

United States Patent

Nijman

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[54] **MINIATURE ELECTRICAL CONNECTOR CONTACTS**

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[73] Assignee: **The Bunker-Ramo Corporation, Oak Brook, Ill.**

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[30] **Foreign Application Priority Data**

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[51] Int. Cl. H01r 13/06

[58] Field of Search 339/176, 252

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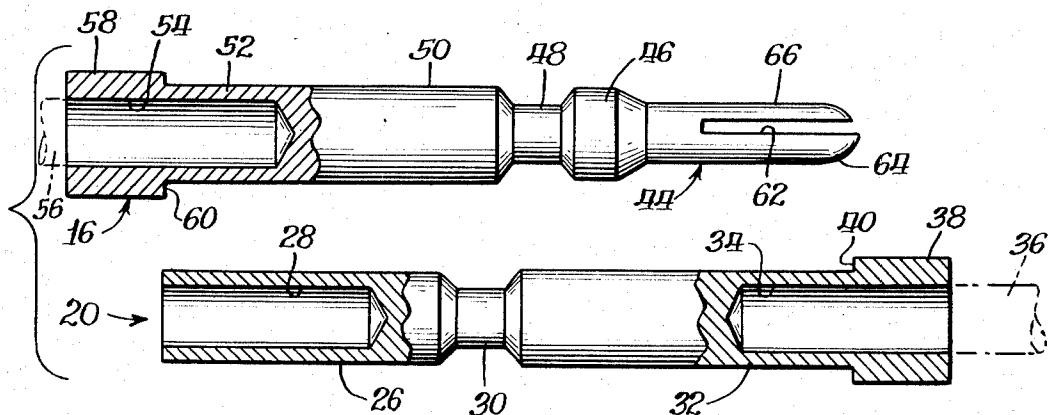
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[57] **ABSTRACT**

A miniature connector in which the pin contact, or male contact member, has separate tines extending generally longitudinally but with their central portions bowed relatively laterally outwardly, their extended ends interengaging, and their outer surfaces curved in both directions; in one form, the tines may be of similar gauge and bowed similarly, while in another form the tines are of different gauge with the heavier one bowed and the lighter one relatively straight; each the male and female contact member has a rear section of generally thin wall but having an enlargement at the rear end to increase crimping effect on a conductor.

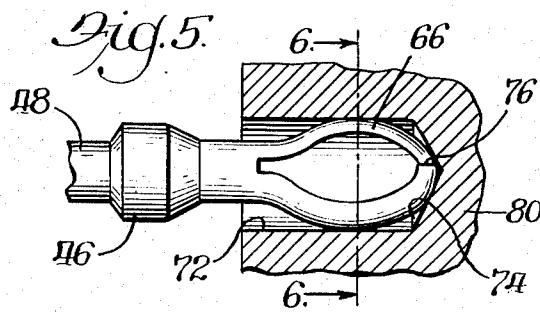
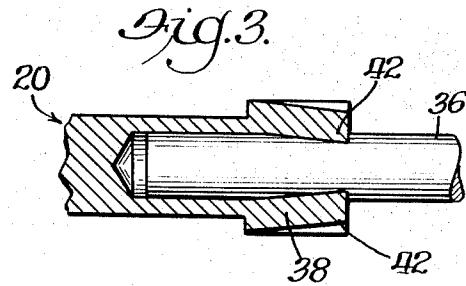
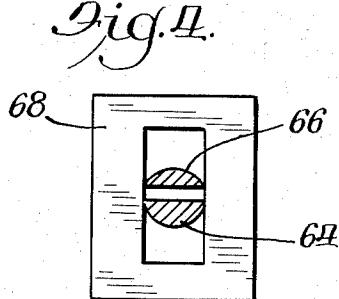
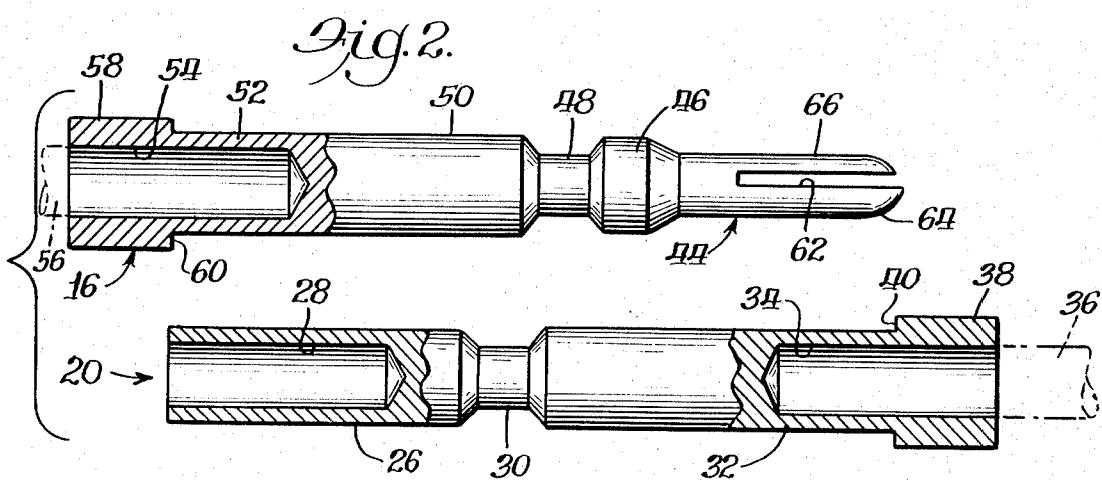
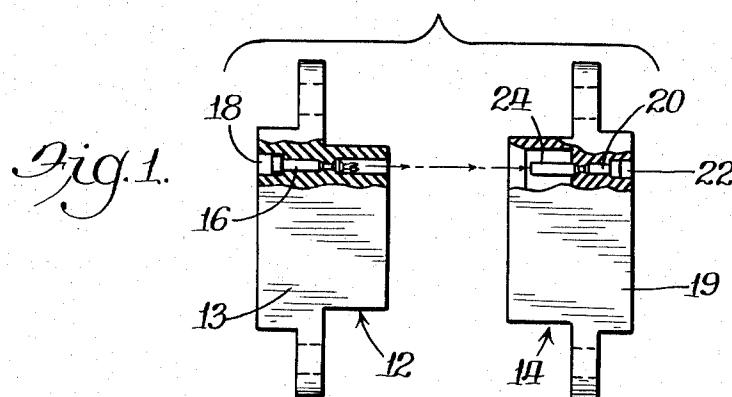
7 Claims, 10 Drawing Figures



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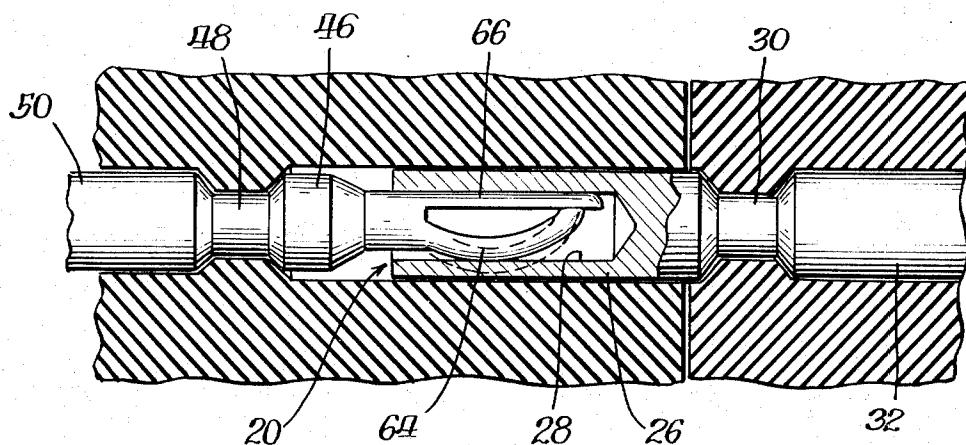
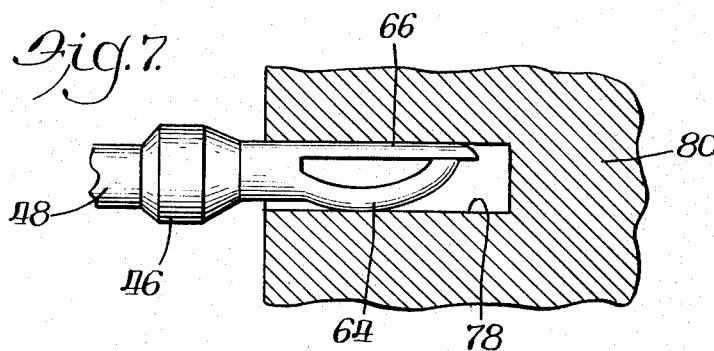
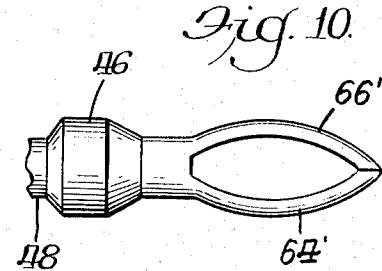
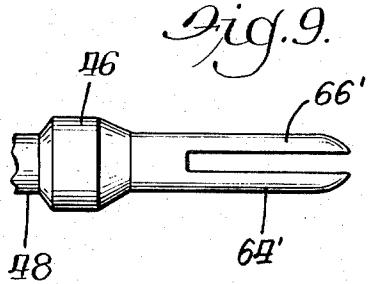


Fig. 8.



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MINIATURE ELECTRICAL CONNECTOR CONTACTS

OBJECTS OF THE INVENTION

The invention relates to a miniature connector or poke home connector.

A broad object of the invention is to produce a miniature connector of the character stated in which the connector members are of extremely small size, and which are adapted to especially effective crimping action on the conductors to which they are connected.

Another object is to produce a miniature connector in which the male member is capable of producing unusually good contact engagement with the cooperating female member.

More specifically an object is to produce a male member of a miniature connector which can be compressed a substantial extent, and which in response to such compression is elongated, producing a constant outwardly biasing effect to maintain constant contact engagement with the counterpart female member.

Another object is to produce a miniature connector in which the male member in one form of the invention has tines of dissimilar gauge, the heavier one being bowed outwardly and the lighter one being relatively straight.

A further object is to provide a miniature connector of the foregoing character which is of extremely simple and inexpensive construction.

Still another object is to provide a novel method of making the miniature connector of the foregoing character.

DESCRIPTION OF A PREFERRED EMBODIMENT

In the drawings:

FIG. 1 shows a pair of blocks of a miniature connector, the respective ones having male and female contact members incorporating the features of the invention;

FIG. 2 is a side view, partially in elevation and partially in section of the contact members;

FIG. 3 is a fragmentary view of a portion of a contact member crimped on a conductor;

FIG. 4 shows a die and the tines of the male contact member therein, in removing the burrs from the tines;

FIG. 5 shows the male contact member in a forming die and the tines as formed thereby;

FIG. 6 is a view taken at line 6—6 of FIG. 5;

FIG. 7 is a view similar to FIG. 5 but in connection with a second forming die;

FIG. 8 shows fragments of the blocks of the connector in interconnected position with one male contact member and one female contact member interconnected;

FIG. 9 shows a fragment of a male contact member with the tines of substantially equal size and gauge; and

FIG. 10 shows the tines of the contact member of FIG. 9 after forming them.

Referring in detail to the accompanying drawings, attention is directed first to FIG. 1 which shows a connector including a pair of members 12 and 14. The member 12 includes a block 13 provided with a plurality of pin contacts or male contact members 16 positioned in corresponding cavities or apertures 18 while the member 14 includes a block 19 provided with a corresponding number of socket contacts or female contact members 20 positioned in cavities or apertures

22, the connector members to be fitted together or connected in the usual manner. The cavities 18 are provided with shoulders 23 and the cavities 22 are provided with shoulders 24, to be referred to again hereinbelow.

The contacts or contact members are formed from rod stock or wire, preferably round and turned down or otherwise treated to form the shapes referred to below. The contacts are preferably of beryllium copper, but alternatively, they may be of phosphor bronze or stainless steel.

The socket contact 20 includes a tubular front end section or portion 26 forming a socket 28 into which the pin contact is inserted. The central section or portion 30 may be solid, while at the rear end is a main relatively thin wall tubular section or portion 32 forming a cavity or socket 34 into which a conductor 36 is inserted. The rear end section is provided with an enlargement 38 forming a forwardly facing shoulder 40, and when the socket contact is inserted into the cavity 22 of the block 19 the shoulder 40 engages the shoulder 24 and limits the extent of its insertion into that cavity. The rear end of the socket contact, at the enlargement 38 is crimped onto the conductor 36 as indicated at 42 in FIG. 3, this enlargement being of importance in that it forms the limiting shoulder 40 and due to the greater mass and corresponding strength thereof a greater crimping action is produced on the conductor.

FIG. 2 shows the pin contact 16 in an intermediate condition of formation, — it includes a forward section 44 and progressing rearwardly an enlargement 46, a reduced shank portion or section 48 and a rear body section or portion 50 which is similar to the rear body section 32 of the socket contact, namely it has a thin wall 52 surrounding a cavity or socket 54 for insertion of a conductor 56. The rear end of the body section is provided with an enlargement 58 defining a forwardly facing shoulder 60 which engages the shoulder 23 in the cavity 18 of the block 13 referred to above, and limits the extent of insertion of the pin contact into that cavity. The rear end section is crimped onto the conductor 56 in the same manner as described above in connection with the socket contact.

After turning down the rod to form the sections of the pin contact referred to above, the forward section 44 is slotted inwardly from the front end as by a saw, forming a slot 62 and a single pair of tines 64, 66. The slot is of substantially uniform breadth while the tines normally are of different thickness or weight or gauge due to the somewhat random location of the sawing operation. The saw may not always be exactly centered, because of the small size of the contact involved, it usually being slightly off center, resulting in a larger and a smaller tine. However, the invention is of sufficient breadth to cover tines of equal thickness as referred to again hereinbelow.

The front section of the pin contact, as represented by the tines 64, 66, as viewed in end (FIG. 6) may be somewhat flattened due to removal of the material in forming the slot, and due to the bowing action referred to below.

Following the slotting operation the tines are forced through a die 68 (FIG. 4) to remove the burrs formed by the sawing operation. The next step is to form the

tines to a bowed shape in a forming die 70 (FIGS. 5 and 6) having a cylindrical cavity 72 with a conical inner end 74. The tines are inserted into the cavity and the ends thereof forced against the conical surface 74 and the contact rotated; the tines are thereby bowed outwardly to the shape shown in FIG. 5, the forward ends thereof interengaging in what most often is an area indicated at 76 and shown as a line in FIG. 6. This area of engagement would be very irregular due to the difference in size of the tines and the irregularities in the surfaces of both, as well as the fact of forcing engagement therebetween.

After shaping the tines to the bowed shape represented in FIGS. 5 and 6, they are inserted into the cavity 78 of a second die 80. The thinner and weaker 15 tine 66 assumes a relatively straight shape while the heavier and stronger tine 64 retains a substantially bowed shape although of lesser bowed extent than before. The cavity 78 is dimensioned so that the resulting transverse dimension (diameter) of the two tines is 20 greater than the diameter of the socket or aperture 28 of the socket contact 20, so as to provide the desired contact engagement therebetween. The formation in the second die 80 forces the heavier tine beyond its normal elastic limit whereby it takes a permanent set, 25 while still retaining a certain degree of elasticity and even after repeated insertions and removals from sockets, it retains its resilience.

FIG. 8 shows the blocks of the connector in inter-fitted position with the contacts in interengagement. As noted above, the transverse dimension of the tines after treatment in the die 80 (FIG. 7) is greater than the transverse dimension of the socket into which the pin contact is to be inserted, such as the cavity or socket 28 in the socket contact of FIG. 8. The relatively straight and light tine 66 remains relatively straight and engages the surface of the contact 28 throughout a substantial area while the bowed heavier tine 64 engages the surface of the socket at a relatively small area, but with substantial pressure. The dot-dash line in FIG. 8 shows 40 the normal expanded or free position of the bowed contact, indicating a constant exertion of pressure against the surface of the socket.

The shape of the tines as described above provides a relatively strong bowed and yielding tine for providing 45 constant contact pressure and eliminates the frailties involved in relying on a relatively thin and light gauge tine which may fail.

The invention, as noted above, also covers the construction in which the tines are of equal weight and 50 thickness, as represented in FIG. 9. In such case the tines are both bowed as in a die as represented in FIGS. 5 and 6 and in this case the pin contact is utilized in such shape.

As an example of the extremely small size of this 55

miniature contact, the pin contact is adapted for insertion into bores not greater than 0.035 inch to 0.040 inch in diameter. The diameter of the stock from which the pin contact is made is not less than about 30 percent of the diameter of a solid bore in which it is to be used. The slot 62 is of about 0.150 inch in maximum length. The contact pressures provided by the tines are of in the neighborhood of 100 grams per tine. The tines are bowed preferably about a transverse axis positioned about midway of the length of the tines. The pin contact is well adapted for use in through holes in printed circuits.

What I claim is:

1. In a miniature connector, a pin contact having a forward contact section including a pair of longitudinally extending tines with their forward ends in contact and spaced apart intermediate their ends, one of the tines being of heavier gauge than the other, and bowed outwardly at its intermediate section from the other and being flexible toward the other in response to insertion of the pin contact into a confining cooperating connector member of smaller transverse dimensions than its own, and the free end of the one tine being thereby projected forwardly longitudinally independently of the other.
2. A pin contact according to claim 1 in which only one of the tines is bowed and the other is relatively straight.
3. A miniature connector according to claim 2 in which the bowed tine is of heavier gauge and substantially stronger than the straight tine.
4. A pin contact according to claim 3 wherein the heavy bowed tine assumes a condition beyond its normal elastic limit but nevertheless possesses a degree of resilient yieldability.
5. A miniature connector comprising:
a socket contact having a socket;
a pin contact having a pin section insertable into the socket of the socket contact;
the pin section including a pair of forwardly extending tines, having their forward ends in contact, one only of the tines being bowed outwardly from the other at its longitudinally intermediate portion and resiliently yieldable toward the other tine, the maximum normal transverse dimension across the pair of tines being greater than the inside diameter of the socket in the socket contact.
6. A miniature connector according to claim 5 in which the bowed tine is of substantially heavier gauge than the other tine.
7. A miniature connector according to claim 6 in which the other tine is relatively straight.

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