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Electric socket contact.

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FR-A-2 389 250
US-A-1 433 878
US-A-3 317 887
US-A-4 072 394

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Description

This invention relates to a socket contact for a separable electrical connector of the type including first and second connector members.

Separable electrical connectors of the plug and receptacle type are used in many applications for connecting multiple pairs of corresponding conductors. Such connectors are widely used in the aerospace field and complex electronic systems in which a single connector may connect hundreds of pairs of wires. In such systems, the connectors must be miniaturized to minimize the weight and size. The wires at the receptacle are connected to individual terminals and the wires at the plug are connected to corresponding terminals. Typically, each of the terminals in one of the connectors is a socket contact, each of the terminals in the other connector is a pin contact and the pin contacts are adapted to telescopically engage with the corresponding socket contacts when the plug and receptacle are in a mated relationship. In order to miniaturize the connectors, the pin and socket contacts need to be very small; for example, the socket contact may be less than 2.5 mm in diameter and less than 13 mm in a length.

Contacts of the type described must be capable of quick and easy connection and disconnection without undue force. Yet each set of contacts must provide excellent electrical conductivity and be capable of repeated connections and disconnections without damage or significant deterioration. When miniature contacts were first introduced, they were manufactured by machining from metal stock since that was the only feasible way to hold the tolerances required for the mating the contacts. However, machined contacts are relatively costly. In recent years such contacts have been made from sheet metal by forming and rolling to produce a “formed” contact.

Formed socket contacts have been developed which comprise an assembly of contact sleeve or liner of spring metal having plural contact fingers at the mating end and a supporting sleeve thereon. The wire receiving end is provided with plural openings and has a supporting sleeve thereon and is crimped into engagement with the wire. Additionally, a mounting flange is provided in the midsection of the contact sleeve. In this construction, the inner sleeve has an open seam from one end to the other, i.e., the abutting edges of the rolled sleeve are not welded or brazed together. A socket contact of this construction and method of making are described in US—A—4 072 394. Formed contacts with welded or brazed seams are disclosed in the following patents: US—A—3 286 223; US—A—3 317 887; and US—A—3 721 943.

In the socket contact described, the contact fingers constitute cantilever beams deflected in a radial direction by the insertion of the mating pin contact. Each of the contact fingers is supported only at its root in the contact sleeve. In order to ensure a good electrical connection between the socket contact and the pin contact, it is necessary to have each finger exerting an appropriate resisting force to radial deflection. If the resisting force is too great the insertion force required for the pin contact is excessive; if the insertion force for the pin contact is too small, the electrical connection between the pin and socket contacts may be defective.

The present invention overcomes the limitations and disadvantages of the prior art arrangements by providing an electric socket contact comprising an elongate sleeve having a wire receiving opening at a rear end and a pin contact receiving opening comprising an annulus formed of resilient contact fingers at a forward mating end, characterized in that a supporting sleeve is disposed in external coaxial relation with said elongated sleeve, an outer sleeve is disposed in external coaxial relation with said supporting sleeve and there is provided mounting means for immovably securing the supporting sleeve to the outer sleeve whereby the supporting sleeve has its rearward end adjacent the wire receiving opening and its forward end extending slightly beyond the forward ends of the contact fingers, said outer sleeve including guide means providing a socket entrance for guiding the pin into centered relation with the annulus at the forward mating end, the wall of the elongated sleeve defining slots extending axially from a mating end and thereby providing contact fingers, each finger extending as a cantilever beam and terminating at a free end, the slots being three in number and circumferentially equally spaced thereby providing a set of three equally spaced contact fingers.

The invention thus provides a socket contact which exhibits a desired contact force and a centering action upon entry of a cooperating contact pin.

One way of carrying out the invention is described in detail below with reference to the drawings which illustrate one specific embodiment of this invention, in which:

FIGURE 1 shows the socket contact assembly in elevation with certain parts broken away;

FIGURE 2 shows detail of construction of the wire receiving end of the socket contact;

FIGURE 3 shows the socket contact of this invention in an electrical connector;

FIGURE 4 shows a contact blank which has been stamped from sheet metal to form the contact sleeve;

FIGURE 5 is an elevation view with parts broken away of the contact sleeve of the socket contact of this invention;

FIGURE 6 is an end view of the sleeve of FIGURE 5;

FIGURE 7 is a sectional view of the supporting sleeve for the socket contact of this in-
within a supporting sleeve 14 which extends the socket contact 10 comprises a contact liner assembled, is shown in FIGURE 1. In general, the electrical connector comprises a receptacle 30 which contains a dielectric insert 32 in which are mounted a plurality of pin contacts 24. The receptacle 30 and the plug 34 includes a plug 34 which contains a dielectric portion 50. The contact sleeve 12 is adapted for mounting in a dielectric insert of an electrical connector member and for telescopic engagement with a pin contact mounted on a mating connector member.

The socket contact, with the parts assembled, is shown in FIGURE 1. In general, the socket contact 10 comprises a contact liner or sleeve 12 disposed in co-axial relationship within a supporting sleeve 14 which extends substantially the full length of the contact sleeve. An outer sleeve or front hood 16 is disposed in co-axial relation over the supporting sleeve 14 and extends from the pin receiving or mating end 18 to a point near the midsection of the contact sleeve 12. The back end of the contact 10 terminates in a wire receiving open 20 which receives a conductor or wire 22. The mating end 18 at the front of the contact is adapted to receive a pin contact 24. Before proceeding with the detailed description of the socket contact 10, it will be helpful to consider the mounting of the socket contact in an electrical connector member.

FIGURE 3 shows a fragmentary view of an electrical connector of the type of which the socket contact of this invention may be used. The electrical connector comprises a receptacle 30 which contains a dielectric insert 32 in which are mounted a plurality of socket contacts 10. The electrical connector also includes a plug 34 which contains a dielectric insert 36 in which are mounted a plurality of pin contacts 24. The receptacle 30 and the plug 34 are adapted to be oriented and drawn together in a mated relationship (by means not shown) so that the pin contact 24 is telescopically inserted into the socket contact 10 to provide an electrical connection therebetween. In this illustration, the insert 32 defines a recess 35 which contains a retention device 40. The socket contact 10 is mounted in the insert 32 by the contact retention device 40 which includes plural deflectable spring fingers 42 which engage a rearward shoulder 44 on the socket contact 10. The socket contact 10 is inserted from the rear of the insert through the retention device and the spring fingers 42 deflect to allow the hood 16 to pass by and then the fingers seat against the rear shoulder 44. Accordingly, the socket contact 10 is maintained in a fixed position within the insert.

Reverting back to FIGURES 4 and 5, contact sleeve 12 is provided with a set of three equally spaced tines or contact fingers 66 at the forward or mating end 18 of the sleeve 12. The contact fingers 66 are formed by punching two equally spaced slots 68 into the sheet metal of the contact sleeve 12 while it is in a flat condition. The slots 68 extend from the pin mating end 18 of the contact sleeve 12 to a location adjacent the midsection of this sleeve and each slot 68 terminates in an arcuate configuration at the root of the contact fingers 66. The contact sleeve 12 in that portion extending from the root of the fingers 66 to the free ends of the fingers is tapered to a smaller diameter at the mating end 18. In other words, each of the contact fingers 66 slopes radially inwardly at its free end. After the forming operation, the contact sleeve 12 is heat treated so that the contact fingers 66 are stress-relieved in the tapered position illustrated. Additionally, the free ends of the fingers 66 are coined to provide bevelled ends 70 to facilitate entry of the...
The supporting sleeve 14 as shown in FIGURES 1 and 7 is a cylindrical metal tube. The sleeve 14 is preferably constructed of stainless steel and is formed by deep drawing to provide a tube having a relatively thin wall of a few hundredths of a millimeter in thickness. The supporting sleeve 14 is provided with an annular, outwardly extending flange 76. The supporting sleeve 14 is disposed externally of the contact sleeve 12 and, as shown in FIGURE 1, the rearward end 78 thereof is in abutting engagement with the stop shoulder 56 on the contact sleeve 12. The forward end 80 of the supporting sleeve 14 extends slightly beyond the ends of the contact fingers 66. It is noted that the forward end of the supporting sleeve 14 is radially spaced from the contact fingers 66 leaving room for radial deflection of the fingers upon the entrance of the pin contact 24.

The annular flange 76 on the supporting sleeve 14 serves to secure the mounting means (44, 76) for securing the support structure for the contact sleeve 12 in external co-axial relation with the supporting sleeve 14. The rearward end of the hood 16 has an inwardly turned annular bight 86 which forms an annular channel 88 adapted to receive the forward end 80 of the supporting sleeve 14. The rearward end of the hood 16 is radially spaced from the annular flange 76 on the supporting sleeve 14. With the hood 16 positioned on the supporting sleeve 14, the bell mouth 44 of the hood 16 is provided with an inwardly turned annular bight 86 which is formed on the outer sleeve or hood 16. The forward end of the hood 16 is preferably made of stainless steel by a deep drawing operation and is formed by deep drawing to provide a tube having a relatively thin wall of a few hundredths of a millimeter in thickness. The forward end of the hood 16 is axially aligned with the socket contact 10 and when the plug and receptacle are drawn together the pin contact 24 is telescopically inserted into the socket contact 10. As the pin contact 24 enters the socket contact, the contact fingers 66 are first engaged by the pin at the bevelled surfaces 70 which facilitate entrance of the pin contact and minimize the axial loading on the contact fingers. The contact fingers are radially deflected as the pin contact enters the socket contact. The three contact fingers 66 exert radial forces on the pin contact and due to the equal angular spacing thereof, the pin and socket contacts tend to remain on center with each other. Each of the three contact fingers exerts a normal force against the pin contact due to the resiliency of the fingers and maintains a good electrical contact therewith. The normal force exerted by the three contact fingers, and hence the axial resisting force against the pin contact, is less than that provided in a socket contact of the same materials and dimensions but having two contact fingers instead of three; additionally the third contact finger enhances the electrical contact. The contact sleeve 12 of this invention having three contact fingers is especially well adapted to fabrication by stamping and rolling as compared to socket contacts with two or four contact fingers, especially where the open seam 46 is disposed diametrically opposite one of the contact fingers.

Claims

1. An electric socket contact comprising an elongated sleeve (12) having a wire receiving opening at a rear end and a pin contact receiving opening comprising an annulus of resilient contact fingers (66) at a forward mating end, characterized in that a supporting sleeve (14) is disposed in external coaxial relation with said elongated sleeve (12), an outer sleeve (16) is positioned on the supporting sleeve (14), the outer sleeve (16) being press fit into the supporting sleeve (14) and there is provided mounting means (44, 76) for immovably securing the supporting sleeve (14) to the outer sleeve (16) whereby the supporting sleeve (14) has its rearward end (78) adjacent the wire receiving opening and its forward end (80) extending slightly beyond the forward ends of the contact fingers, said outer sleeve (16) including guide means (89) providing a socket entrance for guiding the pin into centered relation with the annulus at the forward mating end, the wall of the elongated sleeve (12) defining slots (89) extending axially from a mating end (18) and thereby providing contact fingers (66), each finger (66) extending as a cantilever beam and terminating at a free end, the slots (89) being three in number and circumferentially equally spaced thereby providing a set of three equally spaced contact fingers (66).

2. An electric socket contact according to Claim 1, characterized in that said mounting...
5. An electric socket contact according to Claim 1, characterized in that the guide means (86) form an annular channel (88) received about the forward end (80) of supporting sleeve (14).

4. An electric socket contact according to Claim 3, characterized in that there is provided a wire receiving opening and the means for immovably securing the supporting sleeve to the outer sleeve.

3. An electric socket contact according to Claim 5, characterized in that said contact sleeve terminates in an obliquely extending flange (56) at the wire receiving opening and the means for immovably securing the sleeve between said wire receiving opening and the flange (56) forms an annular channel (88) received about the rearward end (78) of supporting sleeve (14).

2. An electric socket contact according to Anspruch 1, characterized in that the guide means (86) form a ring-shaped guide (86) received about the outwardly extending flange (76) and the guiding sleeve (16) includes a ring-shaped flange (76) that forms an annular channel (88) relative to the ring of the supporting sleeve.

1. An electric socket contact according to Anspruch 1, characterized in that the guide means (86) form a ring-shaped guide (86) extending in a coaxial position on the outer sleeve and the guiding sleeve (16) includes a ring-shaped flange (76) received about the outwardly extending flange (76) of the guiding sleeve (16) and the guiding sleeve (16) is shaped so that it can be crimped inwardly against the guiding sleeve (16) on the wire receiving opening.
Recommandations

1. Un contact électrique à douille qui comprend un manchon allongé (12) ayant une ouverture de réception de fil à une extrémité arrière et une ouverture de réception de contact à fiche comprenant une région annulaire formée par des doigts de contact élastiques (66) à une extrémité d'accouplement avant, caractérisé en ce qu'un manchon support (14) est disposé dans une relation coaxiale externe avec ledit manchon allongé (12), un manchon extérieur (16) est disposé dans une relation coaxiale externe avec ledit manchon support (14) et il est prévu des moyens de montage (44, 76) pour assujettir fixement le manchon support (14) au manchon extérieur (16) de telle sorte que le manchon support (14) a son extrémité arrière (78) adjacente à l'ouverture de réception de fil et son extrémité avant (80) qui s'étend légèrement au-delà des extrémités avant des doigts de contact, ledit manchon extérieur (16) comportant des moyens de guidage (86) qui forment une entrée de douille pour guider la fiche dans une relation centrée avec la région annulaire située à l'extrémité d'accouplement avant, la paroi du manchon allongé (12) comportant des fentes (68) qui s'étendent axialement à partir d'une extrémité d'accouplement (18) et forment, de ce fait, des doigts (66) de contact, chaque doigt (66) s'étendant à la manière d'une poutre en porte-à-faux et se terminant à une extrémité libre, les fentes (68) étant au nombre de trois et étant régulièrement espacées autour d'un cercle formant ainsi un jeu de trois doigts (66) de contact régulièrement espacés.

2. Un contact électrique à douille selon la recommandation 1, caractérisé en ce que lesdits moyens de montage (44, 76) comprennent une colerette (76) s'étendant vers l'extérieur formée au milieu du manchon support (14) et une colerette de retenue annulaire (44) formée à l'extrémité arrière du manchon extérieur (16) adaptée autour de la colerette (76) s'étendant vers l'extérieur.

3. Un contact électrique à douille selon la recommandation 1, caractérisé en ce que les moyens de guidage (86) comportant un bord recourbé annulaire (86) disposé dans une relation coaxiale avec la région annulaire formée par les doigts de contact et formant une rainure annulaire (88) reçue autour de l'extrémité avant (80) du manchon support (14).

4. Un contact électrique à douille selon la recommandation 3, caractérisé en ce qu'il est muni de moyens (62) pour assujettir fixement le manchon support (14) au manchon de contact, ces moyens comportant un doigt qui s'étend dans le manchon de contact entre ladite ouverture de réception de fil et les moyens servant à assujettir fixement le manchon support au manchon extérieur.

5. Un contact électrique à douille selon la recommandation 4, caractérisé en ce que le manchon de contact se termine par une colerette (56) s'étendant obliquement à l'extrémité de réception de fil et l'extrémité arrière (78) dudit manchon support (14) est positionnée contre ladite colerette (56) s'étendant obliquement.

6. Un contact électrique à douille selon la recommandation 5, caractérisé en ce que ledit manchon extérieur (16) et ledit manchon support (14) sont sans joint, en ce que le manchon de contact allongé comporte un joint ouvert s'étendant entre ses extrémités et comporte plusieurs ouvertures (58) dans sa paroi adjacente à l'ouverture de réception de fil, lesdits multiples ouvertures (58) étant espacées circonférentiellement autour du manchon de contact, l'une des ouvertures étant alignée avec le joint (46) de sorte que la paroi de manchon support (14) et la paroi dudit manchon de contact entre les ouvertures (58) peuvent être serrées vers l'extérieur contre un fil (22) disposé dans l'ouverture de réception de fil.