

June 11, 1968

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3,388,367

ELECTRICAL CONNECTOR FOR EITHER FLAT OR ROUND CONDUCTORS

Filed June 20, 1966

2 Sheets-Sheet 1

Fig. 1.

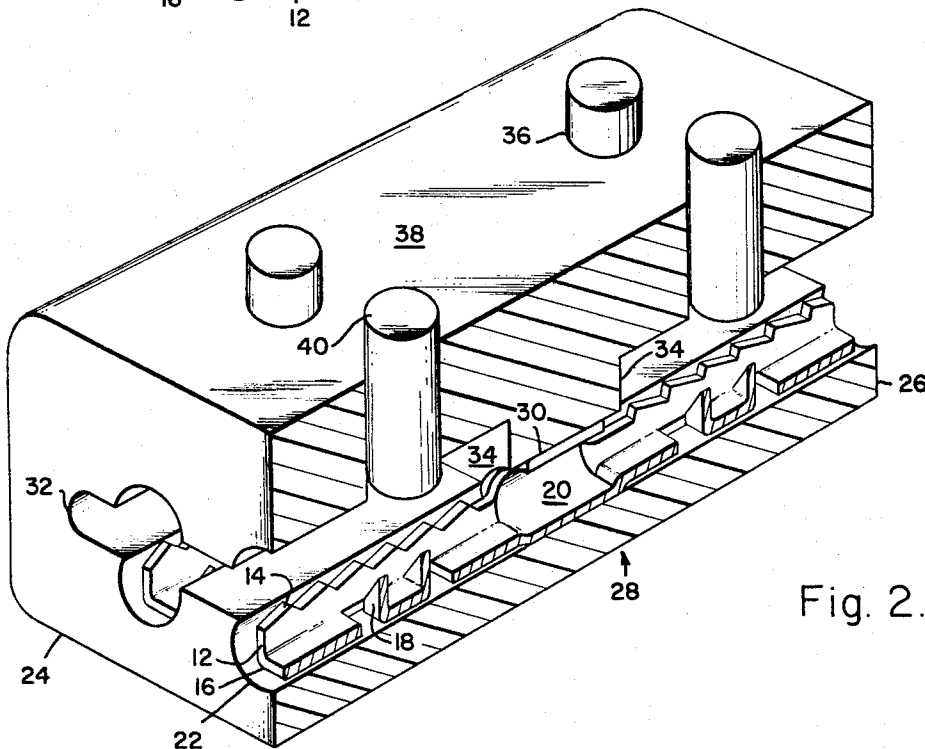
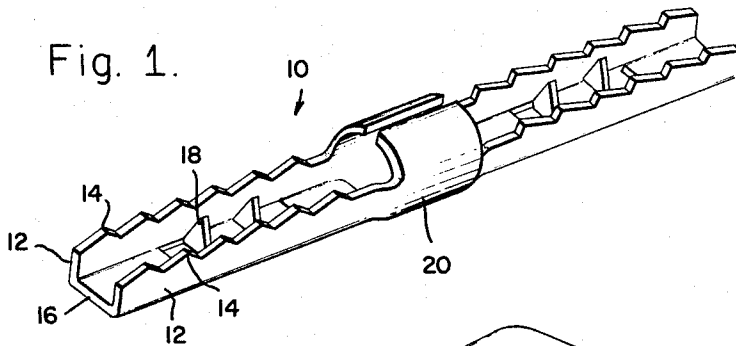
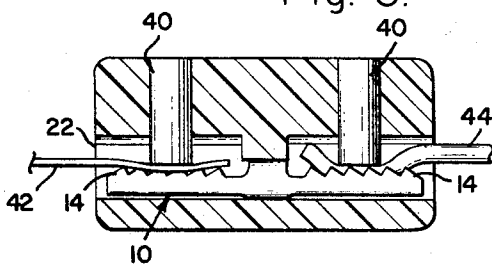


Fig. 2.

Fig. 3.



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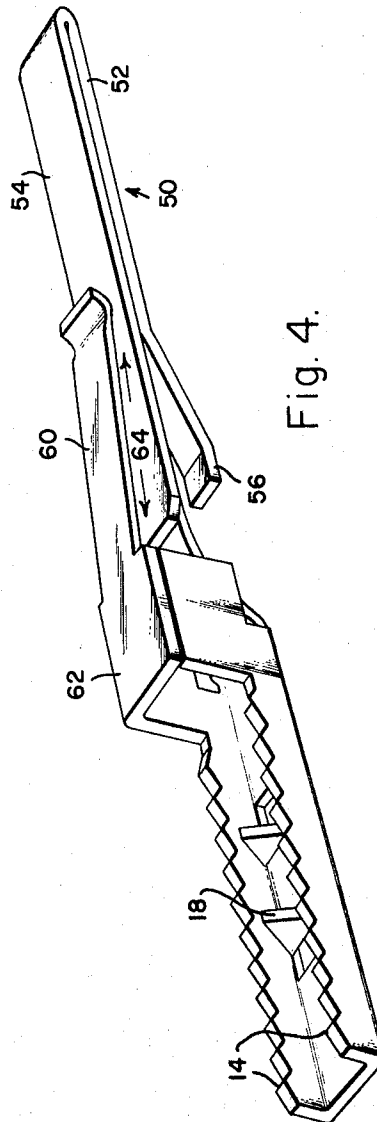
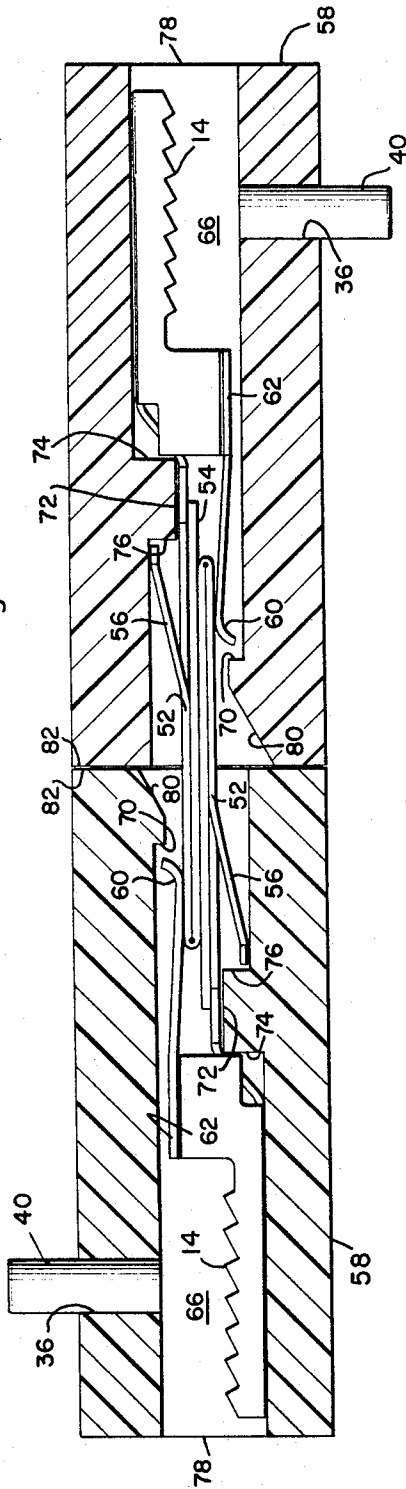
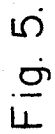
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2 Sheets-Sheet 2



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3,388,367 ELECTRICAL CONNECTOR FOR EITHER FLAT OR ROUND CONDUCTORS

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ABSTRACT OF THE DISCLOSURE

In the disclosed electrical connector, a connector block has an elongated slot and at least one contact chamber which extends through the major cross-section of the connector block and extends across the slot. Within the chamber is a U-shaped contact element, the sides of which have one set of teeth, the bottom portion having another set. A pressure pin forces an insulated electrical conductor placed within the slot onto one of the sets of teeth such that the teeth pierce the insulation of the electrical conductor and make an electrically conductive contact.

The present invention relates to an electrical connector and more particularly to an improved connector for insulated electrical conductors adaptable for use with both flat ribbon or cable-like conductors and the round wire conductors.

The increased utilization of electronic equipment in all areas of our contemporary society has necessitated the development of improved and simplified methods of electrically connecting or interconnecting the systems and components of such equipment. Presently, considerable emphasis has been given to the use of flat multiconductor ribbon-like electrical conductors or tape cable conductors assembled into long ribbons and the desire to interconnect such cables to another cable or to a single conductor of the round wire type.

While a consideration of the structural features of a connector is important, and perhaps paramount in its design, consideration must also be given to the simplicity of such design, as well as the ability of a particular connector to be used in a large number of different applications and environments.

Therefore, an object of this invention is to provide an improved electrical connector for insulated conductors which is usable with electrical conductors of both the tape cable type and the round wire type.

A further object of this invention is to provide an improved electrical connector for insulated conductors which is simple in construction yet usable in many different applications and environments.

A still further object of this invention is to provide an improved electrical connector which is hermaphroditic in construction so that two similar connectors may be mated without the necessity of elements designated as male and female parts such as conventional connectors having pins and sockets.

In general, in its preferred form the present invention comprises a connector block containing a conductor supporting an elongated slot extending inward from a first side and terminating in a wall defining a stop for the conductor. At least one contact chamber extends across the elongated slot from said first side to a second side of the block. A contact clip is retained in the chamber and includes, on at least one end, an insulation piercing portion including a plurality of specifically oriented conductor insulation piercing teeth, a part of said teeth being adaptable to pierce the insulation surrounding a flat ribbon electrical conductor and another part of the teeth being adapt-

able to pierce the insulation surrounding a round individual wire electrical conductor. The other end of the clip contains an electrical contact member such as a second insulation piercing portion, or a mateable contact element which might be hermaphroditic or male and female in configuration. A pressure pin is held in a bore running from a third side of the block to each of the chambers, and once an electrical conductor is positioned in said slot engaging said teeth, the pressure pin is forced into the chamber to bring the end of it into contact with the conductor resulting in the teeth of the piercing portion piercing the insulation of the conductor and making electrical contact with the conductor.

Other advantages of the invention will hereinafter become fully apparent from the following detailed description of two preferred embodiments of the invention when considered in conjunction with the accompanying drawings throughout which like characters indicate like parts, and in which:

FIGURE 1 is a perspective view of an electrical contact element constructed in accordance with the principles of the present invention;

FIG. 2 is a perspective view shown in section illustrating the incorporation of the electrical contact of FIG. 1 in an electrical connector;

FIG. 3 is a side elevational view shown in section illustrating the connector of FIG. 2 in an application wherein a single connector is splicing a tape cable electrical conductor to a round wire electrical conductor;

FIG. 4 is a perspective view of a second embodiment of an electrical contact element constructed in accordance with the principles of the present invention; and

FIG. 5 is a side elevational view shown in section illustrating the incorporation of the electrical contact element of FIG. 4 into an electrical connector and the mating of that element with a similar element to illustrate the formation of a mated connector.

To clearly set forth the principles of this invention it will first be described in a general fashion and then specifically described in two embodiments; a first of which is a connector for interconnection or splicing of insulated flat cable and round wire conductors, the second embodiment is a connector for interconnecting two electrical circuits which has two identical, but mateable halves.

Referring first to FIG. 1, the principles of the present invention are embodied in a contact element 10 having a U-shaped body having sides 12 formed into a plurality of first insulation piercing teeth 14 and a bottom portion 16 having one or more transversely folded second insulation piercing teeth 18. The width of the bottom portion 16 is sufficient to permit a round wire conductor to be inserted between the sides 14. The frequency and shape of the teeth 14, 18 may vary within the principles of this invention, but are sufficient to readily pierce the insulation surrounding a flat cable and round wire, respectively. As clearly seen in FIG. 1 the contact element 10 may be stamped out of sheet metal and formed to constitute an integral piece.

When the contact element 10 is in the form shown in the first embodiment, FIG. 2, it is of a conductive material such as beryllium copper and includes insulation piercing portions at both ends terminating at a central retaining portion 20 which may have a variety of shapes and shown in FIGS. 1 and 2 as generally round and having abutting edges. In this embodiment the contact element 10 is positioned in a contact chamber 22 which extends from a first side 24 to a second side 26 of a connector block 28 typically of a dielectric material such as a rigid plastic of diallyl phthalate. The contact chamber 22 is slightly longer than the length of the contact element 10 and includes one wall having a step 34 defining

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a reduced diameter portion 30 of a diameter sufficient to tightly engage the retaining portion 20 of the contact element 10 for friction fitting said element in the chamber 22. A longitudinal slot 32 extends inward from both the first side 24 and the second side 26 of the connector block 28 and terminates in step 34 defined by the sides of the chamber 22. The step 34 functions to limit the movement of a tape or belt type electrical conductor as it is inserted into the elongated slot, FIG. 3.

A plurality of bores 36 extends from a third side 38 of the block 28 to the chamber 22 and each is aligned with one of the chambers 22 and is of a diameter to receive a pressure rod 40. The pressure rod 40 has a length sufficient to enable it to be inserted into the bore 36 and the aligned chamber 22 sufficiently to force an electrical conductor aligned with the rod into engagement with the insulation piercing teeth of the contact element. This is clearly seen in FIG. 3 wherein the left side of the connector as seen in this figure shows a pressure member 40 forcing a tape cable 42 into engagement with the first insulation piercing teeth 14 resulting in a piercing of the insulation of the cable 42 (not shown). The length of the pressure rod 40 and the height of the first piercing teeth 14 are such that the squeezing of the cable between these two elements will not only pierce the insulation but will also bring the teeth 14 into electrical contact with one or more of the metallic electrical conductors encased within the tape cable 42.

At the right side of FIG. 3 there is shown an insulated wire conductor 44 between the first insulation piercing teeth 14 forced into engagement with the second insulation piercing teeth 18 (not shown in this figure). In a like fashion as that described for the tape cable 42 contact, the length of the pressure rod 40 and the height of the wire piercing teeth 18 are such that contact is made between contact element 10 and the round metallic electrical conductor encased within the round conductor 44. Thus, by the use of a single connector desired electrical connection can be made between the ends of insulated taped cable conductors or the ends of insulated wire conductors without stripping the insulation, or with two cable conductors.

Referring to FIG. 4, the second embodiment of the principles of the present invention shows its application to a connector having identical halves and called in the industry "a hermaphrodite connector" because both halves of the connector function similar to separate male and female connector halves, such as pins and sockets.

The second embodiment contact element includes an insulation piercing portion having first and second insulation piercing teeth 14, 18, respectively, such as that described in relationship to the first embodiment but also includes at the other end of the element a hermaphrodite contact 50. The hermaphrodite contact 50 includes a first leg 52 and a second leg 54 folded in contact and functioning as a blade or the male portion of the contact. The end of the first leg 52 is bent away from the second leg 54 for a retention finger or louver 56 to retain the contact element in a connector block 58 as shown in FIG. 5. The contact element also includes a contact finger 60 which is cantilevered from a central portion 62 of the element into juxtaposition with the second leg to define a length 64 which functions as the female portion of the contact.

As shown in FIG. 5, the contact chamber 66 of the second embodiment has a configuration which enables the contact 50 to be retained therein. One side of the chamber 66 includes a closed entry ledge 70 and the other side of the chamber 66 includes a step 72, having a first shoulder 74 which functions to limit the movement of the contact element in one direction by engagement with the exposed end of the contact barrel 62 and a second shoulder 76 which functions to engage the end of the retention louver 56 thus preventing movement of the contact element 50 in the other direction.

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To position the contact element 50 in the chamber 66 the blade is first inserted into the chamber 66 from a first end 78 of the chamber 66 and as the blade is inserted through the chamber 66 the step 72 depresses the resilient louver 56 which springs back into engagement with the wall of the chamber 66 after it passes the second shoulder 76 of the step 72. At this point the end of the contact finger 60 has ample deflection clearance with the closed entry ledge 70. A beveled portion 80 is formed at a second or other end 82 of the chamber 66 and this portion 80 functions to facilitate the engagement of a second blade with the first blade since it guides the blade into the slot between the contact finger 60 and the folded over second leg 54. As described previously, the connector block 58 includes a bore 36 aligned to permit a force fit pressure rod 40 to be inserted into the chamber forcing the insulated conductor into piercing engagement with the contact element.

While the basic principles of this invention have been herein illustrated and described in two embodiments, it will be appreciated by those skilled in the art that variations in the disclosed arrangements both as to its details and as to the organization of such details may be made without departing from the spirit and scope thereof. Accordingly, it is intended that the foregoing disclosure and the showings made in the drawings will be considered only as illustrative of the principles of the invention and not construed in a limiting sense.

What is claimed is:

1. An electrical connector for electrically connecting first and second insulated electrical conductors comprising:

a connector block defining an elongated slot extending inwardly from a first side of said block and adapted to receive said first insulated electrical conductor, said block defining at least one contact chamber extending across said elongated slot from said first side to a second side and further defining at least one bore extending between a third side and said contact chamber;

a contact element disposed in said contact chamber and including at one end a first contact member defining a U-shaped body having substantially parallel side walls connected by a bottom portion with the edge of said side walls being shaped into a plurality of first insulation piercing teeth and said bottom portion having a plurality of second insulation piercing teeth, said first piercing teeth being adapted to make contact with at least one electrical conductor of an insulated flat multiconductor tape type of cable and said second piercing teeth being adapted to make contact with an electrical conductor of an insulated round type of cable, said contact element having at its other end a second contact member adapted to electrically connect said first insulated electrical conductor to said second insulated electrical conductor; and

a pressure pin in said bore adapted to be inserted therethrough such that the inserted end of said pin engages said first insulated electrical conductor to force said conductor into engagement with one of said first and second pluralities of piercing teeth, said pin exerting a force sufficient to force the said plurality of piercing teeth to pierce the insulation of said first electrical conductor.

2. The electrical connector of claim 1 wherein said chamber includes a contact retaining portion and said contact element includes a resilient pressure portion engageable with said retaining portion to retain said contact element in said chamber.

3. The electrical connector of claim 1 wherein said first insulated electrical conductor and said second insulated electrical conductor are each selected from the group consisting of multiconductor tape cables and round wire type cables, and said elongated slot extends

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inwardly from both said first and said second sides, said second contact member is substantially similar to said first contact member and said connector block includes at least two bores extending between said third side and said contact chamber, each bore including a pressure pin adaptable to force a different one of said insulated electrical conductors into piercing engagement with one of said first and said second teeth.

4. The electrical connector of claim 1 wherein said plurality of first insulation piercing teeth are disposed substantially in the planes of said side walls and wherein said plurality of second insulation piercing teeth are disposed in a plane substantially normal to said planes.

5. The electrical connector of claim 1 wherein said second contact member is an hermaphrodite contact element having both male and female portions.

6. The electrical connector of claim 5 wherein said hermaphrodite contact element includes a blade having a tip defining a male portion and a deflectable contact

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finger in juxtaposition to said blade, said blade and said finger defining a chamber or female portion which is adapted to contact and secure a male tip portion of a second hermaphrodite contact element.

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