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METHOD OF MAKING FORKED CONTACTS

Original Filed March 20, 1961

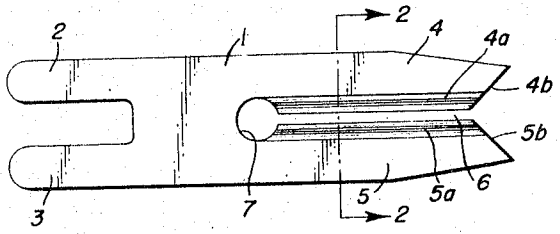


Fig. 1.

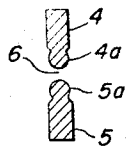


Fig. 2.

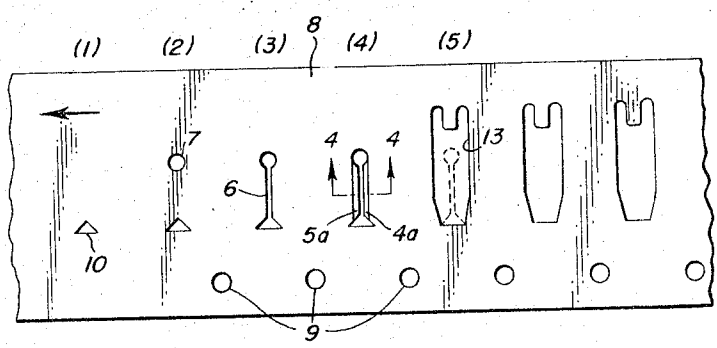


Fig. 3.

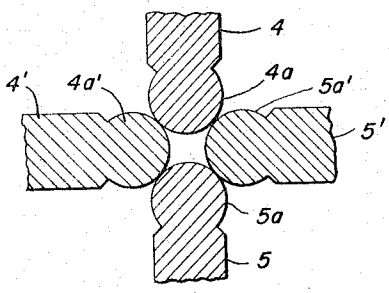


Fig. 5.

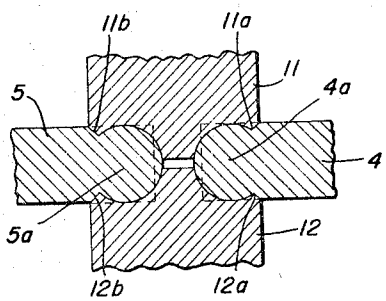


Fig. 4.

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METHOD OF MAKING FORKED CONTACTS

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Continuation of abandoned application Ser. No. 96,947, Mar. 20, 1961. This application June 25, 1964, Ser. No. 381,285

6 Claims. (Cl. 29—155.55)

This application is a continuation of our earlier application Serial No. 96,947, filed March 20, 1961, and now abandoned.

This invention is concerned with contacts for use in forming electrical connectors. The contact is of the bifurcated or forked type where two contacts of identical construction are engaged with their prongs in contact with each other to form a connector. The prongs of each contact function both as a socket and as a prong for the opposing contact.

Contacts of this type are useful for many purposes, one example being used on printed circuit boards as shown in U.S. Patent to Blain 2,946,976 where a set of forked contacts are mounted on the board and another set of contacts are carried by a suitable base or support and oriented to engage the first set. If the inner edge faces of the prongs are formed of flat areas joined along sharp corners, such corners are likely to prevent smooth sliding engagement of two contact pieces, especially if the two pieces are not mounted with their planes exactly at right angles to each other, or if one contact piece is cocked with respect to the other.

An object of the invention is to devise a forked contact of novel structure which will provide for smoother mating of the prongs of a pair of contacts when placed into mating relation.

A specific object is to devise a forked contact in which the surfaces of the inner edges of the prongs of the contact are rounded to conform substantially with a cylindrical surface. In the preferred embodiment the inner edge portions of the prongs are formed as rounded bead portions extending along the active length of each prong.

A further object of the invention is to devise a novel method of forming the improved contact, involving the use of swaging dies to form the beaded edges on the contact prongs.

The invention is illustrated in the accompanying drawing in which:

FIGURE 1 shows a plan view of the novel contact;

FIGURE 2 is a view of a section of FIGURE 1 taken along the transverse plane 2—2 of FIGURE 1;

FIGURE 3 is a plan view on a smaller scale than FIGURE 1 showing a strip of metal from which the contact is formed and showing various stages in the formation of the contact;

FIGURE 4 is a sectional view on a greatly enlarged scale showing a section of FIGURE 3 taken along the cutting plane 4—4 of FIGURE 3 and showing the swaging dies forming the beaded edge portions; and

FIGURE 5 is a transverse sectional view on a greatly enlarged scale showing portions of two contacts arranged in mating relation.

Referring to the drawing, FIGURE 1 shows a plan view of the contact formed from a flat strip of metal. The scale of FIGURES 1 and 2 is considerably enlarged for contacts which would be used on printed circuit panels. The contact is provided with a shank portion **1** having suitable mounting ears **2** and **3** extending from one edge thereof. In the drawing these ears extend rearwardly from the rear end of the shank portion, but they might extend from one of the side edges of the shank portion. At the forward end of the shank portion two prongs **4** and **5** extend forwardly in parallel relation and are separated by a slot or gap **6** which terminates at its rear end in an enlarged opening **7** which, for convenience in producing the necessary die parts, is of circular outline but could be triangular or of other shape.

As shown in FIGURE 2, the inner or facing edge portions *4a* and *5a* of the prongs **4** and **5** on opposite sides of the slot **6** have a rounded surface conforming substantially to a cylindrical surface extending over a circular arc of more than 90°, that is, more than 45° on each side of the common plane of the two prongs. In the particular construction shown the cylindrical surface of the inner edge portions *4a* and *5a* of the prong extend over a circular arc of substantially 270°.

The inner edges of prongs **4** and **5** at the ends thereof are tapered or flared outwardly as shown at *4b* and *5b* to provide converging surfaces at the entrance to slot **6** to facilitate proper mating when two forked contacts are being moved into mating relation.

The manner of forming the contact from a strip of sheet metal, preferably spring tempered phosphor bronze, is as follows:

It will be understood that the metal strip **8** is fed step-by-step into a suitable punch-press which is provided with suitable punch and die tools at different stations or locations, the strip **8** traveling from right to left as shown in FIGURE 3. The strip is properly indexed or piloted in the different stations by a series of pilot holes **9** formed by a punch at one location. At the first station, a suitable punch and die forms the triangular perforation **10** having its broad side parallel with one edge of the strip **8** and the apex directed towards the opposite edge. The apex sides of perforation **10** form the tapered edges *4b* and *5b* for prongs **4** and **5** which are punched out at a later station. It is preferred that the edges *4b* and *5b* be at right angles to each other. At the second station a punch forms the enlarged hole **7**. At the third station a narrow punch cuts a narrow slot **6** through the strip and connecting the holes **7** and **10**. At this point slot **6** has a width less than the thickness of the strip **8** and is slightly wider than in its final form, to allow for a certain narrowing of the slot by the swaging operation.

At the fourth station a pair of swaging dies of the forms shown at **11** and **12** in FIGURE 4 engage the edge portions of the slot walls, both above and below the strip, to form the bead portions *4a* and *5a* extending along the inner edges of prongs **4** and **5**, respectively. This swaging operation causes cold flow of the edge portion of strip **8** and shapes these portions into bead strips of round section as shown in FIGURES 2 and 4. The forming surfaces of dies **11** and **12** conform substantially with cylindrical surfaces having axes located in the mid-plane of strip **8** and having a radius equal to or somewhat less than half the thickness of the strip. The metal flow during swaging also effects some closing of the slot **6** to its proper width. The dotted lines in FIGURE 4 show the shape of the edge portions of the prongs before the swaging or coining operation. The pointed rib-portions *11a*, *11b* and *12a* and *12b* bite into strip **8** and cause a certain flow of metal towards the center of the die without imposing substantial spreading action on the two prongs. These rib portions of die members **11** and **12** serve to hold the prongs against outward displacement laterally of the slot **6** while the rounded portions of die members **11** and **12** are squeezing or coining the inner edge portions of the two prongs into rounded bead form.

At the fifth station a blanking die having the shape of the outline of the contact piece blanks the completed contact piece from the strip **8** and leaves the perforation **13**.

FIGURE 5 shows how the rounded edge portions of the prongs engage each other when two contact pieces are

placed into mating relation, prongs 4 and 5 being on one piece and prongs 4' and 5' on the other piece.

It is desirable that each contact piece be formed so that the gap between the prongs at the end portions is of a width slightly less than near the shank, so that the prongs of each piece will exert a gripping action on the prongs of the other piece when two pieces are in mating engagement.

We claim:

1. The method of forming from a sheet metal strip a forked contact having two parallel prongs formed integrally with a shank portion, said method comprising the steps of forming in said strip two holes spaced apart a distance approximately equal to the required length of the prongs, forming a narrow slot through said strip and connecting said holes, holding portions of said strip on opposite sides of said slot against outward displacement laterally of the slot and simultaneously therewith swaging the edge portions of said strip on opposite sides of said slot to provide rounded surfaces on opposite sides of said slot and conforming substantially to cylindrical surfaces of arcuate extent greater than 90°, and blanking out the shank and integrally attached prong portions from said strip.

2. The method of forming from a sheet metal strip a forked contact having two parallel prongs fromed integrally with a shank portion, said method comprising the steps of forming a narrow slot in said strip between solid portions of said strip to define the gap between portions of said strip which are to form said prongs, holding portions of said strip on opposite sides of said slot against outward displacement laterally of the slot and simultaneously therewith swaging the edge portions of said strip on opposite sides of said slot to provide rounded surfaces on opposite sides of said slot and conforming substantially to cylindrical surfaces of arcuate extent greater than 90°, and blanking out the shank and integrally attached prong portions from said strip.

3. The method of forming from a sheet metal strip a forked contact having two parallel prongs formed integrally with a shank portion, said method comprising the steps of forming a narrow slot in said strip between portions thereof which are to form the prongs of said contact, said slot being wider than the desired gap between said prongs, indenting the portions of said strip on opposite sides of said slot thereby resisting movement thereof against outward displacement laterally of the slot and simultaneously therewith swaging the edge portions of said strip defining said slot by applying pressure to opposite faces thereof causing inward flow of metal to reduce the width of the slot to the desired value, and simultaneously restricting the inward flow of metal to provide rounded surfaces on opposite sides of said slot conforming substantially to cylindrical surfaces extending on opposite sides of the common central plane of said prongs to an arcuate extent of more than 45° on each side of said plane.

4. The method of forming from a sheet metal strip a forked contact having two parallel prongs formed integrally with a shank portion, said method comprising blanking out a portion of said strip to form a narrow slot in said strip between portions of said strip which are to form the prongs of said contact, said slot being defined by square-cornered edge surfaces of said strip, and being wider than the desired gap between the prongs, and swaging the edge portions of said strip defining said slot to cause flow of metal from said square-cornered portions towards the mid-plane of said prongs to reduce the width of said slot to the desired value and to convert said square-cornered edge surfaces into rounded surfaces conforming substantially to cylindrical surfaces extending on opposite sides of the common central plane of said prongs to an arcuate extent of more than 45° on each side of said plane.

5. The method of forming from a sheet metal strip a forked contact having two parallel prongs formed integrally with a shank portion, said method comprising the steps of forming a narrow slot in said strip between portions thereof which are to form the prongs of said contact, said slot being wider than the desired gap between said prongs, swaging longitudinal grooves in opposite faces of each prong portion adjacent said slot to displace metal from each prong portion towards said slot and simultaneously therewith swaging the prong portions between the edges of said slot and said grooves to restrict the inward flow of metal to the desired width of gap between the prong portions and to provide rounded surfaces on opposite sides of said slot conforming substantially to cylindrical surfaces extending on opposite sides of the common central plane of said prongs to an arcuate extent of more than 45° on each side of said plane.

6. The method of forming from a sheet metal strip a forked contact having two parallel prongs formed integrally with a shank portion, said method comprising the steps of forming a narrow slot in said strip between portions thereof which are to form the prongs of said contact, said slot being wider than the desired gap between said prongs, clamping each prong portion of said strip on each side of said slot between die members which bite into opposite faces of the prong portions along a path spaced laterally from the edges of said slot, to hold the slot-forming edge portions of said prong portions against outward displacement laterally of the slot and simultaneously therewith swaging the edge portions of said strip which form said slot to provide rounded surfaces on opposite sides of said slot, conforming substantially to cylindrical surfaces extending on opposite sides of the common central plane of said prongs to an arcuate extent of more than 45° on each side of said plane.

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