Sept. 23, 1969 H. P. J. GILISSEN 3,469,228

ELECTRICAL CONNECTOR

Filed March 3, 1967 3 Sheets-Sheet 1

FIG. 1.

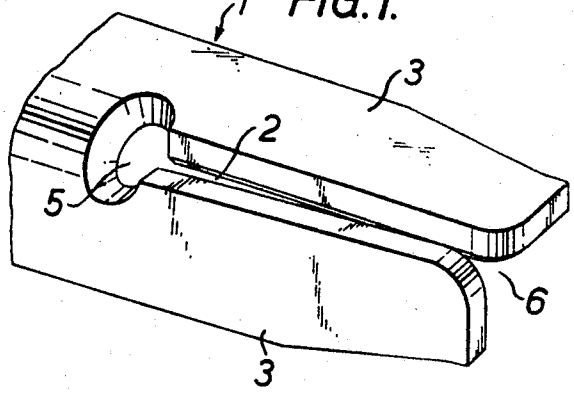


FIG. 2.

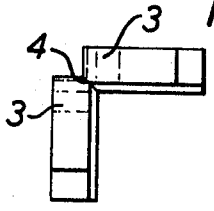


FIG. 3.

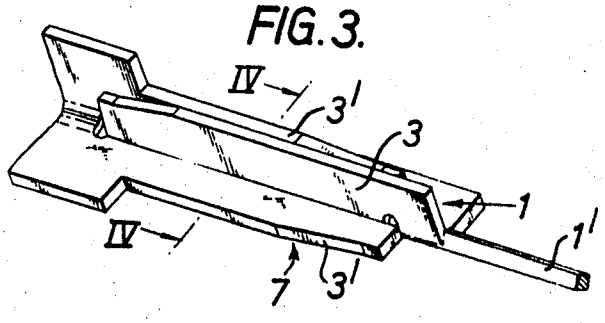
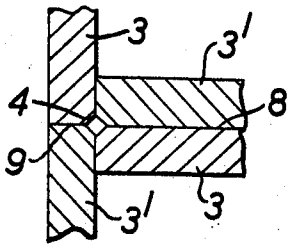


FIG. 4.



Sept. 23, 1969 H. P. J. GILISSEN 3,469,228

ELECTRICAL CONNECTOR

Filed March 3, 1967 3 Sheets-Sheet 2

FIG. 5.

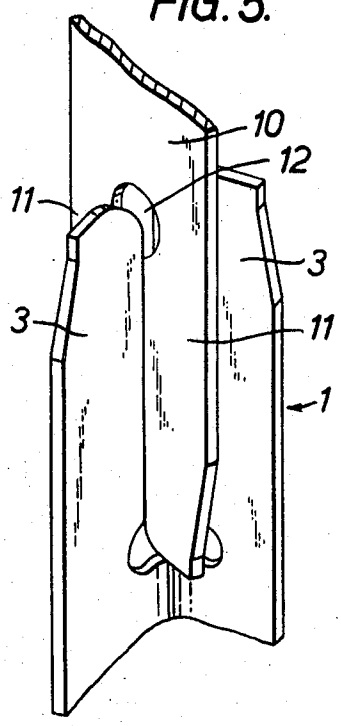
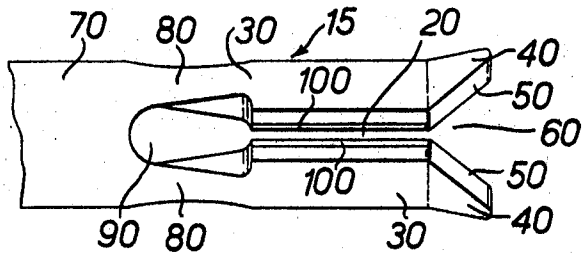


FIG. 6.



Sept. 23, 1969 H. P. J. GILISSEN 3,469,228

ELECTRICAL CONNECTOR

Filed March 3, 1967 3 Sheets-Sheet 3

FIG. 7.

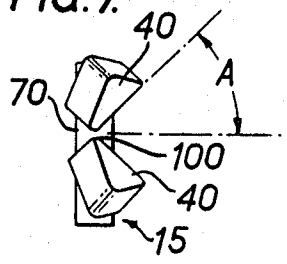


FIG. 8.

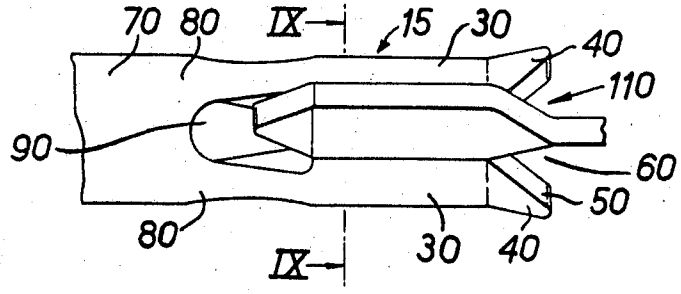
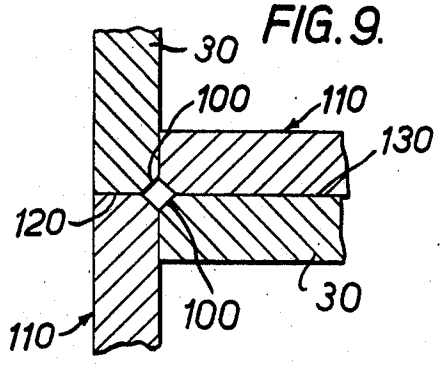


FIG. 9.



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3,469,228

ELECTRICAL CONNECTOR

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Int. Cl. H01r 25/02, 13/02
U.S. Cl. 339—47 16 Claims

ABSTRACT OF THE DISCLOSURE

An electrical connector having prongs disposed at an angle of 90° or thereabout therebetween for mateable engagement with other prongs of a like electrical connector or complementary electrical connector.

This invention relates to electrical connectors.

A readily connectable and disconnectable electrical connection may be provided by employing a pair of mateable sheet metal electrical connectors having interengageable contact surfaces which are maintained in effective electrically conductive engagement when the connectors are mated, by mutual resilient deformation of the connectors. An important feature determining the useful life of such connectors is the extent to which their deformation is resilient rather than plastic, i.e., their deformation-to-set ratio, since permanent deformation beyond certain limits renders the connectors unmateable or the force required to mate or disengage the connectors unacceptably high or low.

According to the invention, an electrical connector comprises a sheet metal contact portion which is slotted to provide a pair of prongs for interdigitation with the prongs of a further such contact portion, the prongs being substantially flat and the contact portion being essentially V-shaped as seen in cross section through the slot. The edges of the prongs, which edges are nearest one another, are preferably chamfered. Since the prongs are not coplanar they are not stressed on mating mainly in the direction of maximum set-to-deformation ratio.

Each prong may be connected to the remainder of the contact portion by a leg of smaller cross-sectional area than the prong, the prong having been so twisted relative to the remainder of the contact portion that the planes of the prongs are essentially perpendicular to one another whereby each prong deflects upon interdigitation of the prongs, in a direction which is angled by substantially 45° relative to the plane of the prong. The legs may be defined by a hole in the contact portion, the hole communicating with the slot and being elongate in the direction of the slot. Each leg prior to being twisted is preferably of constant essentially square cross section.

The prongs preferably have end extensions which are tapered and are bent out of the plane of the prongs to form a mouth providing guide surfaces facilitating the interdigitation.

A connector according to the invention may mate with a forked sheet metal contact element of which the prongs are coplanar.

An object of the invention is to provide an electrical connector having contact prongs disposed at substantially right angles with respect to each other.

Another object of the invention is the provision of an electrical connector having contact prongs with the section from which each contact prong extends being located in the same plane as the contact prong.

A further object of the invention is to provide an electrical connector having contact prongs with the contact prongs being disposed at a 45° angle with respect to the plane of the section from which the contact prongs extend.

An additional object of the invention is the provision of an electrical connector having contact prongs provided with opposed beveled surfaces that converge toward each other.

A still further object of the invention is to provide an electrical connector having contact prongs provided with opposed beveled surfaces that are parallel.

Still an additional object of the invention is the provision of an electrical connector having contact prongs disposed substantially at right angles with respect to each other, the contact prongs being mateable with like or similar prongs of a complementary electrical connector with a low insertion force and able to undergo more than the usual deformation without acquiring a permanent set.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

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 a perspective view of part of a contact portion of an electrical connector according to a first embodiment of the invention;

FIGURE 2 is a front end view of the part shown in FIGURE 1;

FIGURE 3 is a perspective view showing the contact portion of FIGURES 1 and 2 mated with a further and similar contact portion;

FIGURE 4 is an enlarged fragmentary cross-sectional view taken on the lines IV–IV of FIGURE 3;

FIGURE 5 is a perspective view showing the part of FIGURE 1 mated with a known connector contact portion;

FIGURE 6 is an elevational view of a contact portion of an electrical connector according to a second embodiment of the invention;

FIGURE 7 is a front end view of FIGURE 6;

FIGURE 8 is an elevational view showing the contact portion of FIGURE 6 mated with a similar contact portion; and

FIGURE 9 is a cross sectional view taken on the lines IX—IX of FIGURE 8.

Reference will now be made to FIGURES 1 to 5.

As shown in FIGURE 1 the contact portion **1** of an electrical connector comprises a sheet metal body made for example of spring tempered brass and having a central longitudinal slot **2** providing a pair of essentially flat prongs or tines **3**, the planes of which extend as best seen in FIGURE 2, perpendicularly to one another. The edges of the prongs **3**, which edges are nearest one another are chamfered at **4** as best seen in FIGURE 2. The slot **2** terminates in a circular stress relief aperture **5**. The right-hand (as seen in FIGURE 1) ends of the prongs **3** are chamfered to provide a mouth **6**. The contact portion may be formed integrally with an electrical connecting member, for example an electrical tine **1'** for reception in an aperture in an insulating member.

The contact portion may be mated with a further and similar contact portion **7** (FIGURE 3) by interdigitating

the prongs of the portions 1 and 7 as shown in FIGURE 3, the prongs being guided into interdigitated relationship with the aid of the mouth 6 and a similar mouth of the contact portion 7. In the mated condition of the contact portions, the planes of the prongs 3 each extend at right angles to the plane of one of the prongs 3' of the contact portion 7, so that large contact areas 8 and 9 are provided between the two contact portions. Since the prongs 3 and 3' are mainly stressed under the contact pressure afforded by the chamfering of the prongs, substantially at 45° with respect to their planes, i.e., substantially at 45° with respect to the direction of maximum set-to-deflection ratio of the prongs, the prongs are able to accept considerably greater deformation without acquiring a permanent set than the prongs of the known connector discussed above.

As shown in FIGURE 5 the contact portion 1 may also be mated with the known contact portion mentioned above and which is referenced 10. The known contact portion comprises a pair of coplanar prongs 11 provided by a slot (not shown) which terminates in a stress relief aperture 12. In this case also, the prongs 3 are mainly stressed in a direction which is displaced from their planes by approximately 45°.

The chamfered surfaces 4 of the contact portion 1 may be parallel to one another in the unmated condition of the contact portion instead of being convergent towards the mouth 6 as shown in FIGURE 1.

Reference will now be made to FIGURES 6 to 9.

As shown in FIGURE 6, a contact portion 15 of an electrical connector comprises a sheet metal body made for example of spring tempered brass stock and having a central slot 20 providing a pair of flat prongs 30, having end extensions 40 bent out of the planes of the prongs 30 and being tapered at 50 to provide a mouth 60. The prongs 30 are connected by legs 80 to the remainder of the contact element which is formed by a flat plate 70, only part of which is shown, and which may for example have feet (not shown) for staking to a printed circuit panel (not shown) or may form one end of a post (not shown) arranged to be force-fitted into an insulating member (not shown). The legs 80 have been formed by stamping from the contact portion 15, a piece (not shown), to form a hole 90 and each leg 80 has been twisted so that the plane of the prong 30 connected to the leg is angled by 45°, as indicated by broken lines A in FIGURE 7, with respect to the plane of the plate 70. The planes of the prongs 30 thus define an angle of 90°. Prior to the twisting operation the width of each leg was equal to the stock thickness, the untwisted leg being therefore of constant square cross section. The longitudinal edges of the slot 20 are chamfered at 100.

The contact portion 15 may be mated with a further and similar contact portion 110 (FIGURE 8) by interdigitating the prongs 30 of the portions 15 and 110 as shown in FIGURE 8, the prongs being guided into interdigitation, i.e., mated relationship with the aid of the extensions 40 of the contact portions 15 and 110. The cross sections of the twisted portions of the legs 80 are such that each prong 30 deflects on mating by substantially 45° relative to its plane. In the mated condition of the portions 15 and 110, the planes of the prongs of the portion 15 extend at right angles to the planes of the prongs of the portions 110 so that large contact areas 120 and 130 are provided between the two contact portions (FIGURE 9).

It has been found for example that with an overall prong and extension length of .176 inch (.44 cm. approximately) and a leg length of .094 inch (.25 cm. approximately), the stock thickness being .026 inch (.066 cm. approximately), the set-to-deflection ratio of each prong averages about one in sixteen, the deflection being measured .02 inch (.051 cm., approximately) back from the tip of its extension, and that the forces required to separate two mating connectors will be increased or decreased as the case may be by only about 20% where there is a permanent set of .001 inch (.0254 mm.) in either leg, measured as stated above. To achieve such a low set-to-deformation ratio the spring characteristics of the legs, which are dependent upon the leg length and thickness, should be such that a deflection of .001 inch (.0254 cm.), measured as above stated is experienced where the force exerted against the prong on mating is no greater than 40 grams.

This low set-to-deformation ratio is of particular advantage where a substantial number, e.g., 24 mating pairs of connectors are mounted in a pair of insulating blocks, e.g., in a two-part printed circuit edge connector assembly, since block tolerances, e.g., molding tolerances and bent connectors usually result in some misalignment between the connectors of each mating pair.

It will, therefore, be appreciated that the aforementioned and other desirable objects have been achieved; however, it should be emphasized that the particular embodiments of the invention, which are shown and described herein, are intended as merely illustrative and not as restrictive of the invention.

What is claimed is:

1. An electrical connector comprising a sheet metal contact portion which is slotted to provide a pair of prongs for interdigitation with the prongs of a further such contact portion, the prongs being subsantially flat and the contact portion being essentially V-shaped as seen in cross-section through the slot, the planes of the prongs being substantially perpendicular to one another and the edges of the prongs which edges are nearest one another being chamfered.

2. An electrical connector comprising a sheet metal contact portion having a slot providing a pair of prongs for interdigitation with the prongs of a further such contact portion, the prongs being substantially flat and each prong being connected to the remainder of the contact portion by a leg of smaller cross-sectional area than the prong, each said leg being twisted relative to the remainder of the contact portion so that planes of the prongs are substantially perpendicular to one another and each prong deflects upon interdigitation of the prongs in a direction which is angled by substantially 45° relative to the plane of the prong.

3. A connector according to claim 2 in which the legs are defined by a hole in the contact portion, the hole communicating with the slot and being elongate in the direction of the slot.

4. A connector according to claim 2 in which each leg prior to being twisted was of constant essentially square cross section.

5. A connector according to claim 2 in which the prongs have end extensions which are tapered and are bent out of the planes of the prongs to form a mouth providing guide surfaces facilitating the interdigitation.

6. A connector according to claim 2 in which the edges of the prongs nearest one another are chamfered.

7. An electrical connector assembly comprising first and second electrical connectors each having a sheet metal contact portion provided with a slot thereby defining a pair of substantially flat prongs which are interdigitatable with the prongs of the other contact portion, the prongs of the contact portions having chamfered surfaces to afford substantial contact pressure between the prongs and the contact portion of at least one of said connectors being V-shaped as seen in cross section through the slot of that contact portion.

8. An electrical connector comprising tine members having contact-engaging surfaces along a substantial portion of the length thereof, an integral base portion at inner ends of said tine members to maintain said tine members at substantially right angles with respect to each other and said contact-engaging surfaces adjacent each other for engaging contact-engaging surfaces of a com-

plementary electrical connector, said contact-engaging surfaces having chamfered edges nearest each other.

9. An electrical connector comprising a base portion, contact members extending outwardly from said base portion in the same direction as a longitudinal axis of said base portion, said contact members defining a V-shape on a plane at right angles with respect to said longitudinal axis, said base portion maintaining said contact members resiliently disposed adjacent each other, and contact-engaging surfaces on said contact members extending along at least half the length of said contact members and having chamfered edges nearest each other therealong.

10. An electrical connector according to claim **9** wherein said contact-engaging surfaces merge into a substantially circular opening at inner ends thereof.

11. An electrical connector according to claim **9** wherein said contact-engaging surfaces merge into an elongated opening at inner ends thereof.

12. An electrical connector according to claim **9** wherein said contact-engaging surfaces extend toward each other from inner ends to outer ends thereof.

13. An electrical connector according to claim **9** wherein said contact-engaging surfaces are substantially parallel.

14. An electrical connector according to claim **9** wherein said contact members are connected to said base portion by legs of smaller cross-sectional area than said contact members, said legs being twisted relative to said

base portion so that planes of said contact members are substantially perpendicular to one another.

15. An electrical connector according to claim **9** wherein said contact members are disposed in planes substantially perpendicular to one another.

16. An electrical connector assembly comprising first and second electrical connectors each having a sheet metal contact portion which is slotted to provide a pair of essentially flat prongs which are interdigitated with the prongs of the other contact portion, the prongs of the contact portions having chamfered surfaces to afford substantial contact pressure between the prongs and the contact portion of at least one of the connectors being V-shaped as seen in cross-section through the slot of that contact portion, the planes of the prongs of that contact portion extending substantially at right angles with respect to one another.

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