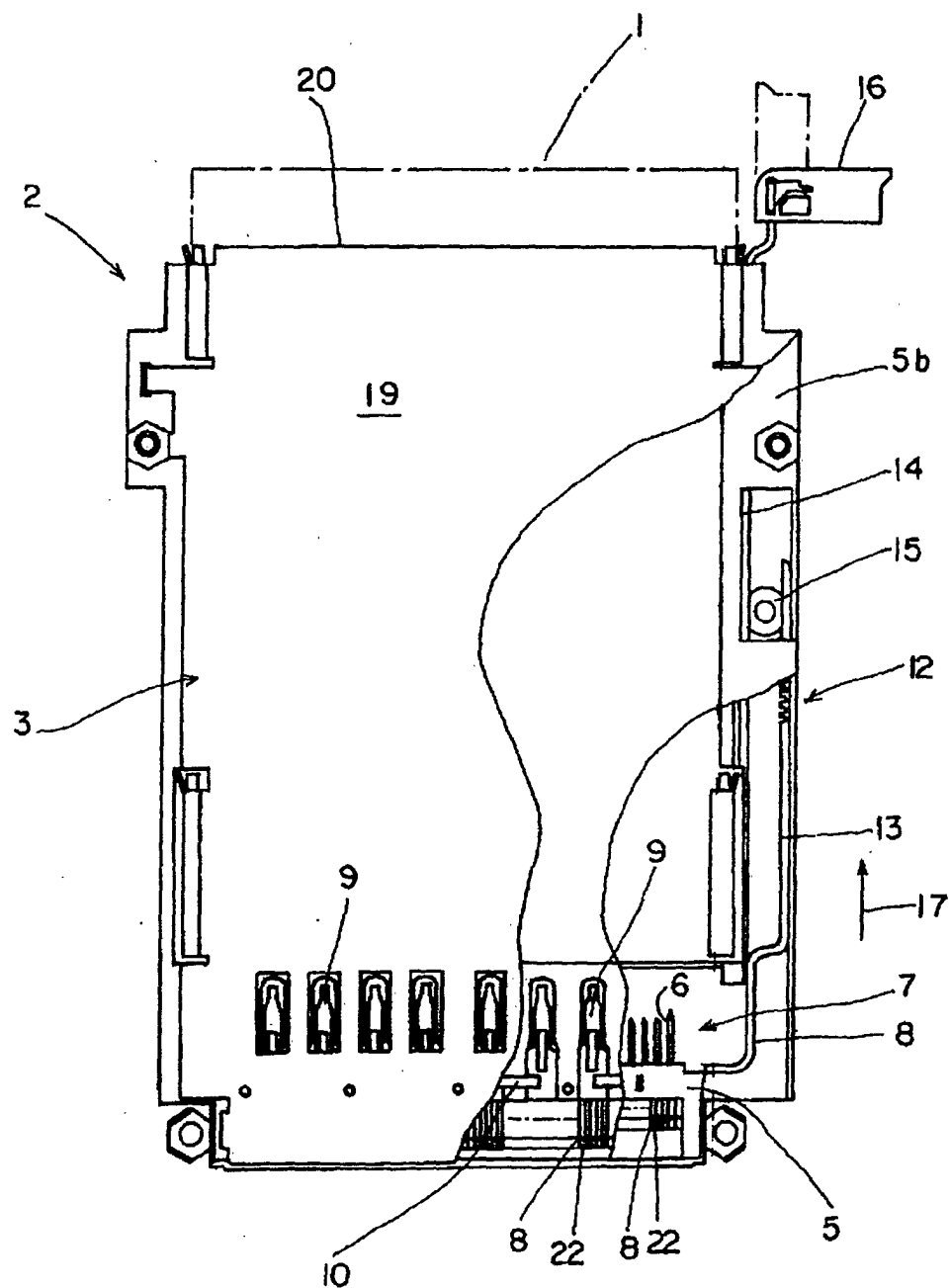


FIG. 4

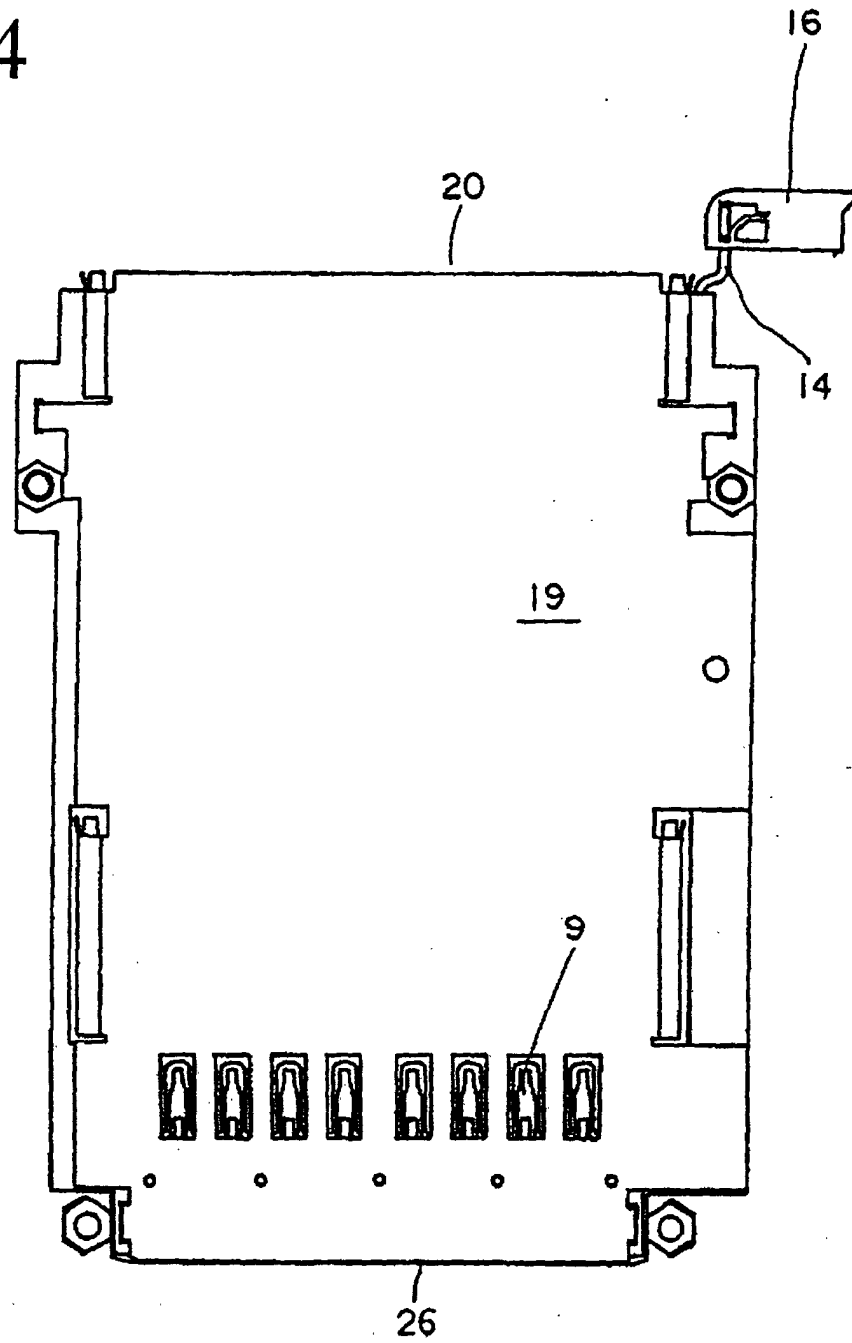


FIG. 5

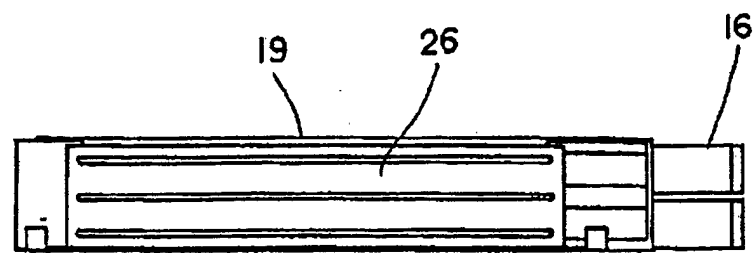


FIG. 6

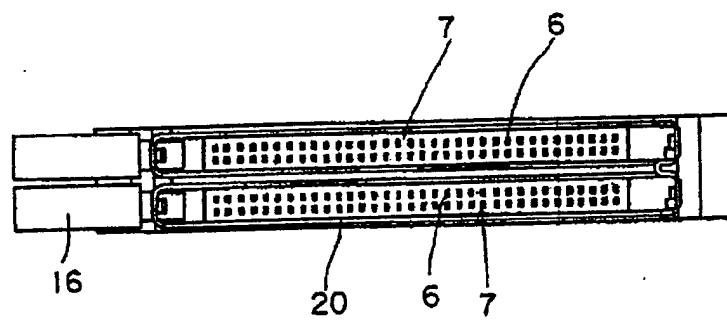


FIG. 7

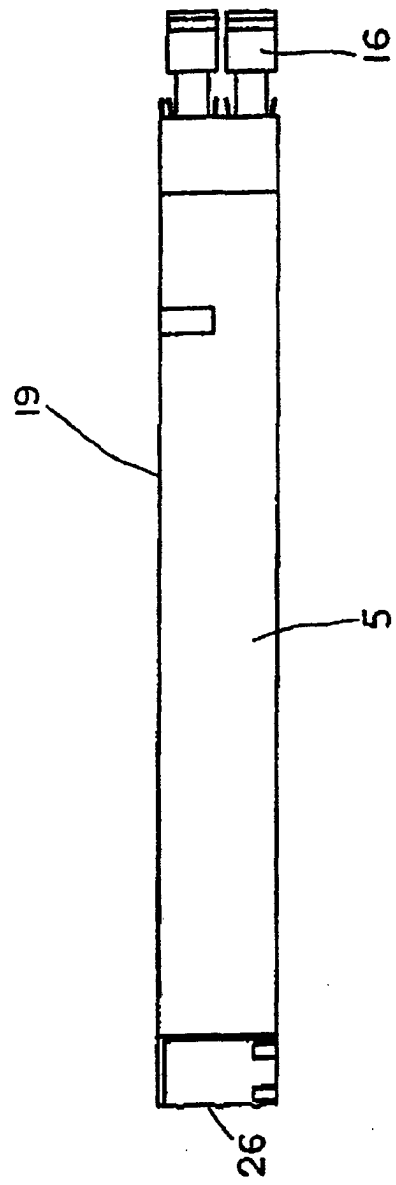


FIG. 8

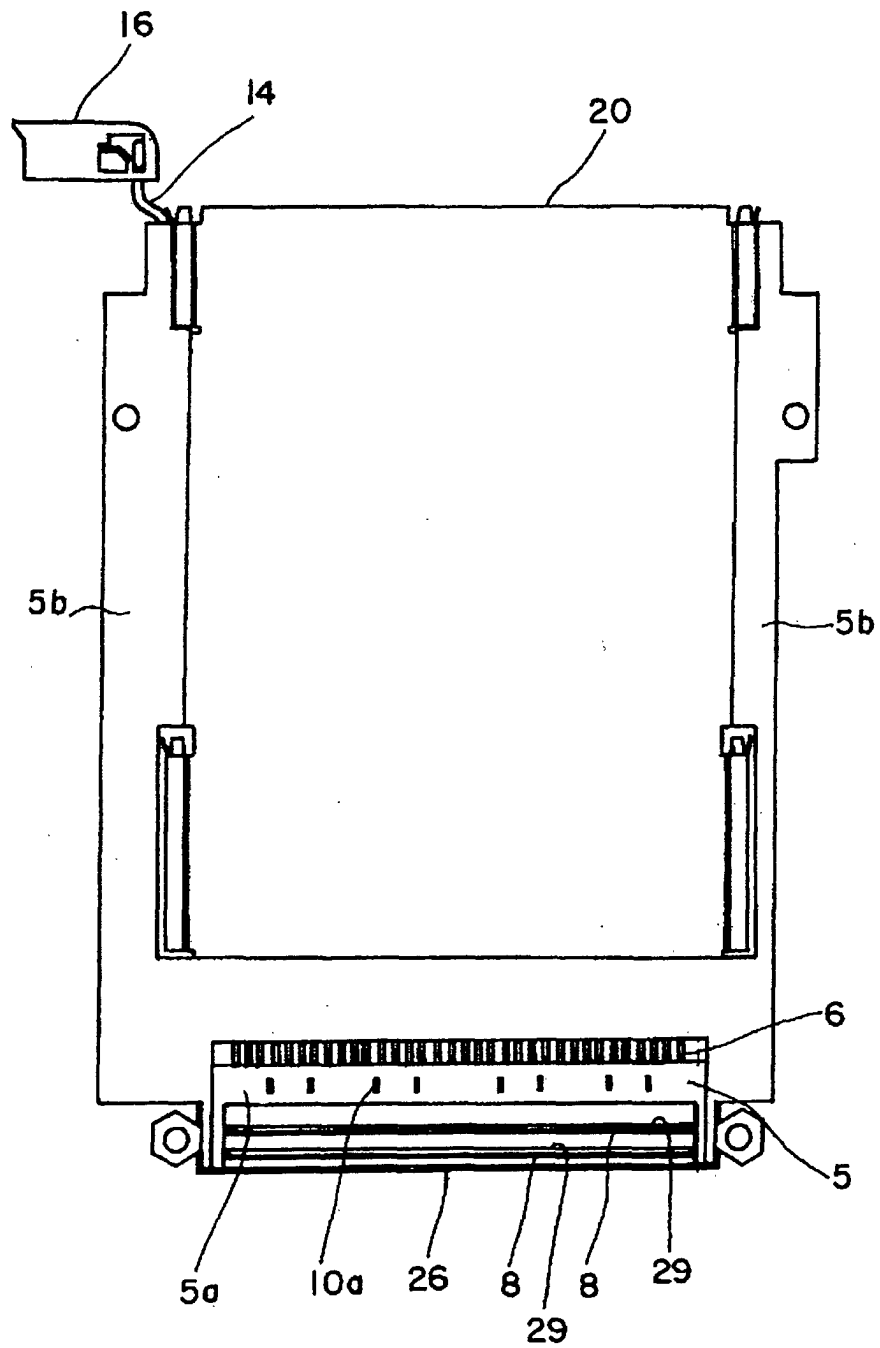


FIG. 9

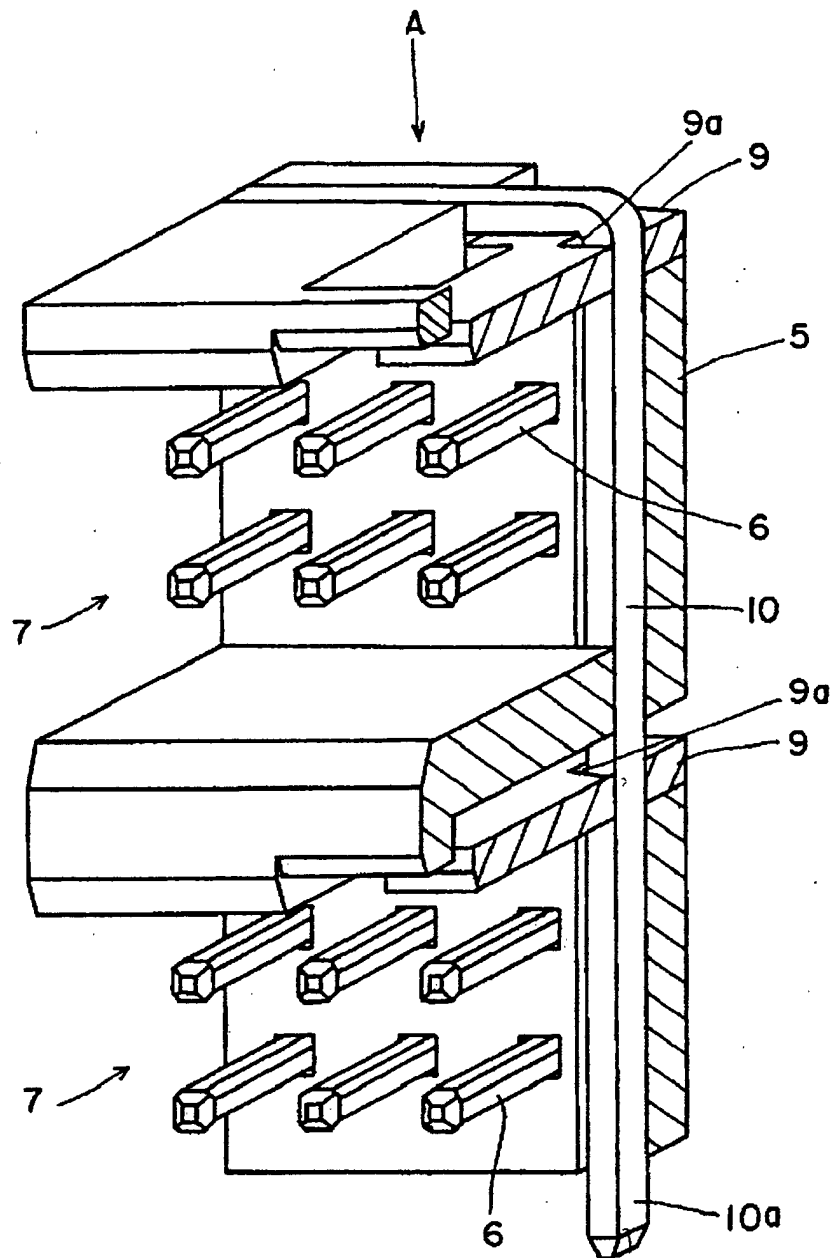


FIG. 10

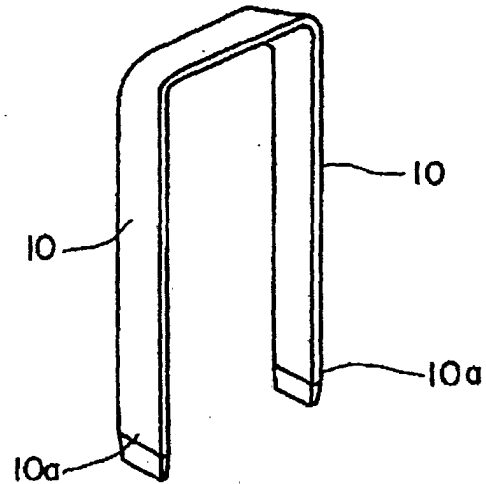


FIG. 11

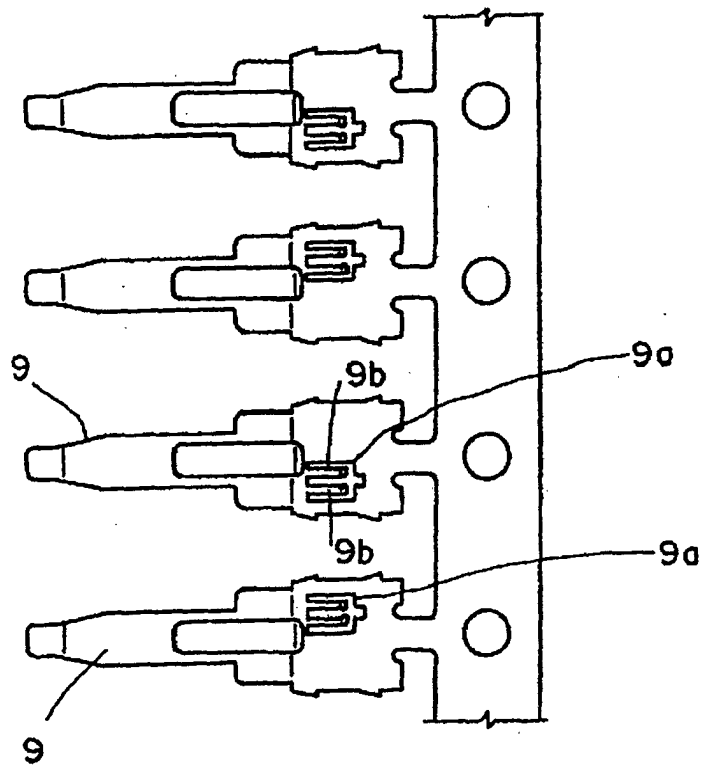


FIG. 12

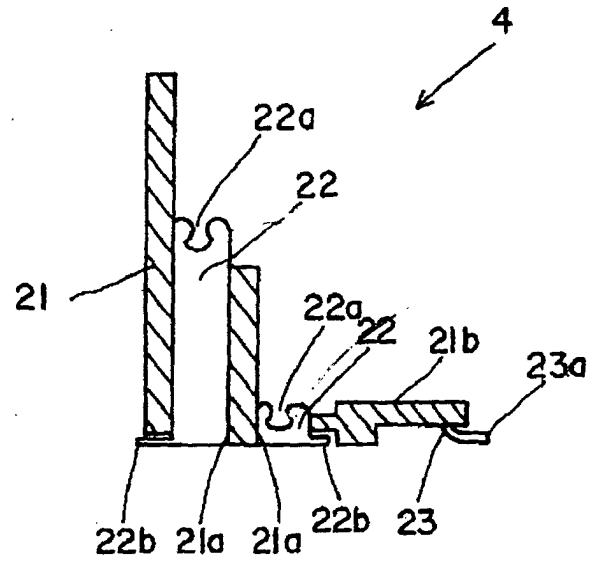


FIG. 13

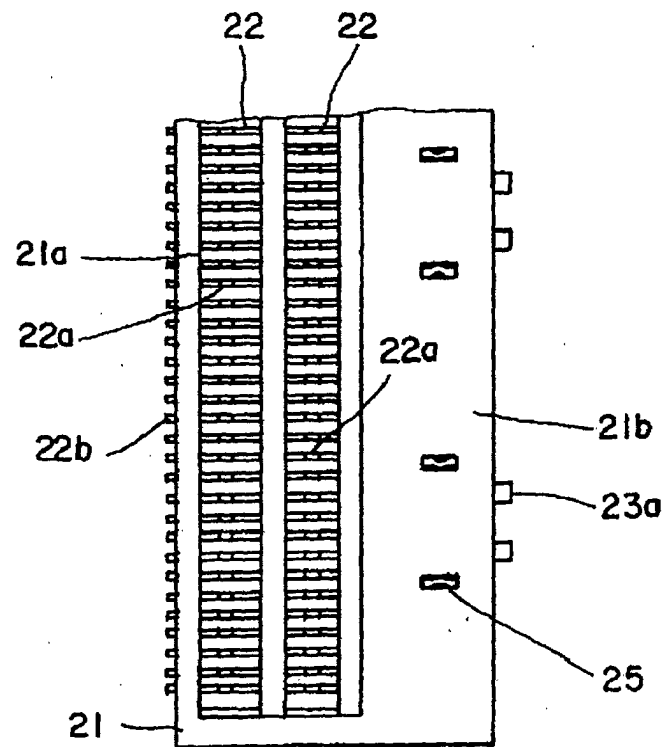


FIG. 14

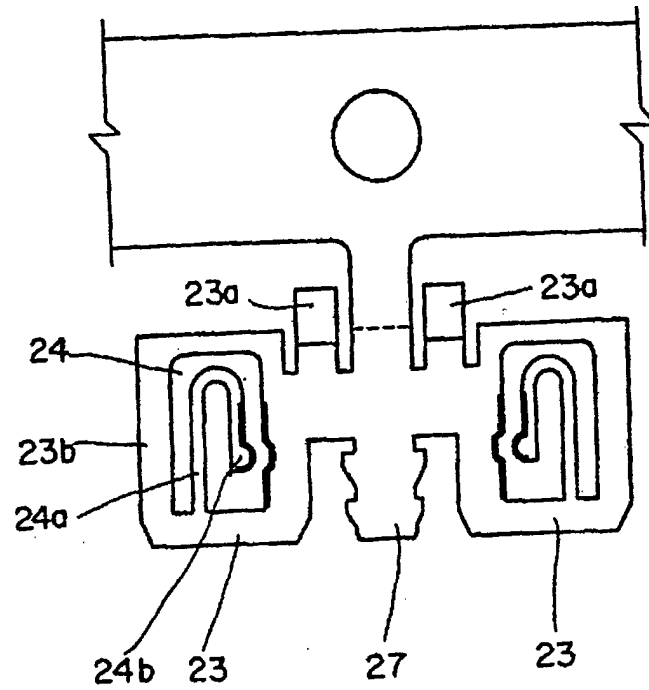
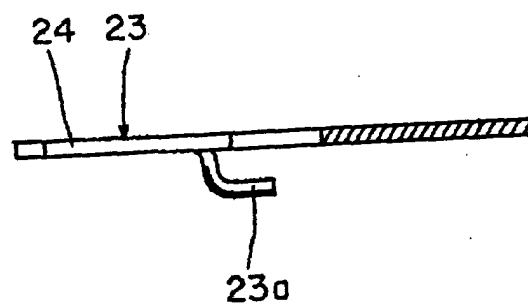


FIG. 15



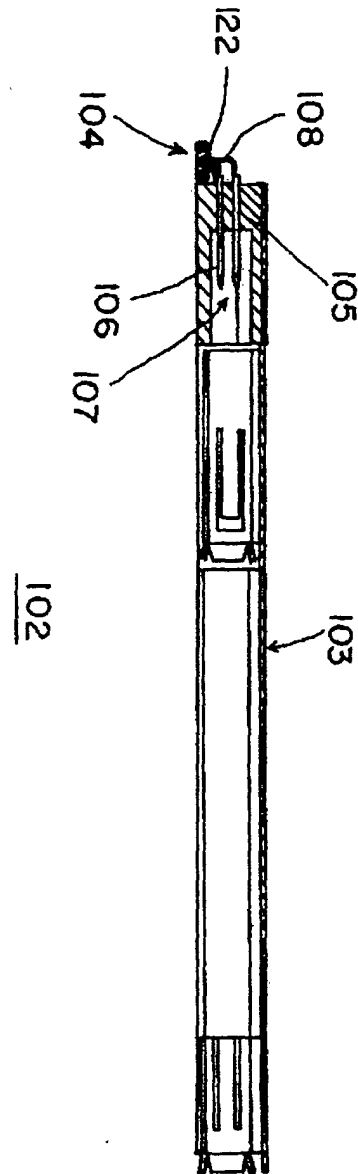
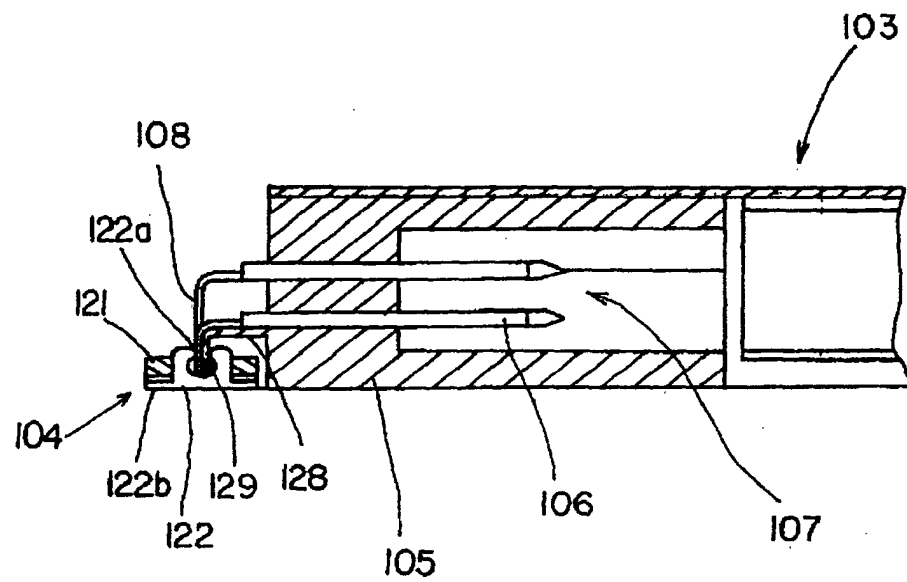


FIG. 16

FIG. 17



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