(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 147 039**
**A2**

# (12) EUROPEAN PATENT APPLICATION

(21) Application number: **84307650.6**

(51) Int. Cl.[4]: **H 01 R 23/70**

(22) Date of filing: **06.11.84**

(30) Priority: **13.12.83 US 561099**

(43) Date of publication of application:
**03.07.85 Bulletin 85/27**

(84) Designated Contracting States:
**AT BE CH DE FR GB IT LI NL SE**

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## (54) Surface mount connector.

(57) The invention disclosed herein is a connector (14) wherein the contact elements (24, 26, 28) include tail sections (32) on one end for being soldered to pads (62) on the circuit board (60). More particularly, the connector (14) carries three rows of contact elements (24, 26, 28) with the tail sections (32) extending out from the housing (22) at different lengths and in a pattern predetermined by the pad spacing and arrangement on the board.

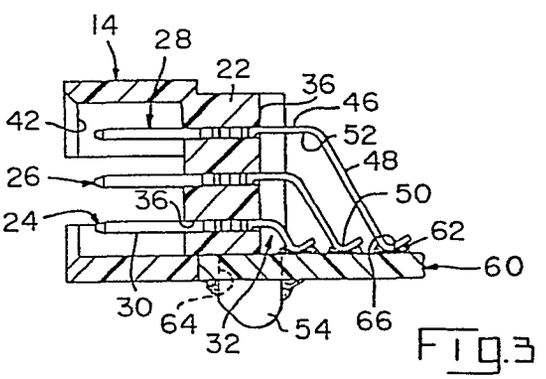


FIG.3

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# SURFACE MOUNT CONNECTOR

It is known from U.S. Patent 3,413,594 to provide a connector having a slot into which a circuit card may be inserted and to solder a row of foot-like free ends on spring contact elements extending from the connector to traces on the board.

It is further known from U.S. Patent 3,966,290 to provide a plastic rivet on a housing for insertion into a hole on a circuit board and to thereafter heat-stake or otherwise enlarge the head of the rivet to permanently mount the housing on the board.

The present invention is intended to provide a connector having several rows of contact elements with tail sections extending out from the connector housing and to solder the foot-like free ends to a circuit board on which the housing is mounted by means of studs which are soldered to the board.

A connector is, according to the present invention, characterised in having a housing with two or more rows of passages and with contact elements therein, said contact elements having tail sections of varying lengths extending outwardly from the housing for being soldered to traces on a circuit board and, further, one or more studs extending from one surface of the housing for being received and soldered in holes in the circuit board.

For a better understanding of the invention, reference will now be made by way of example to the accompanying drawings, in which:

FIGURE 1 is an isometric view showing a two-piece board-to-board connector system with contact elements constructed in accordance with the preferred embodiment of the present invention shown exploded out of the male connector;

FIGURE 2 is a stamped contact element prior to being formed;

FIGURE 3 is a cross-sectional view of the male connector of Figure 1 illustrating the placement and arrangement of the contact elements therein and the fixing of the connector onto the circuit board; and

FIGURE 4 is a cross-sectional view of a stud of metallic composition mounted in the housing of the connector.

The two-piece board-to-board connector system shown in Figure 1 and indicated generally by reference numeral 10 includes straight through receptacle connector 12 and right angle male connector 14. The receptacle connector includes a housing 16 of insulating material and a plurality of contact elements (not shown) having a box style socket at one end, e.g., such as sold by AMP Incorporated of Harrisburg, Pennsylvania. The elements are located in passages 18 and have straight wire-wrap posts at the other end (not shown) which extend outwardly from the back of the housings. Connector 12 is mounted on a mother board (backplane) 20 with the aforementioned posts extending through holes and beyond the back side of the board.

Male connector 14 includes housing 22 and contact elements 24, 26 and 28. Each element has a mating section which in the embodiment shown is pin 30, a tail section 32 and an intermediate, retention section 34. The housing includes three rows of passages 36 which are shown in Figure 2. The rows are parallel to each other and extend between the ends of the housing. Two projecting members 38 and 40 define a shroud 42 on the front of the connector.

Contact elements 24, 26 and 28 have mating sections 30 and intermediate sections 34 which are identical in structural design and dimensions. The mating section shown is a pin having a design adapted to be received conformably in the aforementioned box style socket. The intermediate section includes barbs 44 adapted to dig into the passage walls.

Tail sections 32 are structurally the same for each element. Each section includes a connecting strap 46, an obliquely depending arm 48 and a foot 50 at the free end of the arm. The foot is concave-convex shaped. Dimensional differences in the tail sections between the three contact elements are in the length of strap 48 and arm 50. Element 24 has the shortest strap and arm, element 28 has the longest strap and arm, and element 26

has a strap and arm intermediate in length relative to the other two elements.

Figure 2 shows contact element 24 after being stamped out from a coplanar strip of stock material such as a copper alloy but before being formed. The reference numerals are shown to permit a comparison with the formed element shown in Figures 1 and 3. Reference numeral 52 indicates the bend between strap 48 and arm 50. The elements are plated at the contact areas (pin 30 and foot 50) after forming with the plating being gold over nickel on the pin and tin lead on the foot.

Housing 22 is provided with a pair of depending studs 54. These studs, one being located adjacent each end (on a short length) connector) may be of the same material as the housing, e.g., a polyphenylene sulfide plastic sold under the trademark "RYTON" by the Phillips Petroleum Company of Bartesville, Oklahoma. More preferably, and particularly so in surface mount applications such as disclosed herein, the studs are tin-lead plated brass, ultrasonically secured to housing 22. Figure 4 is a cross-sectional view showing a metallic stud mounted in the housing. The stud includes a circumferential groove 56 into which plastic flows as a result of the ultrasonic bonding. The stud further includes longitudinal ribs 58 out the surface of the stud to prevent the stud from twisting.

Daughter board 60 is provided with a plurality of conductive pads 62 which are part of the circuitry on the board. Further, holes 64 are provided which may be plated but not connected to any of the circuits.

Figure 3 is a cross-sectional view of connector 14 and board 60. The view shows the three contact elements with the intermediate sections located in passages 36. The sections and passages are dimensionally designed so that the barbs 44 dig into the passage walls to hold the elements securely in the housing.

Pins 30 extend forwardly from the passage into shroud 42. Tail sections 32 extend rearwardly from the passage. The

lengths of these sections determine the location of the elements in the housing; i.e., elements 24 are located in the row of passages closest to board 60 so that feet 50 thereon are in registration with the row of pads 62 nearest the back of the housing. Elements 26 are located in the middle row of passages so that feet 50 thereon are in registration with the middle row of pads. Likewise, elements 28 are positioned in the upper row of passages 36 with feet 50 being in registration with the outermost (relatively speaking) row of pads 62.

The elements are oriented in the housing so that the convex surface 66 on feet 50 bear against the appropriate pads.

Connector 14 is placed on board 60 with studs 54 extending through holes 64 and feet 50 bearing against the pads. The board is then subjected to reflow soldering which solders the feet to the pads and the studs in the holes. The stippling in Figure 3 represents the solidified solder. One advantage with the studs being soldered is that they can carry stresses that would otherwise be applied to the tail sections. These stresses can be sufficiently large such that the solder connection between the pad and foot would be broken.

The invention has been shown wherein the mating section on the contact element is pin 30. The mating section could be a socket, flat male tab, or other like interconnecting or mating device.

In addition to the stress relief capabilities of the soldered studs, the straps and arms of the tail sections also are able to absorb stresses which would otherwise affect the solder connection between the foot and pad. These straps and arms act as resilient beams anchored at both ends and having some degree of movement.

The present invention may be subject to many modifications and changes without departing from the spirit or essential characteristics thereof. The present embodiment is therefore intended in all respects as being illustrative and not restrictive of the scope of the invention.

CLAIMS:

1. A surface mount connector (14) for being mounted on a circuit board and having a housing (22) with three rows of passages (36) extending therethrough and having contact elements (24, 26, 28) therein with tail sections (32) extending outwardly from one end of the housing (22), characterised in that the tail sections (32) include a connecting strap (46), an obliquely depending arm (48) and a foot (50) for soldering to a conductive trace (62) on a circuit board (60).

2. The surface mount connector (14) of claim 1 further characterised by the connecting strap (46) and obliquely depending arm (48) being short on contact elements (24), longer on contact elements (26) and longest on contact elements (28) with the contact elements (24) being positioned in the row of passages (36) in the housing (22) closest to the circuit board (60), the contact elements (28) being positioned in the row of passages (36) in the housing (22) furthest from the circuit board (60) and the contact elements (26) being positioned in the row of passages (36) intermediate the other rows of passages (36).

3. The surface mount connector (14) of claim 2 further including studs (54) projecting from a surface of the housing (22) for insertion and soldering in a plated hole (64) in the circuit board (60).

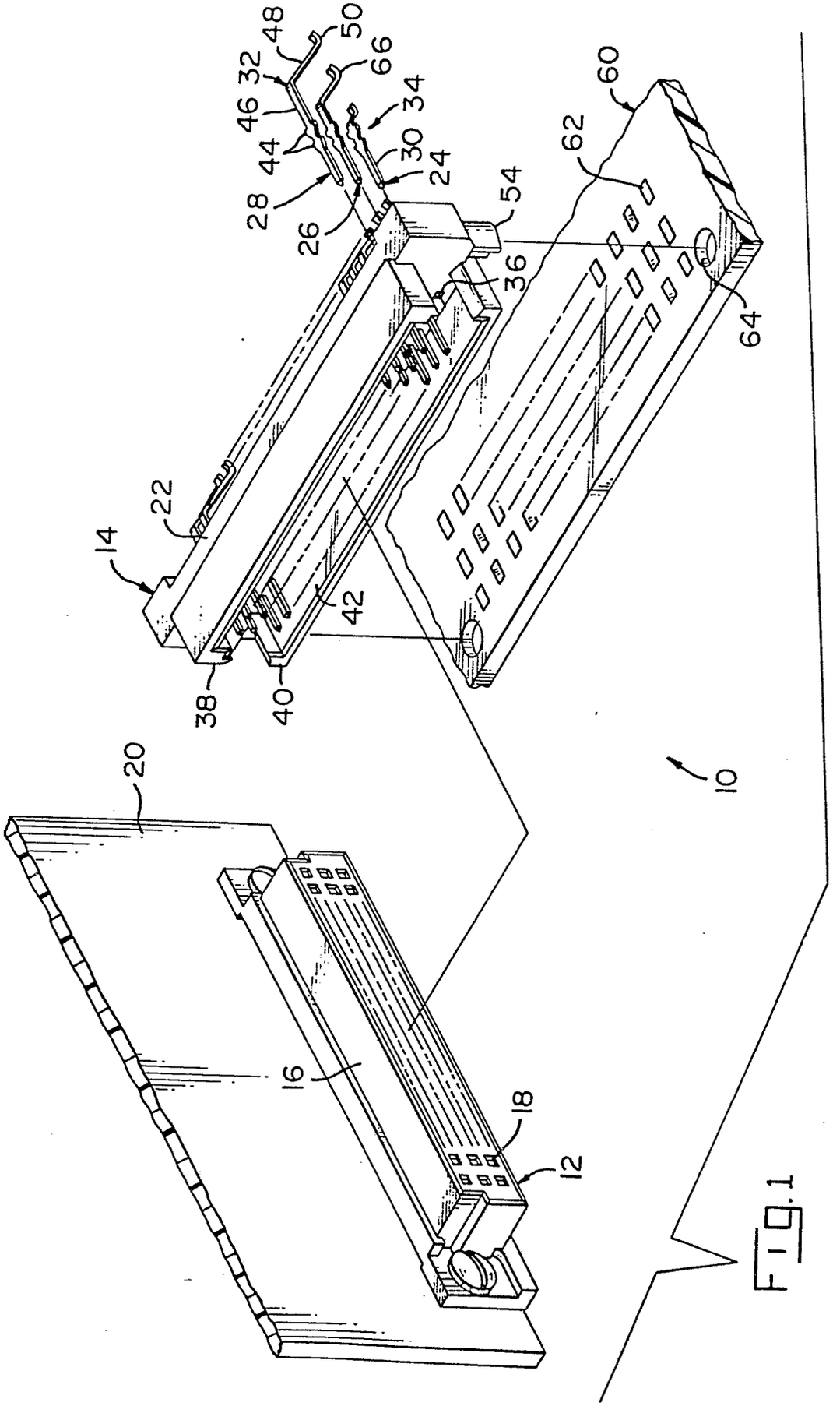
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FIG. 1

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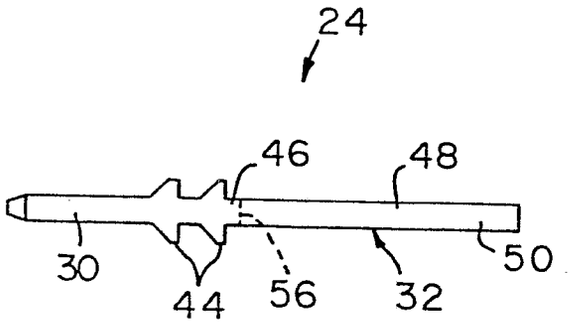


FIG.2

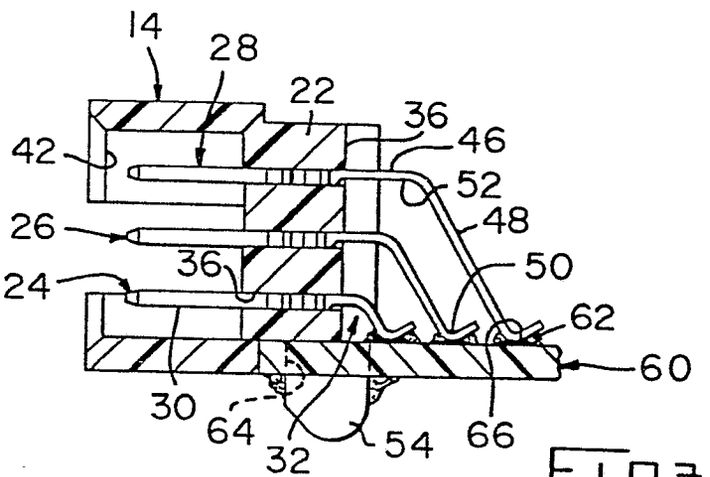


FIG.3

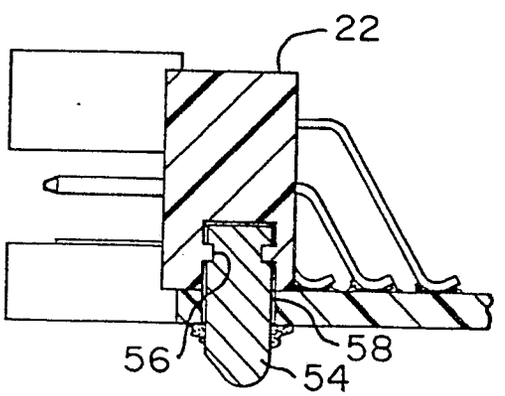


FIG.4