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(54) Tool and method for assembling a printed circuit card.

(57) This invention provides a tool and method for positioning connector springs (6) in a housing (7) and then holding them firmly in place while a tail or arm (63) that extends from each connector spring is soldered to a tab or pad (51) on the edge of a printed circuit card (5). The tool has a plurality of rubber protrusions (81), one for each connector spring in the assembly. These rubber protrusions are wedge shaped and they fit into the contacts (66, 67) on the connector springs to hold the connector springs firmly in an aligned position. Utilizing the method of the present invention the connector springs (6) are first loosely positioned in the holes in the housing assembly. The tool with the wedge shaped protrusions (81) is used to push the connector springs into their final position and to hold them in position during the soldering operation.

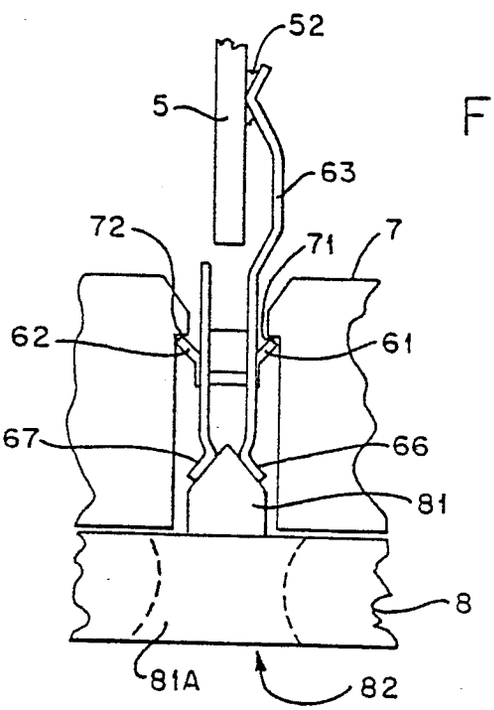

FIG. 2

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TOOL AND METHOD FOR ASSEMBLING A PRINTED CIRCUIT CARD

The present invention relates to a tool and a method for assembling a printed circuit card having a plurality of connector spings, and a housing adapted to hold said connector springs, each of said connector springs having an arm that is adapted to be soldered to a tab on the edge of said printed circuit card, and two contacts that form a slot for insertion of a male connector.

A widely used technology for packaging electronic circuitry is generally termed CARD ON BOARD technology. This technology utilizes relatively large boards which have pins protruding therefrom. Card which have connectors soldered to at least one end thereof are plugged into the board. Electronic components are located on the cards and these components are interconnected by conductive paths on the cards and board.

One example of card on board packaging is the Monolithic System Technology (MST) packaging technology used in the IBM 370 System. A description of this MST packaging technology is given in IBM Maintenance Library Manual SY22-6739-5, Copyright 1969. In MST technology, relatively rigid spring contacts are soldered to the edge of cards. These contacts are next inserted into a plastic contact housing. The spring contacts are protected by the housing and the card can be shipped and handled in this condition. When desired, the card can be plugged into the pins on the board. It is noted that in MST technology the spring contacts are relatively rigid so they can be soldered to the card before they are inserted into the plastic contact housing.

A later and more dense card an board technology is shown in U.S. Patent 4,131,933 and in an article in Electronics Magazine August 2, 1979. This more dense technology was used in the IBM 4341 system and it is called COB technology. In COB technology, due to the density, the contact springs are much smaller and less rigid than the springs used in MST technology. These smaller contact springs can be (1) soldered into the circuit board, (2) soldered to the card, or (3) held in a housing and not be soldered to either the circuit board or to the card. U.S. Patent 4,131,933 shows a package where the contact springs are soldered to the circuit board. An article by Agard et al. in the IBM Technical Disclosure Bulletin, Volume 18, number 8, page 2460, published January 1976, shows a package where the springs are not soldered to either the circuit board or to the circuit card. An article by Chirino et. al. in the IBM Technical Disclosure Bulletin, Volum 25, No 3B, August 1982, page 1410, shows a package where the small connector springs are soldered to the circuit card.

The present invention is directed to the assembly of a package such as that shown in the above referenced article by Chirino et. al. where the connector springs are soldered to the printed circuit card. The Chirino article shows and describes an assembly technique for such springs which has several disadvantages. First, using the tool and technique shown in the Chirino article, the gold contacts on the connector springs are abraded during the assembly operation. Second, the connector springs are not uniformly seated in the housing and as a result there is residual stress on the solder connection between the connector spring and the printed circuit card. Third, the rotation of the springs is not controlled, resulting in additional residual stress on the solder joint. Because of these problems the system shown in the Chirino reference does not provide a consistent, accurate and reliable method and apparatus for assembling the units shown.

The object of the present invention is to provide an improved method and apparatus to facilitate the assembly of contact springs on printed circuit card units.

Another object of the present invention is to provide an improved method and apparatus which will reliably assemble delicate contact springs on the edge of printed circuit cards.

Yet another object is to provide a method and apparatus for reliable, inexpensive and efficient assembly of printed circuit cards which have contact assemblies attached thereto.

A still further object of the present invention is to provide a method and apparatus for consistently and accurately locating connector springs while they are being soldered to a printed circuit card so that there is no residual stress in the solder joint.

The invention as claimed is directed to overcoming the disadvantages associated with the techniques and apparatus described in the above cited references.

The advantage offered by the invention is mainly that there is no stress on the solder connections between the spring contacts and the printed circuit card when plugging the card assembly into e.g. a circuit board.

One way of carrying out the invention is described in detail below with reference to drawings which illustrate a specific embodiment, and in which:

Figure 1 is a partially cut away perspective view of the printed circuit card unit and connector housing being assembled with the present invention.

Figure 2 is an edge or side view of the printed circuit card, housing, connector spring and holding tool of the present invention.

Figure 3 is a perspective view of the printed circuit card assembly, connector and holding tool of the present invention with the connector housing shown by phantom lines.

Figure 4 is a perspective view of the holding tool of the presnet invention.

The present invention relates to a tool and a method for assembling a printed circuit card unit which has a large number of individual connector springs soldered to one edge thereof. Each of these connector springs fits in a hole in a plastic housing. The protruding end of each connector spring has two gold plated contacts. When initially inserted into the hole in the housing, the end of each connector spring is free to move in three linear directions and to rotate. Naturally, the amount of linear movement and the amount of rotation allowed is small (a few hundredth of a mm); however, it is sufficient to insure that the connector springs can be easily inserted into the hole in the housing.

This invention provides a tool and method for properly positioning the connector springs in the housing and then holding them firmly in place while a tail or arm that extends from each contact spring is soldered to a tab or pad on the edge of the printed circuit card. In order to insure proper positioning in the housing, each spring is free to move and rotate in the housing; however, during the assembly operation, the connector must be held firmly in the housing so that latch surfaces on the connector springs are firmly seated on the appropriate surfaces in the housing. In this way there is no residual load or strain on the solder joint between the spring connector and the tab on the card. Furthermore, when a pin or spade is inserted into the connector spring, the stress is taken by the surfaces of the spring which mate with surfaces on the housing and there is no stress or strain on the solder joint.

The present invention provides a tool which has a plurality of rubber protrusions, one for each spring connector in the assembly. These rubber protrusions are wedge shaped and they fit into the gold plated contacts to hold the connector springs firmly in an aligned position with the latching surfaces of the connector held firmly in place.

The rubber protrusions do not abrade the gold contacts; however, they provide individualized pressure on each individual contact spring thereby firmly seating each contact even though there are minor differences in the individual springs and in the holes into which the connector springs fit.

Utilizing the method of the present invention, the spring contacts are first loosely positioned in the holes in the housing assembly. The tool with the wedge shaped protrusions is used to push the connector springs into their final position and to hold them in position during the soldering operation. Once the solder has hardened, the tool is removed. Thereafter, when a pin or spade is inserted into the connector spring, the mating surfaces between the connector and the housing provide the necessary resistance to motion and there is no stress applied to the solder joint.

As shown in Figure 1, the unit assembled with the present invention includes a printed circuit card 5, metal spring connectors 6 (invidually desiganted 6R, 6M and 6L), and a plastic housing 7. The printed circuit card 5 is positioned and held in housing 7 by fingers 7A and 7B. In the specific embodiment shown herein, there are three rows of connector springs 6. Each connector spring 6 has an arm or tail 63 that connects to electrical circuitry (not shown) on card 5.

The connectors 6L on the left side of the card 5 connect to tabs 51 on the left side of card 5. The connectors 6R on the right side of card 5 connect to tabs 51 on the right side of card 5. The connectors 6M in the center row alternately connect to tabs 51 on the right and then on the left of the card 5.

The detail of how connectors 6 fit into housing 7 is shown in Figure 2. Each connector spring 6 fits into a hole in housing 7. Each connector spring 6 is held in the housing 7 by two latch tabs 61 and 62. The latch tabs 61 and 62 respectively engage latching surfaces 71 and 72 in housing 7.

Each connector spring 6 has an arm or tail 63 which is attached to a tab or land 51 (see Figure 3) on card 5 by solder 52 (see Figure 2). In order to insure reliability, it is very important that after the assembly operation, the tail 63 is held in place by tabs 61 and 62 and that there be no strain on solder connection 52. Furthermore, tabs 61 and 62 must be firmly seated on latching surfaces 71 and 72 so that when a pin or spade in inserted between the gold contact surfaces 66 and 67 any force or stress is absorbed by tabs 61 and 62 and latching surfaces 71 and 72 and so that no stress is placed on solder joint 52.

A perspective view of the tool used with the present invention is shown in Figure 3. It has a base plate 8 and a number of molded wedge shaped protrusions 81. The protrusions 81 are

made of fluoro-silicone rubber. As shown in figure 2, base plate 8 has a hole 82 associated with each wedge shaped protrusion 81 and the fluoro-silicone rubber is molded into the holes in the base plate 8. The tool is fabricated by starting with a base plate 8 which has hour-glass shaped holes 82 therein and then molding fluoro-silicone rubber in the holes and extending out to form wedge shaped protrusions 81. The holes in base plate 8 have an hour-glass shape so that the fluoro-silicon rubber is firmly held to the base plate 8.

The only portion of the tool that is subject to substantial wear is the rubber protrusions 81. When these protrusion show wear, the rubber is removed from the base plate 8. New protrusions 81 with associated tabs 81A that extend through the base plate 8 can then be molded onto the base plate 8.

The relative position between the connector springs 6 and the tabs 51 on card 5 is shown in Figure 3 which is a perspective view of the assembly with the housing 7 shown in phantom lines. This figure also shows how the wedge shaped protrusions 81 fit into the contact surfaces 66 and 67 on connector springs 6. The fit between contacts 66 and 67 and wedge shaped member 81 is such that each connector is automatically rotated to the correct position, centered in its associated hole in housing 7, and held firmly in place with connector tabs 61 and 62 firmly engaging surfaces 71 and 72 of the housing. All of the connector springs 6 are simultaneously positioned to the correct position, even though there may be minor variations in the holes in housing 7 and in the individual connector springs 6.

The tool 8 can align and firmly seat each connector 6 so that tabs 61 and 62 are firmly seated on surfaces 71 and 72. This can be done without abrading the contact surfaces 66 and 67.

Claims

1. A tool for assembling a printed circuit card - (5) having a plurality of connector springs (6), and a housing (7) adapted to hold said connector springs, each of said connector springs having an arm (63) that is adapted to be soldered to a tab - (51) on the edge of said printed circuit card (5), and two contacts (66, 67) that form a slot for insertion of a male connector, characterized in that the tool comprises

a base plate (8) having a plurality of retaining means (82) positioned to coincide with the location of said connector springs (6) in said housing (7), and

a plurality of wedge shaped protrusions (81), one attached to said base plate (8) at each of said retaining means (82),

arranged such that said protrusions (81) can fit into said slots formed by said connector spring contacts (66, 67) and hold said connector springs (6) firmly in said housing (7) without abrading said contacts (66, 67) while said arm (63) is soldered to said tab (51).

2. A tool as in claim 1, where said connector springs (6) and said housing have interactive positioning means (61, 62; 71, 72) for holding said connector springs firmly in said housing.

3. A tool as in claim 1, where said retaining means comprise holes (82) in said base plate (8).

4. A tool as in claim 1, where said wedge shaped protrusions (81) are molded from fluoro-silicone rubber.

5. Use of a tool as claimed in claim 1 in a method for assembling a printed circuit card having a plurality of connector springs (6), and a housing - (7) adapted to hold said connector springs, each of said connector springs (6) having an arm (63) that is adapted to be soldered to a tab (51) on the edge of said printed circuit card (5), and two contacts - (66, 67) that form a slot for insertion of a male connector, characterized in that it comprises the steps of

inserting said connector springs (6) into holes in said housing (7) where said springs are held in an aligned position by interactive latching means (61, 62; 71, 72) of said springs (6) and of said housing holes, and

using said tool to hold said connector springs (6) firmly in said holes by pressing the protusions (81) of said tool against said contacts (66, 67) while said arms (63) are soldered to said tabs (51).

6. A tool for aligning and holding a plurality of electrical connectors (6) firmly in holes in a housing (7), each of said connectors having two contact surfaces (66, 67) adapted to receive a male connector, said tool being characterized in that it comprises

a base plate (8) with hour-glass shaped holes (82) therein, the position of said holes coinciding with the position of the holes in said housing, and

a fluoro-silicon rubber mold having a plurality of wedge shaped protrusion (81), one for each of said electrical connectors (6), said rubber mold extending (81A) into the holes (82) in said base plate (8), whereby said mold is held firmly to said base plate,

arranged such that said tool can align and firmly

hold said connectors (6) in said holes without abrading the contact surfaces (66, 67) on said connectors (6).

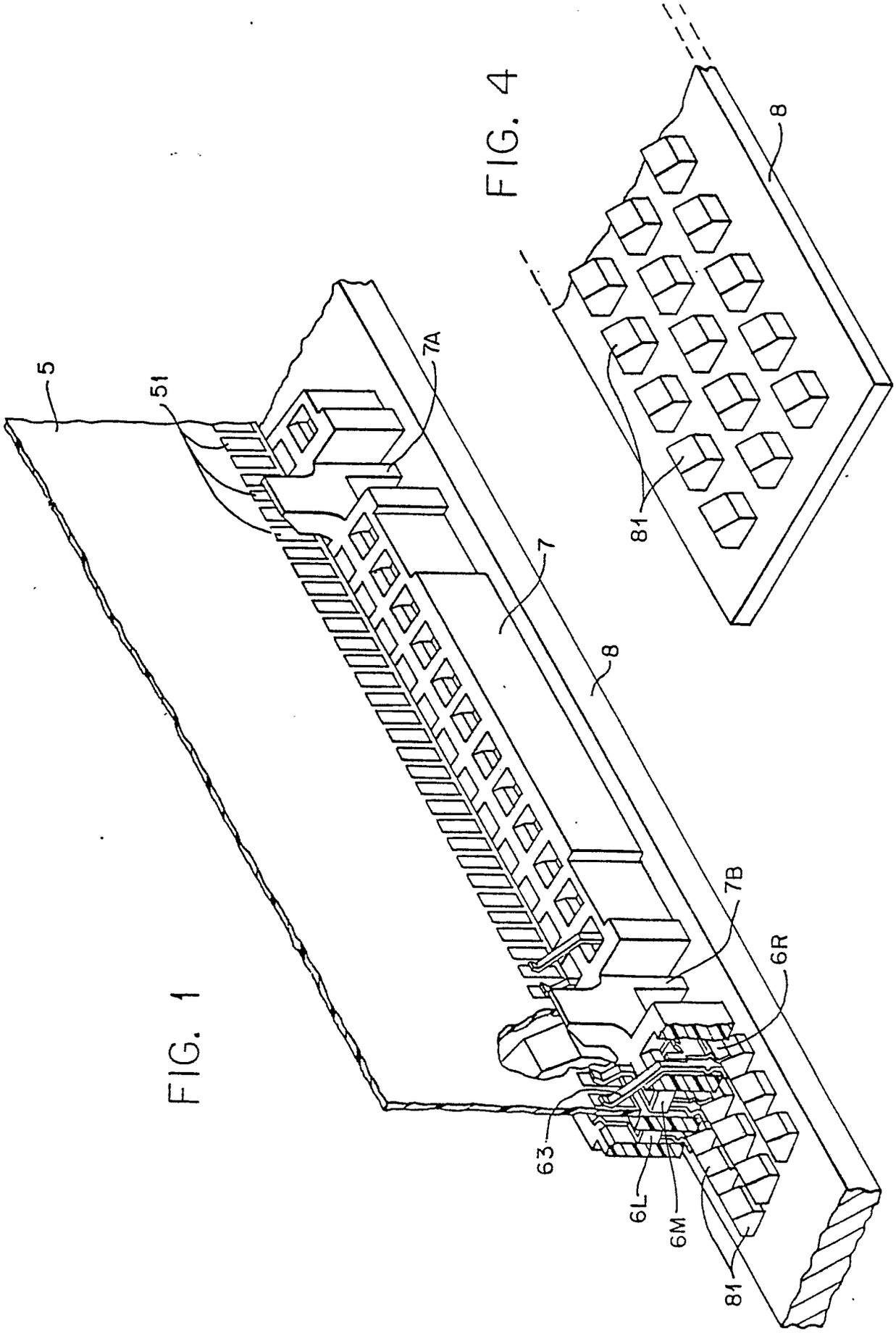

FIG. 1

FIG. 4

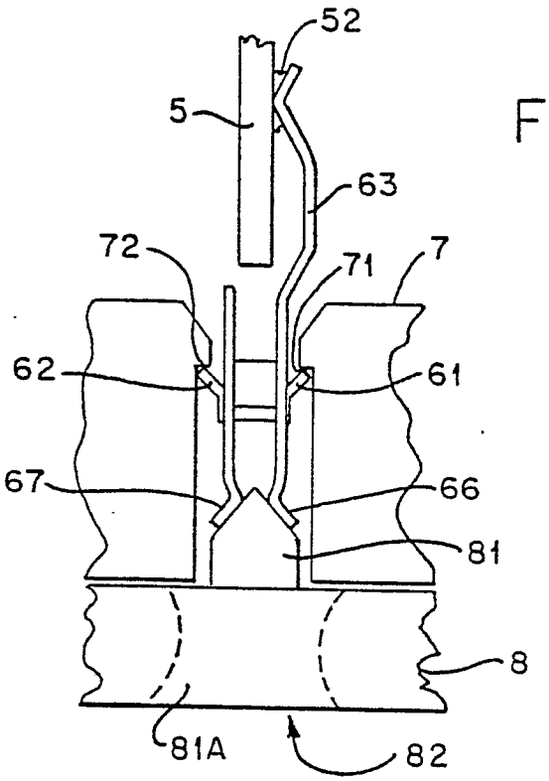
52
5
63
72
71
7
62
61
67
66
81
8
81A
82

FIG. 2

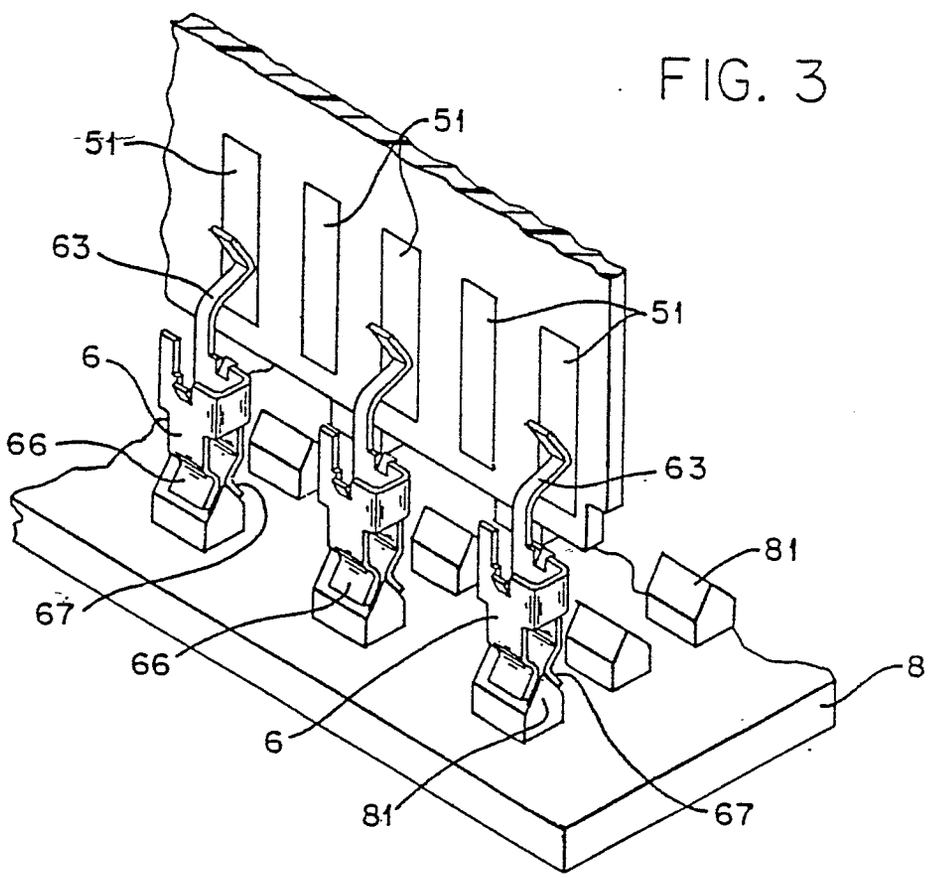
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FIG. 3