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GB 2113018 A EP 0083862 A2

(58) Field of search
UK CL (Edition K) H2E ECAA
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(54) Electrical connectors for flat insulated boards

(57) An electrical connector (10) comprises an insulating housing having at least one row of terminal pins (15) secured in the housing and extending outwardly from one side of the housing, spaced latch members (16, 17) at the ends of the housing and extending in the same direction as the terminal pins, and protuberances (16a, 17a) at the outer ends of at least one of the latch members to keep the contact pads on a flat insulated board from touching the terminal pins (15) until the flat insulated board is fully inserted between the spaced latch members, when the terminal pins are electrically engaged with the contact pads. In the fully inserted position the protuberances fit into openings in the board.

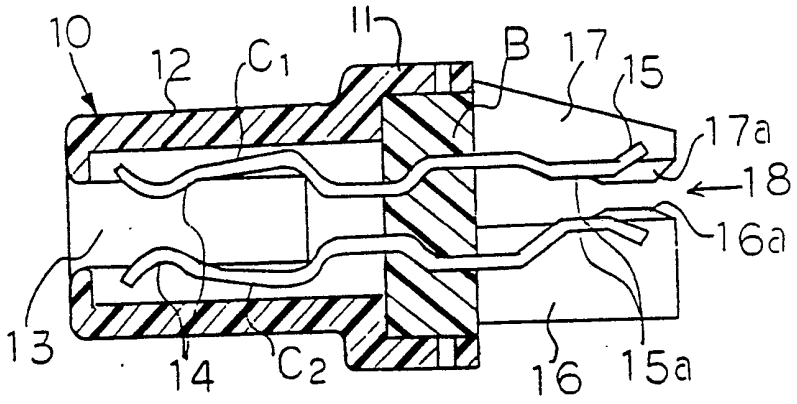

Figure 1D

GB 2 242 579 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

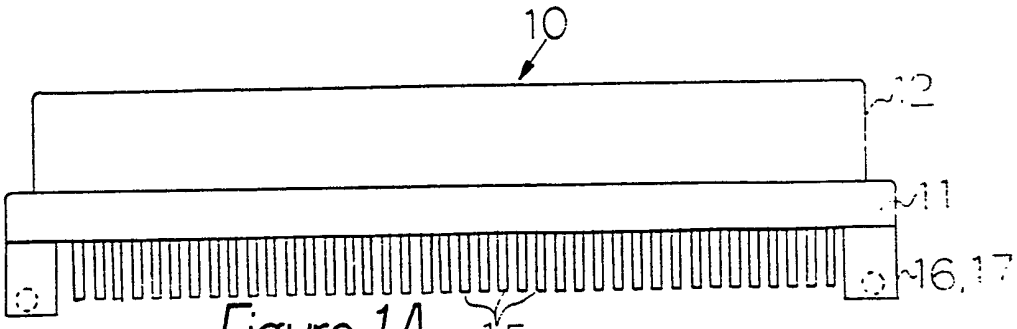

Figure 1A

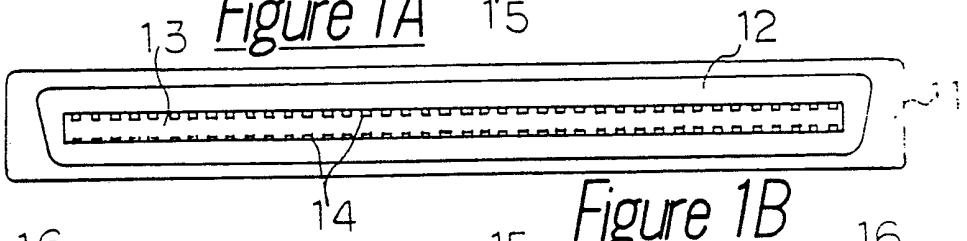

Figure 1B

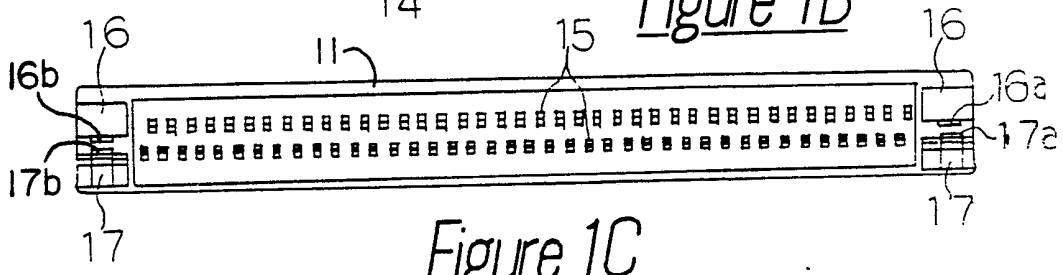

Figure 1C

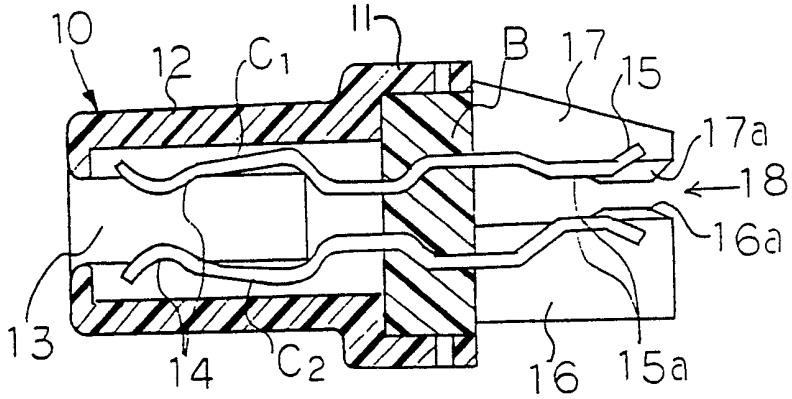

Figure 1D

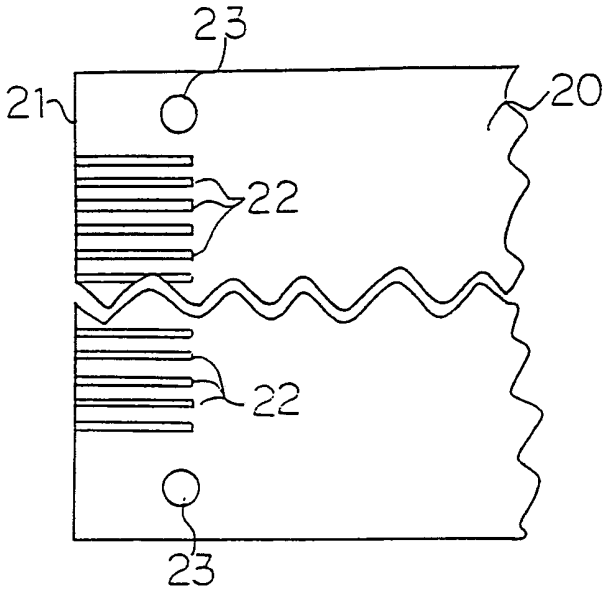

Figure 2

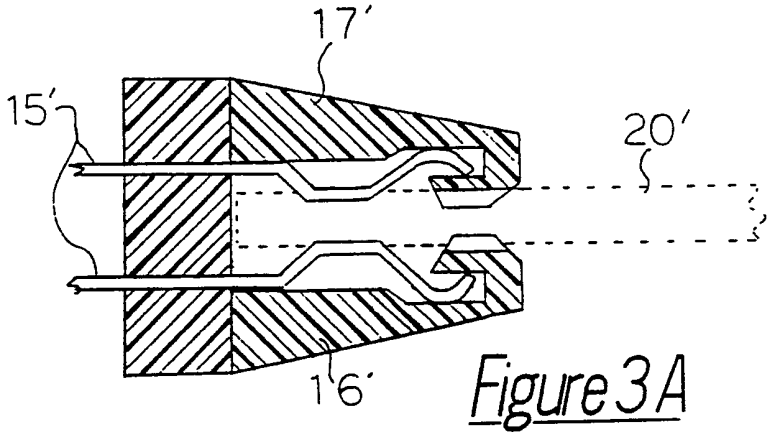

Figure 3A

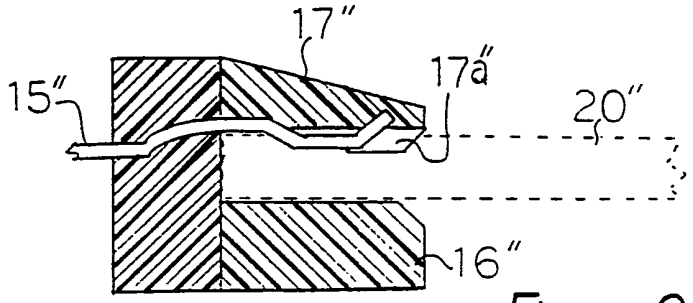

Figure 3B

TERMINAL CONNECTING DEVICE

The present invention pertains to terminal pin electrical connectors, particularly connectors for connecting contact pads formed near the edge of flat insulated boards, with multiple terminal leads such as edge connectors.

Various types of electrical and electronic equipment and applications involving electronic devices include printed circuit boards or substrates (referred to below as insulated board materials, or simply as boards) which incorporate a variety of active and passive electronic components and devices. A variety of electrical connectors are used to make connections between these insulated boards; edge connectors, in particular, are widely utilized.

When connecting the multiple terminal pins of such connectors to contact pads near the edge of insulated boards they are generally either individually soldered, simultaneously flow soldered, or, in some instances, individually welded by laser, etc. However, individual soldering or welding is time consuming and has the disadvantage of increasing manufacturing/assembly costs. Flow soldering resolves this problem by making all the connections at once. It is, however, very difficult or impossible to flow solder terminal pins to contact pads formed on two surfaces.

Recently, a reflow method of soldering has been developed which coats the conductive surface which is to be connected with an extremely thin, approximately 20μm layer of solder paste, mounts the devices with terminal pins being positioned on the coated conductive surfaces and solders them in place with the application of soldering heat. This surface mount technology (SMT) is becoming more and more prevalent. Because this reflow method resolves the problem described above, it is considered an effective connection technique.

Nevertheless, because the solder paste layer noted above is extremely thin, when the connector is inserted and joined to the insulated board, the terminal pins can scrape off the solder paste. Thus, even after being heated, this may result in an imperfect solder connection and reduced reliability. In particular, in the case of terminal pin connections with miniature high density connectors which utilize a high density array of very small contacts, due to the fact that during insertion some force must be applied to the pins which are to be soldered, soldering imperfections have become a serious problem.

Consequently, the purpose of the present invention is the provision of a high reliability terminal pin connection device which effects a sure electrical connection with contact pads by preventing the terminal pins from scraping off the solder paste layer during insertion and connection.

An additional purpose of the present invention is to provide a high reliability edge connector that establishes good electrical connections with contact pads.

In order to resolve the problems noted above and achieve the stated objectives, the terminal pin connecting device of the present invention consists of a protruding latch which is formed on the side surfaces of the insulated housing which encloses the rows of terminal pins and which is positioned in relation to the pins so that when an insulated board with contact pads is inserted into the terminal portion of the device this latch effectively holds the pins away from the surfaces of the contact pads.

When an insulated board possessing contact pads is inserted into the insulated housing with terminal pins, the leading edge of the insulated flat board meets the latch portion protruding from the terminal pin surface

of the insulated housing and effectively keeps the contact pad surfaces of the board away from the rows of terminal pins. Because of this, the terminal pins do not scrape away solder paste due to the fact the insertion is accomplished without the pins actually touching the solder paste layer coating the surfaces of the contact pads.

Once the insulated board has been completely inserted, the front edge of the protruding latch fits into an indentation, opening or cut-out formed in the board and the terminal pins make contact elastically with the solder paste surfaces of the contact pads. Subsequently, when by the application of heat the solder paste is melted, a perfectly soldered connection can be obtained between the terminal pins and contact pads.

As noted above, at the time the insulated board is inserted, because the terminal pins are in fact not touching the solder paste surfaces, there is no possibility of the solder paste layer being scraped away. Consequently, by the application of heat after insertion is completed, the terminal pins and contact pads are successfully soldered together, and there is no danger of solder bridges, etc. being formed between adjacent terminal pins by solder paste which had been scraped away. This is particularly beneficial when applied in the case of pin connections of very small scale, high density edge connectors, etc.

The present invention will be explained in detail below by way of example with reference to the attached drawings, in which:-

FIGURES 1A-D are a top plan view, front elevational view, rear elevation view and an enlarged cross-sectional view of a terminal pin connector device in the form of an edge connector of the present invention;

FIGURE 2 is a part top plan view showing the essential features of a flat insulated board with contact pads for edge connector connections; and

FIGURES 3A and B are cross-sectional views of alternative embodiments of the connector.

As shown in Figures 1A and B, edge connector 10 possesses a long narrow insulated housing made up of a rectangular main housing body 11 with a portion extending upwards, and internal opening 13 as well as a D-shaped contact cover 12 which has two rows of contacts 14. Connector 10 has two rows of terminal pins 15 protruding from the back side of the main body 11. These pins 15, as will be discussed below with reference to Figure 2, are to be electrically connected by soldering with contact pads formed near the edge of both surfaces of an insulated flat board.

As shown in Figure 1C, the two rows of terminal pins 15 are arranged in a high density, staggered alignment. On both ends of main body 11, latches 16 and 17 are placed opposite each other corresponding to the arrangement of terminal pins 15 and positioned to extend further out from the side of main body 11 than the tips of terminal pins 15. On the opposing surfaces of latches 16 and 17 tapered circular latching protuberances 16a and 17b are formed.

As shown enlarged in Figure 1D, the insulated housing of edge connector 10 is of two-piece construction. In base section B, insert molded multiple conductor parts C1,C2 are held in the upper and lower levels. The left side of base section B might be, for example, receptacle (female) contacts 14, while in opening 13 a plug (male) connector or printed circuit board with contact pads can be inserted to make matable electrical connections.

To the right of conductors C1,C2 are located the terminal sections 15 which are to be connected to the

contact pads of the insulated board. These terminal pin sections 15 are also formed with upper and lower parts, each having roughly parallel solder connection areas 15a. The gap 18 between the terminal pins 15, arranged along the upper and lower sections, is approximately the same as the thickness of the insulated board to be inserted in it. Latches 16,17 at both ends of the terminal pins section 15 are higher than each of the pins 15 and have at their tips, for example, tapered circular protuberances 16a and 17b extending into the gap. For this reason, the gap at the tips of latches 16 and 17 is narrower.

Figure 2 is a top plan representation of a section of insulated board 20 which is to be inserted into gap18 of edge connector 10 shown in Figure 1. On both surfaces of insertion edge 21 of this board 20 multiple contact pads 22 are formed with a pitch or spacing corresponding to the terminal pins 15 of connector 10. Not indicated is the fact that either the complete surfaces or the connection areas of each of the contact pads 22 is coated with a thin layer of solder paste approximately 20μm thick. This solder paste is the well-known mixture of solder and flux. Also, openings 23, for example roughly circular openings, are formed in the board 20 at positions corresponding to protuberances 16a and 17a of latches 16 and 17.

When the edge 21 of insulated board 20 is inserted into the gap 18 between terminal pins 15 of connector 10, since the leading edge of board 20 first comes into contact with protuberances 16a and 17a, the larger protuberance 17a deflects board 20 more than smaller protuberance 16a. Consequently, the solder paste layer is not scraped away because terminal pins 15 are kept away from the contact pads 22 on the upper surface of insulated board 20. However, when board 20 is fully inserted into the gap, protuberances 16a and 17a fit

into openings 23 on board 20 and terminal pins 15 make contact with contact pads 22 and the solder paste layer on the surfaces of the pads. When heated in this state, the solder paste coating melts and the terminal pins 15 and contact pads 22 on the upper side are soldered together to make the connection. Electrical connection between the terminal pins 15 on the lower side and the contact pads 22 on the lower surface (not shown in the figure) can then be batch soldered with the conventional flow solder method.

Due to the fact that latches 16 and 17 are designed to keep terminal pins 15 on the reflow solder connection side away from the solder paste layer on contact pads 22 when insulated board 20 is pushed in during insertion, protuberance 16a on the latch 16 side is not essential. Nevertheless, since both protuberances 16a and 17a by fitting into openings 23 serve to strengthen the connection between terminal pins 15 and contact pads 22 on the board 20 after soldering, it is desirable to have at least a small protuberance 16a.

Figures 3A and B show other practical examples of the terminal pin connection device of the present invention. In Figure 3A, latches 16' and 17' are formed to receive the free ends of terminal pins 15'. Free ends of terminal pins 15' are inserted and held along the inner walls defining slots of the latches 16' and 17'. Then, by forming protuberances on the opposing surfaces of the end portions of latches 16' and 17', when flat board 20' is inserted, the interval between the terminal pins is enlarged, and it is possible to very effectively prevent contact with, and the scraping away of the solder paste layer on the surfaces of the contact pads. As a result, terminal pins 15' on both sides can be connected by reflow soldering techniques.

Figure 3B shows another example of a terminal pin connection device wherein the contact pads on one side

of a flat insulated board 20'' are connected with one row of terminal pins 15'' using reflow soldering techniques. In this case also, only the inner surface of the end portion of latches 17'' have protuberances 17a''. In other respects since this is the same as in Figure 1, a detailed explanation is omitted here.

In the foregoing, the terminal pin connection device of the present invention was explained using the example of it being used for an edge connector, but the invention is in no way limited to only this example. It is understood that it is possible for there to be various changes and transformations. For instance, the present invention could easily be applied to the connectors for IC cards which have gold plated contact pads and which must undergo multiple insertions and removals: a soldered connection is not an essential or required element. Similarly, opening 23 might also be an indentation or notch in the surface of the flat insulated board.

CLAIMS:

1. An electrical connector for electrical connection with contact pads on a flat insulated board, comprising:

an insulating housing having at least one row of terminal pins secured in said housing and extending outwardly from one side of the housing;

latch members at the ends of the housing and extending in the same direction as the terminal pins and being spaced from each other; and

protuberances at the outer ends of at least one of the latch members to keep the contact pads on the flat insulated board from touching the terminal pins until the flat insulated board is fully inserted between the spaced latch members whereby the terminal pins are electrically engaged with the contact pads.

2. An electrical connector as claimed in claim 1, wherein protuberances are located at the outer ends of the latch members and opposed to one another.

3. An electrical connector as claimed in claim 2, wherein the protuberances on one of the latch members are higher than the protuberances on the other of the latch members.

4. An electrical connector as claimed in claim 1, 2 or 3, wherein two rows of terminal pins are secured in said housing and the outer ends of the latch members have inner walls defining slots in which free ends of the terminal pins are disposed.

5. An electrical connector as claimed in any preceding claim, wherein the protuberances are disposed into openings in the flat insulated board.

6. An electrical connector for electrical connection with contact pads on a flat insulated board, constructed substantially as hereinbefore described with reference to Figures 1A-D and 2 or Figures 3A-D of the accompanying drawings.

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