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Brorein

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[54] **CORD CONNECTOR FOR PRINTED WIRING CARDS**

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[73] Assignee: **General Cable Corporation,** New York, N.Y.

[22] Filed: **May 18, 1971**

[21] Appl. No.: **144,594**

[52] **U.S. Cl.**..... **339/176 MP,** 339/17 L, 339/186 M, 339/196 M, 339/275 B

[51] **Int. Cl.** **H01r 13/58,** H05k 1/02

[58] **Field of Search** ..... 339/17 R, 17 L, 17 LM, 339/17 F, 17 LC, 18 R, 18 P, 196 R, 196 M, 195 R, 192, 176 M, 176 MF, 176 MP, 95, 97, 99, 103, 107, 119, 125, 136, 75 M, 75 MP, 184, 186, 217, 210, 275

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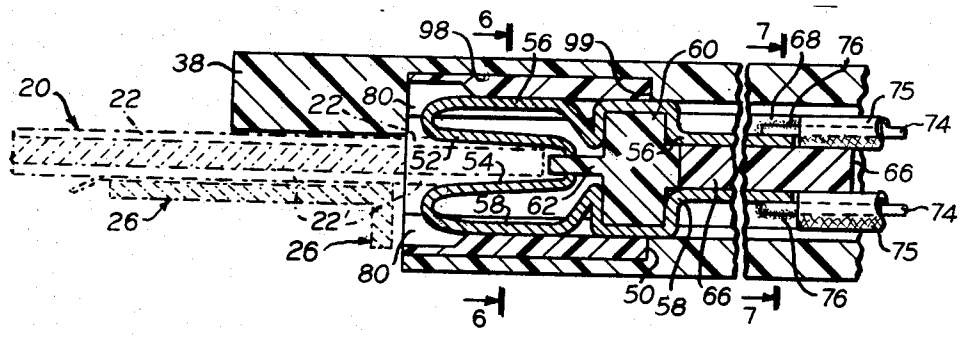
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[57] **ABSTRACT**

This electric cable connector for printed wiring cards has an insert spacer at the location where the contacts of the connector are joined to the conductors of the cable and between the upper and lower layers of contacts when the connector is for a double-faced printed wiring card. The spacer has channels for the individual contacts with the sides of the channels forming barriers between adjacent contacts and providing for convenient soldering of the conductors to the contacts of the connector. The use of shrink tubes is no longer necessary. The connector assembly has a shell or housing that houses the connector body, the spacer and the wires of the electrical cable; and there is a polarizing tongue extending from the housing in position to cooperate with a depression in the handle of a printed wiring card.

20 Claims, 12 Drawing Figures



2 Sheets-Sheet 1

FIG. 2.

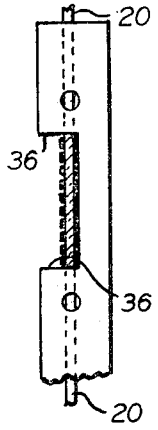


FIG. 1.

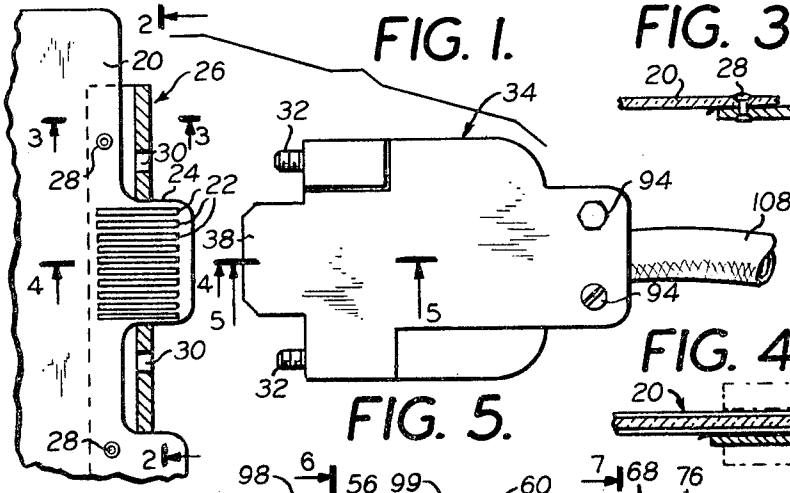


FIG. 3.

FIG. 4.

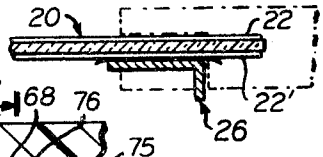


FIG. 5.

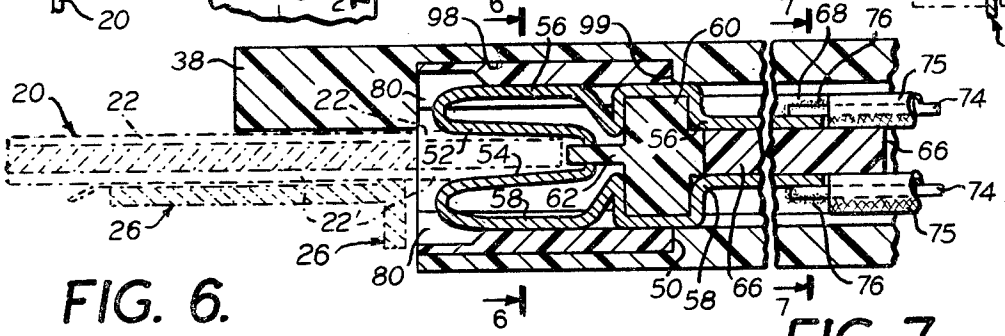


FIG. 6.

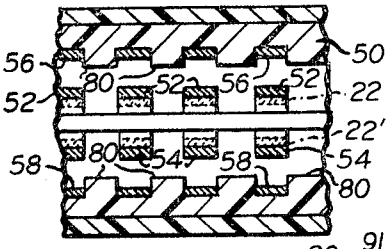


FIG. 7.

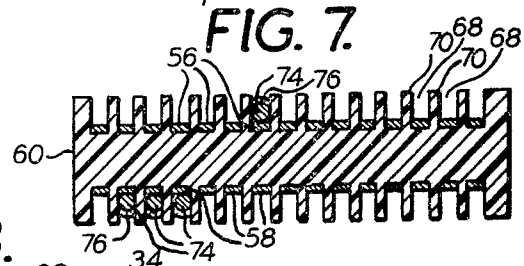


FIG. 8.

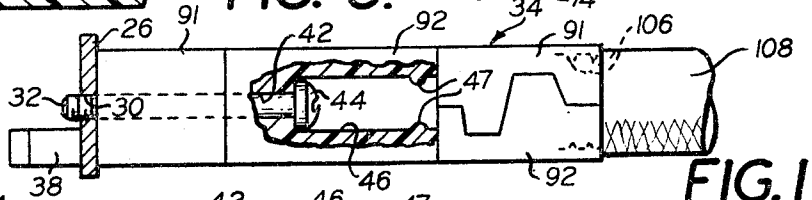


FIG. 9.

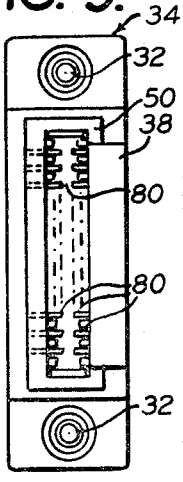


FIG. 10.

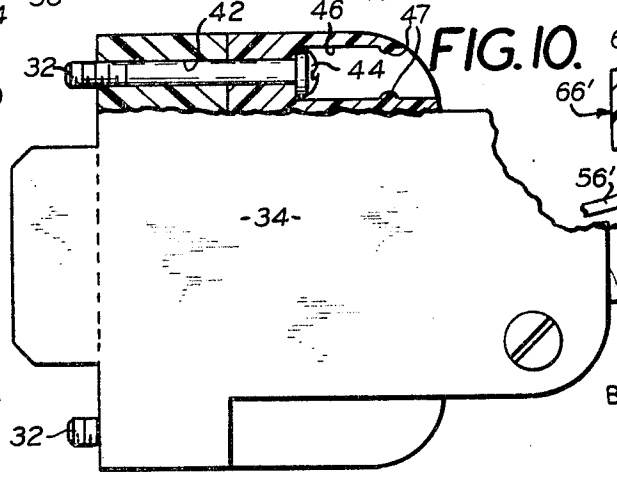
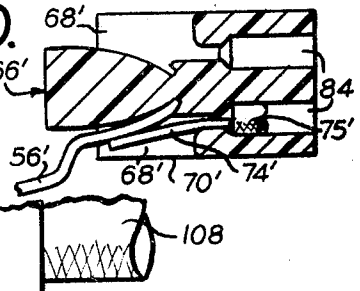


FIG. 11.



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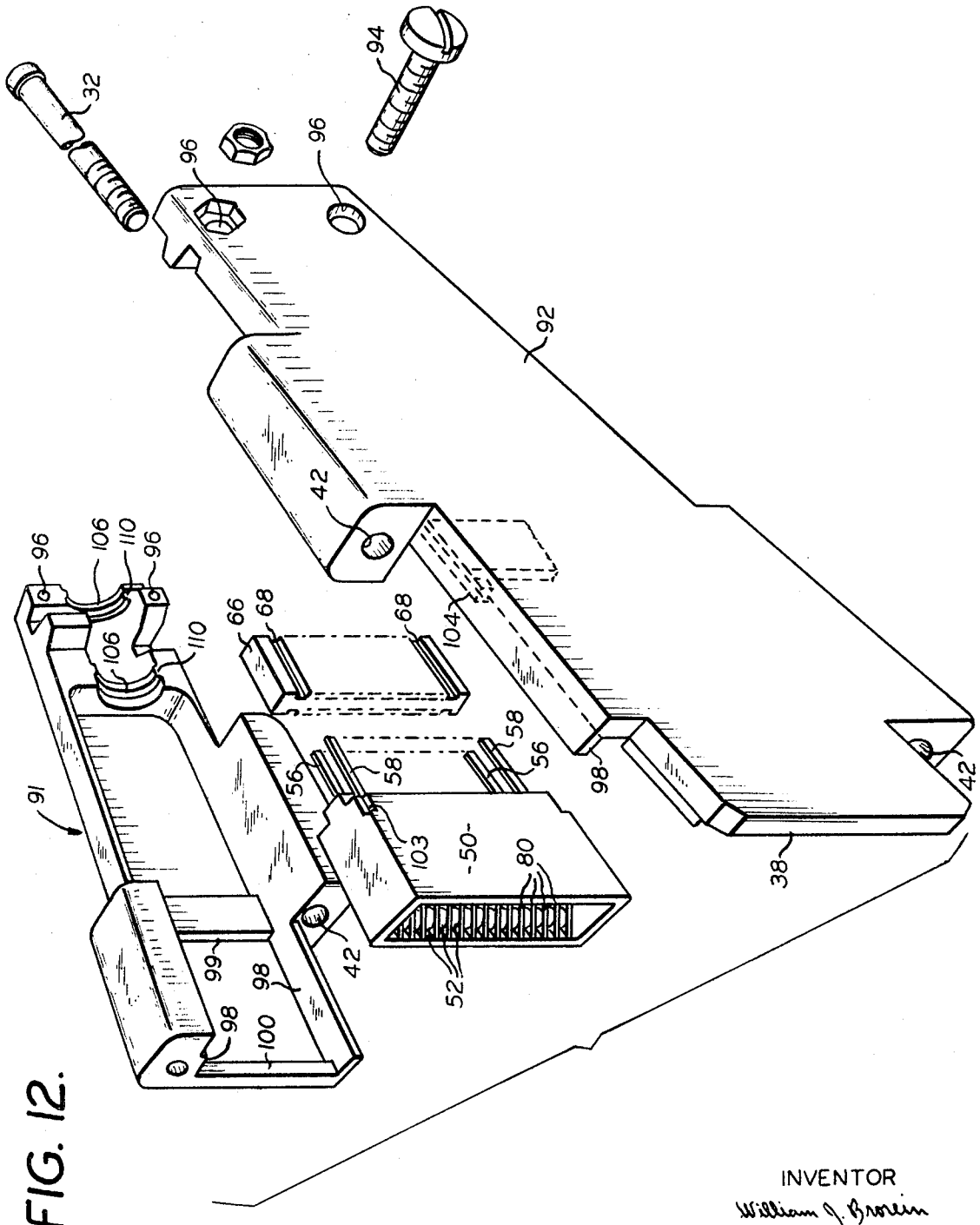


FIG. 12.

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CORD CONNECTOR FOR PRINTED WIRING CARDS

BACKGROUND AND SUMMARY OF THE INVENTION

Printed wiring cards have edge portions for different sections of the circuits on the cards brought into parallel relation to touch the respective contacts of a connector that slides over an extending edge of the card. Rails or handles extend along the edge of the card, usually spaced outwardly from the card itself, but connected therewith as a unitary assembly.

The connector that overlaps the edge of the card has contacts parallel to one another and closely spaced. For example, there may be as many as 20 contacts per inch on each side of the connector in position to touch the corresponding printed circuit contacts along the edge of the card. Each of the connector contacts has to be connected with a conductor of an external wire or cable circuit and each contact may have to be connected with a conductor of a different external circuit.

To support of ends of contacts that are to be soldered to external conductors, and to facilitate the soldering, this invention provides a spacer that has barriers between the contacts and that provides support for the conductors adjacent to the locations at which they are to be soldered. In the preferred embodiment, the spacer is made of white polytetrofluoroethylene or other heat resistant material so as to be suitable with infra-red soldering or by conventional soldering methods.

The spacer of this invention is preferably a separate piece from the connector body that houses the contacts so that it can be interchangeable, and different spacers can be used with different connector bodies depending upon the number and spacing of contacts and other differences that prevent standardizing on a single design of spacer.

The invention has a shell made of insulating material that:

1. Encloses and holds in place and in proper orientation the connector body, spacer, and the end of the cable that has the conductors that are connected to the connector terminals.
2. Provides a polarizing means with the printed wiring board by use of the projecting tongue. The projecting tongue is sufficiently long to prevent any of the electrical contacts from touching if an attempt is made to mate the connector incorrectly with the board.
3. Provides an internal polarizing key to properly orient the connector body within the shell and with respect to the external polarizing tongue.
4. Provides a cable grip and transmits any mechanical pull on the cable directly to the handle on the printed wiring card. It prevents any stress on the cable from reaching the relatively fragile contacts of the connector.
5. The shell provides a tightly fitting cover over the spacer and prevents any of the cable conductors from moving out of their channels in the spacer.
6. The shell provides a means for fastening the connector to the printed wiring card.
7. The fastening or mounting screws are captivated by protrusions within the bores in the shell. This prevents the screws from falling out and becoming lost when the connector is disengaged from the printed wiring card.
8. The mounting screws are allowed to "float" or move within tthe bores in the shell so that one screw at a time can be tightened fully to bring the connector flush with the handle on the wiring card without interference from the other screw.
9. The two halves of the shell are interlocked and are pinned together along both edges by the mounting screws. Extra clamping force is obtained in the cable grip area by means of the two transverse clamping screws.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

BRIEF DESCRIPTION OF DRAWING

In the drawing, forming a part hereof and which like reference characters indicate corresponding parts in all the views:

FIG. 1 is a view of a connector made in accordance with this invention and a fragmentary view of a printed circuit card with which the connector is used;

FIG. 2 is a fragmentary view of the printed circuit card and handle, the view being taken on the line 2—2 of FIG. 1;

FIGS. 3 and 4 are sectional views taken along the lines 3—3 and 4—4, respectively of FIG. 1;

FIG. 5 is a greatly enlarged fragmentary sectional view taken on the line 5—5 of the connector with the card shown in phantom to illustrate the working relation with the printed circuit card and the connector;

FIG. 6 is a fragmentary, sectional view on the line 6—6 of FIG. 5;

FIG. 7 is a sectional view through the spacer shown in FIG. 5, the section being taken on the line 7—7 of FIG. 5 but showing conductors and connectors in only a few of the channels of the spacer;

FIG. 8 is a side elevation, partly broken away and a section, of the connector shown in FIG. 1;

FIG. 9 is an end view of the connectors shown in FIG. 1 but on an enlarged scale;

FIG. 10 is a fragmentary view of the connector shown in FIG. 1 partly broken away showing the screws by which the connector is connected with the handle of a printed circuit card;

FIG. 11 is a sectional view showing a modified form spacer for use with the connector shown in the other views; and

FIG. 12 is an exploded perspective view of the connector shown in FIGS. 1 - 10.

DESCRIPTION OF PREFERRED EMBODIMENT

FIG. 1 shows a printed circuit card 20 which has circuits on its surface terminating in a number of parallel conductor strips 22 which extend out towards the end of a tab 24 projecting from the edge of the card 20. The card has a handle portion 26 which is of T-shaped cross-section, as shown in FIG. 3; and which is connected to the printed circuit card 20 by suitable means such as rivets 28.

The handle 26 has threaded openings 30 for receiving screws 32 of a connector 34 which is attached to the card and which connects with the circuits of the card in a manner which will be explained. The handle 26 has a cutout section 36 (FIG. 2) over the tab 24 for receiving a tongue 38 (FIG. 1) of the connector 34.

This tongue 38 is a polarizing tongue and it insures that the connector 34 is applied over the tab 24 with the right orientation.

In the construction illustrated, the tongue 38 insures that the connector 34 is not applied to the card 20 upside down. FIGS. 8 and 9 show the way in which the screws 32 extend through portions of the electric cable connector 34. There are openings 42 in the shell of the electric cable connector 34 from which the screws 32 extend; and the screws 32 have heads 44 which fit into counterbores 46 of the openings 42. These screw heads clamp against the annular bottom surfaces of the counterbores 46.

There are protrusions 47 on the walls of the counterbores which captivate the screws 32. The heads of the screws are too large to pass the protrusions 47; and the protrusions 47 are spaced from the bottom surfaces of the counterbores far enough to give the screw 32 a "float" distance so that the threads of the screw can move into the opening 42. This permits one screw at a time to be tightened fully to bring the connector 34 flush with the handle 26. When the connector is to be attached to the handle 26 of the printed circuit card 20, the screws 32 are screwed into the openings 30 by inserting a screwdriver into the counterbores 46 which provide access and guide the screwdriver tip to the heads 44 of the screws 32.

The FIG. 5 shows the internal construction of the connector 34. There is a connector body 50 which is preferably one piece of plastic material. Within the connector body 50 there are upper contacts 52 which are arranged in parallel relation with one another across the width of the connector body, as shown in FIG. 6, and these contacts 52 touch the conductor strips 22 (FIG. 1) on the top surface of the card 20. If the printed circuit card 20 is one which has circuits on both its upper and lower surfaces, then the connector body 50 also has lower contacts 54 (FIGS. 5 & 6), similar to the upper contacts 52 but in a position to touch conductor strips 22' (FIG. 4) on the bottom surface of the card 20.

The upper contacts 52 are formed by folding back the forward ends of connectors 56 which extend through an end wall 60 of the connector body 50 and for some distance beyond the end wall 60. This end wall 60 can be of one piece construction with the rest of the connector body 50 or it can be an inserted piece as shown in FIG. 5; but whatever the construction, it is made a fixed part of the connector body 50 with a row of openings for the upper connectors 56 to extend through, and the connectors 56 are formed so that they are bent against the inner and outer faces of the end wall 60 to hold the connectors 56 against displacement in the direction of their longitudinal extent. The lower contacts 54 are similarly formed by folding back the end portions of lower connectors 58 which extend through openings in the end wall 60 as shown in FIG. 5. The connector body 50 shown in the drawing is a commercial product that is used in making the combination of this invention.

There is a tongue 62 extending forwardly from the inner surface of the end wall 60 and this tongue 62 provides a stop against which the ends of the contacts 52 and 54 abut so that these contacts 52 and 54 can be under spring tension at their folds and still not contact with one another, being held apart by the tongue 62.

When the tab 24 of the printed circuit card 20 is inserted into the connector body 50, the conductor strips 22 on the tab 24 displace the contacts 52 and 54 away from one another so that the spring tension of these contacts hold them firmly against the conductor strips 22 of the card. FIG. 5 shows the printed circuit card 20 and shows the tab extending into the connector body and it will be apparent that the contacts 52 and 54 are displaced and moved away from one another with the tab 24 inserted into the connector body 50.

As shown in FIG. 5, the connectors 56 and 58 extend for a substantial distance beyond the back wall 60 and this invention provides a spacer 66 interposed between the upper row of connectors 56 and the lower row of connectors 58. This spacer has channels 68 formed by ridges 70 which are so spaced from one another that the channels 68 provide grooves for receiving the connectors 56 and 58. There is a separate channel 68 for each of the connectors 56 and 58 and the ridges 70 effectively separate the connectors 56 from one another across the top of the spacer 66 and the connectors 58 from one another across the bottom while the main body of the spacer 66 separates the upper row of connectors 56 from the lower row of connectors 58. The sections 91 and 92 which form the housing or shell molded from a high impact strength insulating material such as Nylon, Polycarbonate or Noryl.

Referring to FIGS. 5 and 7, conductors 74, for connection with the respective connectors 56 and 58, are inserted into the channels 68 so as to overlie at least a portion of the length of the connectors 56 and 58. These conductors 74 have their insulation 75 removed for the portion of their length that is to be soldered to the connectors 56 or 58 and they are electrically connected to the connectors 56 and 58 by solder 76.

The soldering operation can be performed in a number of ways. For example, the connectors 56 and 58 can have their surfaces which are in the channels 68 coated with solder before being placed in the channels 68. The connectors 56 and 58 can be manufactured with solder coated ends. After the conductors 74 are inserted into the proper channels 68, they can be held in contact with the connectors 56 and 58 and infra-red heat applied to fuse the solder 76. Any other known soldering methods can be used and if some of the connectors 56 or 58 are to be joined together in a common circuit, the particular ridges can be removed and the solder applied to these particular connectors can be increased in quantity so that it extends across the space between them to electrically connect the circuits which are to be connected in common. A metal strip is used across the width of the connector if all contacts on one side are to be made common.

Since the conductors 74 are soldered to the connectors 56 and 58 while the parts are held in the channels 68 of the spacer 66, it is necessary that the spacer 66 be made of material which is capable of withstanding the heat of molten solder. Polytetrofluoroethylene is a material which is particularly suitable for the spacer 66. By making the spacer 66 of white polytetrofluoroethylene the spacer reflects heat which does not strike the metal in the channels 68 and this protects the plastic of the spacer from much of the infra-red heat.

FIG. 9 shows the front of the connector 34 and shows ridges 80 which are formed on the inside of the connector body in position to separate the connectors 56 and 58 from one another; but the ridges 80 are low enough

so that they do not extend between the folded back portion of the conductors **56** and **58** which form the upper and lower contacts **52** and **54**, respectively. This construction is most clearly apparent by comparing FIGS. **5** and **6**. Thus the ridges **80** do not prevent the contacts **52** and **54** from touching the conductor strips **22** of the printed circuit card.

FIG. **11** shows a modified form of the spacer **66** shown in the other Figures. In FIG. **11** there is a spacer **66'** which has ridges **70'** forming channels **68'** between them. However, in spacer **66'** there are openings **84** in alignment with each of the channels **68'**. These openings have one portion, adjacent to the channel **68'** which is of a diameter to receive the end of a conductor **74'** from which the insulation has been removed; and there is a larger diameter counterbore at the other end of the opening **84** which will receive the insulation **75'** of the conductor **74'**.

When inserting a conductor **74'** into the spacer **66'**, the conductor **74'** is pushed into the selected opening **84** as far as it will go. When the insulation **75'** on the conductor **74'** strikes the shoulder formed by the bottom of the counterbore of the opening **84**, the bare end of the conductor **74'** is extending the proper distance into the aligned channel **68'** to overlap the end portion of the connector **56'** to which it is to be soldered. The spacer **66'** is assembled with the connector body **50** in the same way as the spacer **66** as shown in FIG. **5** with the extending ends of the connectors in the corresponding channels of the spacer.

FIG. **12** is an exploded perspective view of the structure shown in FIG. **5**. The connector body **50** is enclosed in a shell or housing formed of two mating sections **91** and **92** which are held together by screws **94** extending through openings **96** in the different sections **91** and **92** and by screws **32** through holes **42**. The sections **91** and **92** which form the housing or shell are molded from a high impact strength insulating material such as nylon, polycarbonate or noryl. The connector body **50** is retained in the shell by side walls **98**, an inner shoulder **99** and a front lip **100**.

A broad ridge **101**, of which the shoulder **99** forms one side, contacts firmly with one face of the spacer **66** when the sections **91** and **92** of the housing shell are in assembled relation with one another; and a corresponding ridge **102** on the inside surface of the shell section **92** contacts firmly with the other side of the spacer **66**. These ridges hold the spacer tightly against displacement and prevent conductors and contacts in the channels **68** of the spacer from coming out of these channels.

It is essential that the connector body **50** be correctly oriented in the housing or shell. Provision is made to provide an internal polarizing key in the shell properly related to the external polarizing tongue **38**. In FIG. **12** the connector body **50** has a keyway **103** formed by leaving a recess at the rearward end of the upper front corner of the connector body. A key **104** on the inside of the shell section **92** fits into the keyway **103** when the connector body is inserted in the housing with the intended orientation. If inserted any other way the key **104** holds the connector body in a raised position and the sections **91** and **92** of the shell cannot be brought together to let the openings **42** align with one another to receive the screws **32**.

For clearer illustration in FIG. **5**, the section through the shell is all cross-hatched in one direction. FIG. **5** is not intended to illustrate the shell's structure. There is an opening **106** (FIG. **12**) through the back of the shell with ridges **110** for clamping a multi-conductor cable **108**, shown in FIG. **8**, and all of the conductors **74** are part of the core of the multi-conductor cable **108**.

When the sections **91** and **92** are connected together by the screws **32** and **94**, the cable **108** is clamped by circumferential ridges **110** on the side walls of the opening **106** to hold the cable securely.

The preferred embodiments of the invention has been illustrated and described, but changes and modifications can be made and some features can be used in different combinations without departing from the invention as defined in the claims.

What is claimed is:

1. An electrical cable connector for connecting a generally circular cable, containing a multiplicity of separately insulated conductors, to the edge contacts of printed wiring cards, including in combination a connector body which houses parallel rows of electrical connectors that touch the edge contacts of the wiring card, the connectors having portions that contact with surfaces of the connector body for holding the connectors against displacement with respect to the connector body in the direction of the longitudinal length of said connectors, the ends of the connectors extending beyond the connector body on the side thereof remote from the card, and a spacer with rows of passages in different planes and in which the conductors and the extending ends of the connectors are located and in which the ends of the conductors overlap and connect with the connectors, the spacer having at least a portion of the length of said passages open at the top, but with side barriers between the passages and substantially narrower than the passages, for access to the extending connectors and the overlapping conductors to connect each connector with its overlapping conductor.

2. The electrical cable connector described in claim **1** characterized by the spacer being a separate piece from said connector body for insertion between the extending ends of the connectors of said parallel rows and having its front portion in contact with the connector body when the extending ends of the connectors are in the passages and in position to be overlapped by the conductors.

3. The electrical cable connector described in claim **2** characterized by the rearward portions of the passages of the spacer being openings through a rearward face of the spacer, said openings being of continuous circumferential extent and the forward portions of the passages being channeled with the sides of the channels forming the barriers between the passages.

4. The electrical cable connector described in claim **3** characterized by the openings being in the rearward face of the spacer and being of enlarged diameter at the rearward ends and of reduced diameter toward their forward ends, and the change in diameter is an abutment for insulation on each conductor to limit the extent to which the conductor is inserted into the opening and the resulting overlap of the connector and the end of the conductor beyond said insulation.

5. The electrical cable connector described in claim **2** characterized by the passages in the spacer being open channels throughout their length with the sides of the channels forming the side barriers between the passages, said side channels being wide enough to receive

insulated end portions of the conductors with bare portions of the conductors beyond the insulation for contact with the extending ends of the connectors.

6. The electrical cable connector described in claim 2 characterized by the spacer being of one piece construction and being held against displacement normal to the planes of said layers of connectors by the connectors themselves.

7. The electrical cable connector described in claim 2 characterized by the spacer being held against the forward displacement by the connector body and being held against displacement in all other directions by a surrounding shell and by the connectors and the conductors that are connected to said connectors.

8. The electrical cable connector described in claim 1 characterized by the spacer including the barriers thereof being made of plastic material that can withstand the heat of molten solder used to join the connectors to the conductors, and the depth of the passages being greater than the combined heights of a bare end portion of one of the conductors and an extending end of one of the connectors.

9. The electrical cable connector described in claim 8 characterized by the spacer being made of white polytetrafluoroethylene for reflecting heat of an infrared soldering operation.

10. The electrical cable connector described in claim 1 characterized by the connector assembly comprising sections that connect together to form a shell that houses the connector body, the spacer and the end portions of the conductors, and that clamps the cable which includes said conductors, one section of the shell having a tongue that extends through a cutout section in a handle of the wiring card, with which the connector is intended to be used, for polarizing the connector.

11. The electrical cable connector described in claim 10 characterized by the printed wiring card having a handle spaced along most of its length from the edge of the card along which the printed circuit edge contacts are located, connecting means spanning the space between the handle and the edge of the card for securing the handle to the card, and an opening in the handle over the edge portions where the printed circuit edge contacts are located for receiving the tongue of the connector when the connector is assembled with the card with the intended polarity orientation.

12. The electrical cable connector described in claim 11 characterized by the polarizing tongue projecting beyond the connector body for sufficient distance to strike the handle before the card and connector are brought close enough together for any contact of the connector to touch any contact of the card when the tongue of the shell is in any position other than a position of alignment with said opening in the handle.

13. The electrical cable connector described in claim 10 characterized by internal polarizing means in the shell that houses the connector body including key and keyway means, one of which is on the connector body and the other of which is on the shell for preventing assembly of the connector and shell in any relation except one particular orientation of the connector body in the shell.

14. The electrical cable connector described in claim 1 characterized by the connector assembly comprising sections that connect together to form a shell that houses the connector body, the spacer and the end portions of the conductors, and that clamps the cable which includes the conductors, a printed wiring card having a handle portion connected along the edge of the wiring card having edge contacts with which the connector is used, detachable fastening means for connecting the handle of the wiring card with the shell that clamps the cable whereby any mechanical pull on the cable is transmitted directly to the handle on the printed wiring card and stress on the cable is prevented from reaching the contacts of the connector.

15. The electrical cable connector described in claim 1 characterized by the connector assembly comprising sections that connect together to form a shell that houses the connector body, the spacer and the end portions of the conductors, and that clamps the cable which includes said conductors, faces on the different sections of the shell in position to contact firmly with opposite sides of the spacer when the sections of the shell are in assembled relation with one another, and fastening means holding the sections of the shell in assembled relation with the spacer clamped between them for preventing any of the conductors from moving away from the spacer and out of the channels in the spacer.

16. The electrical cable connector described in claim 1 characterized by the connector assembly comprising sections that connect together to form a shell that houses the connector body, the spacer and the end portions of the conductors, and that clamps the cable which includes said conductors, a printed wiring card having a handle portion, and detachable fastening means for connecting the shell with the handle portion of the card.

17. The electrical cable connector described in claim 16 characterized by the detachable fastening means being screws that extend through bores in the housing including counterbores in which the heads of the screws are located, and limit stops including protrusions extending from the sides of the bores in position to prevent the screws from being removed from the bores when disengaged from the wiring card.

18. The electrical cable connector described in claim 17 characterized by the limit stops being spaced from one another axially of the length of the screws to allow the screws to "float" with a free axial movement, when disconnected from the card, sufficient to bring each screw into its bore whereby another screw can be tightened fully to bring the connector flush with the handle of the card without interference from the first screw.

19. The electrical cable connector described in claim 16 characterized by detachable fastening means being screws, the shell having two sections that are secured together by the screws that connect the shell to the card, and other screws extending in different directions from the first screws and in position to clamp the sections of the housing into firm contact with a cable entering an opening in the shell between confronting sections of the shell.

20. The electrical cable connector described in claim 1 characterized by the connector including a shell housing the connector body and comprising a molding of high impact strength insulating material from the group consisting of Nylon, Polycarbonate, and Noryl.

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