

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 December 2011 (01.12.2011)

PCT

(10) International Publication Number
WO 2011/150307 A2

(51) International Patent Classification:

H01R 13/629 (2006.01) **G06K 17/00** (2006.01)
H01R 12/72 (2011.01)

(21) International Application Number:

PCT/US2011/038289

(22) International Filing Date:

27 May 2011 (27.05.2011)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

201003713-3	27 May 2010 (27.05.2010)	SG
201003712-5	27 May 2010 (27.05.2010)	SG

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: SIM CARD CONNECTOR

(57) Abstract: A SIM card connector comprises an insulating body defining a top surface, a bottom surface, and a plurality of terminals formed integrally with the insulating body by insert molding. Each terminal comprises a fixing portion comprising a first fixing portion nearer the bottom surface of the insulating body and a second fixing portion connecting with the first fixing portion, the second fixing portion including a plate-like section disposed adjacent to the top surface of the insulating body and extending in a direction approximately parallel to the major surfaces of the insulating body.



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SIM CARD CONNECTOR

BACKGROUND OF THE INVENTION

Related Applications

[0001] This application claims priority to Singapore Application No. 201003713-3, filed May 27, 2010 and to Singapore Application No. 201003712-5, filed May 27, 2010, both of which are incorporated herein by reference in their entirety.

Field of the Invention

[0002] The present invention relates to a connector, and more particularly, to a connector suitable for use as a SIM card connector.

Description of the Related Art

[0003] As the electronic and information technology advances, SIM card connectors are popularly applied. However, as consumer demand for electronic devices of compact size continues to grow, electronic devices, especially portable devices such as mobile phones, are becoming increasingly lighter and thinner. To help meet such demand, it would be helpful to reduce the SIM card connector size accordingly. One common way to reduce size is to insert a molded insulating body with terminals of a SIM card connector, which allows for a thinner SIM card connector because the insulating body does not need extra space for installing the terminals.

[0004] Referring to FIGS. 1 and 2, Chinese Patent Publication Number CN201160170Y discloses a SIM card connector 8. The SIM card connector 8 includes an insulation body 81 and plural conductive terminals 82. The insulation body 81 is formed with plural terminal slots 83. The conductive terminal 82 includes a contact portion 821, a connecting portion 822, and a fixing portion 823,

wherein the contact portion 821 and the fixing portion 823 extend in a direction opposite from the connecting portion 822. The insulation body 81 is insert-molded with the plural conductive terminals 82. After insert-molding, the contact portion 821 extends in the corresponding terminal slot 83 and protrudes from the upper surface of the insulation body 81; the connecting portion 822 extends in the insulation body 81; and the fixing portion 823 is bent and extends along the same plane as the insulation body 81.

[0005] After a SIM card is inserted, the contact portion 821 is pushed down and elastically deforms, and simultaneously, the connecting portion 822 exerts force on the insulation body 81 around the connecting portion 822. To sustain the force from the connecting portion 822, the insulation body 81 must have sufficient strength, and additionally, the securing force of the insulation body 81 to the connecting portion 822 must also be sufficient so that the conductive terminal 82 can be firmly secured after it is pushed down by the SIM card. Because the connecting portion 822 of the conductive terminal 82 has a planar shape, and to sustain the force from the connecting portion 822 and to provide sufficient securing force of the insulation body 81 to the connecting portion 822, the insulation body 81 must be thick and insert molded around the connecting portion 822. The need to wrap the connecting portion 822 by a thick insulation body 81 may inhibit progress in the miniaturization of the SIM card connector.

[0006] Taiwan Patent No. M328092 discloses a SIM card connector 7 having an improved thin insulating body 70. As shown in FIG. 3, the SIM card connector 7 comprises an insulating body 70, a plurality of terminals 71 received in the insulating body 70, and a shield 72 placed over the insulating body 70. The insulating body 70 includes a bottom wall 700 and a pair of side walls 701 extending upward from the two sides of the bottom wall 700. Each side wall 701 includes a locating platform 702 and a locking platform 703. The shield 72 is a square thin metal slice, comprising two sides extending downward and including a plurality of covering slices 720, wherein one covering slice 720 provides a locking hole 721

corresponding to the locking platform 703 on the side wall 701 of the insulating body 70. The shield 72 can be assembled according to the following procedure: the shield 72 is positioned upon the insulating body 70; the locking platform 703 is retained in the locking hole 721 of the shield 72; and the back end of the shield 72 is against the locating platform 702. As such, the relative relationship between the shield 72 and the insulating body 70 is secured. The insulating body 70 has a pair of side walls 701 to improve the strength of the insulating body 70 and reduce the warpage of the insulating body 70. However, in contrast to a plate-like insulating body, the insulating body 70 needs an irregular and complex mold for manufacturing.

[0007] Based on the above, it can be appreciated that further improvements to a connector suitable for use with SIM cards would be appreciated.

SUMMARY OF THE INVENTION

[0008] In an embodiment, a SIM card connector is provided, comprising: an insulating body defining a top surface, a bottom surface, and a plurality of passageways; a plurality of terminals formed integrally with the insulating body by insert molding, each terminal comprising a spring arm inclined upward into the corresponding passageway; a contact portion formed in one end of the spring arm; a fixing portion connecting with the spring arm; and a solder portion connecting the fixing portion. The fixing portion comprises a first fixing portion disposed adjacent to the bottom surface of the insulating body and a second fixing portion connecting with the first fixing portion, wherein the second fixing portion includes a plate-like section disposed adjacent to the top surface of the insulating body and extending in a direction approximately parallel to the major surfaces of the insulating body.

[0009] One embodiment provides a SIM card, which comprises the first fixing portion shaped into a plate and having an opening in the middle thereof, and the second fixing portion crookedly bridging the opening. In another embodiment, the second fixing portion is in the shape of two wings inclined upward from two opposite sides of the first fixing portion, wherein the free end of each wing is flat or

curved. The spring arm and the soldering portion respectively extend from two different ends of the first fixing portion at an obtuse angle. The free end of the soldering portion extends outside of the insulating body, and is shaped into an enlarged portion to increase the soldering area thereof for contacting a PCB. Furthermore, the bottom of the first fixing portion, the bottom of the soldering portion, and the bottom of the insulating body are on the same plane. The top surface of the second fixing portion is exposed and not hidden by the top surface of the insulating body.

[0010] In another embodiment, a SIM card connector comprising an insulating body having four corners and two opposite edges, a plurality of terminals, a metal frame, and a plurality of engaging elements is provided. The plurality of terminals are insert-molded with the insulating body. The metal frame comprises a top plate and two side plates. The two side plates are disposed opposite to the top plate and bent to be adjacent to two opposite edges of the insulating body. Each side plate includes two soldering slices. The soldering slice is disposed adjacent to a respective one of the corners and extends toward the insulating body and beyond the respective edge of the insulating body. The plurality of engaging elements are insert-molded with the insulating body and disposed with respect to the soldering slices. Each engaging element comprises a base and a soldering portion. The soldering portion extends from the base and is located adjacent to the respective at least one soldering slice. In an embodiment, the SIM card connector assembly can be provided, which includes the above-mentioned SIM card connector and a printed circuit board, wherein the above-mentioned SIM card connector is mounted on the printed circuit board.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention is illustrated by way of example and not limited in the accompanying figures in which like reference numerals indicate similar elements and in which:

- [0012] FIG. 1 shows a prior art SIM card connector;
- [0013] FIG. 2 is a perspective view showing the SIM card connector of FIG. 1;
- [0014] FIG. 3 is a perspective view showing a prior art SIM card connector;
- [0015] FIG. 4 is a top perspective view of an embodiment of a SIM card connector showing an insulating body being assembled into a metal frame;
- [0016] FIG. 5 is a perspective view showing an embodiment of a SIM card connector viewed from below;
- [0017] FIG. 6 is an exploded showing an arrangement of a metal frame, a molded insulating body, a plurality of terminals, and a plurality of engaging elements ;
- [0018] FIG. 7 is an exploded showing an arrangement of a metal frame, a molded insulating body, a plurality of terminals, and a plurality of engaging elements;
- [0019] FIG. 8 is a perspective view showing an embodiment of a SIM card connector and a PCB to which it will be mounted;
- [0020] FIG. 9 is a perspective view showing an embodiment of a SIM card connector assembly;
- [0021]
- [0022] FIG. 10 is a perspective view in partial cutaway of an embodiment of an insulating body along a direction parallel to a terminal's lengthwise direction, and shows the integration of the fixing portion of the terminal and the insulating body and the integration of an engaging element and the insulating body;
- [0023] FIG. 11 is a perspective view in partial cutaway of an embodiment of an insulating body along a direction parallel to a terminal's widthwise direction, and shows the integration of the fixing portion of the terminal and the insulating body;
- [0024] FIG. 12 is a perspective view of an embodiment of a SIM card connector mounted on a PCB;
- [0025] FIG. 13 is a perspective view of an embodiment of an insulating body integrated with a plurality of terminals and a plurality of engaging elements;
- [0026] FIG. 14 is a perspective view of the terminal of the SIM card connector of FIG. 13;

[0027] FIG. 15 a perspective view in partial cutaway of an insulating body along a direction perpendicular to the inserting direction A, and shows the integration of the fixing portion of the terminal and the insulating body of the SIM card connector of FIG. 13;

[0028] FIG. 16 is a perspective view in partial cutaway of an embodiment of an insulating body along a direction parallel to a terminal's lengthwise direction, and shows the integration of the fixing portion of the terminal and the insulating body and the integration of an engaging element and the insulating body; and

[0029] FIG. 17 is a perspective view in partial cutaway of an insulating body along a direction perpendicular to the inserting direction A, and shows the integration of the fixing portion of the terminal and the insulating body

DETAILED DESCRIPTION OF THE INVENTION

[0030] The detailed description that follows describes exemplary embodiments and is not intended to be limited to the expressly disclosed combination(s). Therefore, unless otherwise noted, features disclosed herein may be combined together to form additional combinations that were not otherwise shown for purposes of brevity.

[0031] The depicted embodiments allow for the provision of a SIM card connector comprising an insulating body and a plurality of terminals. Certain features allow the thickness of the insulating body of such a SIM card connector to be further reduced, while retaining the ability to securely hold the terminals. Furthermore, certain embodiments can help provide a simple configuration that is resistant to warpage.

[0032] FIG. 4 shows an embodiment of a SIM card connector 1. Referring to FIGS. 4, 5, and 8, the SIM card connector 1 may comprise an insulating body 2, a plurality of terminals 3, a frame 4, and a plurality of engaging elements 5. The insulating body 2 can include four corners and two opposite edges 27. The plurality of terminals 3 can be insert-molded with the insulating body 2. The frame 4 may

include a top plate 40 and two side plates 41. The top plate 40 may cover or not cover the insulating body 2, and the two side plates 41 may be disposed opposite to the top plate 40 and bent to be adjacent to the two opposite edges 27. Each side plate 41 may include two soldering slices 410. Each soldering slice 410 can be disposed adjacent to one corner of the insulating body 2, and may extend toward the insulating body 2 and beyond the respective edge 27 of the insulating body 2. The plurality of engaging elements 5 can be integrated with the insulating body 2 and disposed with respect to the plurality of soldering slices 410. Each engaging element 5 may include a base 50 and a soldering portion 51. The soldering portion 51 extends from the base 50, and is located adjacent to the respective soldering slice 410.

[0033] As shown in FIG. 8, an inserting-card space 10 is formed between the insulating body 2 and the metal frame 4 so that a corresponding SIM card (not shown) can be inserted along an inserting direction A and can contact the terminals 3.

[0034] FIG. 5 shows a perspective view of a SIM card connector 1 according to one embodiment of the present invention. FIGS. 6 and 7 are exploded views showing an arrangement of a metal frame 4, a molded insulating body 2, a plurality of terminals 3, and a plurality of engaging elements 5 according to one embodiment of the present invention.

[0035] As shown in FIGS. 5 to 7, the insulating body 2 can substantially be in a shape of rectangle, and comprises a top surface 20, a bottom surface 21 opposite to the top surface 20, and a plurality of passageways 22 extending through the insulating body 2 from the top surface 20 to the bottom surface 21. In this embodiment, the plurality of passageways 22 are arranged in two rows along the inserting direction A of a SIM card, and an open slot 23 is formed between the two rows of passageways 22 and extends through the insulating body 2 from the top surface 20 to the bottom surface 21. As shown in FIG. 4, each edge 27 of the insulating body 2 may include two notches 24, which may be formed with respect to the engaging elements 5 and expose the respective soldering portions 51. In the

present invention, each notch 24 is disposed adjacent to a corresponding corner of the insulating body 2.

[0036] Each terminal 3 comprises a spring arm 30, a contact portion 31, a fixing portion 32, and a soldering tail 33. The spring arm 30 inclines upward into the corresponding one of the plurality of passageways 22. The contact portion 31 is formed in one end of the spring arm 30, and protrudes into the inserting-card space 10. The fixing portion 32 extends from the other end of the spring arm 30, and is insert-molded in the insulating body 2. The fixing portion 32 comprises a first fixing portion 320 disposed close to the bottom surface 21 of the insulating body 2, and a second fixing portion 321 disposed close to the top surface 20 of the insulating body 2 and connecting with the first fixing portion 320. The first fixing portion 320 is flat and has an opening 322 in the middle; and the second fixing portion 321 is bent and configured to be bridged over the opening 322. Alternatively, the top surface of the second fixing portion 321 can be flat or curved. The insulating material 25, such as plastic, will flow into the opening 322 during insert-molding of the insulating body 2 with the plurality of terminals 3. Thus, each terminal 3 has a larger area contacting the insulating body 2 in a limited vertical space than in the prior art, consequently strengthening the securing force of the insulating body 2 to the terminal 3. The soldering tail 33 extends from another end of the first fixing portion 320 at an obtuse angle with respect to the spring arm 30. The end of the soldering tail 33 extends out of the insulating body 2, wherein the ends of soldering tails 33 in the front row along the inserting direction A are disposed outside the insulating body 2, and the ends of soldering tails 33 in the back row are disposed in the open slot 23 of the insulating body 2. In the present embodiment, to securely solder the terminals 3 on a printed circuit board PCB 6 (see FIGS. 8 and 9), the free end of the soldering tail 33 is shaped into an enlarged portion 330 to increase the soldering area contacting the PCB 6.

[0037] In order to make the SIM card connector 1 as thin as possible, the bottom of the first fixing portion 320 is exposed and not hidden by the bottom surface 21 of

the insulating body 2, i.e., the bottom of the first fixing portion 320, the bottom of the soldering tail 33, and the bottom of the insulating body 2 are in the same plane; and the top of the second fixing portion 321 is exposed and not hidden by the top surface 20 of the insulating body 2.

[0038] The metal frame 4 comprises a top plate 40 extending above the top surface 20 and two side plates 41 disposed on opposite sides of the top plate 40. The two side plates 41 are vertically bent downward to be adjacent to two opposite edges 27 of the insulating body 2 so as to extend along the opposite side walls of the insulating body 2 in a direction parallel to the inserting direction A. Each side plate 41 includes two separate soldering slices 410 for soldering the frame 4 to the PCB 6 and for supporting the insulating body 2. In the present embodiment, each side plate 41 includes two pairs of soldering slices 410. The two soldering slices 410 in each pair extend toward the insulating body 2 and parallel to the top plate 20, are disposed side by side, and define a gap 411 therebetween.

[0039] The plurality of engaging elements 5 are provided corresponding to the soldering slices 410. In the present invention, an engaging element 5 is provided adjacent to each corner of the insulating body 2. Each engaging element 5 includes a base 50 and a soldering portion 51. The base 50 is insert-molded within the insulating body 2, comprising an opening 500 in its middle and a securing portion 501 connecting to the opposite sides of the opening 500 and bridged over the opening 500. The insulating material 25 flows into the opening 500 during insert-molding of the engaging element 5 into the insulating body 2, such that the engaging element 5 will be securely fixed in the insulating body 2 even though the insulating body 2 is very thin, approximately 0.2 mm.

[0040] The base 50 of the engaging element 5 can be disposed adjacent to the respective edge 27 of the insulating body 2 with the soldering portion 51 extending toward the edge 27. The soldering portion 51 can be covered by the insulating body 2, or can be exposed by forming a notch 24 on the edge 27 so that the solder joint between the soldering portion 51 and the respective soldering pads 61 can be

inspected. The bottom surface of the soldering portion 51 and the bottom surfaces of the corresponding soldering slices 410 can be in the same plane. In this embodiment, a recess 26 is provided and configured to receive the corresponding soldering portion 51 and the corresponding soldering slices 410. Under such circumstance, the bottom portion of the soldering portion 51 may protrude in comparison to the recess surface of the respective recess 26. Further, the bottom of the base 50 can be exposed and not hidden by the bottom of the insulating body 5. In one embodiment, the bottom surface of the soldering slices 410, the bottom surface of the soldering portion 51, the bottom surface of the base 50, and the surface bottom of the insulating body 2 can be in the same plane. Consequently, a SIM card connector 1 is obtained.

[0041] As shown in FIG. 9, one embodiment of the present invention proposes a SIM card connector assembly 100, which includes the above-mentioned SIM card connector 1 and a printed circuit board (PCB) 6. Referring to FIGS. 8 and 9, the PCB 6 defines a plurality of first soldering pads 60 corresponding to the soldering tails 33 of the terminals 3, and a plurality of second soldering pads 61 corresponding to the soldering slices 410 of the side plates 41. After the insulating body 2 and the metal frame 4 are assembled together, each pair of soldering slices 410 at the side plate 41 is received in one corresponding recess 26 of the insulating body 2, and the soldering portion 51 corresponding to the pair of soldering slices 410 is disposed in the gap 411 to be soldered on the same second soldering pads 61. Before reflow soldering the SIM card connector 1 to the PCB 6, a dummy card (not shown) is inserted into the inserting-card space 10 to hold the insulating body 2 down during reflow soldering. Next, the solder tails 33 of the terminals 3 are soldered on the corresponding first soldering pads 60, and the soldering slices 410 of the metal frame 4 and the soldering portion 51 of the engaging element 5 are soldered on the corresponding second soldering pads 61. The metal frame 4 and the insulating body 2 can be simultaneously soldered to the printed circuit board. Thus, the warpage of the insulating body 2 can be prevented. After reflow soldering, the dummy card is

removed. The notches 24 allow direct observation of the soldering quality.

[0042] As shown in FIGS. 4 and 12, and as mentioned above, the SIM card connector 1 comprises an insulating body 2, a plurality of terminals 3 formed integrally with the insulating body 2 by insert molding, and a metal frame 4 including two side plates 41 and a top plate 40 connecting the two side plates 41. As shown in FIG. 12, the metal frame 4 and the insulating body 2 define a card-insertion space 10 configured to allow a SIM card to be inserted in the direction indicated by arrow A to electrically engage the plurality of terminals 3.

[0043] FIG. 4 shows a perspective view of a SIM card connector 1 according to one embodiment of the present invention. FIGS. 6 and 7 are exploded views showing an arrangement of a metal frame 4, a molded insulating body 2, a plurality of terminals 3, and a plurality of engaging elements 5 according to one embodiment of the present invention. FIG. 10 is a perspective view in partial cutaway of an insulating body 2 along a direction parallel to a terminal's lengthwise direction, showing the integration of the fixing portion 32 of the terminal 3 and the insulating body 2 and the integration of an engaging element 5 and the insulating body 2, according to one embodiment of the present invention. FIG. 11 is a perspective view in partial cutaway of an insulating body 2 along a direction parallel to a terminal's widthwise direction, showing of the integration of the fixing portion 32 of the terminal 3 and the insulating body 2, according to one embodiment of the present invention.

[0044] As shown in FIGS. 5, 6, 7 and 11, the insulating body 2 can be rectangularly shaped and comprises a top surface 20, a bottom surface 21 opposite to the top surface 20, and a plurality of passageways 22 extending through the insulating body 2 from the top surface 20 to the bottom surface 21. In this embodiment, the plurality of passageways 22 are arranged in two rows along the inserting direction A of a SIM card. An open slot 23 is formed between the two rows of passageways 22 and extends from the top surface 20 through to the bottom surface 21.

[0045] Each terminal 3 comprises a spring arm 30, a contact portion 31, a fixing portion 32, and a soldering portion 33. The spring arm 30 extends upward into a corresponding one of the plurality of passageways 22. A contact portion 31 is further formed in one end of the spring arm 30, and protrudes into the card-insertion space 10. The fixing portion 32 extends from the other end of the spring arm 30, and is insert molded in the insulating body 2. Furthermore, the fixing portion 32 comprises a first fixing portion 320 near the bottom surface 21 of the insulating body 2, and a second fixing portion 321 near the top surface 20 of the insulating body 2 and connecting with the first fixing portion 320. The first fixing portion 320, the insulating material layer 25 of the insulating body 2, and the second fixing portion 321 are arranged in cross sections across the insulating body 2 where the first fixing portion 320 and the second fixing portion 321 are located. The soldering portion 33 extends from one end of the fixing portion 32 at an obtuse angle with respect to the spring arm 30 so that the length of the spring arm 30 can be increased without causing any interference and the elasticity of the spring arm 30 can be improved. The ends of the soldering portions 33 in the front row along the inserting direction A extend to the outside of the insulating body 2, while the ends of the soldering portions 33 in the back row are disposed in the open slot 23 of the insulating body 2. In the present embodiment, in order to securely solder the terminals 3 on a printed circuit board PCB 6 (see FIG. 5), the end of the soldering portion 33 is configured with an enlarged portion 330 so as to increase the soldering area thereof for contacting the PCB 6.

[0046] In the present embodiment, the fixing portion 32 comprises a first fixing portion 320 that is flat and has an opening 322 in its middle, wherein the fixing portion 32 further comprises a second fixing portion 321 including a plate-like section 324 and the second fixing portion 321 crookedly bridges over the opening 322. The plate-like section 324 of the second fixing portion 321 is disposed above the opening 322, is adjacent to the top surface of the insulating body, and extends in a direction approximately parallel to the major surfaces of the insulating body 2. As

shown in FIG. 7, the plate-like section 324 is disposed adjacent to the top surface 20 of the insulating body 2, and extends in a direction approximately parallel to the major surfaces of the insulating body 2 so that a top surface of the plate-like section 324 may face upward. The top surface of the plate-like section 324 can be curved or flat, and the top surface of the plate-like section 324 may or may not emerge at the top surface 20 of the insulating body 2 as shown in FIG. 10. In one embodiment, the top surface of the plate-like section 324 may be flat and flush with the top surface 20 of the insulating body 2. In addition, the bridging second fixing portion 321 can have an arc shape as shown in FIG. 10, or can have a trapezoid shape as shown in FIG. 16.

[0047] The spring arm 30 and the soldering portion 33 respectively extend from two different ends of the first fixing portion 320 at an obtuse angle. The insulating material, such as plastic, can flow into the opening 322 during insert molding of the plurality of terminals 3 to the insulating body 2. As shown in FIGS. 10 and 11, the first fixing portion 320, the insulating material layer 25 of the insulating body 2, and the second fixing portion 321 are arranged in sections across the insulating body 2 where the first fixing portion 320 and the second fixing portion 321 are located. FIG. 10 is a perspective view in partial cutaway of an insulating body 2 along a direction parallel to a terminal's lengthwise direction, showing the integration of the fixing portion 32 of the terminal 3 and the insulating body 2 and the integration of an engaging element 5 and the insulating body 2. FIG. 11 is a perspective view in partial cutaway of an insulating body 2 along a direction parallel to a terminal's widthwise direction, showing of the integration of the fixing portion 32 of the terminal 3 and the insulating body 2. It can be seen that, in each section along the first fixing portion 320 and the second fixing portion 321, a part 250 of the insulating material layer 25 is on the bottom of the second fixing portion 321, and another part 251 of the insulating material layer 25 is on the top of the first fixing portion 320. Thus, the terminal 3 can have a larger contact area with the insulating body 2 than a prior terminal in a limited vertical space, thereby creating a greater securing force

between the insulating body 2 and the terminal 3.

[0048] The bottom surface of the first fixing portion 320 of each terminal 3 may emerge at the bottom surface 21, yet does not need to be flush with the bottom surface 21. However, in order to make the insulating body 2 as thin as possible, the first fixing portion 320 preferably can be flush mounted; namely, the bottom surface of the first fixing portion 320 can emerge at the bottom surface 21 of the insulating body 2. Furthermore, the top surface of the second fixing portion 321 can emerge at the top surface 20 of the insulating body 2 as well. In addition, the bottom surface of the first fixing portion 320, the bottom surface of the soldering portion 33, and the bottom surface of the insulating body 2 can be on the same plane so as to further reduce the thickness of the insulating body 2.

[0049] In particular, the bottom surface of the first fixing portion 320 emerges from the bottom surface 21 and is substantially flush with the bottom surface 21 of the insulating body 2. In addition, the opening 322 may be defined by two opposite side surfaces, to which the second fixing portion 321 separately connect, and the second fixing portion 321 may crookedly bridge over the opening 322 so that after insert molding, a portion of the insulating body 2 can be formed in the opening 322 and below the second fixing portion 321 such that the insulating body 2 and the second fixing portion 321 are engaged in a mutually hooked manner, resulting in stronger engagement between the insulating body 2 and the second fixing portion 321. The crookedly bridging second fixing portion 321 may have an arc shape, which can be bowed upward if the first fixing portion 32 is disposed adjacent to the bottom surface 21 of the insulating body 2, or bowed downward if the first fixing portion 32 is disposed adjacent to the top surface 20 of the insulating body 2.

[0050] The metal frame 4 comprises a top plate 40 and two side plates 41 extending from two ends of the top plate 40. Close to each end of each side plate 41, at least one soldering slice 410 extends from the edge of the side plate 41 and toward the insulating body 2. In the present embodiment, the at least one soldering slice 410 includes a pair of soldering slices 410. Corresponding to each pair of

soldering slices 410, the SIM card connector 1 further comprises four engaging elements 5 insert molded at the four corners of the insulating body 2. That is, each corner of the insulating body 2 is provided with an engaging element 5. Each engaging element 5 defines a securing slice 50 corresponding to each pair of soldering slice 410 in each end of the side plates 41. Referring to FIG. 12, the PCB 6 is provided with a plurality of solder pads 60 corresponding to the soldering portions 33 of the terminals 3 and the soldering slices 410 of the solder plates 41. After the SIM card connector 1 is soldered to the PCB 6, each securing slice 50 and its corresponding soldering slice 410 can be soldered on the same solder pad 60. Consequently, the insulating body 2 can be prevented from warping which could otherwise be caused by the extremely thin profile of the insulating body 2 during the soldering process.

[0051] The SIM card connector 1 has various embodiments. Referring to FIGS. 13 to 15, another embodiment of the SIM card connector 1 is illustrated, wherein the fixing portion 32 of each terminal 3 is different from the above embodiment but belongs to the same general invention concept. The fixing portion 32 comprises a first fixing portion 320 shaped into a plate and a second fixing portion 321, wherein the first fixing portion 320 is nearer the bottom surface 21 of the insulating body 2 than the second fixing portion 321, and the second fixing portion 321 is nearer the top surface 20 of the insulating body 2. The spring arm 30 and the soldering portion 33 respectively extend from two different ends of the first fixing portion 320 at an obtuse angle. The second fixing portion 321 may include two wings 323 extending respectively from two opposite sides of the first fixing portion 320. As shown in FIG. 14, each wing 323 includes a distal plate-like section 324', and each wing 323 extends crookedly upward and then extends alongside the top surface 20 to form the plate-like section 324' disposed adjacent to the top surface 20 of the insulating body 2 and extending in a direction approximately parallel to the major surfaces of the insulating body 2 as shown in FIG. 15. The first fixing portion 320, the insulating material layer 25 of the insulating body 2, and the second fixing

portion 321 are arranged in cross sections across the insulating body 2 where the first fixing portion 320 and the second fixing portion 321 are located. That is, a part 252 of the insulating material layer 25 is on the top of the first fixing portion 320, and another part 253 of the insulating material layer 25 is on the bottom of the second fixing portion 321. The free end of the soldering portion 33 can be shaped into an enlarged portion 330 to increase the soldering area thereof for contacting the PCB 6. Thus, each terminal 3 can have a larger contact area engaging the insulating body 2 than a prior art terminal, thereby strengthening the securing force of the insulating body 2 to the terminal 3.

[0052] As shown in FIGS. 15 and 17, the plate-like section 324' may have a top surface that can either emerge at the top surface 20 or be hidden by the top surface 20, and the top surface of the plate-like section 324' can be either flat as shown in FIG. 15 or curved as shown in FIG. 17. As mentioned above, to make the insulating body 2 as thin as possible, the bottom surface of the first fixing portion 320 is preferably exposed and not hidden by the bottom surface 21 of insulating body 2. In particular, the bottom surface of the first fixing portion 320, the bottom surface of the soldering portion 33, and the bottom surface of the insulating body 2 can be on the same plane. The top surface of the plate-like section 324', can be exposed and not hidden by the top surface 20 of the insulating body 2.

[0053] The above embodiments are illustrated in order to facilitate understanding of the present invention, and shall not be deemed as limitations to the present invention. Persons skilled in the art can obtain numerous embodiments besides the above without creative work under the teaching and suggestion of the present invention, for example, as an alternation of the first embodiment, the second fixing portion 321 may include an opening 322 in the middle thereof; and the first fixing portion 320 may bridge the opening 322 with a shape of downward arc having a top surface that can be flat or curved. The spring arm 30 and the soldering portion 33 respectively extend from two different ends of the second fixing portion 321 at an obtuse angle. Similarly, as an alternative form of the second embodiment, the

fixing portion 32 may comprise a first fixing portion 320 and a flat second fixing portion 321; the spring arm 30 and the soldering portion 33 may respectively extend from two different ends of the second fixing portion 321 at an obtuse angle; the first fixing portion 320 may include two wings 323 extending upward from opposite sides of the second fixing portion 321, and the free end of each wing 323 can be flat. In another embodiment, the first fixing portion 320 may include only one wing 323.

[0054] As can be appreciated, therefore, in certain embodiments the fixing portion 32 of the terminal 3 includes a first fixing portion 320 and a second fixing portion 321, wherein the first fixing portion 320 is nearer the bottom surface 21 than the second fixing portion 321, and the second fixing portion 321 is nearer the top surface 20 than the first fixing portion 320; and the first fixing portion 320, the insulating material layer 25 of the insulating body 2, and the second fixing portion 321 are arranged in cross sections across the insulating body 2 where the first fixing portion 320 and the second fixing portion 321 are located. Therefore, certain depicted embodiments can provide both small size and high stability.

[0055] As can be further appreciated, in certain embodiments terminals are insert molded into an insulating body and can include a fixing portion that is partially exposed from the top surface and the bottom of the insulating body, namely, the fixing portion is not completely wrapped by a thick insulating body. Therefore, the thickness of the insulating body can be further reduced; as a result, the thickness of the SIM card connector can be further reduced. Most of the fixing portion is wrapped by the insulating body so that the terminal can have a large contact area with the insulating body, creating a greater securing force between the insulating body and the terminal. Due to the greater securing force between the insulating body and the terminal, the security of the terminal need not be diminished even though the thickness of the insulating body is reduced to expose a portion of the fixing portion.

[0056] In certain embodiments, a SIM card connector can comprise an engaging element in each end of the insulating body thereof, wherein each engaging element

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has a soldering portion to be soldered on the same solder pad provided for the corresponding soldering slice of the frame. This can minimize the warpage of the insulating body, consequently decreasing the risk of failed soldering. The stability of the SIM card connector is improved. In addition, this can help minimize the number of solder pads of the PCB so as to enable an electrical product of small size.

[0057] The disclosure provided herein describes features in terms of preferred and exemplary embodiments thereof. Numerous other embodiments, modifications and variations within the scope and spirit of the appended claims will occur to persons of ordinary skill in the art from a review of this disclosure.

What is claimed is:

1. A SIM card connector, comprising:
 - an insulating body defining a top surface, a bottom surface, and a plurality of passageways extending through the insulating body, from the top surface to the bottom surface;
 - a plurality of terminals formed integrally with the insulating body by insert molding; each of the plurality of terminals comprising:
 - a spring arm extending upward into the corresponding one of the plurality of passageways;
 - a contact portion formed in one end of the spring arm;
 - a fixing portion connecting with the spring arm, the fixing portion comprising:
 - a first fixing portion having a bottom surface and disposed adjacent to the bottom surface of the insulating body; and
 - a second fixing portion connecting with the first fixing portion, the second fixing portion including a plate-like section having a top surface, the plate-like section disposed adjacent to the top surface of the insulating body and extending in a direction approximately parallel to the major surfaces of the insulating body; and
 - a solder portion connecting with the fixing portion.
2. The SIM card connector of Claim 1, wherein the top surface of the plate-like section emerges from the top surface of the insulating body.
3. The SIM card connector of Claim 2, wherein the bottom surface of the first fixing portion emerges from the bottom surface of the insulating body.
4. The SIM card connector of Claim 1, wherein the bottom surface of the first fixing portion emerges from the bottom surface of the insulating body.
5. The SIM card connector, comprising:
 - an insulating body defining a top surface, a bottom surface, and a plurality of

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passageways extending through the insulating body, from the top surface to the bottom surface;

a plurality of terminals formed integrally with the insulating body by insert molding; each of the plurality of terminals comprising:

a spring arm extending upward into the corresponding one of the plurality of passageways;

a contact portion formed in one end of the spring arm;

a fixing portion connecting with the spring arm, the fixing portion comprising:

a first fixing portion having a bottom surface and disposed adjacent to the bottom surface of the insulating body; and

a second fixing portion connecting with the first fixing portion, the second fixing portion including a plate-like section having a top surface, the plate-like section disposed adjacent to the top surface of the insulating body and extending in a direction approximately parallel to the major surfaces of the insulating body; and

a solder portion connecting with the fixing portion, wherein the first fixing portion is flat and has an opening in its middle, the second fixing portion includes the plate-like section, and the second fixing portion crookedly bridges over the opening with the plate-like section disposed above the opening, wherein the top surface of the plate-like section is curved or flat.

6. The SIM card connector of Claim 5, wherein the first fixing portion is flush mounted on the bottom surface of the insulating body.

7. The SIM card connector of Claim 6, wherein the top surface of the plate-like section is flat, and the top surface of the plate-like section is flush with the top surface of the insulating body.

8. The SIM card connector of Claim 7, wherein a bottom surface of the solder portion is flush with the bottom surface of the first fixing portion.

9. The SIM card connector of Claim 8, wherein the free end of the soldering portion extends outside of the insulating body.

10. The SIM card connector of Claim 9, wherein the bottom surface of the first fixing portion, the bottom surface of the soldering portion, and the bottom surface of the insulating body are on the same plane.

11. The SIM card connector of Claim 10, wherein the free end of the soldering portion is shaped into an enlarged portion to increase a soldering area.

12. The SIM card connector of Claim 11, wherein the spring arm and the soldering portion respectively extend from two different ends of the first fixing portion at an obtuse angle.

13. The SIM card connector, comprising:

an insulating body defining a top surface, a bottom surface, and a plurality of passageways extending through the insulating body, from the top surface to the bottom surface;

a plurality of terminals formed integrally with the insulating body by insert molding; each of the plurality of terminals comprising:

a spring arm extending upward into the corresponding one of the plurality of passageways;

a contact portion formed in one end of the spring arm;

a fixing portion connecting with the spring arm, the fixing portion comprising:

a first fixing portion having a bottom surface and disposed adjacent to the bottom surface of the insulating body; and

a second fixing portion connecting with the first fixing portion, the second fixing portion including a plate-like section having a top surface, the plate-like section disposed adjacent to the top surface of the insulating body and extending in a direction approximately parallel to the major surfaces of the insulating body; and

a solder portion connecting with the fixing portion, wherein the first fixing portion is shaped into a plate, the second fixing portion includes two wings extending respectively from opposite sides of the first fixing portion, and the wing extends alongside the top surface of the insulating body to form the plate-like section.

14. The SIM card connector of Claim 13, wherein the top surface of the plate-like section of the wing is flat or curved.

15. The SIM card connector of Claim 14, wherein the first fixing portion is flush mounted on the bottom surface of the insulating body.

16. The SIM card connector of Claim 15, wherein the top surface of the plate-like section of the wing is flat, and the top surface of the plate-like section of the wing is flush with the top surface of the insulating body.

17. The SIM card connector of Claim 16, wherein a bottom surface of the solder portion is flush with the bottom surface of the first fixing portion.

18. The SIM card connector of Claim 17, wherein the free end of the soldering portion extends outside of the insulating body.

19. The SIM card connector of Claim 18, wherein the bottom surface of the first fixing portion, the bottom surface of the soldering portion, and the bottom surface of the insulating body are on the same plane.

20. The SIM card connector of Claim 19, wherein the free end of the soldering portion is shaped into an enlarged portion to increase a soldering area.

21. The SIM card connector of Claim 20, wherein the spring arm and the soldering portion respectively extend from two different ends of the first fixing portion at an obtuse angle.

22. A SIM card connector, comprising:

an insulating body having four corners and two opposite edges;

a plurality of terminals insert-molded with the insulating body;

a metal frame, comprising:

a top plate; and

two side plates disposed opposite to the top plate and bent to be respectively adjacent to the two edges of the insulating body; each side plate including two soldering slices each disposed adjacent to a respective one of the corners and extending toward the insulating body and beyond the edge of the insulating body; and

a plurality of engaging elements insert-molded with the insulating body and disposed with respect to the soldering slices, each engaging element comprising:

a base; and a soldering portion extending from the base and located adjacent to the respective soldering slice.

23. The SIM card connector of Claim 22, wherein each side plate comprises two pairs of soldering slices, each pair of soldering slices is disposed adjacent to the respective corner, and the soldering slices in each pair define a gap, within which the respective soldering portion is disposed.

24. The SIM card connector of Claim 23, wherein the insulating body includes a plurality of recesses formed on a bottom surface of the insulating body and disposed with respect to the two at least one soldering slices, wherein the at least one soldering slice is received in the corresponding recess.

25. The SIM card connector of Claim 24, wherein each of the edges of the insulating body includes two notches formed with respect to the engaging elements, and each notch exposes the respective soldering portion of the engaging element.

26. The SIM card connector of Claim 25, wherein the base of each engaging element is insert-molded within the insulating body, comprising an opening in the middle thereof, and a securing portion connects to opposite sides of the opening and is bridged over the opening.

27. The SIM card connector of Claim 26, wherein a bottom surface of the

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soldering slice, a bottom surface of the soldering portion corresponding to the soldering slice, and the bottom surface of the insulating body are in the same plane.

28. The SIM card connector of Claim 27, wherein a bottom surface of the base is exposed and flush with the bottom surface of the insulating body.

29. The SIM card connector of Claim 28, wherein a top surface of the securing portion is exposed and flush with a top surface of the insulating body.

30. A SIM card connector assembly comprising the SIM card connector of Claim 22 in combination with a printed circuit board.

31. The SIM card connector assembly of Claim 30, wherein the soldering slice and the respective soldering portion are soldered on a soldering pad of the printed circuit board.

32. The SIM card connector assembly of Claim 31, wherein each side plate comprises two pairs of soldering slices, each pair of soldering slices is disposed adjacent to the respective corner, and the soldering slices in each pair define a gap, within which the respective soldering portion is disposed.

33. The SIM card connector assembly of Claim 32, wherein the insulating body includes a plurality of recesses formed on a bottom surface of the insulating body and disposed with respect to the soldering slices, wherein the soldering slice is received in the corresponding recess.

34. The SIM card connector assembly of Claim 33, wherein each of the edges of the insulating body includes two notches formed with respect to the engaging elements, and each notch exposes the respective soldering portion of the engaging element.

35. The SIM card connector assembly of Claim 34, wherein the base of each engaging element is insert-molded within the insulating body, comprising an opening in the middle of the base, and a securing portion connects to opposite sides of the opening and is bridged over the opening.

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36. The SIM card connector assembly of Claim 35, wherein a bottom surface of the soldering slice, a bottom surface of the soldering portion corresponding to the soldering slice, and the bottom surface of the insulating body are in the same plane.

37. The SIM card connector assembly of Claim 36, wherein a bottom surface of the base is exposed and flush with the bottom surface of the insulating body.

38. The SIM card connector assembly of Claim 16, wherein a top surface of the securing portion is exposed and flush with a top surface of the insulating body.

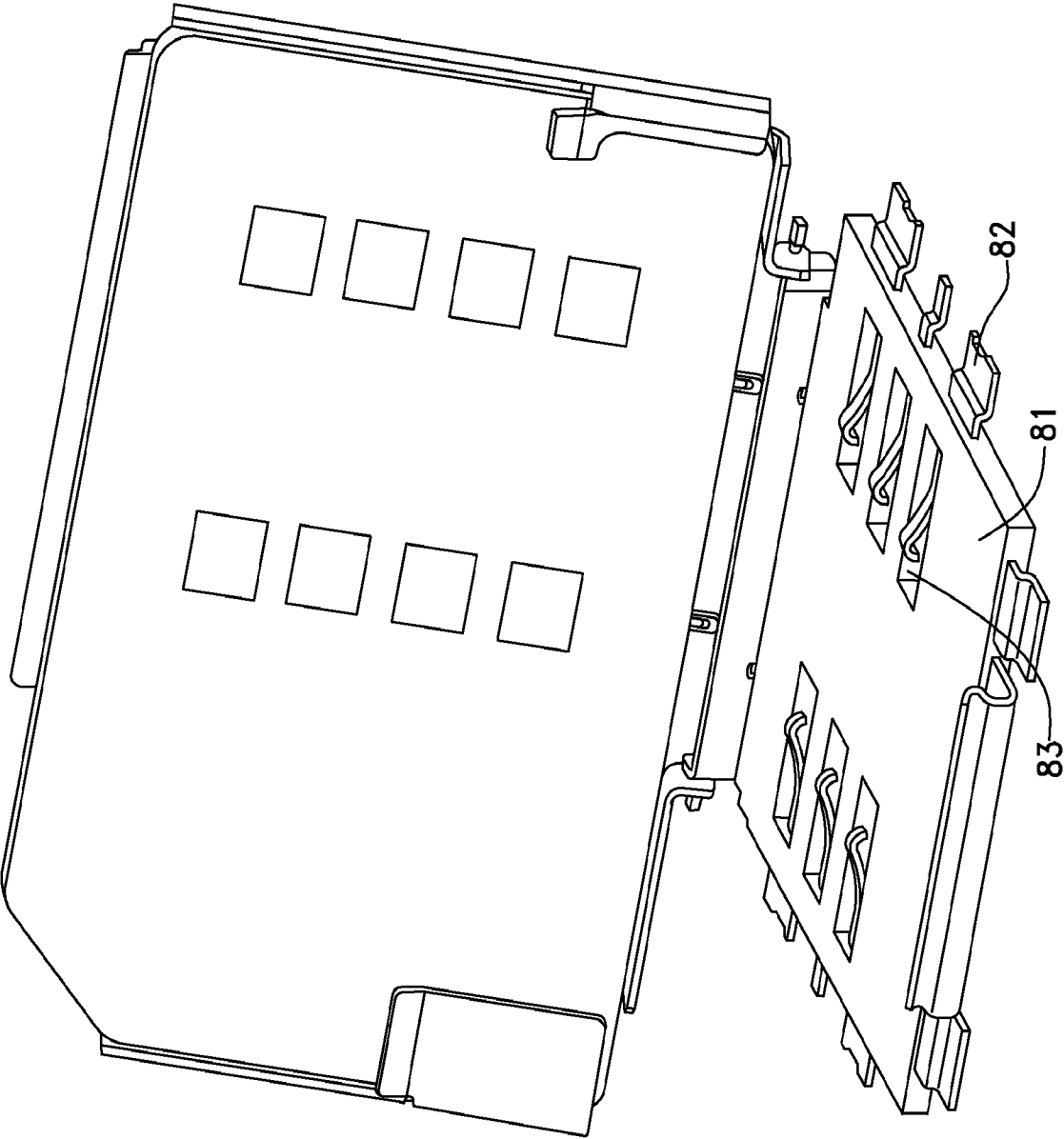


FIG. 1

80

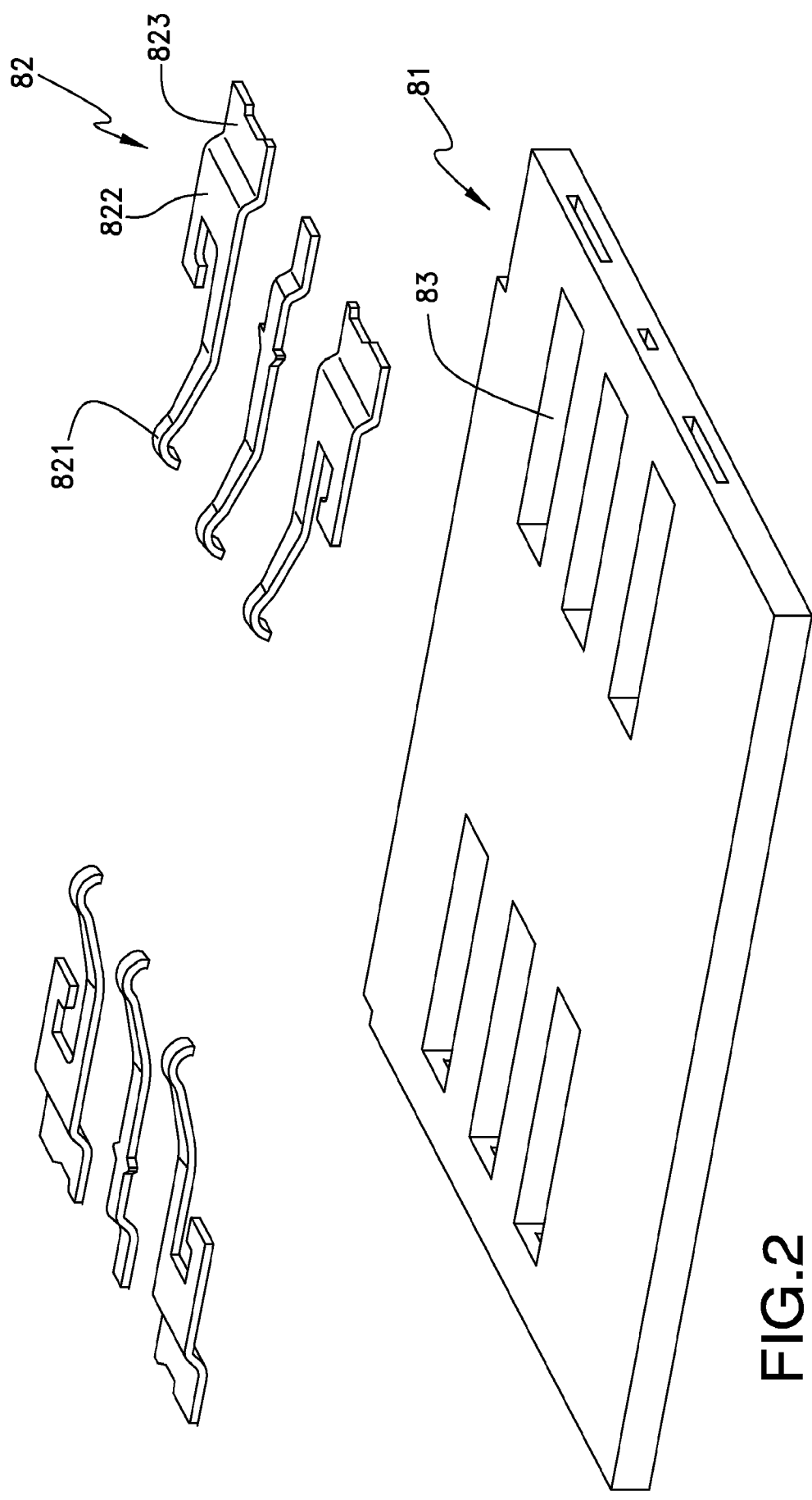


FIG. 2

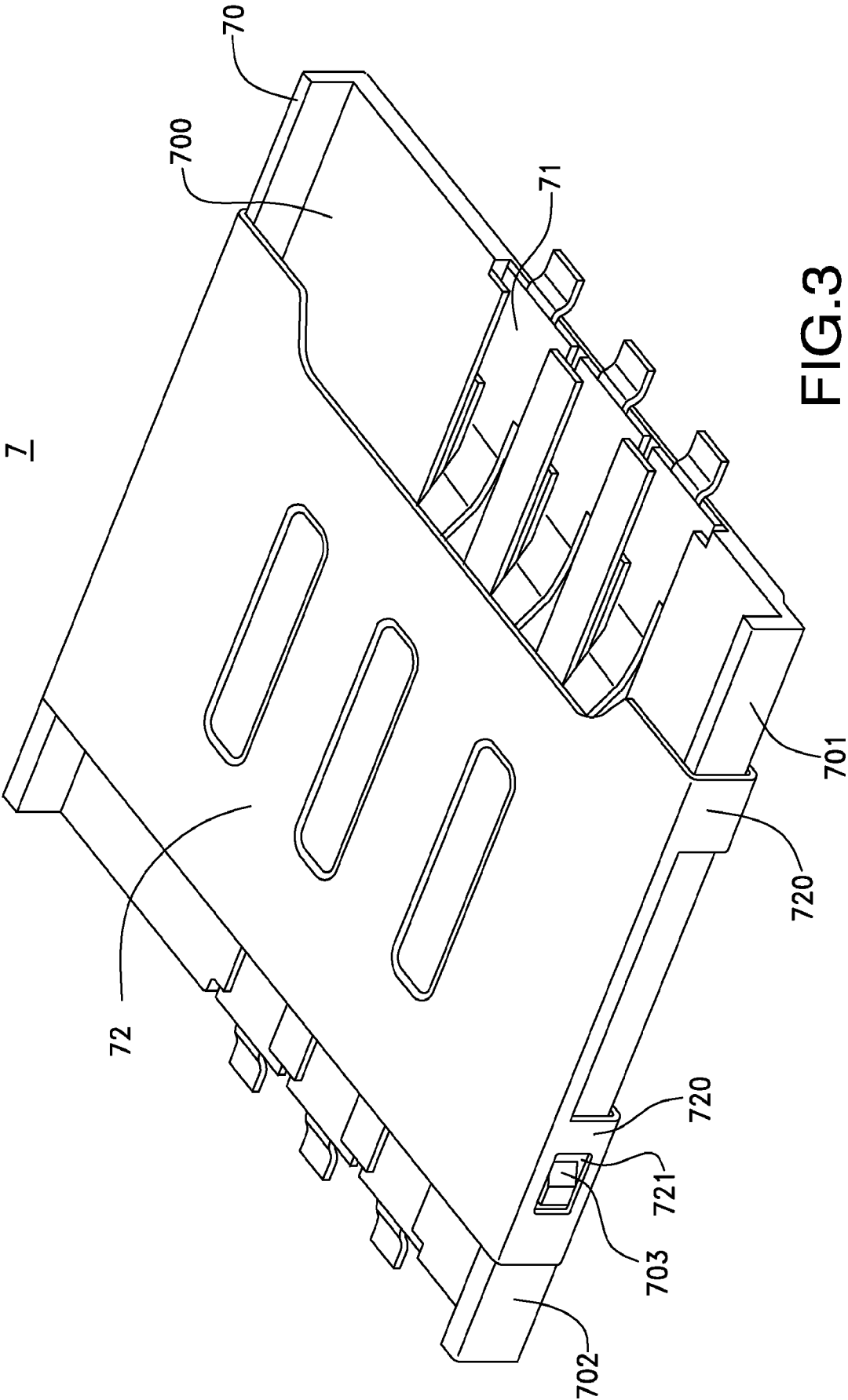


FIG. 3

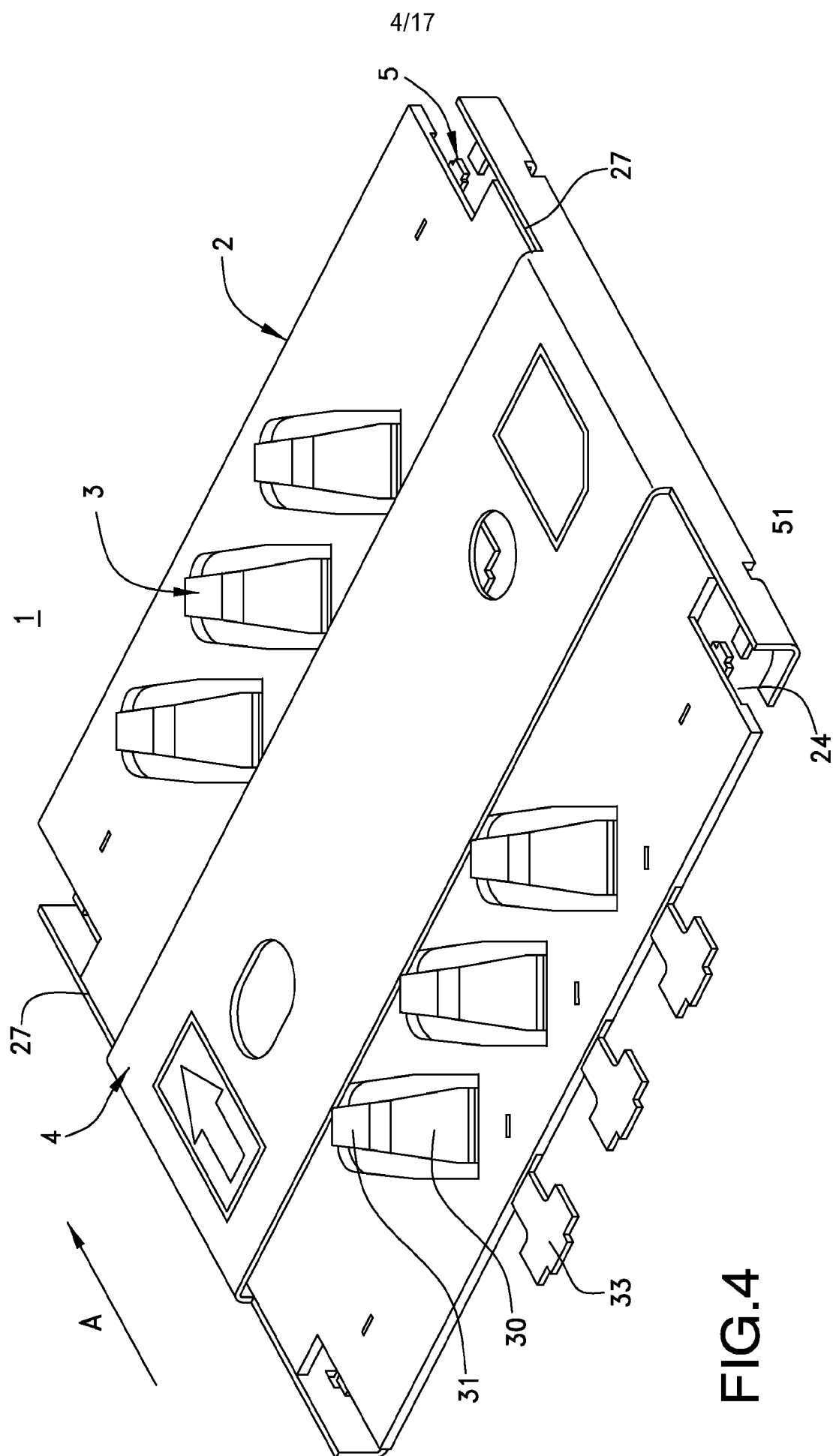
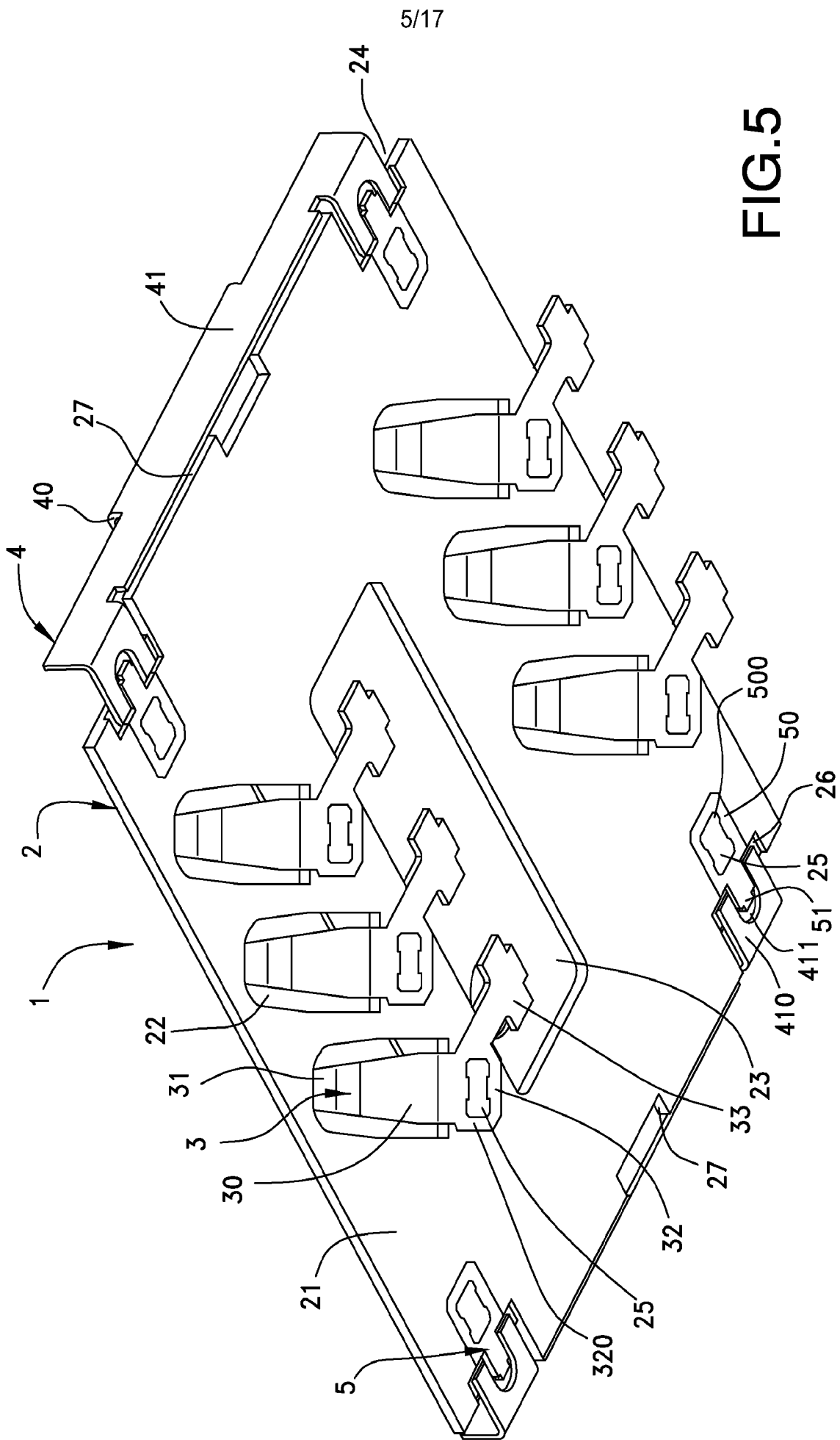


FIG. 4



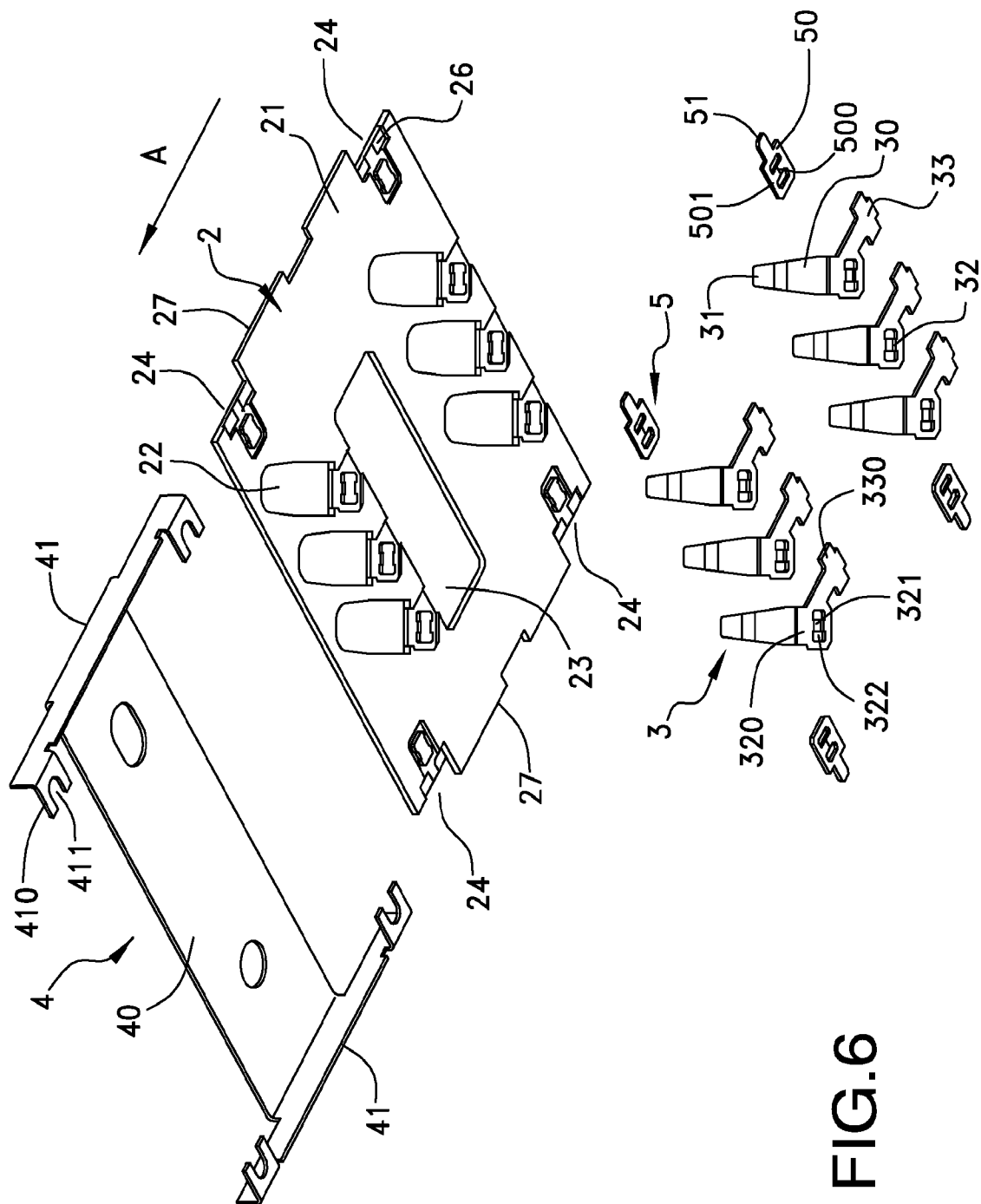


FIG. 6

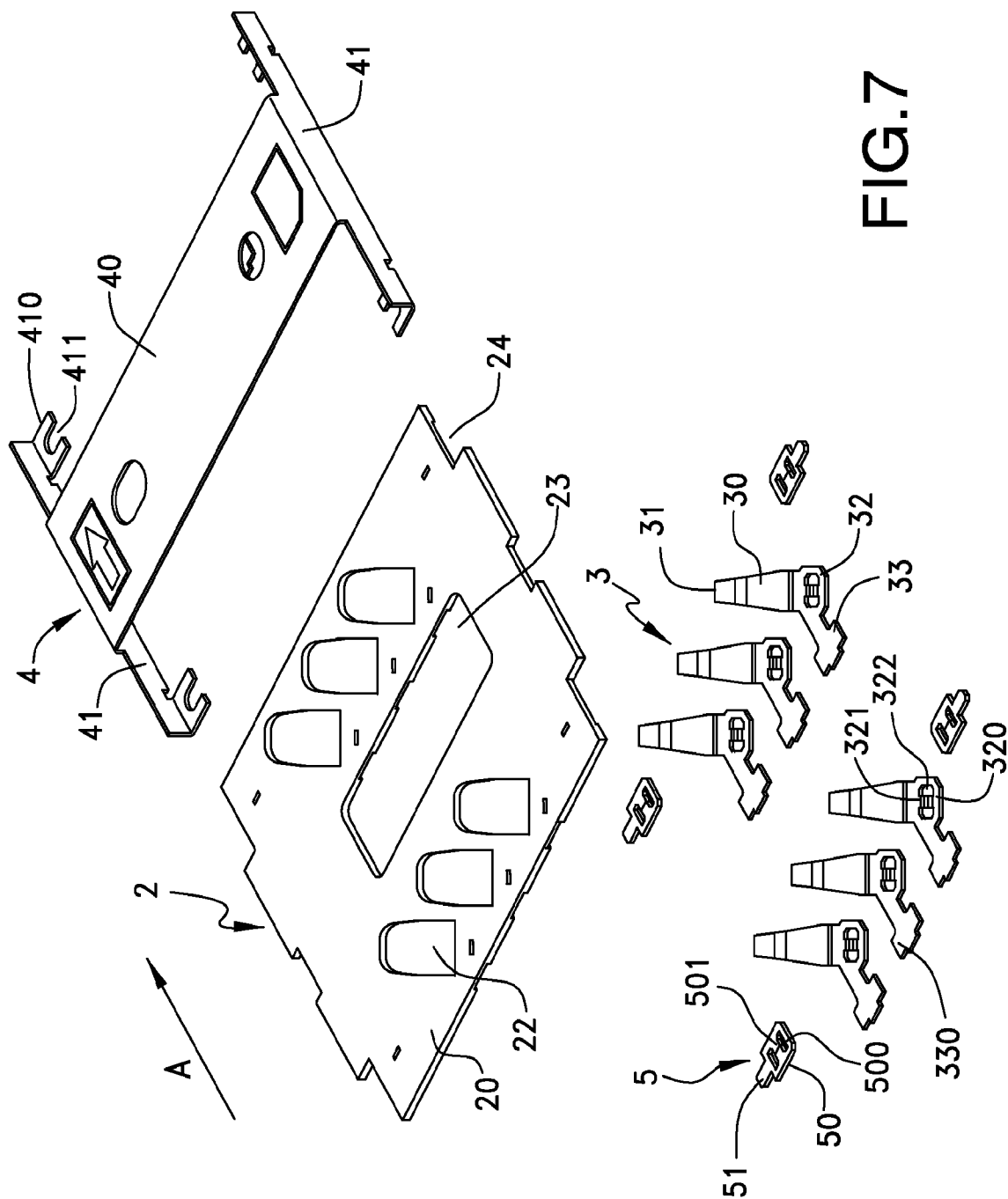


FIG. 7

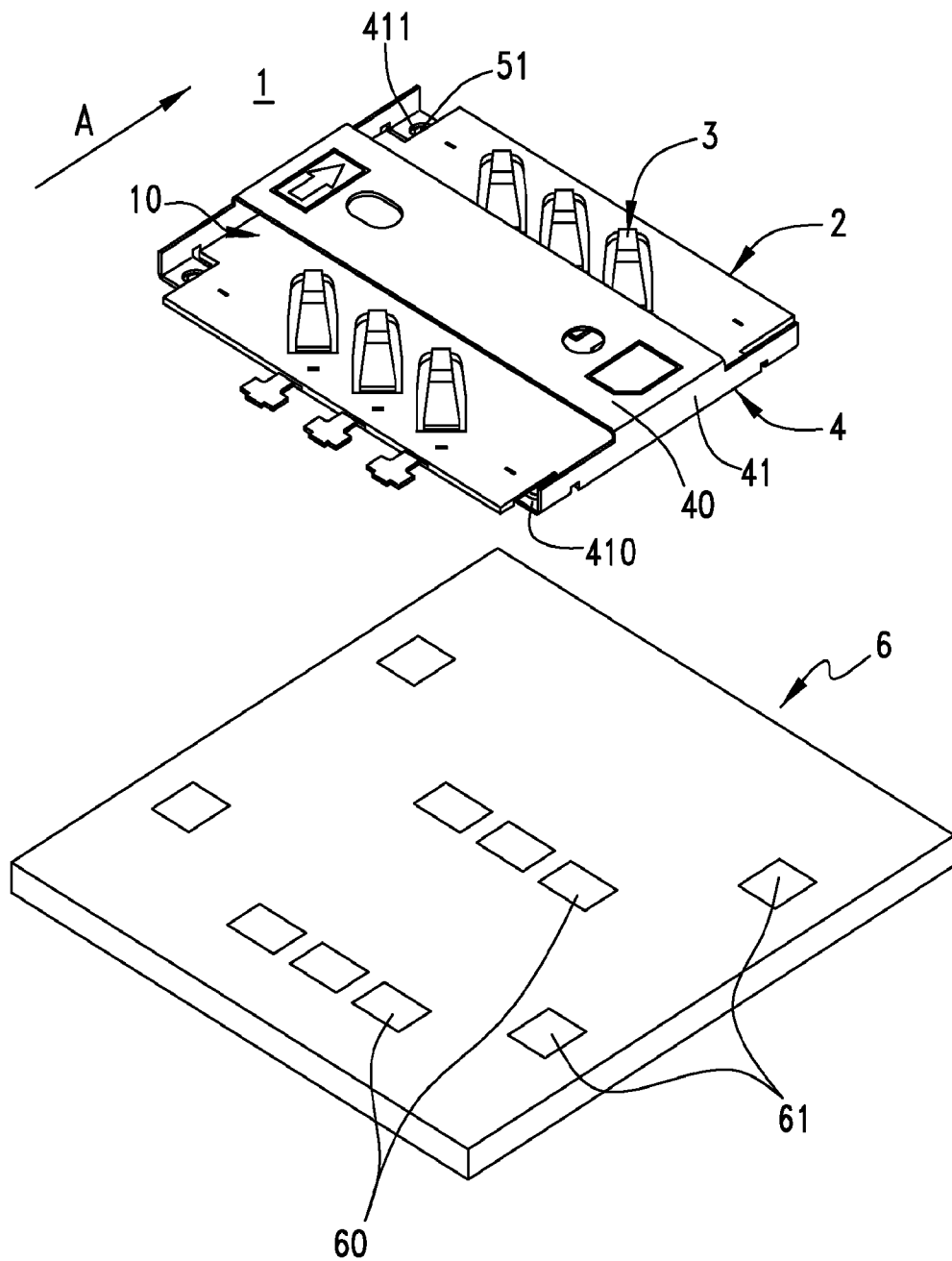
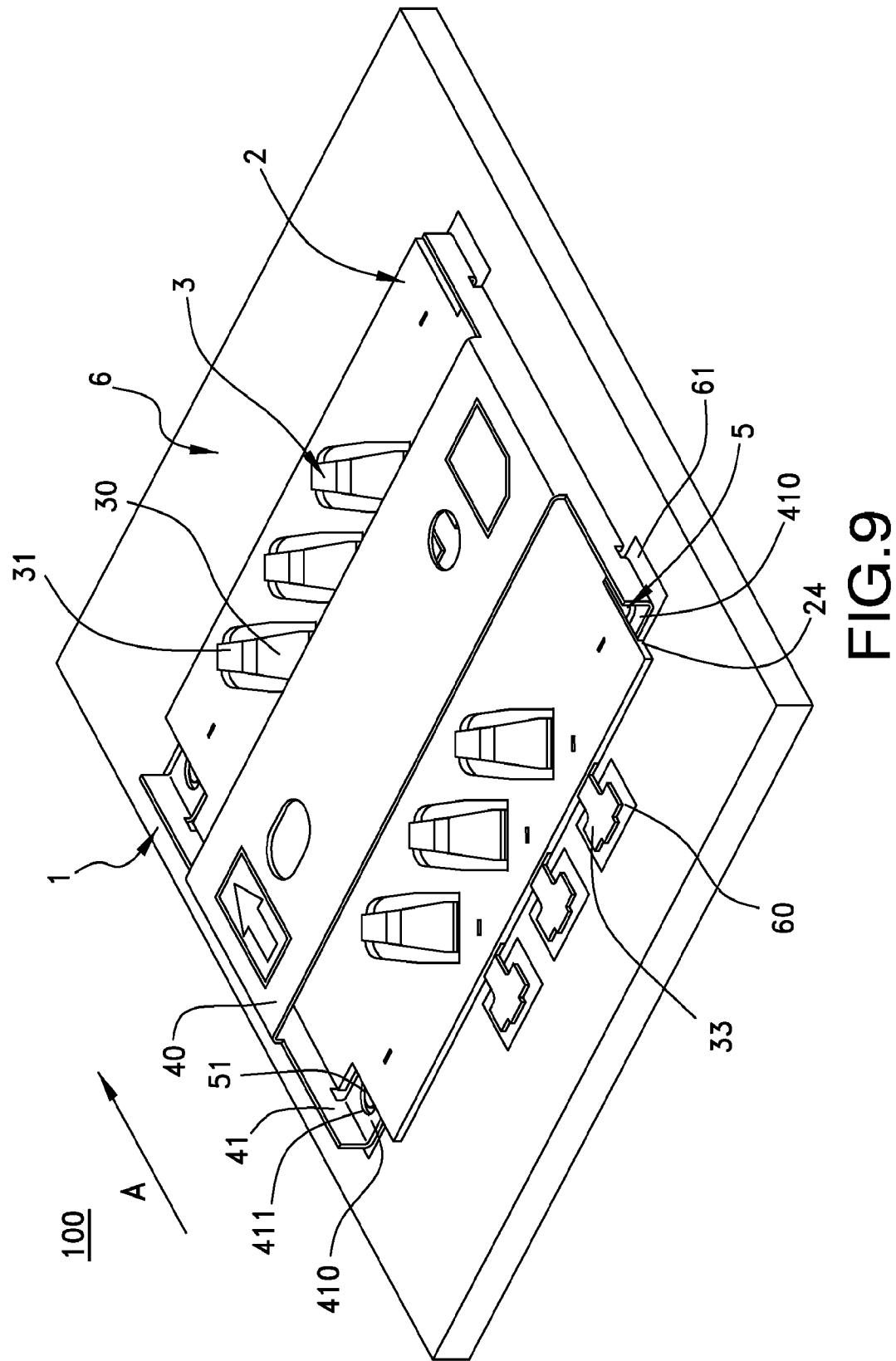


FIG.8



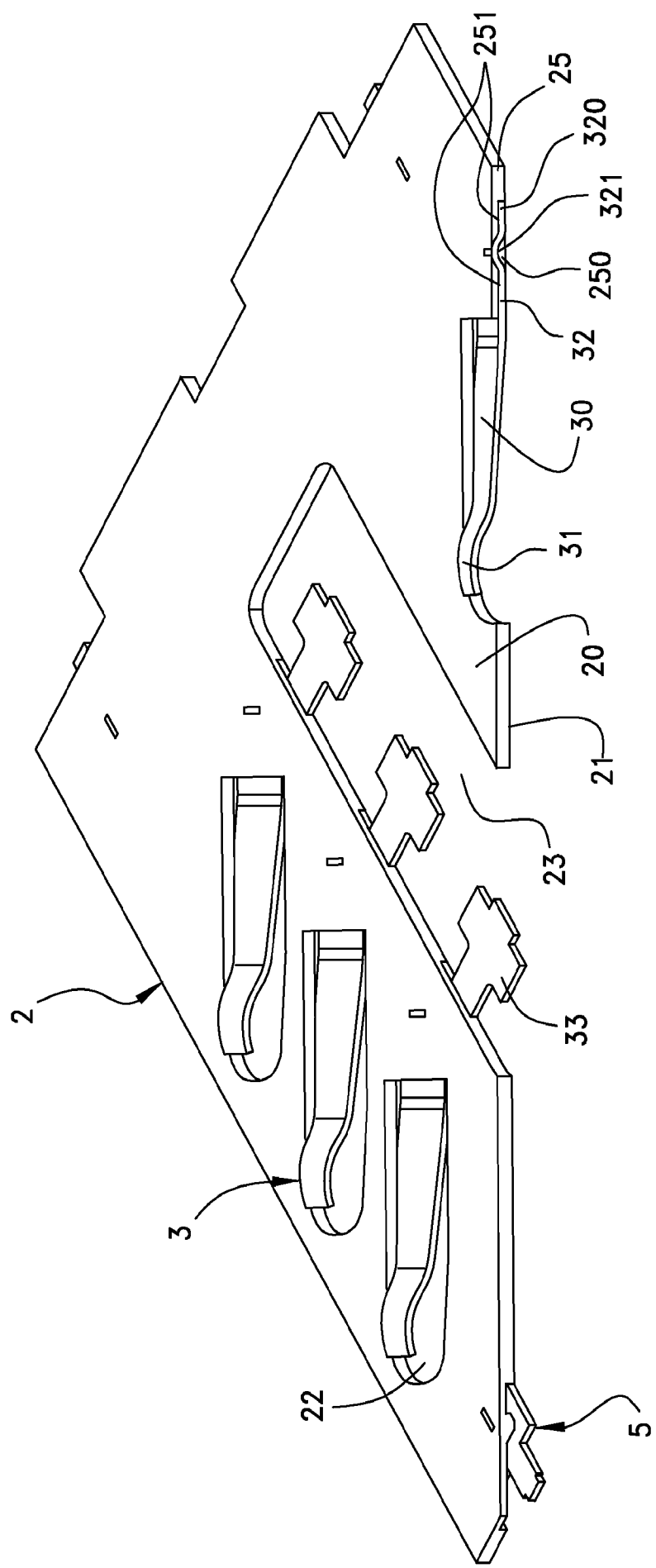


FIG.10

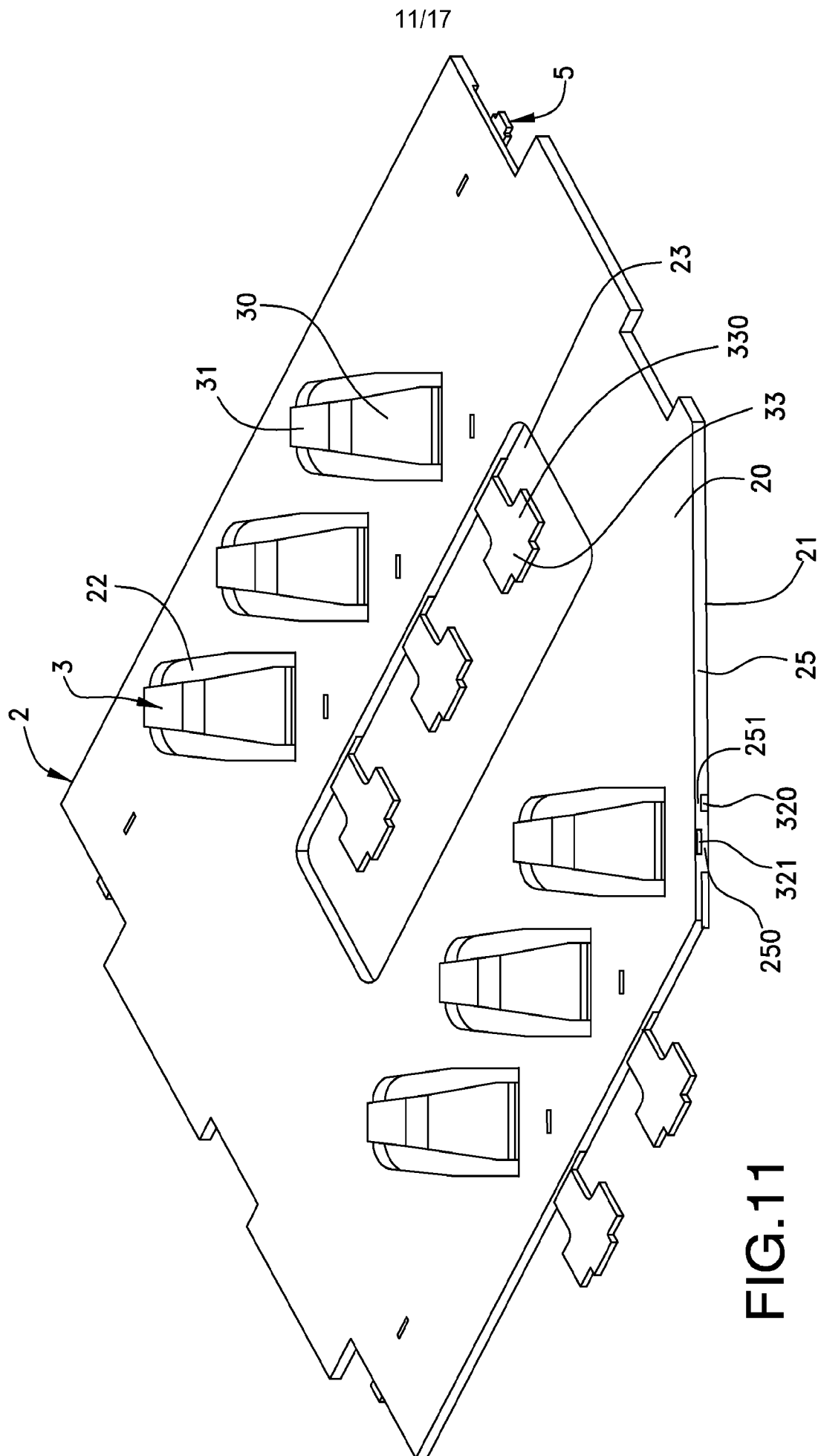


FIG. 11

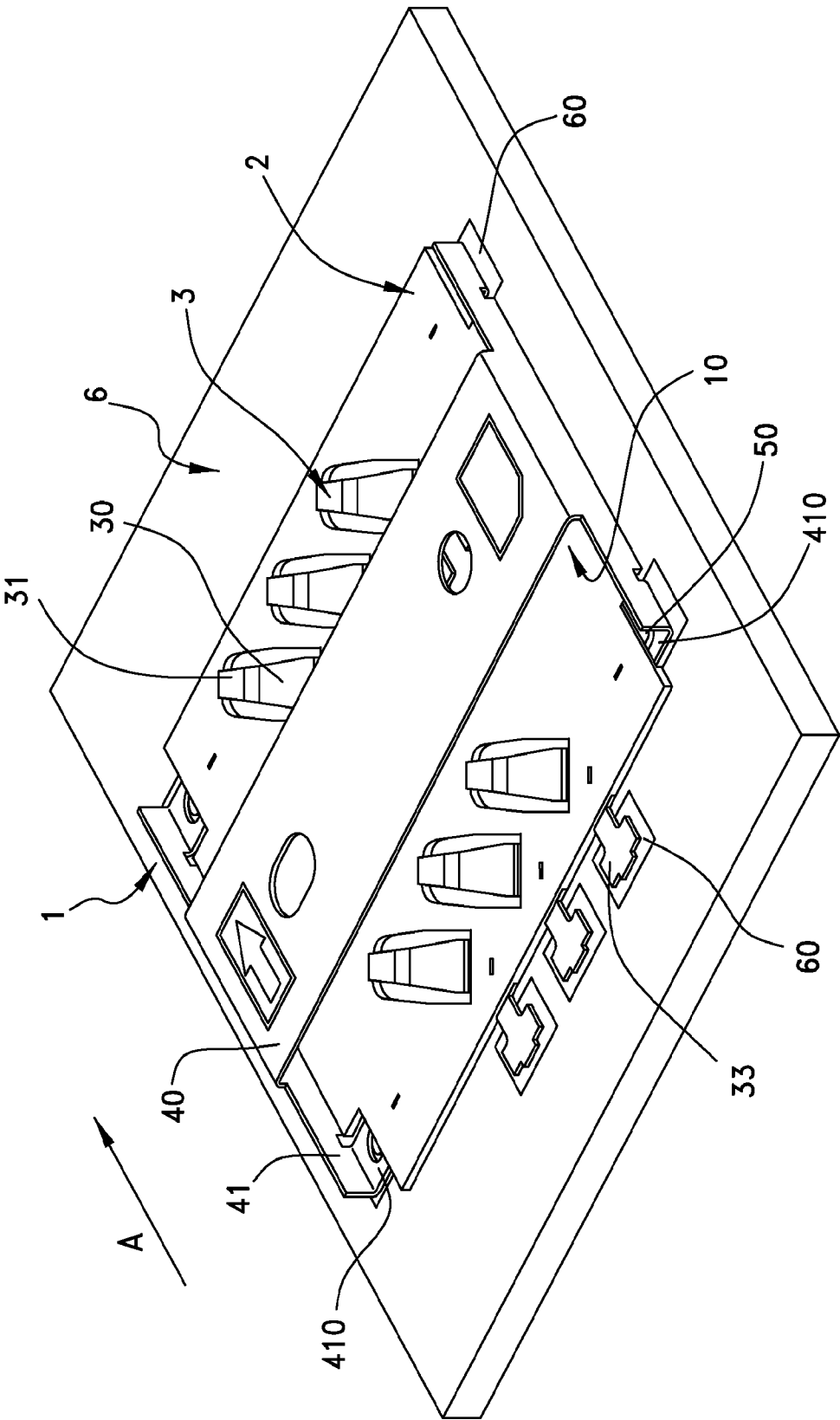


FIG.12

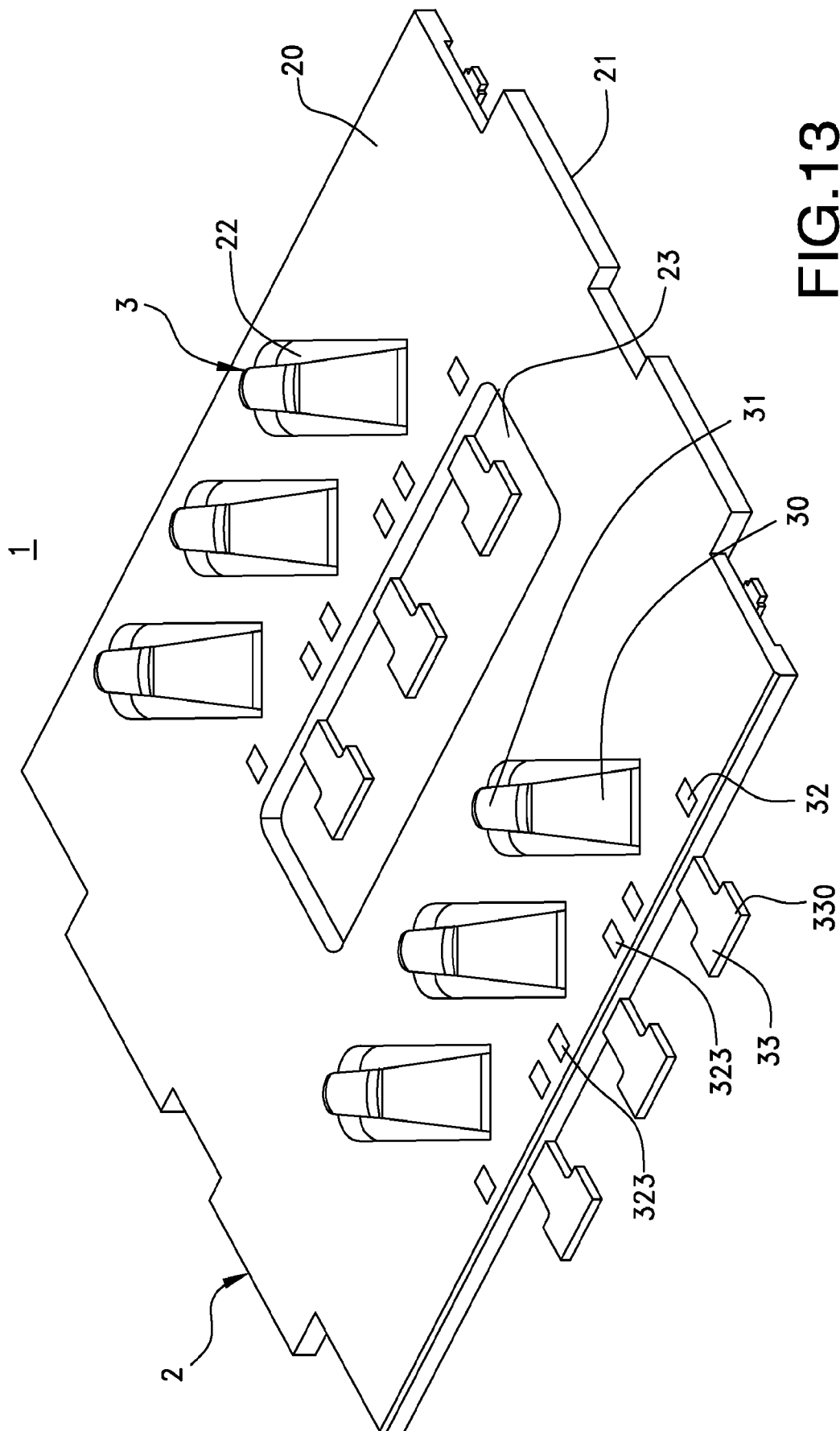


FIG. 13

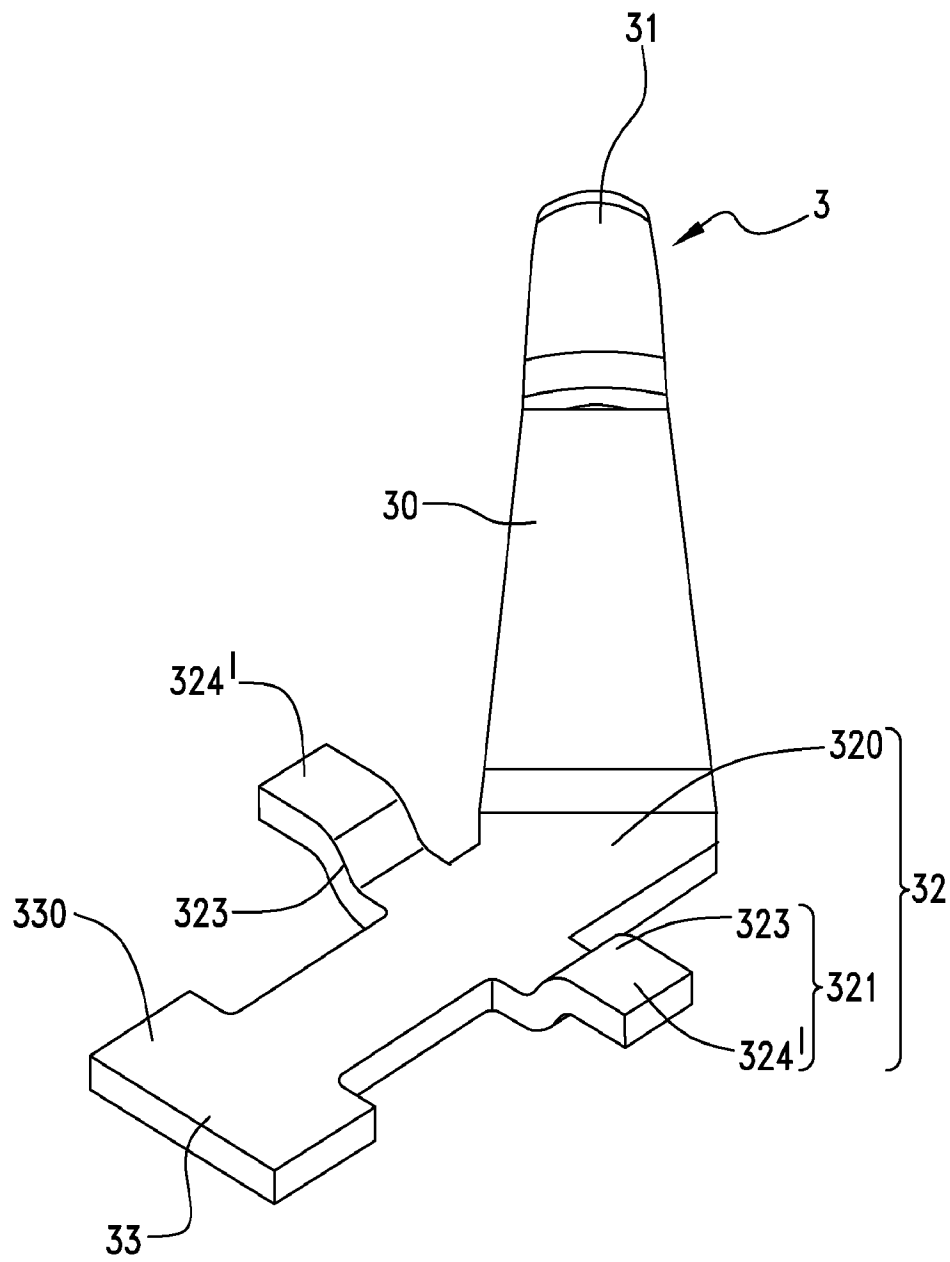


FIG.14

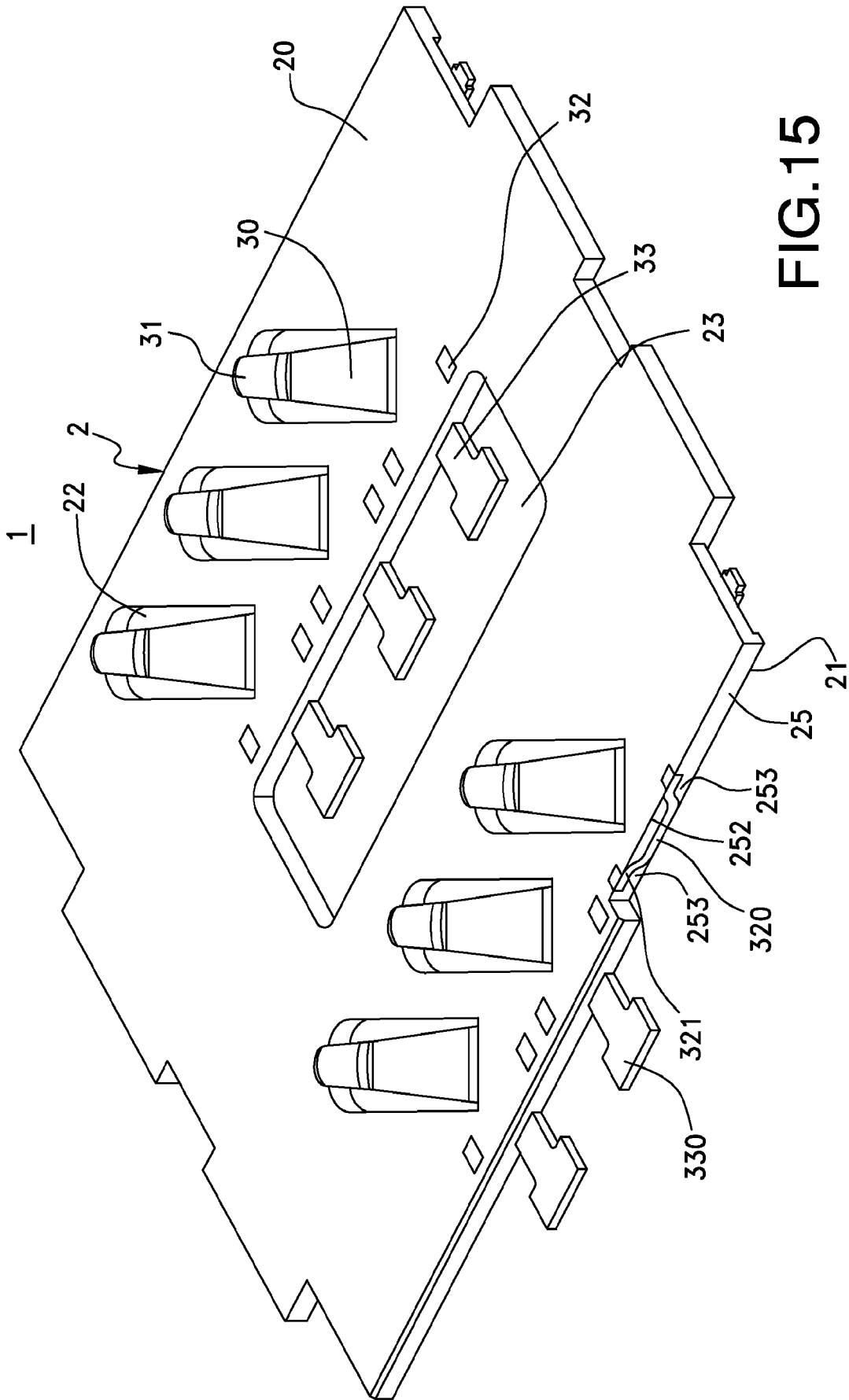


FIG.15

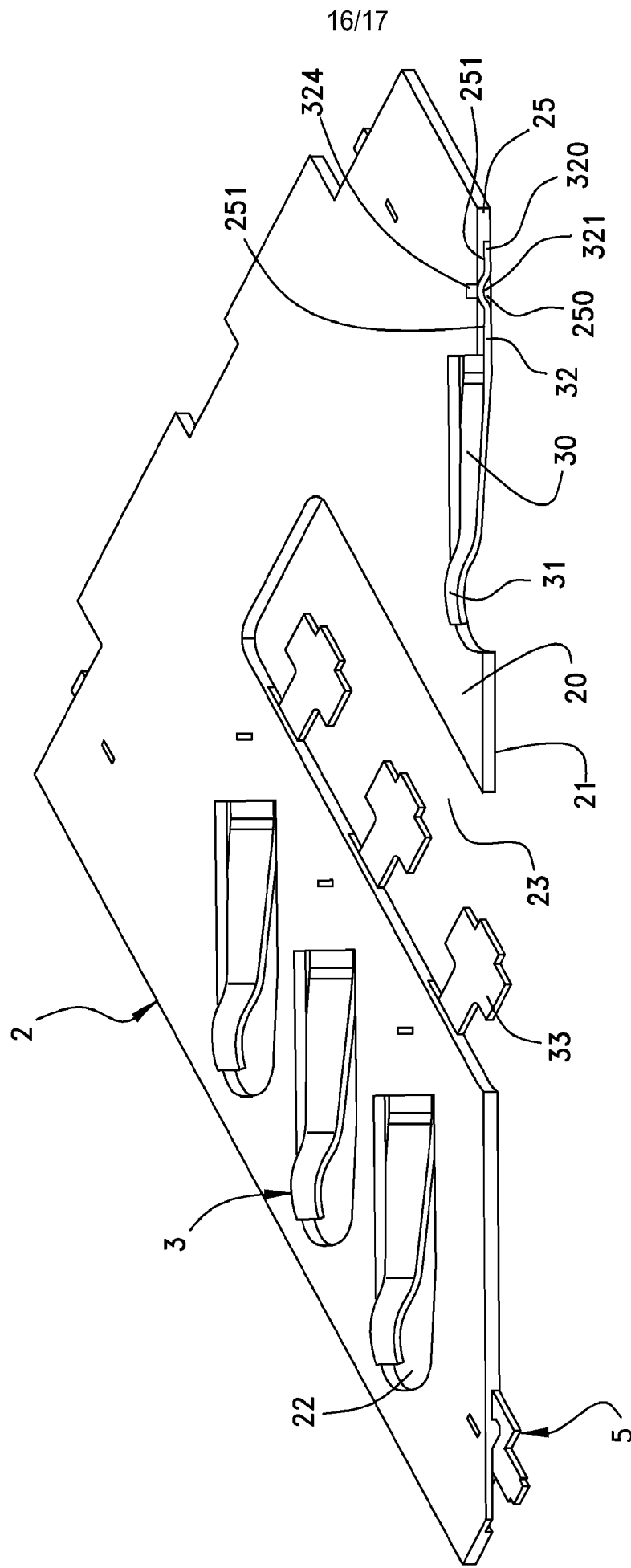


FIG.16

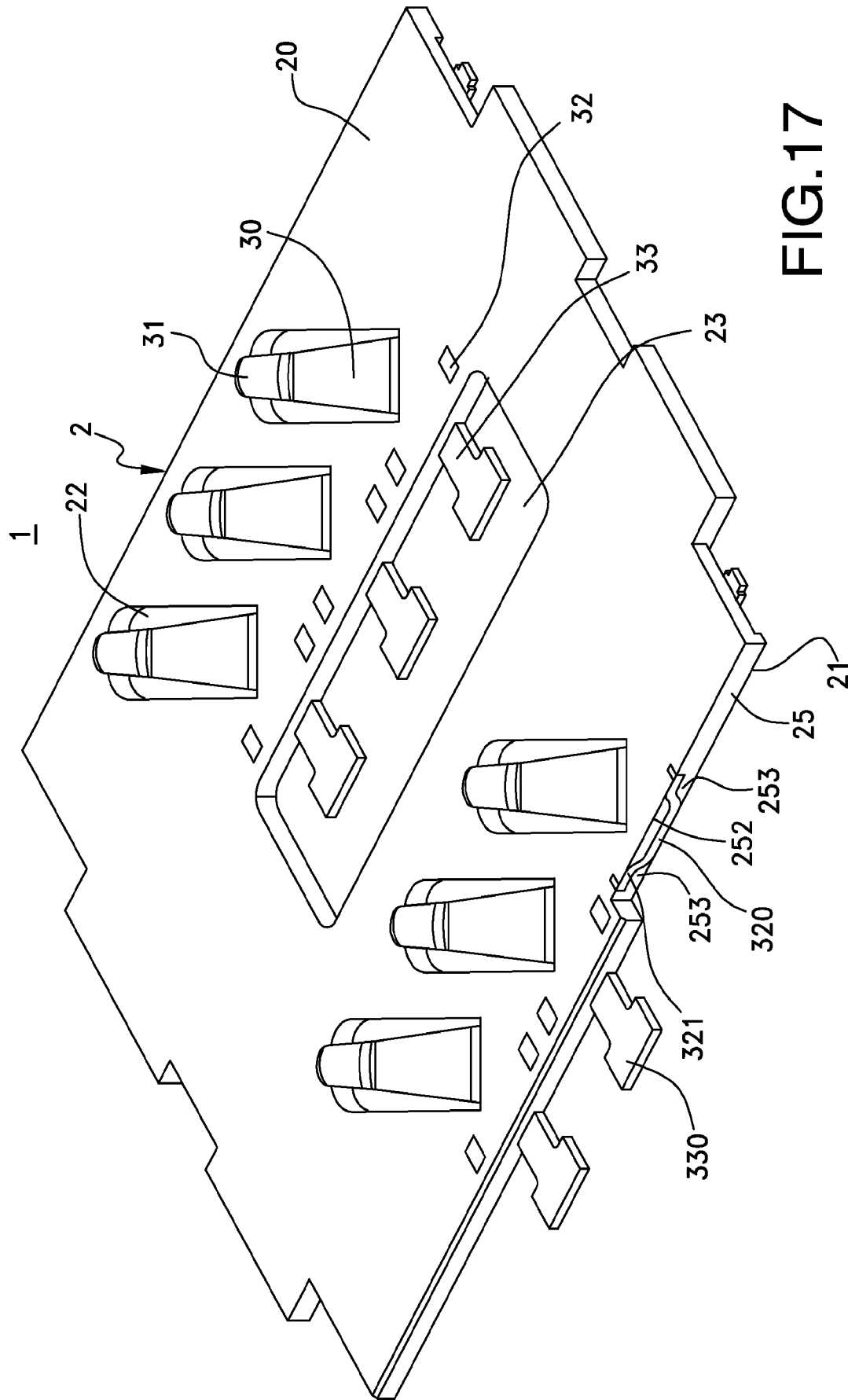


FIG.17