Dec. 23, 1969 H. R. N. DE VUYST ET AL 3,486,163

PRINTED CIRCUIT CONNECTOR SPRING CONTACT DEVICE

Filed Jan. 25, 1968 2 Sheets-Sheet 1

FIG. 1.

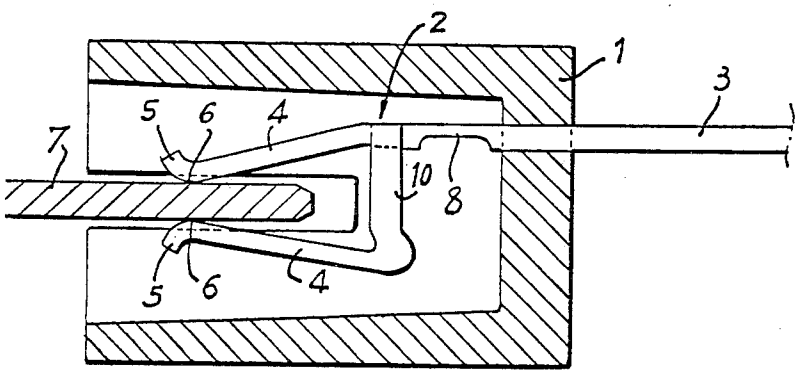
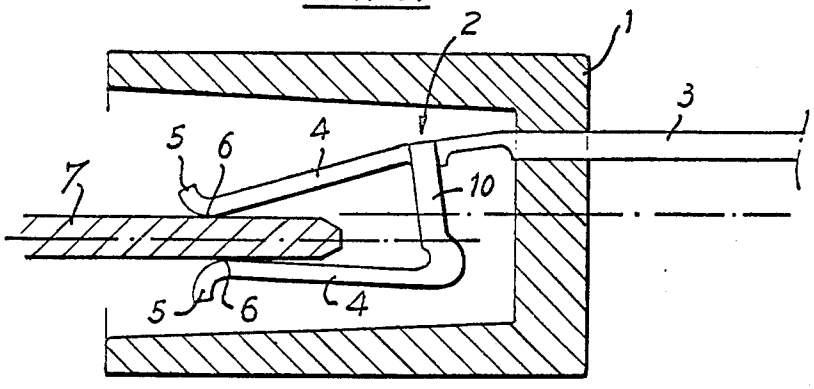


FIG. 2.



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Filed Jan. 25, 1968 2 Sheets-Sheet 2

FIG. 3.

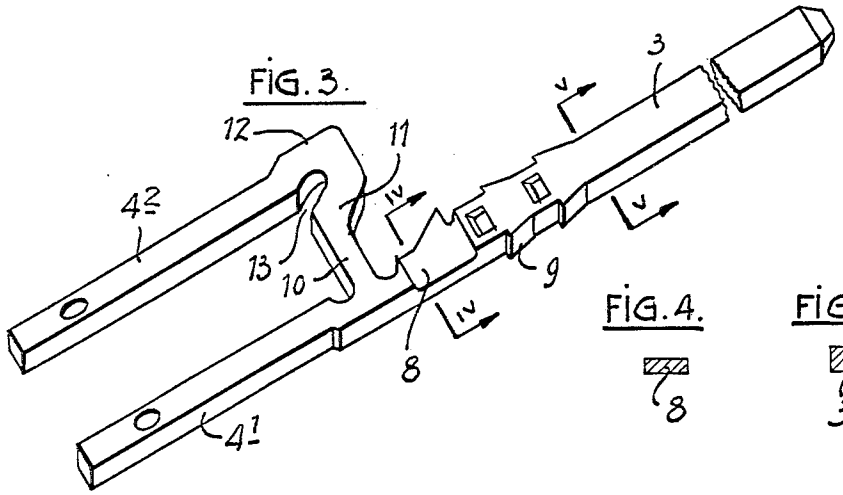


FIG. 4.

FIG. 5.

FIG. 6

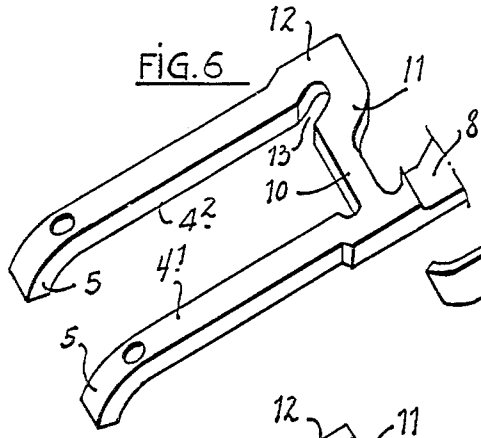


FIG. 7.

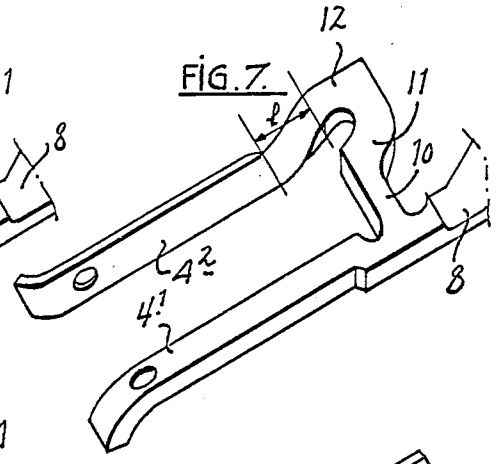


FIG. 8.

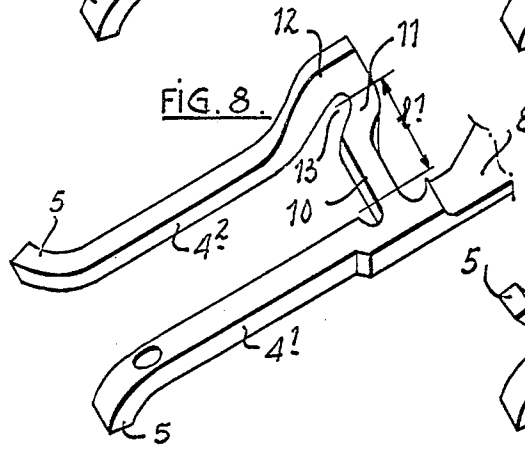
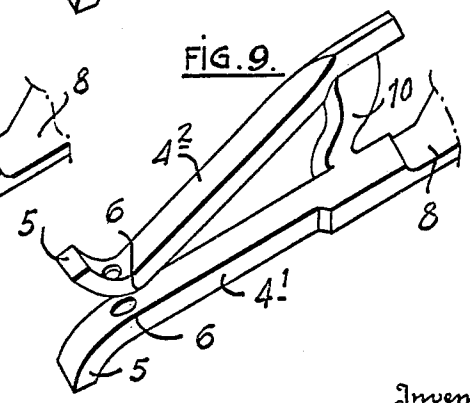


FIG. 9.



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PRINTED CIRCUIT CONNECTOR SPRING CONTACT DEVICE

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U.S. Cl. 339—64 2 Claims

ABSTRACT OF THE DISCLOSURE

A fork-shaped contact element to be used in electrical connectors of the type which engage the conductor-bearing edge of printed circuit boards. The contact includes a resilient fork-shaped forward end which straddles the edge of a circuit board, and an integral rear tail portion which serves as an anchor and as a terminal post for securing external conductors to the contact. An integral weakened portion between the tail and the forward end acts as a resilient hinge to permit alignment motion of the forward end relative to a connector housing when the tail portion has been anchored to the housing.

This invention relates, in general, to electrical connectors of the edge-engaging type for printed circuit boards. More specifically, it relates to fork-shaped contact elements for use in such electrical connectors, wherein provision is made for accommodating variations in alignment of parts without affecting the contact pressure between mating conductive surfaces.

The prior art contains examples of connectors for printed circuit boards in which individual contact elements have fork-shaped forward ends for straddling inserted circuit boards, and rearward tail portions for anchoring the contacts within a connector housing. The two arms of the forked ends generally are of resilient structure, so as to provide a springy "pincer" grip on opposite sides of an inserted board.

In the prior art devices of this type, it has been customary to attach the fork arms rigidly to the extending tail. Because of this, the force of the "pincer" grip may be reduced substantially by even a slight misalignment of the inserted circuit board relative to the position of the tail anchor portion. Such misalignment may occur easily as a result of variations in dimensional tolerances in the circuit boards and in the positioning of contact elements within a connector housing.

Some of the prior art contact elements have had the additional disadvantage of two-part construction. In these, a separate forked spring member is employed, to obtain the desired resilience, in combination with a conductor part or parts which have optimum conductive properties. Such two-part construction involves added expense in materials and in assembly costs, and does not succeed in eliminating any of the misalignment problems mentioned above.

Accordingly, it is an object of this invention to provide a resilient contact element of forked-arm construction, for printed circuit boards, in which gripping force between the fork arms is substantially independent of misalignment between the board and the contact.

A further object of this invention is the provision of a contact element of the type described which can be fabricated easily and inexpensively from a unitary piece of blank stock.

A feature of this invention is the provision of an integral weakened portion between the forward forked end of the contact and the rearward anchor portion so that the fork may change position as a unit relative to the anchor.

These and other and further objects, features and advantages of this invention will be more particularly pointed out and distinctly claimed in the following specification and claims, considered in conjunction with the accompanying drawings, in which:

FIGURES 1 and 2 are transverse sectional views through a connector for printed circuit boards, constructed in accordance with this invention, and showing insertion of a circuit board in aligned and misaligned positions, respectively;

FIGURE 3 is a perspective view of a blank from which a contact element may be formed in accordance with this invention;

FIGURE 4 is a section view taken along line IV—IV of FIGURE 3;

FIGURE 5 is a section view taken long line V—V of FIGURE 3;

FIGURES 6 through 9 are perspective representations of progressive stages in the formation of a contact element from the blank illustrated in FIGURE 3.

Referring to the drawings more particularly, it may be seen that FIGURE 1 illustrates a contact element **2** disposed within a connector housing **1** of insulating material. The contact element comprises: a forked forward end formed of fork arms **4** and connecting base portion **10**, a rearward "tail" or terminal post **3**, and an integral connecting portion **8** of weakened structure formed between post **3** and base **10**. The forward ends **5** of fork arms **4** are bent so as to form a pair of opposed contact surfaces **6**. As illustrated in FIGURE 1 contact surfaces **6** will be urged into engagement with opposite sides of a printed circuit board **7** inserted between them. The resilience of arms **4** and base **10** provides the force for engagement of surfaces **6** with a board **7**.

It should be noted that arms **4** and base **10** form a unit in which the "pincer" gripping force exerted by the arms is substantially independent of any external structure. This unit, formed of arms **4** and base **10**, is integrally coupled to terminal anchor post **3** by weakened connecting portion **8**. The weakened portion acts in the manner of a flexible "hinge" to permit the forked forward end to be deflected as a unit relative to a fixed position of post **3**. The advantageous result of this flexure may be seen readily from comparison of FIGURES 1 and 2 of the drawings. In FIGURE 1, circuit board **7** has been inserted between fork arms **4** along the center line which is defined by the undeflected position of contact **2** within housing **1**. In FIGURE 2 circuit board **7** has been inserted between arms **4** along a plane which is displaced from the "at rest" center line described above. As a result of inserting circuit board **7** in this manner, fork arms **4** and base **10** have been deflected as a unit about "hinge" **8** from their "at rest" position, so as to grip the circuit board with substantially undiminished force in the new position. The flexure of weakened portion **8** which allows accommodation of the misalignment, is shown clearly.

A contact element capable of performing in the manner which has been described may be constructed readily from a blank shaped as shown in FIGURE 3. The weakened hinge portion **8** may be formed by means of a stamping or swaging operation to change the cross-sectional configuration of that portion of terminal post **3** from the shape shown in FIGURE 5 to that shown in FIGURE 4. The reduced thickness of portion **8**, produced by this operation, readily permits flexure of the contact element at this point as has been described.

To achieve the forked-shape shown in FIGURES 1 and 2, the blank of FIGURE 3 may be bent first at the ends **5** of arms 4^1 and 4^2 as shown in FIGURE 6. Then, arm 4^2 may be twisted 90 degrees about its axis over the length *l* relative to hooked portion **12** as shown in FIGURE 7. This step is necessary so as to bring arm 4^2 into proper position for ultimate opposition to arm 4^1. It should be noted that the blank shown in FIGURE 3 may be formed preferably by having leg 4^2 initially disposed substantially perpendicularly to leg 4^1 and then bending the leg first as shown at reference point **11** and then as shown at reference point **12** to achieve the hooked step **13**. This procedure enhances the resilience of the fork which is eventually defined by these two arms.

Following the step shown in FIGURE 7, the extention portion **12** on leg 4^2 may be bent up out of the plane of the blank, as shown at **11** in FIGURE 8, and connecting portion **10** may be further bent at right angles to the initial plane of the blank so as to bring arms 4^1 and 4^2 into the opposed position illustrated at FIGURE 9.

The foregoing steps and operations will result in the formation of a contact element **2** in which the forward arms **4** will be able to "float" freely, in effect, about hinge portion **8** relative to the interior cavity of a housing **1** which has been firmly anchored to the tail post portion **3** of the contact element.

The invention has thus been described but it is desired to be understood that it is not confined to the particular forms or usages shown and described, the same being merely illustrative, and that the invention may be carried out in other ways without departing from the spirit of the invention; therefore, the right is broadly asserted to employ all equivalent instrumentalities coming within the scope of the invention, and by means of which objects of this invention are attained and new results accomplished, as it is obvious that the particular embodiments herein shown and described are only some of the many that can be employed to obtain these objects and accomplish these results.

We claim:

1. An electrical contact device, for an electrical connector for printed circuit boards and the like, integrally formed of a unitary piece of blank stock having a given surface and comprising:

a forward forked end having a pair of opposed contact arms and a base element resiliently coupling said arms together for engaging a flat circuit conductor therebetween;

a rearward tail portion capable of being securely anchored to a connector housing;

a stiffly flexible hinge portion coupling said tail portion to said forked end;

wherein one of said pair of opposed contact arms is initially disposed substantially perpendicularly to the other of said arms in a common plane, and the said one of said arms is rotated about its own longitudinal axis and is bent out of the plane of said flat blank so as to bring the given surface of said blank stock on said one arm into substantially opposed relationship with the same given surface of said blank stock on the other of said arms.

2. An electrical contact device in accordance with claim **1** wherein said hinge portion comprises a non-elastically deformed section of said blank stock.

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U.S. Cl. X.R.

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