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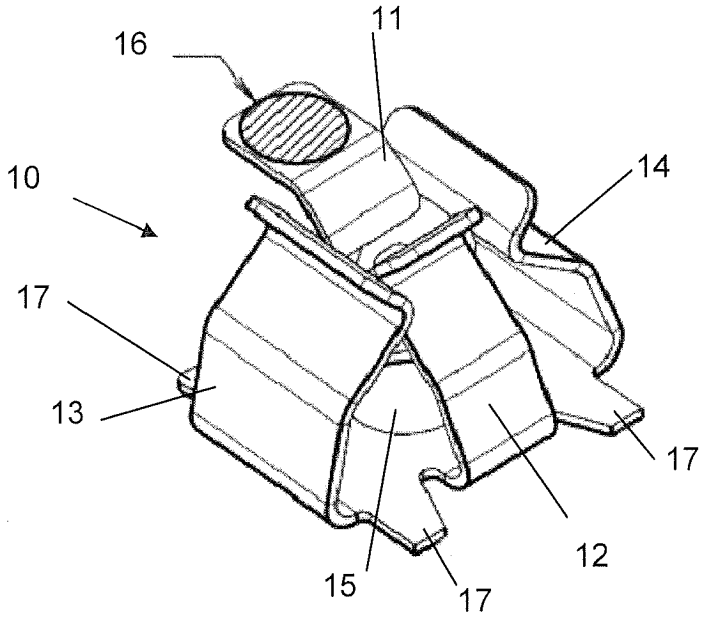
(54) Electrical contact and method of manufacture of electrical contact

(57) A surface mount female electrical contact is provided, comprising a socket for receiving an electrical pin, the socket comprising a base and a plurality of contact fingers extending upwardly from the base to form electrical connection with the male electrical pin, the socket further comprising at least one guide member extending upwardly from the base to position the electrical pin when received from above the socket. A method of manufacturing a female contact is also provided, comprising: providing a flat conductive sheet; stamping a base portion in the sheet; stamping the sheet with a plurality of contact fingers, and a plurality of guide members; bending the plurality of contact fingers upwards away from the base portion towards each other; and bending the plurality of guide members upwards away from the base portion towards each other.

FIG. 1



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Description

[0001] The present invention relates to electrical contacts and a method of manufacture of such contacts.

[0002] An electrical connection can be made between two electrical devices usually using a male and female electrical contact. One part of the connection has a male contact with an electrical pin and the other part is a female contact in the form of a socket for receiving the male contact.

[0003] Known male and female contacts include a tubular shaped contact section which has a square or circular cross section and receives a conducting portion of a male contact. The forces exerted by the conducting portion of the male contact on the contact section can vary in such configurations and affect the stress /strain of the contact section thereby affecting the performance and durability of the connector.

[0004] According to a first aspect of the invention, a female electrical contact is provided comprising a socket for receiving an electrical pin, the socket comprising a base and a plurality of contact fingers extending upwardly from the base to form electrical connection with the male electrical pin, the socket further comprising at least one guide member extending upwardly from the base to position the electrical pin when received from above the socket. Preferably, there are a plurality of guide members. At least one of the contact fingers may comprise a planar portion on which a pick and place tab is located.

[0005] This provides a way to guide a male pin in a female contact which does not require a moulding and/or another separate method of a alignment. In this embodiment, this is achieved by an integrated guide means.

[0006] The socket contact is preferably bent up from a single sheet-metal blank to form a resilient, rectangular, pin receiving portion, the pin receiving portion comprising two contact fingers formed by bending two oppositely positioned fingers from the blank towards each other, and the pin receiving portion further comprising two guide members formed by bending two oppositely positioned fingers from the blank towards each other. At least one of the contact fingers or the guide members may comprise a planar portion on which a pick and place tab is located.

[0007] From a second aspect, the present invention provides a method of manufacturing a female contact, comprising: providing a flat conductive sheet; stamping a base portion in the sheet; stamping the sheet with a plurality of contact fingers, and a plurality of guide members; bending the plurality of contact fingers upwards away from the base portion towards each other; and bending the plurality of guide members upwards away from the base portion towards each other. With this method, a female contact can be made using a bending and cutting process from a single sheet of material. This provides ease of manufacture and single piece construction for automatic placement on to a printed circuit board (PCB).

[0008] In use, a mating male pin is aligned to mate with the two contact points using the guide members.

[0009] From a third aspect, a PCB is provided comprising a female contact as defined hereinbefore, wherein the contact is positioned on the surface of the PCB.

[0010] Embodiments of the invention will now be provided by way of example only with reference to the drawings in which:

Fig.1 shows a perspective view of a contact according to a first embodiment;

Fig. 2 shows a view of the contact of Fig. 1 from above;

Fig. 3 shows a cross-sectional view of the contact of Fig. 2 taken from line X-X;

Fig. 4 shows a cross-sectional view of the contact of Fig.2 taken from line Y-Y;

Fig. 5a shows a partial cross-sectional first side view of a printed circuit board and a contact of Fig. 1 with the contact positioned on the PCB, and a partial cross-sectional side view of another printed circuit board and an electrical pin, with the contact having received the pin from above.

Fig. 5b shows a second side view of the arrangement of Fig. 5a taken from another side to that of Fig. 5a;

Fig. 6a shows a partial cross-sectional first side view of a printed circuit board and a contact of Fig. 1 with the contact positioned on the PCB, and a partial cross-sectional side view of another printed circuit board and an electrical pin, with the contact having received the pin from below.

Fig. 6b shows a second side view of the arrangement of Fig. 6a taken from another side to that of Fig. 6a;

Fig. 7 shows a perspective view of a reel housing a plurality of contacts of Fig. 1.

[0011] A contact of a first embodiment is described with reference to figures 1 and 2. The contact 10 is formed from a single flat conductive sheet having two fingers of similar width which are bent upwardly to form two oppositely located contact fingers 11,12. Two guide fingers 13,14, each having a relatively larger width to the contact fingers are formed in the flat conductive sheet and bent upwardly to form oppositely located guide members. The guide members 13,14 are wider to assist in protecting the contact members 11,12 when a male pin is inserted into the contact 10 from above and can prevent the contact 10 tipping over when packaged, for example, in tape and reel packaging (see Fig. 7). The contact fingers 11,12 and guide members 13,14 extend from the edge of a

base of the contact 10. The contact 10 has a hole 15 in the base of the contact which can align with a corresponding hole in a printed circuit board on which the contact is to be surface mounted. Thus, the contact 10 is a surface mountable contact rather than being designed to be pressed into a hole or slot.

[0012] When viewed from above as in Fig. 2, a rectangular cross section is formed between the inners edges of the two contact fingers 11, 12 and two guide members 13, 14. With this type of configuration, it is possible to use this female contact 10 to receive different types of male pin such as those with a square, rectangular or circular cross section. Typical cross sectional sizes of male pins are 1 mm square pins, 1 mm x 0.2-1.6mm rectangular pins, or 1-2mm diameter circular pins. The configuration can accept male pins of numerous pin sizes.

[0013] The guide members 13, 14 are resilient in the sense that they can be moved outwards from their default position when a male pin abuts them but return to their default position when the force of the pin is removed.

[0014] The conductive sheet may be formed of any suitable conductive material such as phosphor bronze alloy. It may be coated with a suitable material such as tin or nickel.

[0015] The base of the contact 10 has legs 17 extending outwardly from the side of the base on which the contact fingers 11, 12 are located for positioning on a PCB. In this particular embodiment, there is a pair of legs on each side of the base. It will be appreciated that the number of legs could be varied if required.

[0016] Referring to fig. 3, in order to form the two contact fingers 11, 12 in this embodiment, they are upwardly formed by being bent generally inwards from the base of the contact 10 towards each other until a contact point A at which they are a distance which is where a male pin would electrically couple to the contact fingers 11, 12, and the contact fingers are at this point bent outwards away from each other. Referring particularly to finger 11, a first part 11 a of the finger is bent in at an acute angle *a* to the base on the contact, a second part 11 b of the finger is bent further inwards at a further point B at an obtuse angle to part 11 a about that point B towards the base until the contact point A where a third part 11c of the finger is bent outwards forming an angle b which is typically ninety degrees but can be any angle which allows a sufficient contact point A with a male pin. It will be understood that the other contact finger 12 will have a similar configuration to the finger 12. However, one of the fingers and in this particular embodiment finger 11 has a fourth part 11 d that is bent to be substantially parallel to the base of the contact 10. This is a pick and place area 16 and enables a pick and place vacuum nozzle (not shown) to automatically place the contact 10 on to a solder pad on a PCB.

[0017] Referring to fig. 4, the guide members 13,14 are formed in a similar manner to the contact fingers 11,12 in that they are bent generally inwards from the base of the contact 10 towards each other to form upwardly standing members. At a point C where the members 13, 14 are directly adjacent the contact fingers 11, 12, they are bent outwards to form a generally "L" shape portion similar to the contact fingers 11, 12. Referring particularly to guide member 13, a first part 13a of the member is bent in at an acute angle c to the base on the contact, a second part 13b of the member is bent further inwards at a further point D at an obtuse angle to part 13b about that point D towards to base until the point C where a third part 13c of the member is bent outwards forming an angle d which is typically ninety degrees but can be any angle which provides sufficient guidance to the male pin to allow self centring of the male pin. It will be understood that the other guide member 14 will have a similar configuration to the member 13. The arrangement of the fingers 11, 12 and guide members 13, 14 allows for self centring of a male contact in an X and Y direction i.e. along two axes.

[0018] The bends circled on figs. 3 and 4 (at points B and D) allow additional over-bend correction to be added if required during the stamping process which is advantageous to this design process. The bends allow for fine adjustments to be made in tooling to correct any spring back variation that will occur in different base metals that this contact may be made out of. This contact 10 could be made from a variety of metals; stainless steel, beryllium copper, brass and phosphor bronze and plated in nickel, tin over nickel silver over nickel and gold over nickel.

[0019] Referring to figs. 5a and 5b, the contact 10 is shown attached to a PCB 20. A male pin 30 with a rectangular cross section is attached to another PCB 40. In the figures, the male pin 30 has been received by the contact 10 from above (direction C) and is in the coupled position. The guide fingers 13,14 have served to self-centre the male mating pin when the pin is inserted from above. The male pin is electrically contacted at contact point A with the contact fingers 11,12. The hole 15 in the base of the contact 10 is not required for the contact operation, although it does allow a variety of male pin lengths to be accommodated. The contact 10 would still self-centre without the male pin 30 passing through the hole 15 in this configuration.

[0020] Referring to figs. 6a and 6b, a different form of connection between the contact 10 and male pin 30 of figs. 5a and 5b is shown. However, the contact 10 is still capable of providing the same functionality as in figs. 5a and 5b. In figs. 6a and 6b, the male pin 30 is received from below (direction D) the contact 10. The hole 15 in the base of the contact 10 receives the male pin 30 and male pin passes through the centre of the contact 10 and is exposed above the contact 10. The guide members 13,14 self-centre the pin 30 whilst the contact fingers 11,12 form the electrical contact with the pin 30 at contact point A.

[0021] Referring to fig. 7, a number of contacts 10 can be stored in a reel 50 and each contact can be easily picked from the reel using a vacuum nozzle because of

the pick and place area 16 provided on the contact.

[0022] The contact 10 is capable of being manufactured using a cold forming process where the contact material can harden during a stamping process and the properties of the material can change to improve the material's spring properties and to better define the bend points of the contact fingers and guide members.

[0023] As mentioned above, the contact 10 is surface mounted to the surface of a printed circuit board, for example. In order to electrically connect the contact to the surface, soldering is normally required. In this embodiment, reflow soldering is used. This is a process in which a solder paste (a sticky mixture of powdered solder and flux) is used to temporarily attach the contact 10 to contact pads on a PCB, after which the entire assembly is subjected to controlled heat, which melts the solder, permanently connecting the joint. Heating may be accomplished by passing the assembly through a reflow oven or under an infrared lamp or by soldering individual joints with a hot air pencil. The goal of the reflow process is to melt the solder and heat the adjoining surfaces, without overheating and damaging the electrical components. In the reflow soldering process; there are usually four stages, called "zones", each having a distinct thermal profile: *preheat, soak*, *reflow*, and *cooling.* Reflow soldering can help to reduce PCB manufacturing costs by not having to drill holes in the PCB unlike other methods which require the PCB to be drilled to accept two solder pins.

[0024] It will be appreciated that the guide members are not limited to the particular configuration described above although this shape is advantageous. Modifications can be carried out to achieve the same effect of self-alignment using guide members integrated with the contact fingers that form the female contact.

Claims

1. A surface mount female electrical contact comprising a socket for receiving an electrical pin, the socket comprising a base and a plurality of contact fingers extending upwardly from the base to form electrical connection with the male electrical pin, the socket further comprising at least one guide member extending upwardly from the base to position the electrical pin when received from above the socket.

2. The contact of claim 1, wherein the socket comprises a plurality of guide members.

3. The contact of claims 2 or 3, wherein the contact fingers are positioned opposite each other and the guide members are positioned opposite each other.

4. The contact of any of claims 1,2 or 3, wherein the contact fingers and guide member extend upwardly from edges of the base.

5. The contact of any of claims 2 to 4, wherein the contact fingers and/or the guide fingers comprise a plurality of portions that are bent with respect to each other.

6. The contact of any preceding claim, wherein the base is provided with a hole.

7. The contact of any preceding claim, wherein at least one of the contact fingers or the guide member comprises an extension portion to enable pick up by a vacuum nozzle.

8. The contact of claim 7, wherein the extension portion is substantially parallel to the base member.

9. The contact of any preceding claim, further comprising a plurality of legs extending outwardly from the side of the base on which the contact fingers are positioned.

10. A method of manufacturing a female contact, comprising: providing a flat conductive sheet; stamping a base portion in the sheet; stamping the sheet with a plurality of contact fingers, and a plurality of guide members; bending the plurality of contact fingers upwards away from the base portion towards each other; and bending the plurality of guide members upwards away from the base portion towards each other.

11. The method of claim 10, wherein the contact fingers are positioned opposite each other and the guide members are positioned opposite each other.

12. The method of claim 10 or 11 wherein the contact fingers and guide members extend upwardly from edges of the base portion.

13. The method of any of claims 10, 11, or 12, further comprising forming a hole in the base portion.

14. The method of any of claims 10 to 13, wherein at least one of the contact fingers or the guide members comprises an extension portion to enable pick up by a vacuum nozzle.

15. A printed circuit board comprising a female contact according to any preceding claim, wherein the contact is positioned on the surface of the PCB.

FIG. 1

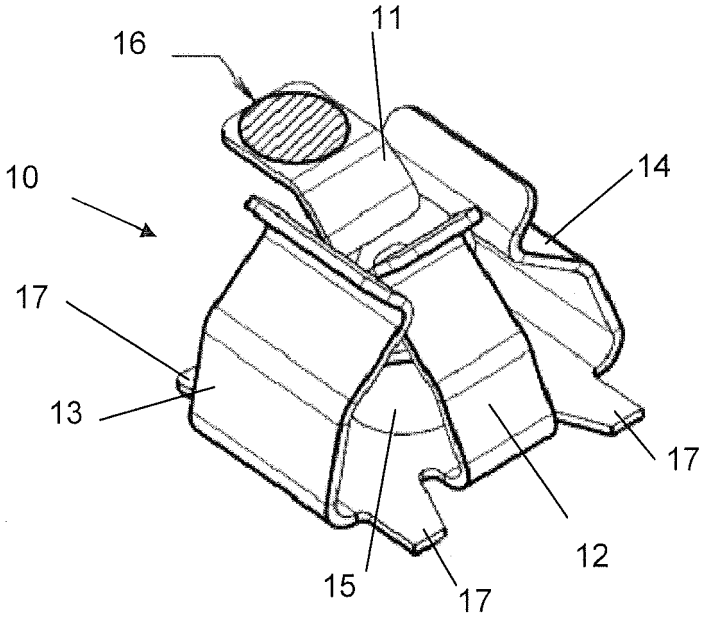
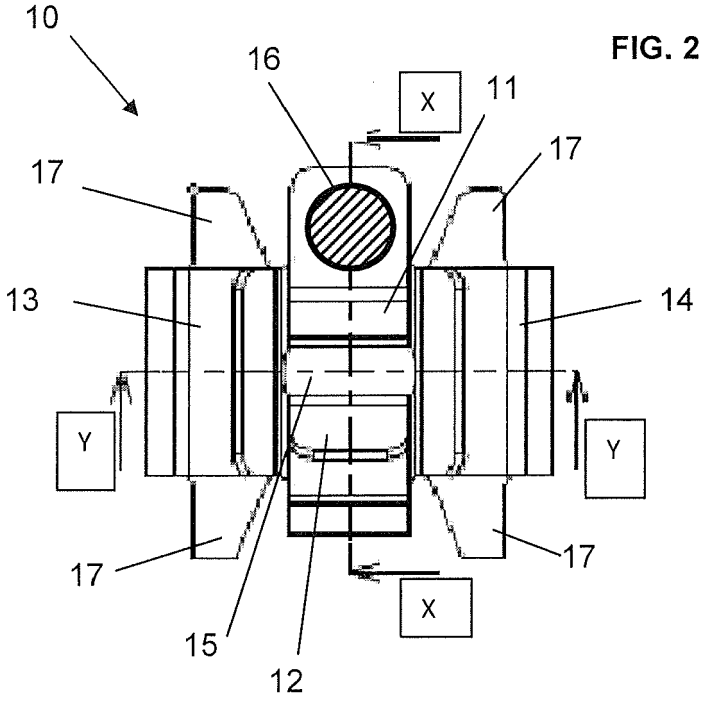


FIG. 2



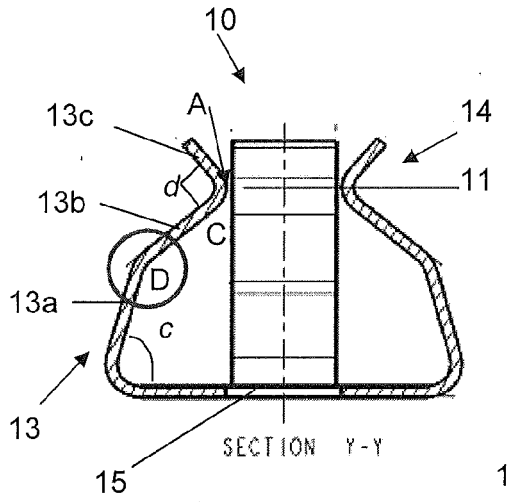


FIG. 4

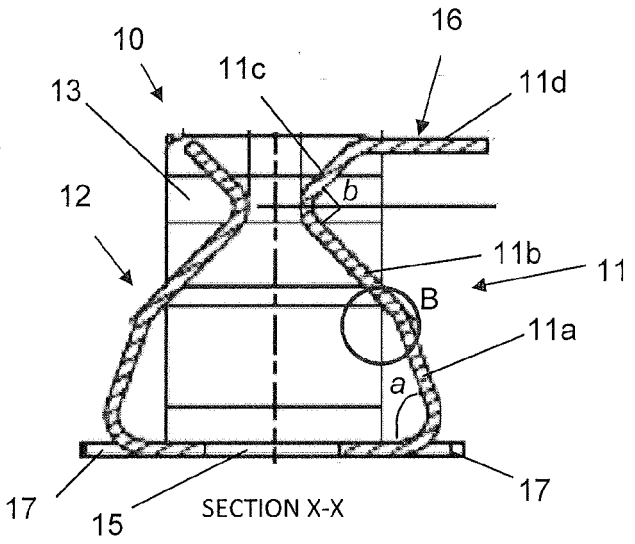


FIG. 3

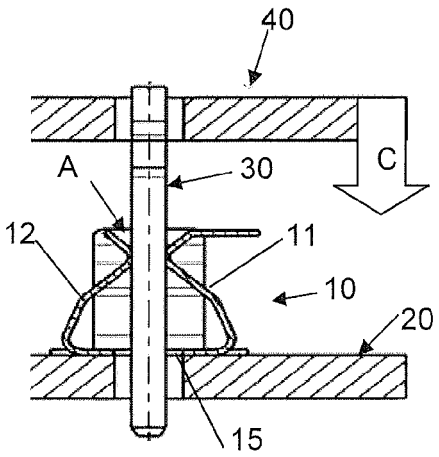


FIG. 5a

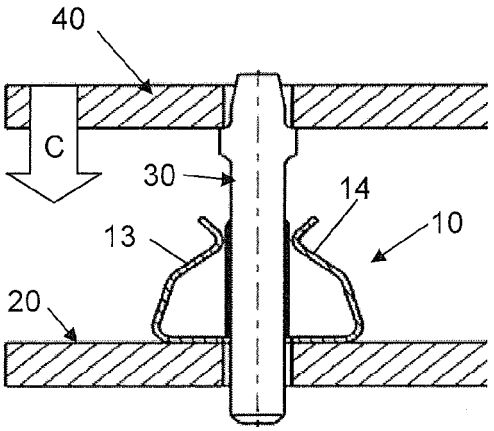


FIG. 5b

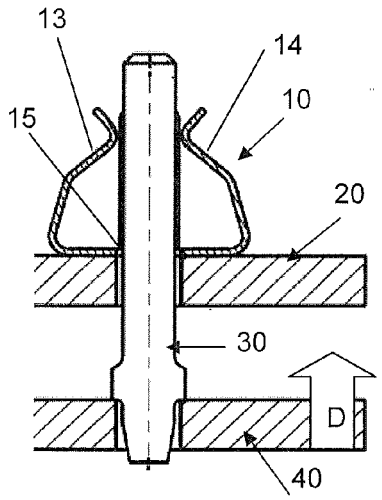


FIG. 6a

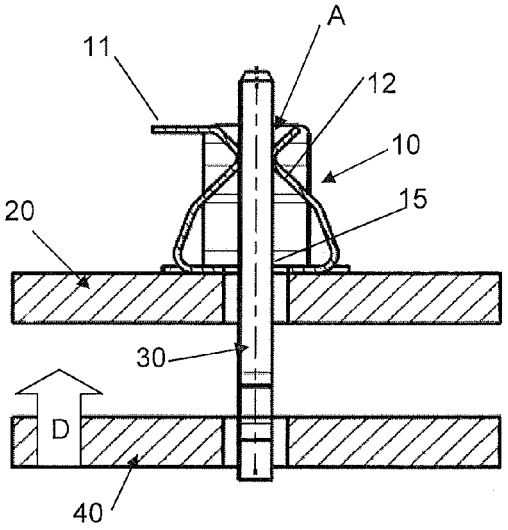


FIG. 6b

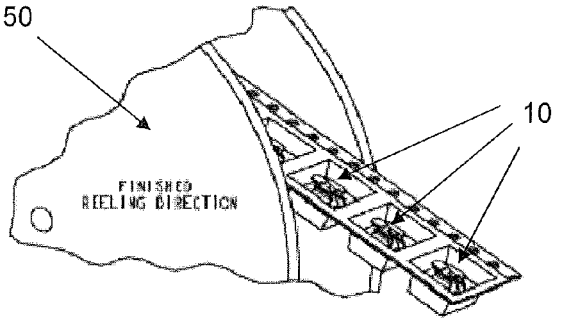


FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 12 16 5727

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 709 574 A (BIANCA GIUSEPPE [US] ET AL) 20 January 1998 (1998-01-20) * figures 1-6 * * column 3, line 1 - column 4, line 45 * -----	1-3,5-8, 10,11, 13-15	INV. H01R12/57 H01R12/52
X A	US 6 837 755 B1 (KITAJIMA YOSHIKAZU [JP] ET AL) 4 January 2005 (2005-01-04) * figures 1-5 * * column 1, line 47 - column 2, line 46 * * column 3, line 43 - column 5, line 33 * -----	1,7,9,15 4,5,14	
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TECHNICAL FIELDS SEARCHED (IPC)
H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 August 2012	Henrich, Jean-Pascal

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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