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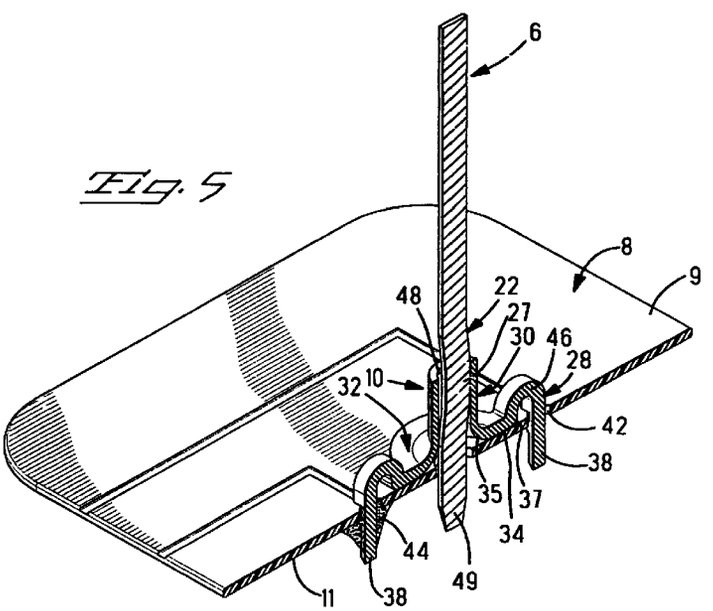
(54) Flexible circuit electrical connector assembly

(57) An FFC connector assembly (2) comprises a housing (4), a plurality of pin terminals (6) stitched or moulded to the housing, each of the pin terminals (6) having compliant contact sections (22) inserted into tubular contact sections (30) of terminals (10) pre-mounted and soldered to a flat flexible circuit (8).

Fig. 5



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Description

[0001] This invention relates to an electrical connector assembly for a flat flexible circuit, the assembly comprising an electrical terminal mountable on the flexible circuit.

[0002] Flexible circuits are used in a wide variety of electrical and electronic applications, the flexible circuit typically comprising a thin flexible substrate (e.g. of plastic material) on which are deposited conductive tracks or traces for interconnecting electrical components mounted on the flat flexible circuit (FFC) or interconnected thereto via connectors mounted on the FFC. Connectors may either comprise individual contacts that are soldered or crimped to the FFC, or a plurality terminals mounted in an insulative housing, each terminal comprising a connection section tail that is crimped or soldered to the FFC. The connection of connectors to FFC differs from certain connection techniques employed with substantially rigid circuit boards. For example printed circuit boards (PCB) are often provided with plated through-holes for reception of compliant pin connection sections of terminals, which do not need to be subsequently soldered. The latter connections are robust and durable. In addition, certain compliant pins provide good electrical contact without requiring soldering, and enable simple press-fit assembly.

[0003] It would desirable to provide a connection for FFC with the above mentioned advantages. It is therefore an object of this invention to provide a robust and durable electrical connection to FFC. It would be further advantageous to provide such connection in a manner that is simple to assemble. It would be advantageous to provide such connection without requiring soldering during assembly between a connector and the FFC.

[0004] Objects of this invention have been achieved by providing the FFC connector assembly according to claim 1. Disclosed herein is a FFC electrical connector assembly comprising a FFC terminal mountable on the FFC, the FFC terminal comprising a connection section for connection to the FFC, a base, and a contact section for receiving a compliant pin terminal contact section, wherein the base has a surface for resting against the FFC and the connection section extends therefrom and has a contact tail for electrically engaging circuit traces on the FFC, and the contact section extends substantially orthogonally from the base in the form of a tube defining a cavity therein for receiving in an interference fit the compliant pin terminal contact section.

[0005] The contact section tube may advantageously be of substantially cylindrical shape. The contact section tube may be open at an end proximate the base section in order to allow the pin terminal to project through the FFC. The FFC may be provided with a hole having a diameter smaller than the cavity of the contact section in order to prevent flux of solder into the contact section cavity. The connection section may be provided in the form of a contact tail provided with retention barbs for insertion and retention through holes of the FFC, the contact tail subsequently soldered to the FFC on a side thereof opposite to the contact section. Two or more contact tails of the connection section may be provided around the periphery of the base section for secure mechanical support to the FFC.

[0006] The base section may be provided with a substantially flat surface for abutment against the FFC, thereby providing, inter alia, a rest surface for abutment of a tool thereagainst during insertion of the compliant pin terminal sections into the cavities of the FFC terminals. The FFC terminals may thus be assembled and soldered to the FFC and subsequently pressed onto the compliant pin terminal contact sections of a connector in simple assembly steps. A simple die against which the FFC terminal base sections rest (via the FFC) provides a support against the force of insertion of the multiple pin terminals into the FFC terminals during assembly. Advantageously, the pin terminals may thus be pre-assembled (for example moulded or stitched) onto a connector housing and subsequently the FFC with the pre-assembled (soldered) FFC terminals connected to the compliant sections of the pin terminals.

[0007] The advantages of compliant pin terminals, in particular durability robustness and final assembly without soldering, are thus maintained. The latter also enables the FFC to be assembled within an enclosure of the connector assembly that may be difficult to access with soldering techniques.

[0008] Further advantageous aspects of the invention will be described in the claims, or will be apparent from the following description and drawings.

[0009] An embodiment of this invention will now be described by way of example with reference to the figures in which;

Figure 1 is a simplified cross-sectional view through a FFC connector assembly according to this invention;

Figure 2 is a perspective view of an FFC terminal of the assembly according to this invention, the FFC terminal mounted on an FFC and receiving a compliant pin terminal contact section;

Figure 3 is an exploded perspective view of the elements of figure 2;

Figure 4 is a perspective view viewed towards an opposite side of the FFC of figure 2;

Figure 5 is a cross-sectional perspective view of the assembly of figure 2.

[0010] Referring to figure 1 in conjunction with figures 2-5, a flat flexible circuit or cable (FFC) connector assembly 2 comprises a housing 4 and a plurality of terminals 6 mounted in the housing, and a FFC 8 connected to the connector terminals 6 via FFC terminals 10. The connector terminals 6 in this embodiment are pin terminals that may be mounted or stitched through a base wall 12 of the housing 4 which separates the con-

nector mating section 14 from the connector FFC connection section 16. The mating section 14 comprises a mating section housing 18 defining a cavity 19 for receiving a complementary connector therein having terminals for engaging mating sections 20 of the connector terminals 6.

[0011] Although in this embodiment the terminals 6 are preferably pin terminals, it is also possible to provide such terminals with mating sections in the form of conventional receptacle terminals matable with prior tab terminals. The terminals further comprise compliant pin terminal contact sections 22 extending into the FFC section 16 of the housing 4, which defines an enclosure 24 receiving the FFC 8 therein for enclosing and protecting the FFC. The FFC may be further connected to other electrical devices or connectors.

[0012] The compliant pin terminal contact sections in this embodiment advantageously comprise a pair of arcuate or outwardly bowed spring beams 26, 27 stamped in opposite directions from adjacent halves of a substantially square cross-section pin, as best seen in figure 3. This known compliant contact section for pin terminals is advantageously used for insertion through plated through-holes of substantially rigid printed circuit boards. Other conventional compliant contact sections formed from pin terminals are however known and could also be employed n the present invention.

[0013] Referring to figures 2-5, the FFC terminal 10 comprises an FFC connection section 28 interconnected to a pin terminal contact section 30 via a base section 32. The base section 32 has a substantially planar FFC support or bearing surface (see figure 5) 34 mountable contiguous the upper side 9 of the FFC 8, and extends between an inner periphery 35 to an outer periphery 37 which in this embodiment are substantially circular but which could also have other shapes (for example polygonal or rectangular). The FFC connection section 28 extends from the outer periphery 37 and comprises a contact tail 38 provided with retention barbs 40, the contact tails 38 for insertion through a hole 42 in the FFC 8, the contact tail 38 being soldered (see figure 5) with a solder fillet 44 to an underside 11 of the FFC 8. The retention barbs 40 secure and position the contact tails 38 to the FFC prior to soldering, as best seen in figure 4. The contact tails 38 extend substantially perpendicularly to the base section plane 34 and are interconnected to the outer periphery 37 of the base section through a U-shaped bridging portion 46 that loops over the upper side 9 of the FFC 8 in order to provide clearance between the base support surface 34 and the solder fillet 44 such that a stable close seating of the base section against the FFC is ensured, taking into account the flux action of molten solder.

[0014] The contact section 30 of the FFC terminal extends from the inner periphery 35 of the base section 32 in the form of a tube extending orthogonally to the base section 32 and defining a pin receiving cavity 48 receiving the compliant contact section 22, and in particular the compliant beams 26, 27 thereof in an interference fit therein. In this embodiment, the tubular cross-sectional profile is circular, but could also be provided in other cross-sectional shapes, for example polygonal or rectangular or elliptical. The circular shape is the simplest and enables the pin to be oriented in any angular position about its axis with respect to the FFC terminal. The FFC terminal 10 may be stamped and formed from sheet metal whereby the tubular pin terminal contact section 30 is deep drawn. The end of the tubular contact section 30 proximate the base section 32 is open and allows the tip 49 of the pin terminal 6 to project through the FFC 8 whereby the FFC is provided with a small hole 50 at the position of the pin terminal tip for this purpose. The hole 50 is small, in particular smaller than the cross-section of the pin terminal or the contact section cavity 48 in order to prevent flux of solder into the FFC contact section 48. The hole 50 is subsequently enlargend when the pin terminal tip 49 is pierced therethrough.

[0015] The FFC 8 can thus be pre-assembled with a plurality of the FFC terminals 10 which are then soldered to the FFC, and subsequently the FFC may be connected to the plurality of compliant contact sections 22 of the terminal 6 pre-mounted to the housing 4, in a single assembly step. No soldering thereafter is required however in certain application this is possible if desired. A robust and durable connection between FFC and terminals of a connector is thus provided, and in addition no soldering is required, in the final assembly of the connector.

Claims

1. A FFC electrical connector assembly comprising a FFC terminal (10) mountable on FFC (8), the terminal comprising a connection section (28) for connection to the FFC (8), a base (32), and a contact section (30) for receiving a compliant pin terminal contact section (22) of a terminal (6), wherein the base (32) has a surface (34) for resting against the FFC (8) and the connection section (28) extends therefrom and has a contact tail (38) for electrically engaging circuit traces on the FFC, and the contact section (30) extends substantially orthogonally from the base (32) in the form of a tube defining a cavity (48) therein for receiving in an interference fit the compliant pin terminal contact section (22).

2. The connector assembly of claim 1 wherein the base section (32) of the FFC terminal (10) is substantially planar and extends between an inner periphery (35) to an outer periphery (37) forming a substantially planar support surface (34) mountable contiguous the FFC (8).

3. The connector assembly of claim 1 or 2 wherein the connection section (28) of the FFC terminal (10)

comprises a contact tail (38) insertable through a hole (42) in the FFC (8) for soldering to an underside (11) of the FFC, the contact tail (38) interconnected to the base section (32) via a U-shaped bridging portion (46) that loops over an upper side (9) of the FFC (8).

4. The connector assembly of claim 3 wherein the connection section bridging portion (46) is integrally interconnected to an outer periphery (34) of the base section (32).

5. The connector assembly of any one of the preceding claims wherein the contact section (30) of the FFC terminal (10) is in the form substantially of a cylindrical tube.

6. The connector assembly of any one of the preceding claims wherein the FFC is provided with a small hole (50) substantially centrally positioned below the contact section (30) of the FFC terminal (10), the hole (50) being smaller than the cross-sectional surface area of the pin terminal (6) or contact section cavity (48), in order to prevent solder flux from entering into the cavity (48).

7. The connector assembly of any one of the preceding claims, wherein the assembly includes the FFC (8), a plurality of the connector terminals (6), and a housing (4) to which the terminal (6) are mounted.

8. The connector assembly of the preceding claim wherein the FFC (8) is received within an enclosure (16) on an FFC side (24) of the connector housing (4), and the terminals (6) are pin terminals stitched or moulded through a separating wall (12) of the housing (4) into a cavity (19) on a mating section (14) of the housing (4).

9. A method of assembling a FFC connector assembly (2) comprising the steps of:

providing an FFC terminal (10) as defined in any one of the preceding claims, an FFC (8) as defined in any one of the preceding claims, terminals (6) as defined in any one of the preceding claims, and a housing (4) as defined in any one of the preceding claims;
assembling the terminals (6) to the housing;
separately mounting and soldering the FFC terminals (10) to the FFC (8); and
subsequently inserting simultaneously a plurality of the compliant pin terminal contact sections (22) of the terminals (6) into a corresponding plurality of FFC terminals (10) soldered to the FFC (8).

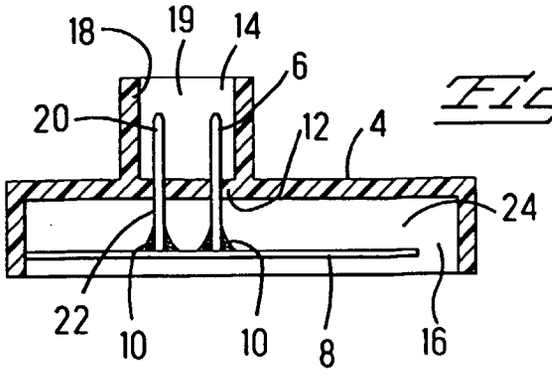

Fig. 1

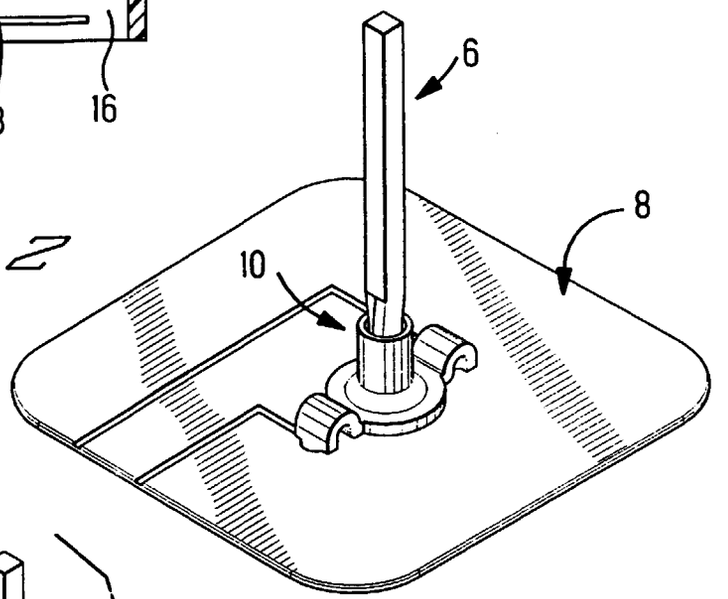

Fig. 2

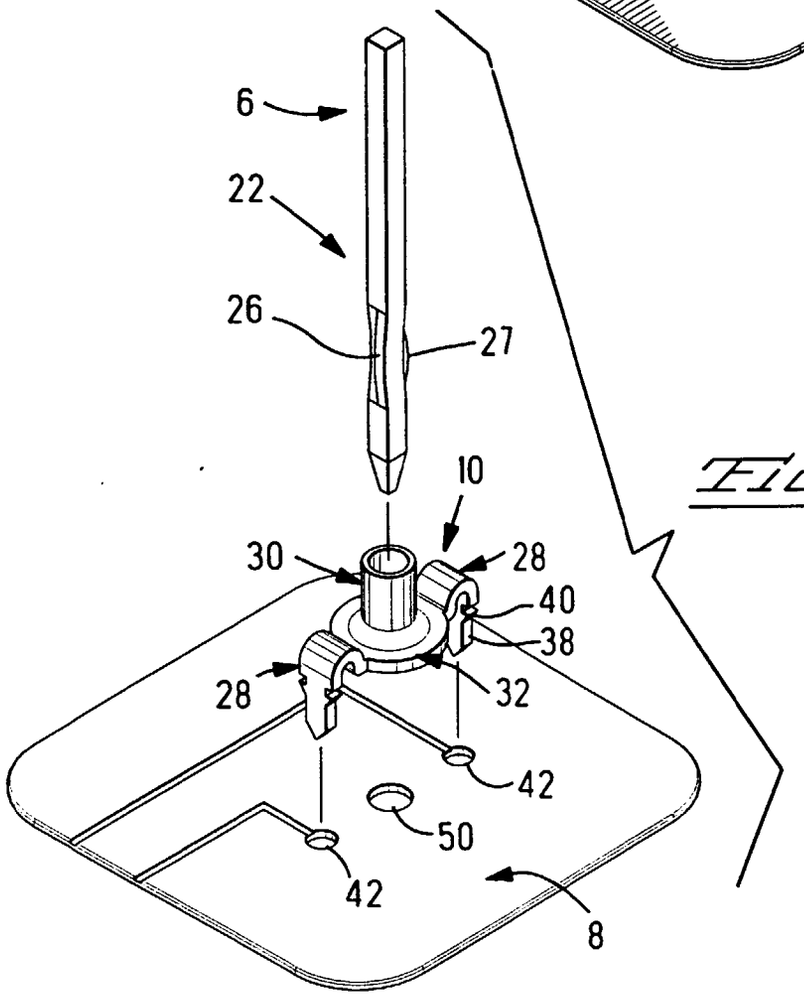

Fig. 3

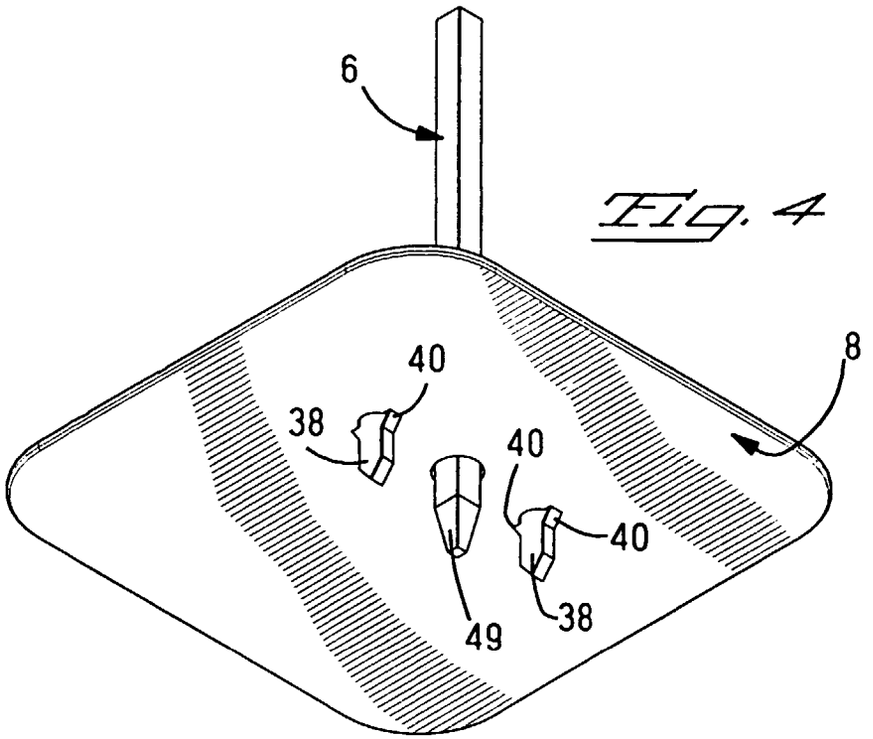
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Fig. 4

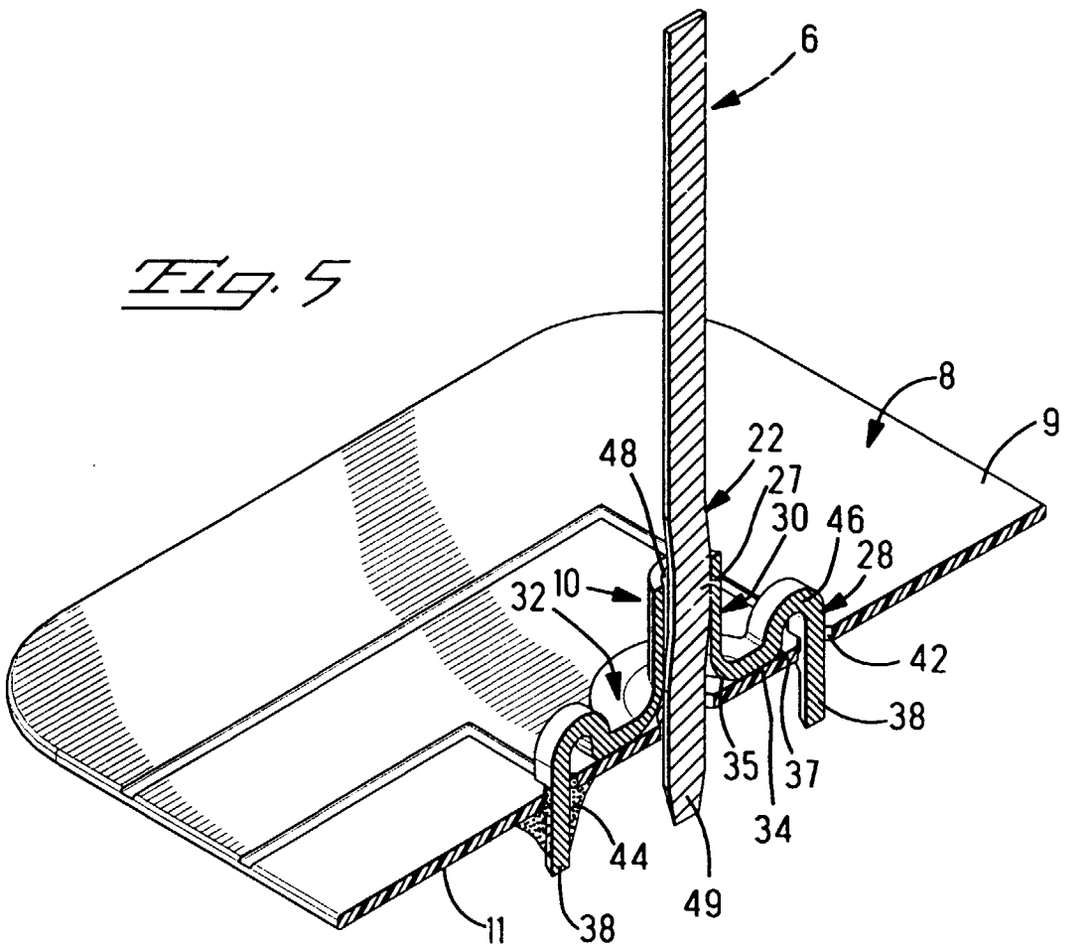
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Fig. 5