United States Patent

Hardesty et al.

[15] **3,699,498**

[45] **Oct. 17, 1972**

[54] **DEVICES FOR MAKING ELECTRICAL CONNECTIONS**

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[21] Appl. No.: **33,211**

[52] **U.S. Cl.** .....**339/64 M,** 339/91 R, 339/107, 339/206 P, 339/221 M, 339/99 R

[51] **Int. Cl.** **H01r 13/62**

[58] **Field of Search**.....339/65, 64, 66, 91, 97–99, 339/103, 107, 206–208, 210–211, 213, 217, 221, 47–49

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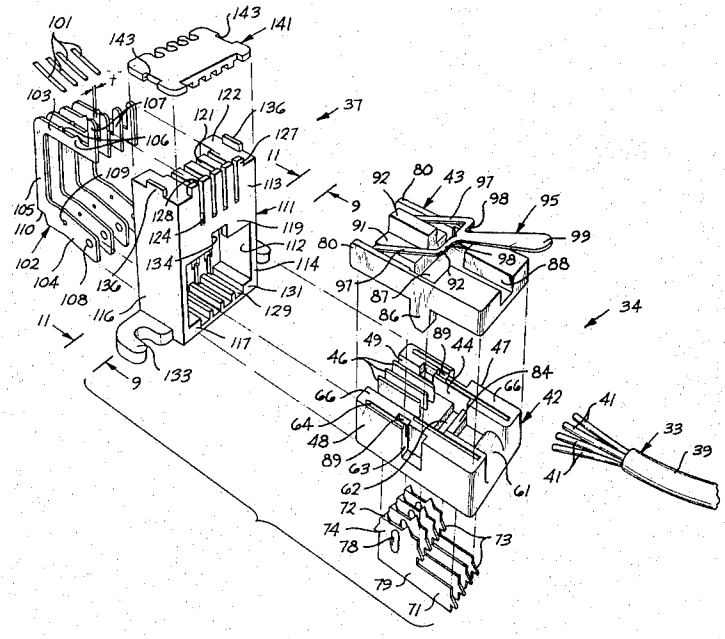
[57] **ABSTRACT**

Identical miniature plugs are attached to both ends of a telephone cord. The plugs are mated with miniature jacks in the handset and in the base of a telephone. A plurality of stand-up, blade terminals are positioned in spaced troughs of a housing of the plug with each of the terminals having tangs that pierce the insulation of insulated tinsel conductors of the cord placed in the troughs and pressed into engagement with the tangs by associated ribs formed in a lid of the housing which is welded ultrasonically to the housing. The mating jack has a plurality of U-shaped stand-up, blade terminals with provisions similar to the plug for making electrical contact with conductors leading into the jack. One leg of each of the U-shaped terminals of the jack is caused to engage an associated one of the terminals in the plug when the plug is inserted into the jack. The plug and the jack have facilities for providing strain relief for both the cords and the individual conductors.

37 Claims, 17 Drawing Figures



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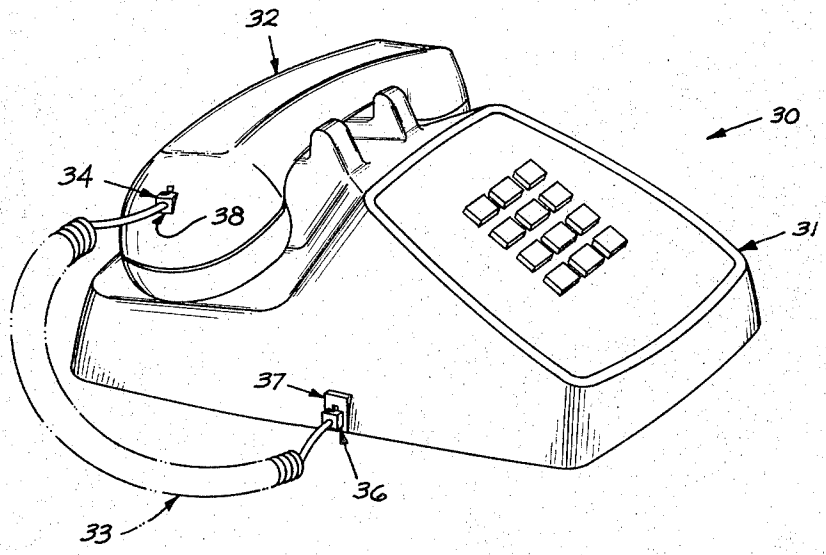

FIG. 1

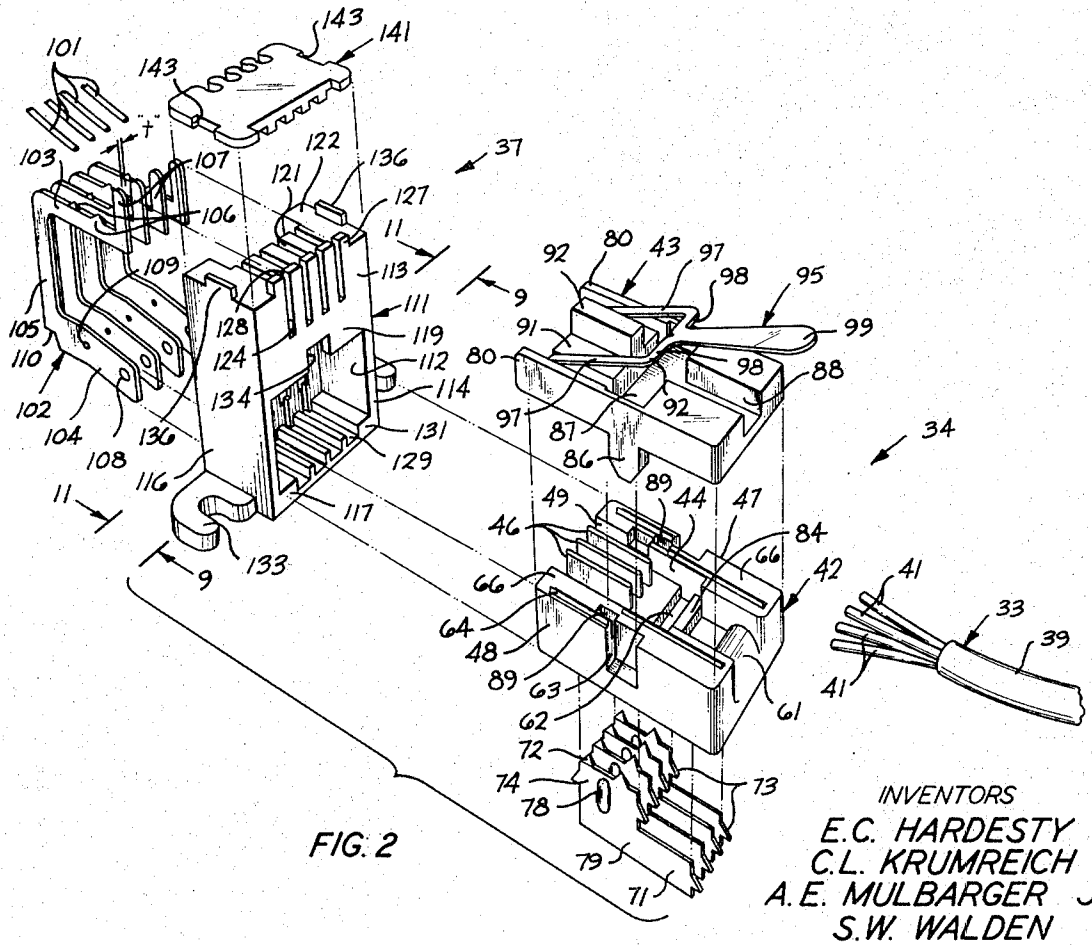

FIG. 2

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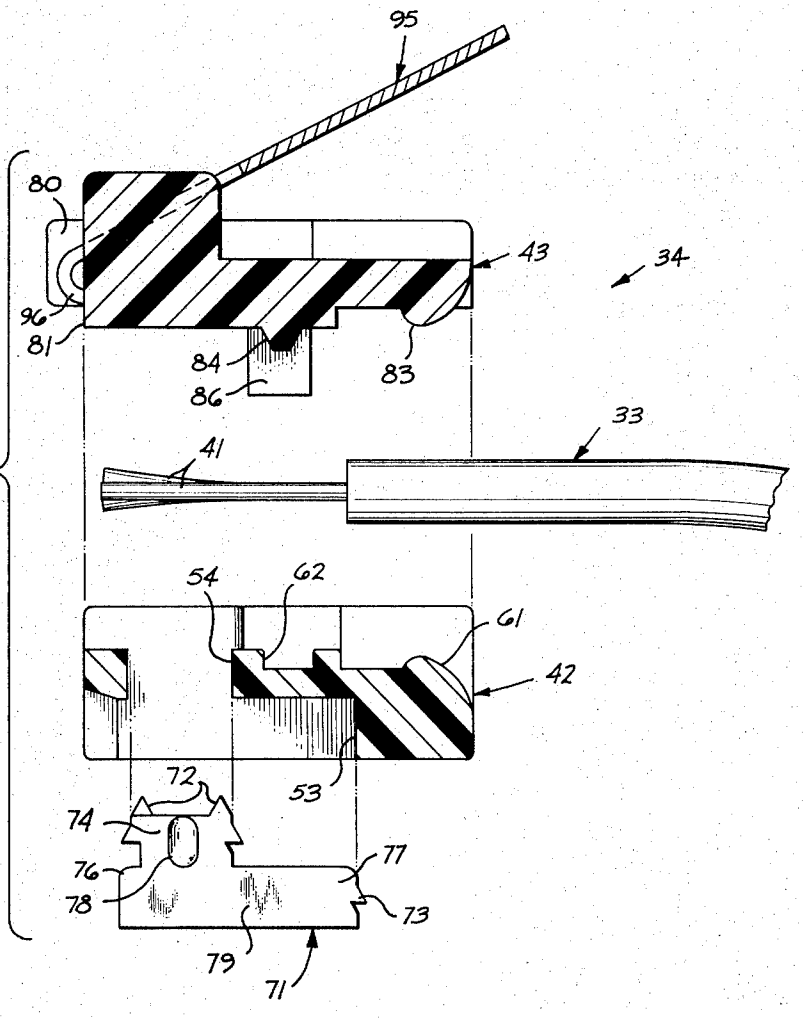


FIG. 3

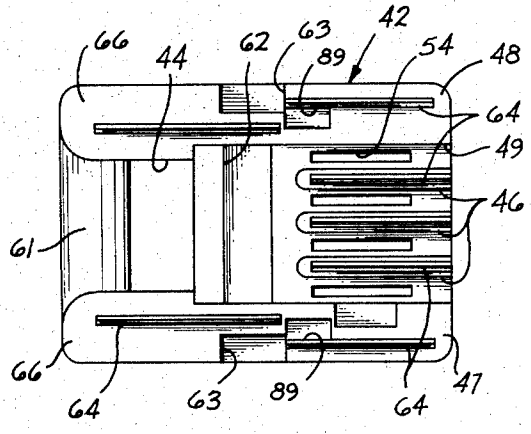


FIG. 4

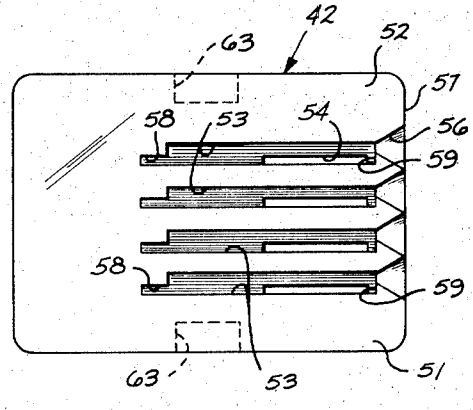


FIG. 5

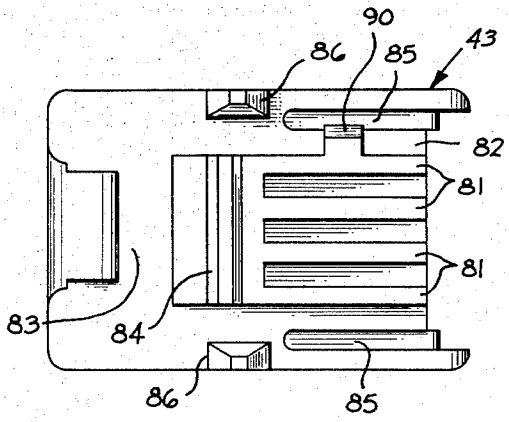


FIG. 6

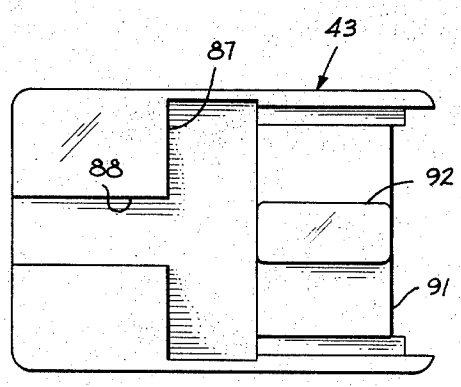


FIG. 7

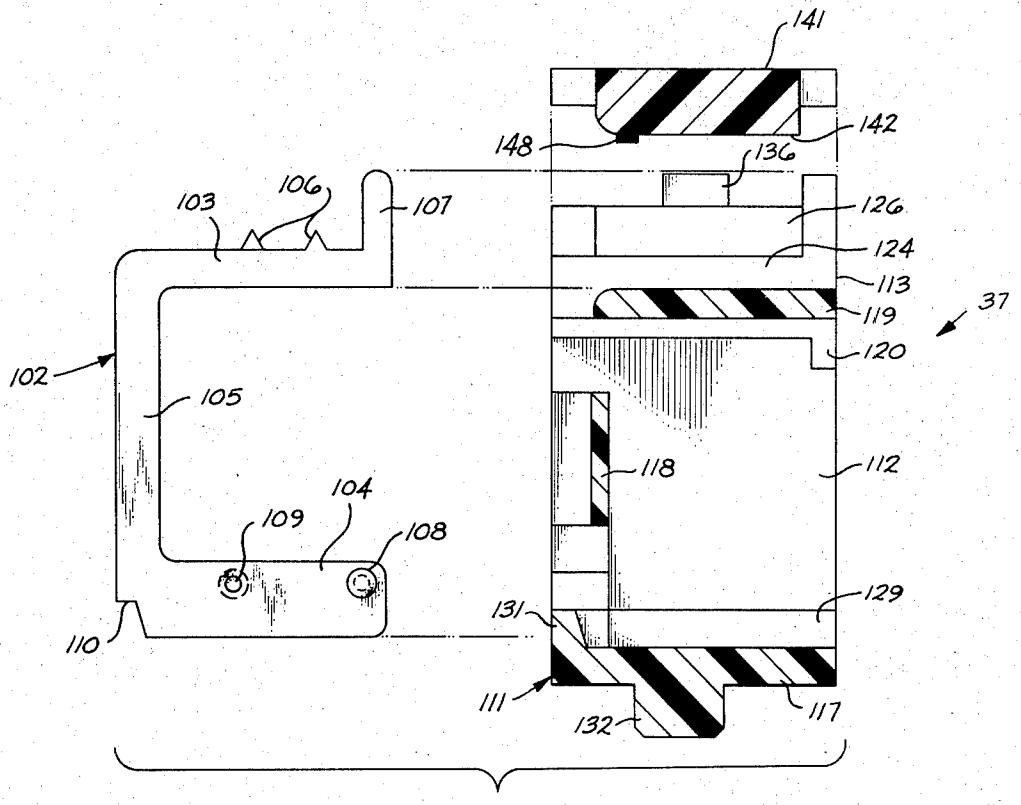


FIG. 8

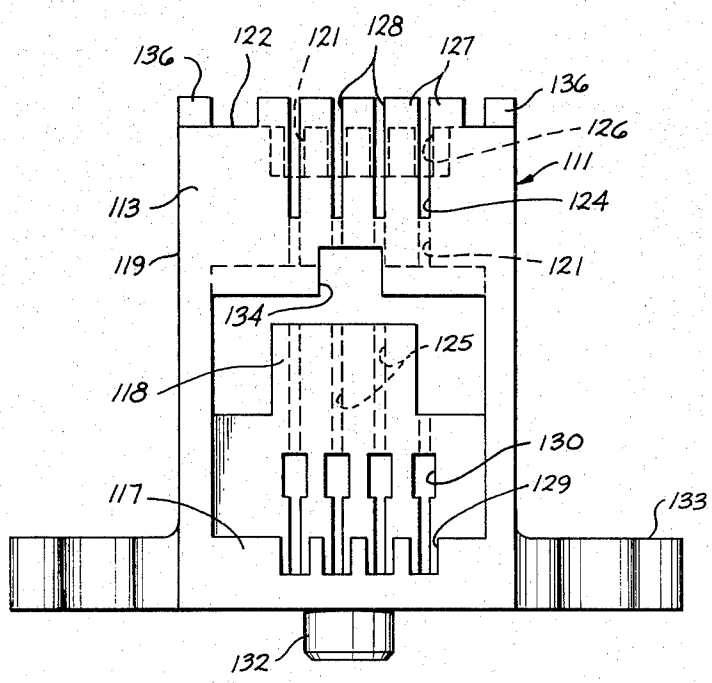


FIG. 9

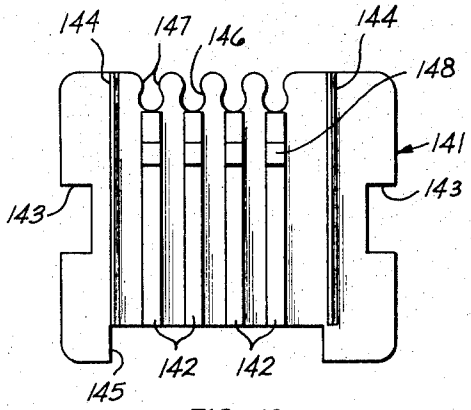
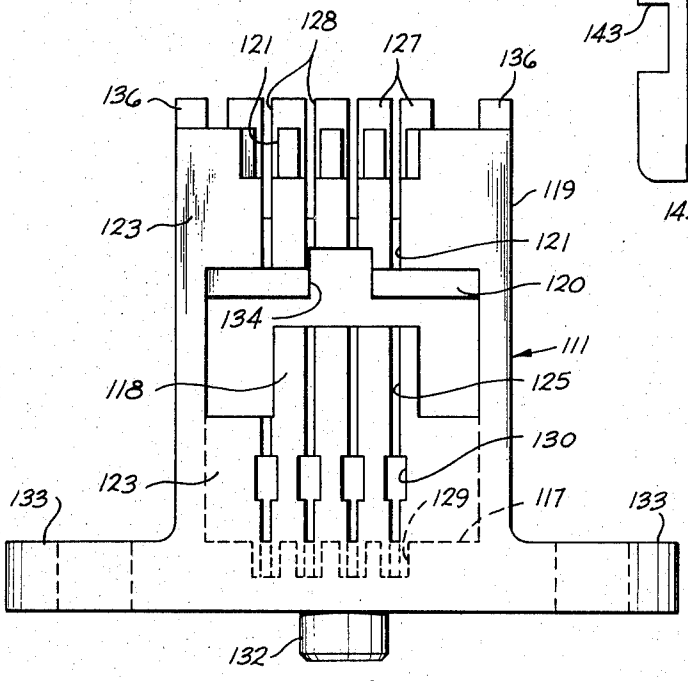


FIG. 10



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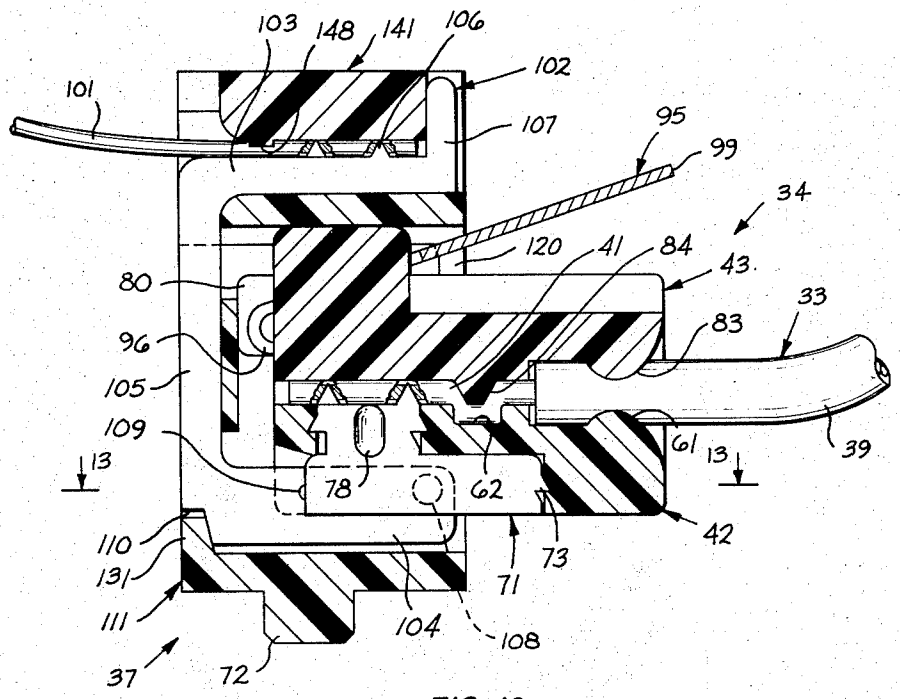
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FIG. 12

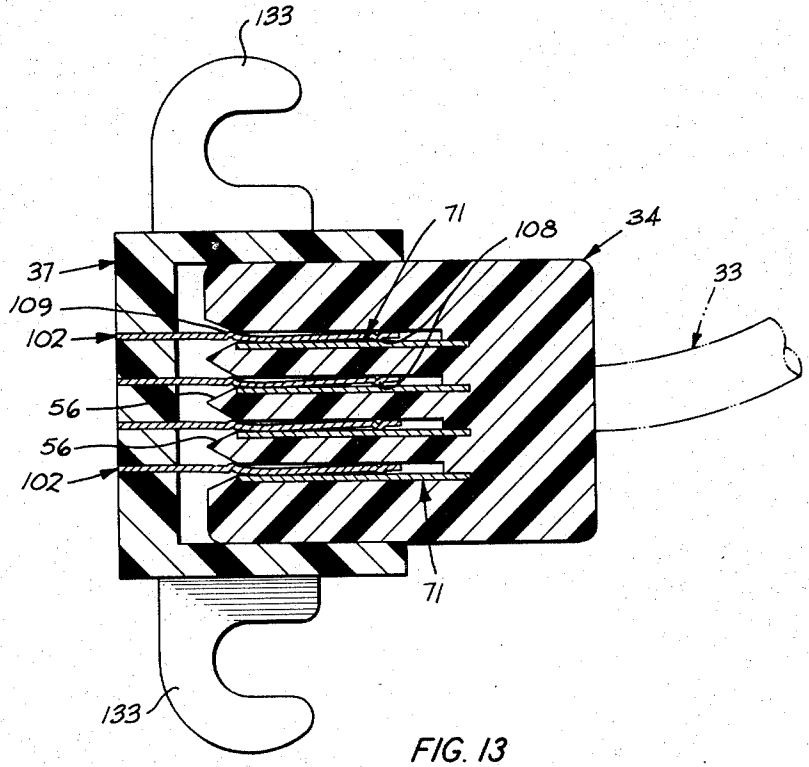
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FIG. 13

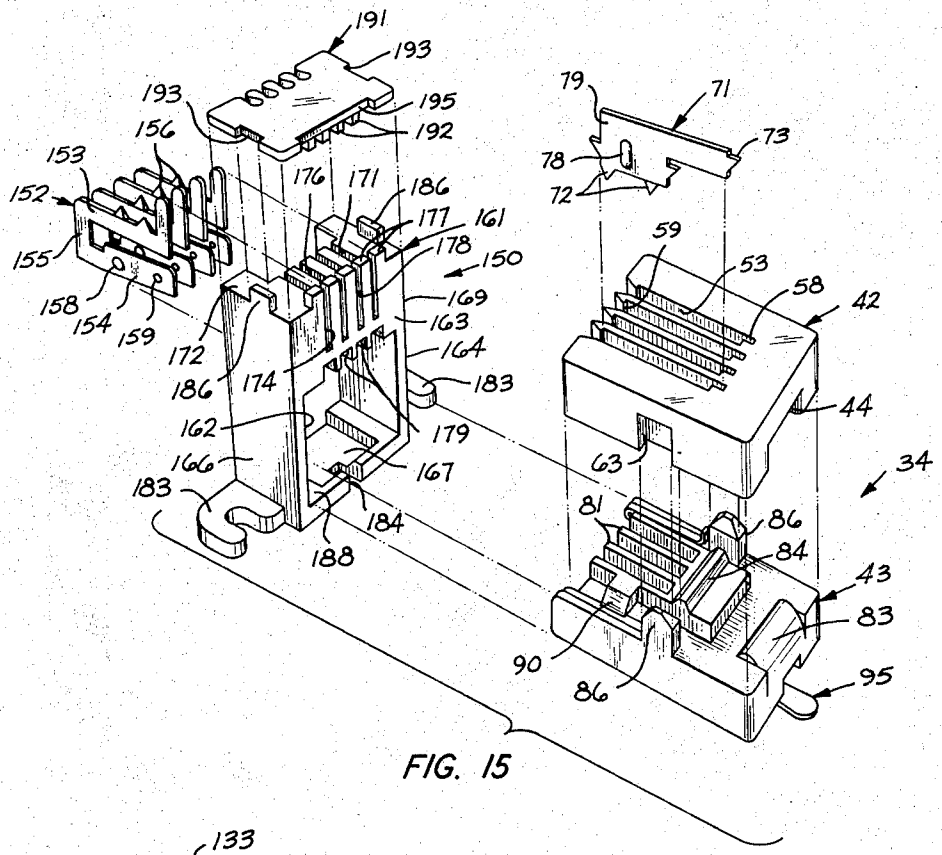
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FIG. 15

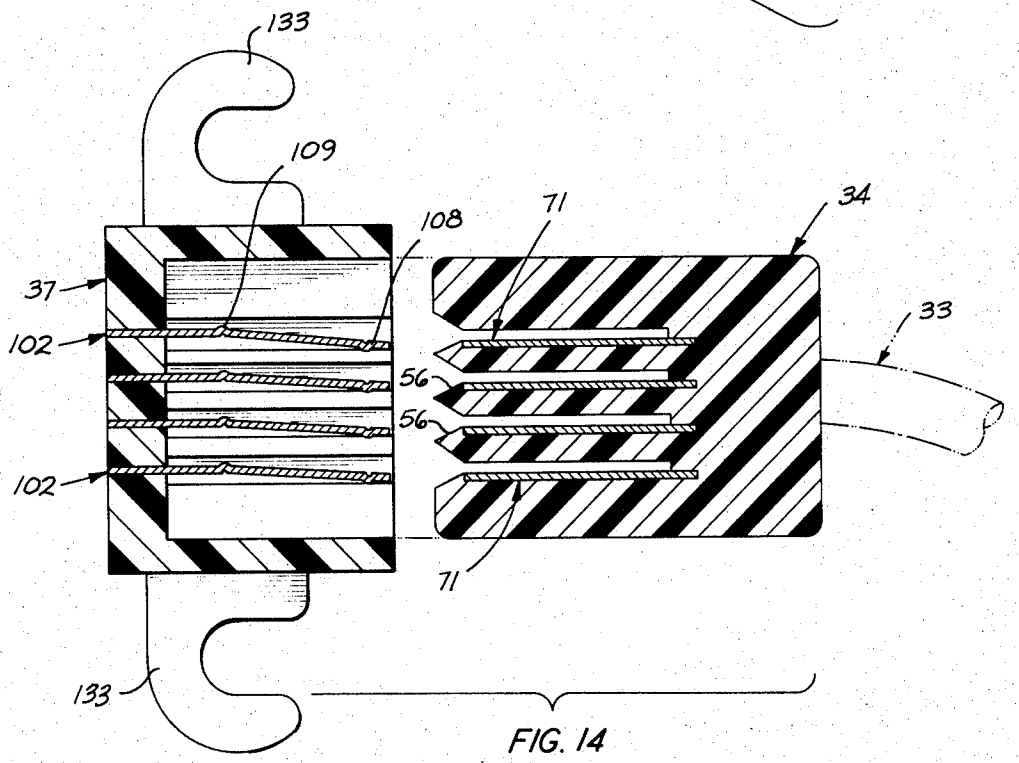
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FIG. 14

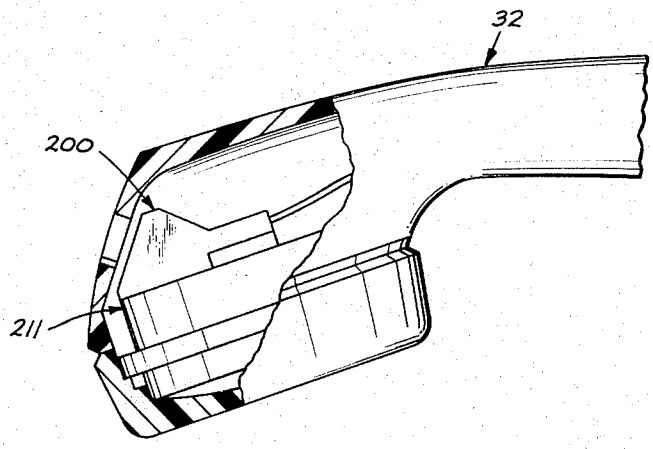
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FIG. 16

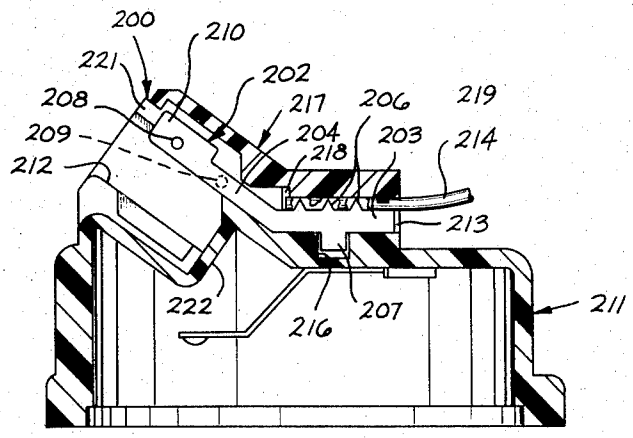
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FIG. 17

DEVICES FOR MAKING ELECTRICAL CONNECTIONS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to devices for making an electrical connections; and more particularly, to miniature devices for making electrical connections between conductors and electrically conductive terminals wherein the conductive terminals are assembled with dielectric members to form plugs and jacks and for then mating the plugs and jacks to make electrical connections between the terminals of the plugs and the terminals of the jacks.

2. Description of the Prior Art

In the communications industry, there has been an increasing demand for plug type electrical connectors on straight and retractile handset and line cords which are used to connect a base and a handset of a telephone, and to connect the base of the telephone to a terminal block. Efforts have been made to develop plug type connectors having provisions for facilitating the installation thereof.

One of the plug type connectors which has been in use for some time, in particular model telephone sets, is described in U.S. Pat. No. 3,369,214, issued on February 13, 1968, to C.L. Krumreich et al. In the presently used plugs, a plurality of terminals are applied to each of a plurality of insulated conductors included in a jacketed length of cordage. These terminals are mounted within a dielectric structure which is secured to the associated cordage. The dielectric portions of the plugs which are attached to both ends of a length of the cordage cooperate with receptacles in the handset and the base of the telephone to align properly the terminals of the plug with mating terminals within the handset and the base.

Although the plug, described in U.S. Patent 3,369,214, functions satisfactorily, the increased demand has required the introduction of manufacturing economies in both the plug assembly and the attachment of the plug to the associated cordage. Many conventional retractile cords are formed of conductors which are enclosed within a resilient plastic jacket that is rendered retractile after being wound on a mandrel and subjected to relatively high temperatures. From a manufacturing standpoint, it becomes more efficient for an operator to attach plug type connectors to each of a plurality of straight cords draped over a handling dolly before the cords have been rendered retractile.

The plug described in U.S. Pat. No. 3,369,214 includes a number of plastic parts which are riveted together. As the riveted plugs are subjected to the high temperatures needed to render the cords retractile, the stresses introduced by the riveting of the plastic parts together may manifest themselves in distortions of the plastic components of the plug. Hence, when the plugs are formed of molded pieces of plastic which are riveted together, it becomes impractical to preassemble the plugs to cordage which will eventually be rendered retractile. The retractile cords must be handled individually by an operator doing the attachment process with accompanying loss in operator handling time.

In a subsequently developed plug, as is disclosed in an application for U.S. patent, Ser. No. 758,502, filed Sept. 9, 1968, in the name of E.C.Hardesty, an electrical connector for a retractile type electrical cord was provided which could be assembled to the cord before the cord is heat treated to render the cord retractile. Moreover, the connector can be exposed to the same environments to which the cord is exposed for treatment without the connector incurring any degradation of its properties.

The connecting device described in the Hardesty application can be fabricated by using conventional molding techniques with provisions for electrical conductors having electrically conductive terminals attached thereto, and which can be readily assembled to, and disassembled from, an integral dielectric portion without distortion of the terminals.

Although the connecting device described in the Hardesty application overcomes some of the problems previously alluded to, the size of that device is such that it may not be conveniently adapted for use on all model telephones.

There is still a need for a universal type of electrical connecting unit which may be readily assembled to a retractile cord and which has miniature-enough dimensions so that the device may be readily assembled to a mating unit in the handset and to the base of any model telephone. Such a device must be capable of being preassembled to cordage either prior to or subsequent to rendering the cordage retractile, must be capable of being easily inserted in the mating units in the telephone components by either a subscriber or an installer and must be small enough so that it may be compatible with existing telephone and terminal structures with minimum modifications thereto, and with future miniature electronic telephone sets.

It is an object of the invention to provide a device for making electrical connections wherein conductive terminals are assembled with dielectric members to form a plug and a jack and to cause the terminals to engage electrically conductors positioned within the plug and the jack, and for making electrical connections between the terminals of the plugs and the terminals of the jacks.

It is a further object of the invention to provide a device for making electrical connections between telephone apparatus, and which is of relatively small dimensions so that the device may be adapted to be used in existing telephone apparatus with minimum modifications thereto and which may be installed easily by either a subscriber or an installer.

It is another object of this invention to provide a plug which may be attached to each end of a retractile cord by automated methods of and apparatus for manufacture and which may be preassembled thereto prior to or subsequent to the cords being rendered retractile and which is adapted to be received in a mating jack positioned in the base and in the handset of a telephone set by either a subscriber or an employee-installer.

SUMMARY

With these and other objects in mind, the present invention contemplates a device for making an electrical connection which includes a plug assembly having mating dielectric parts which are provided with facilities for receiving a plurality of conductors to confine and separate the conductors. One of the mating parts has terminal-receiving facilities formed therein and has a

plurality of electrically conductive terminals positioned in the terminal-receiving facilities. The terminals of the plug assembly are designed to become, and to be retained, engaged electrically with associated ones of the conductors positioned in the assembly when the parts are mated.

The device also includes a jack assembly having a dielectric portion which has a cavity complementary to at least portions of the plug assembly to permit insertion of at least portions of the plug assembly into the jack assembly. The dielectric portion of the jack assembly includes mating dielectric parts having facilities for receiving a plurality of conductors and for confining individually the conductors. One of the mating parts of the jack assembly has walls which define terminal-receiving passages. The jack assembly also includes a plurality of electrically conductive terminals with at least portions positioned in the passages in the one part of the jack assembly and designed to become, and be retained, engaged electrically with conductors positioned therein when the parts of the jack assembly are mated. The walls of portions of the terminal-receiving passages are designed to permit a predetermined lateral deflection of the associated portions of the associated terminals.

Portions of the jack-assembly terminals are received in the associated ones of the terminal-receiving facilities of the plug assembly to engage electrically with the associated plug-assembly terminals when the plug assembly is inserted into the cavity of the jack assembly. Each of the jack-assembly terminals has at least a portion thereof anchored in the jack assembly and has the portion thereof which engages the associated terminal in the plug assembly being received in the portions of the associated passage and designed to have a predetermined lateral deflection to facilitate the mating of the plug and jack assemblies, and to maintain good electrical contact between the jack-assembly terminals and the plug-assembly terminals.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and features of the present invention will be more readily understood in the following detailed description of specific embodiments thereof when read in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of a telephone set showing a retractile cord having an inventive plug attached to each end thereof and inserted into an inventive jack in a handset and a base portion of the telephone set;

FIG. 2 is an exploded perspective view of the inventive device which illustrates the plug aligned with, but disassembled from the inventive jack;

FIG. 3 is an enlarged exploded sectional view of the inventive plug of FIG. 2 which illustrates individual conductors of a jacketed cord which are to be confined between a mating lid and base of the plug and further illustrating one of a plurality of stand-up blade terminals aligned with the plug for assembly thereto;

FIG. 4 is a plan view of the base of the plug of FIG. 2 which illustrates several details of that portion of the base which mates with the lid;

FIG. 5 is a bottom plan view of the base of the plug of FIG. 2 which illustrates a plurality of terminal-receiving grooves having flared entrances;

FIG. 6 is a bottom plan view of the lid of the plug of FIG. 2 which illustrates several details of that portion of the lid which mates with the base;

FIG. 7 is a top plan view of the lid of the plug of FIG. 2.

FIG. 8 is an enlarged exploded sectional view of the inventive jack of FIG. 2 taken along lines 8—8 which illustrates a housing and a cover with one of a plurality of terminals aligned with the jack for mounting on the housing;

FIG. 9 is an end elevational view of the housing of the jack of FIG. 2 taken along lines 9-9 thereof;

FIG. 10 is a bottom plan view of the cover of the jack shown in FIG. 8;

FIG. 11 is an end elevational view of the housing of the jack of FIG. 2 taken along lines 11—11 thereof;

FIG. 12 is a sectional view of the inventive device of FIG. 2, which illustrates an assembled one of the plugs inserted into a cavity in an assembled one of the jacks in, for example, the base portion of a telephone;

FIG. 13 is a complete sectional view of the assembled device of FIG. 12 taken along lines 13—13 thereof which illustrates the mating of the terminals of the plug with the terminals of the jack;

FIG. 14 is a view similar to FIG. 13 with the plug withdrawn from the cavity in the jack;

FIG. 15 is an exploded perspective view of the inventive device which illustrates the inventive plug aligned with, but disassembled from, another embodiment of the inventive jack;

FIG. 16 shows an elevational view, partially in section, of a handset portion of a telephone showing still another embodiment of the inventive jack, and

FIG. 17 is an enlarged sectional view of the embodiment of the inventive jack of FIG. 16.

DETAILED DESCRIPTION

Referring now to FIG. 1, there is shown a telephone, designated generally by the numeral 30, which includes a base, designated generally by the numeral 31, and a handset, designated generally by the numeral 32. A retractile cord, designated generally by the numeral 33, interconnects the base 31 and the handset 32. A line cord (not shown) interconnects the base 31 and a terminal block (not shown). The line cord (not shown) in general use today is a straight cord.

The retractile cord 33 is provided with a plug, designated generally by the numeral 34, at the handset end thereof, and with a plug, designated generally by the numeral 36 at the base end thereof. The plug 34 is adapted to be mated with a jack, designated generally by the numeral 38, which is mounted in the handset 32, while the plug 36 is adapted to be mated with a jack, designated generally by the numeral 37, mounted in the base 31 of the telephone 30. The plugs 34 and 36 attached to opposite ends of any one cord 33 are identical and are designed to be received universally in any one of the jacks which will be installed in the telephone apparatus. However, in the event that retractile cords be used for both the line cord and the handset cord, then precautions would have to be taken so that an installer may readily identify which is the line cord and which is the set cord.

In FIG. 2, there is shown an exploded perspective view of the plug 34 and the jack 37 which embody the

principles of the invention. The retractile cord 33 includes a jacket 39 and a plurality of insulated conductors 41—41. A portion of the jacket 39 is removed from the cord 33 adjacent each end thereof to facilitate connecting the conductors 41-41 at each end of the cord to one of the plugs 34-34.

As can best be seen in FIGS. 2 and 3, the plug 34 includes a rigid, dielectric base portion, designated generally by the numeral 42, and a mating rigid, dielectric lid portion, designated generally by the numeral 43. The rigid, dielectric base and lid portions 42 and 43, respectively, can be easily molded by using conventional injection-molding techniques. Referring now to FIGS. 2 and 4, it can be seen that the base portion 42 includes a passage 44 having a plurality of spaced parallel longitudinally formed partitions 46—46 formed integrally with the base portion. The partitions 46—46 project into the passage 44 and together with a side wall 47 and a side wall 48 of the base portion form a plurality of conductor-receiving troughs 49—49 for receiving the individual conductors 41—41 of the cord 39. The conductor-receiving troughs 49—49 confine the conductors 41—41 against lateral movement in the passage 44.

A plurality of parallel-formed terminal-receiving grooves 53-53 (see FIG. 5) are formed in the base portion 42 to open to a surface 52 with each one of the grooves being associated and aligned with an associated one of the conductor-receiving troughs 49—49. Each one of the terminal-receiving grooves 53-53 communicates with the associated one of the conductor-receiving troughs 49—49 by a slotted opening 54 (see FIGS. 4 and 5). Moreover, each one of the terminal-receiving grooves 53-53 has a flared entrance 56 which opens to a surface 57 (see FIG. 5) which extends transversely of the surface 52 of the base portion 42. Each of the terminal-receiving grooves 53—53 has a restrictive portion 58 (see FIG. 5) formed at one end thereof and a shoulder 59 projecting transversely of and into the entrance 56 at the other end thereof.

In order to provide strain relief for the cord 33, a raised portion 61 (see FIGS. 2 and 3) is formed integrally with the base portion 42 transverse of a longitudinal axis of the passage 44 and projecting into the passage. In order to provide strain relief for the conductors 41—41, the base portion 42 is formed with a transversely extending channel 62 (see FIGS. 2 and 3) which is interposed between the raised portion 61 and the conductor-receiving troughs 49—49. The base portion 42 has several additional features for facilitating the assembly of the cord 33 and the lid portion 43 therewith.

The base portion 42 of the plug 34 also includes a guideway 63 opening to the outwardly facing surface of each of the side walls 47 and 48 thereof (see FIGS. 2 and 4). Finally, in order to facilitate the bonding ultrasonically of the lid portion 43 to the base portion 42, a plurality of energy directors or guides 64—64 are formed integrally with a top surface 66 of the walls 47 and 48 and along top surfaces of the partitions 46—46 (see FIGS. 2 and 4). The energy directors 64—64 are dimensioned to provide for adequate bonding of the lid portion 43 to the base portion 42 in accordance with the specifications provided by manufacturers of commercial ultrasonic equipment. For example, reference is made to an article by D. J. Kolb, "Designing PLastic Parts for Ultrasonic Assembly" printed in the Mar. 16, 1967 issue of *Machine Design*.

Prior to the assembly of the lid portion 43 with the base portion 42 of the plug 34, electrically conductive terminals 71—71 are assembled to the base portion. As can best be seen in FIGS. 2 and 3, each one of the terminals 71—71 is generally L-shaped and made from a generally flat strip of and electrically conductive resilient material such as phosphor-bronze. Moreover, each one of the terminals 71—71 includes at least one contact tang 72 which is used to pierce the insulation of an associated one of the conductors 41—41 to establish electrical contact therewith.

The terminals 71-71, shown in FIG. 2, have two contact tangs 72-72 formed integrally therewith to facilitate penetration of the insulation of the conductors 41—41 to insure engagement of the tangs with the conductive portions of the conductors. To this end, the tangs 72—72 are coined so that one side of one of the tangs is sloped in one direction while the opposite side of the other one of the tangs is sloped in another direction at some angle to the one direction.

Each one of the terminals 71—71 is also formed with a plurality of anchoring barbs 73—73 which penetrate the material defining the terminal-receiving grooves 53—53 and the slotted openings 54—54 of the base portion 42 when the terminals are assembled therewith in order to secure the terminals within the base portion.

As shown in FIGS. 2 and 3, the terminals 71—71 are assembled to the base portion 42 by aligning the terminals with associated ones of the terminal-receiving grooves 53—53. Each one of the terminals 71—71 is aligned with the associated one of the terminal-receiving grooves 53-53 so that an extended portion 74 (see FIG. 3) of the terminal is aligned with the associated one of the slotted openings 54—54. Then, as the terminal 71 is moved into the associated one of the terminal-receiving grooves 53—53, a leading end 76 thereof is moved into engagement with the shoulder 59 (see FIG. 5) formed at the other end of the terminal-receiving groove. A trailing end 77 of the terminal 71 is received in the restrictive portion 58 (see FIG. 5) of the aligned terminal-receiving groove 53. In this way, the terminal 71 is restrained from unintended longitudinal movement relative to the base portion 42.

As can be seen in FIGS. 2 and 3, each of the terminals 71—71 is also formed with a crown 78 for engaging the opposed wall of the associated slotted opening 54. The crown maintains the terminal 71 to one side of the terminal-receiving groove 53 to prevent lateral displacement thereof during the insertion process in the associated one of the terminal-receiving grooves and maintains the terminal in engagement with the adjacent wall of the groove. In this way, a contact portion 79 of each of the terminals 71—71 is seated properly within the associated one of the terminal-receiving grooves 53—53, with the leading end 76 of each of the terminals in engagement with the shoulder 59 and with the trailing end received in the restrictive portion 58.

When each one of the terminals 71—71 is assembled properly with the base portion 42, the tangs 72—72 thereof protrude through the associated one of the slotted openings 54—54 into the associated one of the conductor-receiving troughs 49—49. Moreover, the

proper positioning of the terminals 71—71 in the grooves 53—53 centers the tangs 72—72 within the troughs 49—49 to align the tangs with the longitudinal axes of the associated conductors 41—41 and maintain the tangs in alignment therewith to insure that the tangs engage the conductive portion of the insulated conductors. Finally, when the terminals 71—71 are assembled properly to the base portion 42, the edges of the terminals opposite the contact tangs 72—72 are flush with the surface 52. The base portion 42 is in condition to receive the cord 33 and the conductors 41—41 and then to be assembled to the lid portion 43.

Referring now to FIGS. 2, 6 and 7, there is shown the lid portion 43 which is designed to be mated with the base portion 42 to form the plug 34. The lid portion 43 includes a plurality of spaced parallel longitudinally formed ribs 81—81 which project from a surface 82 thereof. When the lid portion 43 is aligned with the base portion 42, each one of the ribs 81—81 is aligned with an associated one of the conductor-receiving troughs 49—49.

The conductors 41—41 are separated and individual ones thereof placed in the associated ones of the conductor-receiving troughs 49—49 to be confined laterally between adjacent ones of the partitions 46—46. Then, when the lid portion 43 is mated with and bonded ultrasonically to the base portion 42, the ribs 81—81 are interposed between associated ones of the partitions and extend into associated ones of the conductor-receiving troughs 49—49. The ribs 81—81 engage the associated ones of the conductors 41—41 in the associated ones of the conductor-receiving troughs 49—49 and confine the conductors between the ribs and the bottom of the troughs while the conductors are confined laterally between the adjacent ones of the partitions 46—46. The tangs 72—72 of the associated ones of the terminals 71—71 are caused to penetrate the insulation of the conductors 41—41 and establish electrical contact between the terminals and the conductors.

The thickness of the terminals 71—71 is smaller than the diameter of the conductors 41—41 and the mating of the lid portion 43 to the base portion 42 could tend to roll the conductors laterally and squeeze the conductors between the associated terminal and the wall of the associated trough 49 instead of achieving the required penetration of the insulation by the tangs 72—72. However, the coining of the contact tangs 72—72 is accomplished to have the dimensions transverse of the terminals between the tips of the contact tangs to be such that the insulation of the conductors 41—41 will necessarily be penetrated when the lid portion 43 is mated to the base portion 42.

The lid portion 43 has several additional features for facilitating the assembly of the cord 33 and conductors therewith. As can best be seen in FIG. 3, the lid portion 43 is formed with raised portion 83 (see also FIG. 6). transversely of the ribs 81—81 and which cooperates with the raised portion 61 of the base portion 42 to clamp the jacket 39 of the cord 33 therebetween (see FIG. 12) to provide strain relief for the jacketed portion of the cord. It will be observed from FIG. 12 that the cooperating raised portions 61 and 83 have a rounded configuration to avoid sharp corners which constitute high stress areas and could be melted during the ultrasonic bonding of the lid portion 43 to the base portion 42.

Moreover, the lid portion 43 is also formed with a ridge 84 formed transversely of the ribs 81—81 and interposed between the ribs and raised portion 83. When the lid portion 43 is assembled to the base portion 42, the ridge 84 cooperates with the channel 62 to form a labyrinth and cause the individual conductors 41—41 to follow a tortuous path therethrough (see FIG. 12). This provides a snubbing action for the individual conductors 41—41 thereof (see FIG. 3) and provides strain relief for the individual conductors.

Additionally, the lid portion 43 includes a pair of spaced grooves 85—85 (see FIG. 6) which open to a surface which is adjacent the base portion 42 when the lid portion is mated to the base portion. One of the ribs 81—81 which is adjacent one of the grooves 85—85 includes a lip 90 formed integrally therewith. The lip 90 projects partially across and is undercut to space the lip above the bottom of one of the grooves 85—85. The grooves 85-85 and the lip 90 are used for mounting facilities which latch the plug 34 to the jack 37.

The lid portion 43 is provided with facilities for assembly thereof with the base portion 42. A positioning key 86 (see FIGS. 2 and 6) is formed integrally with the lid portion 43 on each side thereof and projects laterally from the surface 82 thereof. In the assembly of the plug 34, the lid portion 43 is aligned with the base portion 42 to align the ribs 81 with the conductor-receiving troughs 49—49 and to align the positioning keys 86—86 with the guideways 63—63 formed in the base portion. Then, when the lid portion 43 is moved into engagement with the base portion 42 to engage the surface 82 thereof with the energy guides 64—64, the positioning keys 86-86 are received in the guideways 63—63 to prevent inadvertent relative movement between the base portion and the lid portion during the ultrasonic bonding of the lid portion to the base portion.

Additional facilities are provided for facilitating the assembly of the plug 34 to the jack 37. As can best be seen in FIG. 7, the lid portion 43 has a recess 87 having a narrow portion 88 extending from one end thereof. The lid portion 43 is formed with a T-shaped block 91, spaced from side walls 93 and 94 of the lid portion, projecting into the recess 87 and having a tongue 92 for guiding the plug 34 into the jack 37. Also, the lid portion 43 is formed with a pair of spaced bumpers 80—80 projecting from a leading end thereof.

Moreover, a latch, designated generally by the numeral 95, which, for example, may be made from a flat piece of resilient metal or from a plastic material, is attached to the lid portion 43 spanning the T-shaped block 91. The latch 95 is formed to have a pair of spaced securing fingers 96—96 (see FIG. 3), having hooked ends, which are mounted in the grooves 85—85 in the lid portion 3, with the hooked ends projecting outwardly from one end thereof. The other ends of the securing fingers 96—96 are then reversely bent to form spaced side or leg members 97—97. One of the fingers 96—96 is pressed past the overhanging lip 90 and snapped into place in the groove 85 so that the finger is retained between the groove and the base to prevent unintended lateral movement thereof. When the lid portion 43 is mated with the base portion 42, the hooked ends of the fingers cooperate with holes 89—89 in the base portion to prevent unintended longitudinal movement. The side members 97—97 are formed

to continue laterally toward one another with arm portions 98—98 which are joined to a release tab 99. When an operator depresses the release tab 99, the side members 97—97 are designed to be received in the space between the T-shaped block 91 and the side walls 93 and 94, and the release tab is designed to be moved into the narrower portion 88 of the recess 87.

In describing the jack 37, reference is made to FIGS. 2 and 8–14. The jack 37 is used to connect electrically a plurality of conductors 101—101 (see FIG. 12) from within the handset 32, for example, to a plurality of terminals, designated generally by the numerals 102—102. Each of the terminals 102—102 is generally U-shaped and made from a substantially flat piece of electrically conductive spring-like stock material such as phosphor-bronze having a thickness t. As can be observed from FIG. 2, the thickness of the terminals 102—102 is substantially less than the dimensions of the terminals in the plane of the U. Each of the terminals 102—102 has a first leg 103 connected to a second opposite leg 104 by a connecting portion 105. The first leg 103 has at least one contact tang 106 formed integrally with, and extending laterally therefrom. The first leg 103 also has an upstanding portion 107 formed at a free end thereof (see FIGS. 2 and 8). The second leg 104 has a first crown or dimple-like projection 108 and a second crown 109 projecting laterally from opposite sides thereof (see FIGS. 2 and 8). Finally, each of the terminals 102—102 has a cutout portion 110 at the intersection of the connecting portion 105 and the second leg 104. Moreover, as can best be seen in FIGS. 2 and 14, each of the second legs 104—104 is formed so that a portion thereof adjacent the free end is bent out of the plane of the terminal. This prestresses the terminal 102 and presets the terminal to insure that the leading ends of the terminals will be received in the flared entrances 56—56, and cause additional pressure to insure the engagement of the crown 108 with the associated one of the terminals 71—71 when the plug 34 is mated with the jack 37.

The jack 37 includes a housing, designated generally by the numeral 111 (see FIG. 2) in which are mounted the terminals 102—102. The housing 111 is made from a block of rigid dielectric material similar to that used to construct the plug 34. In order to mate the plug 34 with the jack 37, the jack housing 111 has a cavity 112, complementary to at least portions of the plug, formed therein and opening to a surface 113 of the housing. The cavity 112 is defined in part by spaced side walls 114 and 116, a bottom wall 117, a rear wall 118 (see FIG. 8), a main body portion 119 of the housing, and an overhang 120.

Also, the housing 111 is formed with a plurality of spaced parallel terminal-receiving grooves 121—121 opening to two adjacent transversely extending external surfaces 122 and 123 thereof (see FIG. 11). Each of the terminal-receiving grooves 121-121 has a narrow terminal-receiving portion 124 for receiving the first leg 103 of one of the terminals 102-102 and a somewhat wider conductor-receiving portion 126 which opens to the surface 122. The conductor-receiving portions 126—126 of the terminal-receiving grooves 121—121 extend from the surface 123 (see FIGS. 8 and 9) to a point spaced from the external wall 113. However, the terminal-receiving portions 124—124 extend from the surface 123 through the main body portion 119 to the surface 113.

As can best be seen in FIG. 11, the portions of the terminal-receiving grooves 121—121 which open to the surface 123 are aligned with associated ones of a plurality of grooves 125—125 cut in the rear wall 118. The grooves 125—125 terminate in associated ones of a plurality of holes 130—130 which open into the cavity 112. The holes 130—130 have portions thereof which are somewhat wider than the slots 125—125 to facilitate insertion of the second legs 104—104 of the terminals 102—102 having the crowns 108 and 109 into the cavity 112.

In order to complete the provisions for mounting the terminals 102—102 in the housing 111, the main body portion 119 of the housing has a lip 127 which extends above the surface 122 (see FIGS. 2 and 9). A plurality of slotted openings 128—128 are cut through the lip 127 and connect with associated ones of the terminal-receiving portions 124—124 of the terminal-receiving grooves 121—121. In the embodiment shown in FIGS. 2 and 11, the rear wall 118 extends only partially along the side walls 114 and 116 toward the body portion 119. Finally, the bottom wall 117 is formed with a plurality of internal grooves 129—129 (see FIGS. 2 and 9) which face into the cavity 112 and a bridge 131 (see FIG. 8) spanning the grooves.

The terminal-receiving grooves 121—121 and 125—125 and the internal grooves 129—129 define generally U-shaped passages for receiving the terminals 102—102. Each of the terminals 102—102 is mounted in the housing 111 with the first leg 103 thereof anchored in the terminal-receiving portion 124 of the associated one of the terminal-receiving grooves 121—121 with the tangs 106—106 thereof protruding into the conductor-receiving portion 126 (see FIG. 12). The connecting leg 105 of each of the terminals 102—102 is received in the portion of the terminal-receiving groove 121 which opens to the external surface 123 and in the associated one of the grooves 125—125 in the rear wall 118. Finally, the second leg 104 of each of the terminals 102—102 is inserted through the associated one of the holes 130—130 and is positioned in an associated one of the grooves 129—129 with the cutout portion 110 seated in engagement with the bridge 131.

It will be recalled that the terminals 71—71 are flush with the surface 52 of the base portion 42 of the plug 34. However, in jack 37, the second legs 104—104 are not flush with the tops of the walls of the grooves 129—129, but instead protrude thereabove. The portion of each of the second legs 104—104 which protrudes above the tops of the groove walls is thus made available for receipt in an associated one of the terminal-receiving grooves 53—53 when the plug 34 is mated to the jack 37.

It should be observed from FIGS. 2 and 9 that the width of each of the grooves 129—129 in a direction transverse to the longitudinal axis of the grooves is somewhat larger than the thickness of the second leg 104 of the terminal 102 to be received therein. After the terminals 102—102 are mounted in the terminal-receiving grooves 121—121, it is unnecessary to provide support for the second legs 104-104 thereof. However, the grooves 129—129 function to insulate the

second legs 104—104 from one another and limit the lateral movement of the second legs. In this way the deflection of the second legs 104-104 of the terminals 102—102 is controlled to prevent the second legs from being turned out of alignment with the longitudinal axis of the jack 37 when the plug 34 is inserted into the jack.

The terminals 102—102 are mounted in the housing 111 so that the first legs 103—103 are anchored therein. This causes bending stresses to be developed in the second legs 104—104 which are free to be deflected in the grooves 129—129 as the second legs are mated with the terminals 71—71 of the plug 34. The resiliency of the material of the terminals 102-102 causes the pre-stressed legs 104—104 to maintain the crown 108 in engagement with the associated one of the terminals 71—71.

Because of the mounting arrangement of the terminals 102—102 in the housing 111, the terminals may be subjected to torsional stresses when the plug 34 is inserted into the jack 37. Although the first legs 103—103 of the terminals 102—102 are anchored in the housing 111, the second legs 104—104 are designed to be deflected laterally within predetermined limits. The deflection of the second legs 104—104 may be accompanied by a certain amount of twist in the connecting legs 105—105 which permits a controlled reduction of the bending stresses in the second legs. The mounting of the terminals 102—102 is designed to optimize the engagement thereof with the terminals 71—71 without causing unduly high bending stresses in the terminals 102—102.

The housing 111 has several additional features to facilitate the assembly and installation thereof with telephone apparatus. The housing 111 includes a stud 132 formed with the bottom wall 117 and depending therefrom. The stud 132 is received in an opening (not shown) in the telephone base 31, for example, to position accurately the jack 37 therein. A mounting lug 133 extends laterally from each of the side walls 114 and 116 to permit attachment of the jack 37 to the telephone 30 or a terminal block (not shown). The housing 111 is also formed with a guide slot 134 in the overhang 120 of the main body portion 119 thereof for receiving the tongue 92 of the lid portion 43 of the plug 34 to guide the plug into the cavity 112. A pair of spaced alignment keys 136—136 are formed integrally with the housing 111 and extend from the surface 122 thereof (see FIGS. 2 and 9) to facilitate assembly of the housing with a cover 141.

As can best be seen in FIGS. 2 and 10, the cover 141 is adapted to be mated with the housing 111. The cover 141 has a plurality of ribs 142—142 (see FIG. 10) formed on one surface thereof and which are received in associated ones of the terminal-receiving grooves 121—121 when the cover is mated with the housing 111. In order to facilitate the alignment of the cover 141 with the housing 111, the cover has alignment slots 143—143 cut in opposed lateral edges thereof for receiving the alignment keys 136—136. Moreover, a plurality of energy guides 144—144 are formed on an underside thereof to facilitate the bonding ultrasonically of the cover 141 to the housing 111. The cover 141 has a notch 145 formed along one edge thereof with the notch dimensioned to receive the lip 127.

Finally, the cover 141 has a plurality of cul-de-sacs 146—146 formed along a trailing edge thereof and aligned with associated ones of the terminal-receiving grooves 121—121. The cul-de-sacs 146-146 are formed having an inner portion which is sized to that of the diameter of one of the conductors 101—101. But the entrance to each of the cul-de-sacs 146—146 is somewhat narrowed (see FIG. 10) so that one of the conductors must be compressed between opposing bights 147—147 to be moved into the inner nesting portion. When the cover 141 is bonded to the housing 111, the conductors 101—101 are pressed into associated ones of the cul-de-sacs 146—146 to provide strain relief for the conductors during the use of the telephone 30. A raised portion 148 formed on the underside of the cover 141 presses the conductor 101 against the surface 122 to provide additional strain relief for the conductors.

It should be appreciated that the mini plug 34 and jack 37 have dimensions small enough so that the jack may be installed in existing telephone apparatus. For example, the terminals 71—71 are approximately 0.345 inch long with a thickness of 0.010 inch. The plug 34 measures approximately 0.595 inch along a longitudinal axis through the passage 144 thereof, by 0.332 inch wide, by 0.360 inch deep as measured from the surface 52 of the base portion 42 to the external surface of the lid portion 43 when the lid portion is mated with the base portion. The housing 111 of the jack 37 has an approximate length of 0.400 inch, a width of 0.470 inch and a height of 0.770 inch.

Moreover, it should be appreciated that the terminals 71—71 and 102—102 are mounted in the plug 34 and the jack 37, respectively, with a minimum center to center spacing of approximately 60 mils which permits the miniature sizes of the dielectric parts. The mounting arrangement of the terminals 71—71 and 102—102 together with the conductors permits terminals to be of a blade, stand-up type with the thickness thereof being generally smaller than the cross sectional dimension of the conductors.

In order to mate the plug 34 and the jack 37, a subscriber or an installer moves the plug 34 into proximity of the jack 37 and aligns the plug with the jack so that the tongue 92 is aligned with the guide slot 134 in the housing 111.

With the tongue 92 aligned with the guide slot 134 in the housing 111, the operator moves the plug 34 along a path of travel parallel to the longitudinal axis of the passage 44 in the plug and into the cavity 112 until the bumpers 80—80 of the lid portion 43 engage the rear wall 118. The seating of the cutout portion 110 of the terminals 102—102 with the bridge 131 resists the forces imparted to the terminals as the terminals are moved into the flared entrances 56—56 of the plug 34.

The second leg 104 of each of the stand-up blade terminals 102—102 of the jack 37 is received in an associated one of the terminal-receiving grooves 53—53 of the base portion 42 to engage the associated ones of the terminals 71—71 of the plug 34 (see FIGS. 12 and 13). Because of the pre-set of portions of the second legs 104—104, the crowns 108, which are moved first into the associated ones of the grooves 53—53 tend to be urged into engagement with the associated ones of the terminals 71—71. As can best be seen in FIG. 13,

the crown 109 on each of the second legs 104—104 of the terminals 102—102 engages the opposed wall of the associated terminal-receiving groove 53 to further urge the crown 108 of the terminal into engagement with the associated one of the first terminals 71—71 secured within the terminal-receiving groove in the plug 34.

The overall thickness of the terminal 102 including the projecting dimension of the crowns 108 and 109, plus the thickness of the terminal 71 is greater than the width of each of the terminal-receiving grooves 53—53. Thus, when the terminals 71—71 are positioned in the grooves 53—53, the remaining width of the grooves is less than the overall thickness of the terminal 102. Then, when portions of the second legs 104—104 of the associated terminals 102—102 are moved into the terminal-receiving grooves, the crowns 109—109 press against the walls of the associated grooves. Moreover, the relation between the overall thickness of the leg 104 and the useable width of the terminal-receiving groove 53 causes the second leg to assume a serpentine shape when the contact portion of the second leg is caused to be moved into the associated one of the terminal-receiving grooves. This urges the crowns 108—108 into engagement with the terminals 71—71 (see FIG. 13) to insure adequate contact pressure between the crowns 108—108 and the terminals 71—71.

It may also be observed from FIGS. 2 and 12 that the latch 95 provided on the plug 34 is used to secure the plug within the jack 37. In this regard, the insertion of the plug 34 into the jack cavity 112 causes the latch 95 to be urged into the recess 87 of the lid portion 43 of the plug. Then, when the plug 34 is positioned properly within the jack cavity 112, the resiliently mounted latch 95 is biased upwards from the recess 87 of the lid portion 43 of the plug to move the arm portions 98—98 toward the main body portion 119 of the jack 37 until the arm portions are captured and retained behind the overhand 120 as the release tab 99 protrudes through the guide slot 134 (see FIG. 12).

Then, when it is desired to disconnect the plug 34 from the jack 37, the subscriber or installer merely depresses the release tab 99 and withdraws slidably the plug from within the cavity 112. A replacement cord 33 provided with a plug 34 at each end thereof may be connected easily to the telephone 30.

Turning now to FIG. 15, there is shown a jack 150 which is an alternate embodiment of the jack 37 that embodies the principles of the present invention. In FIG. 15, there is also shown a mating plug identical to the plug 34 shown in FIG. 2, except that it is inverted from the position shown in FIG. 2 to mate with the jack 150 to engage a plurality of terminals 152—152 in the jack with associated ones of the terminals 71—71 of the plug.

Each of the terminals 152—152 is made from a generally flat strip of electrically conductive spring-like material such as phosphor bronze and is generally U-shaped having a first leg 153 and a second opposed leg 154 connected therebetween by a portion 155. The leg 153, a portion of the leg 154 and the connecting portion 155 lie substantially in the same plane. A portion of the second leg 154 adjacent the free end thereof is prebent out of the plane to prestress the second leg to function similar to the second leg 104 of the terminals 102—102. The first leg 153 is provided with at least one contact tang 156 which pierces the insulation of associated ones of conductors (not shown) and with an upstanding portion 157 for anchoring the terminal against longitudinal movement relative to the jack 150. Finally, the second second leg 154 of each of the terminals 152—152 is provided with a crown 158 and a crown 159 formed integrally with and protruding from opposed sides of the second leg.

The first and second legs 153 and 154, respectively, of the jack 150 are spaced apart a substantially lesser distance than the first and second legs 103 and 104 of the terminals 102—102 of the jack 37. The distance between the legs 103 and 104 of the terminals 102—102 must be sufficient to receive the plug 34 therebetween (see FIG. 2), with the contact portions 79—79 of the terminals 71—71 engaging an upper portion of the second legs 104—104 of the terminals 102—102 (as viewed in FIG. 2) which faces into the U and is closest to the first leg thereof. In the present jack embodiment, the plug 34 is received in the jack 150 so that a lower portion (as viewed in FIG. 15) of the second legs 154—154 engage the contact portions 79-79 of the plug terminals 71—71.

The dielectric portion of the jack 150 is similar to that of the jack 37 and includes a housing 161 molded from a block of dielectric material and having a cavity 162 opening to a surface 163 thereof. The cavity 162 is defined by a side wall 164, a side wall 166, a bottom wall 167, a rear wall 168, and a main body portion 169 of the housing.

The housing 161 has a plurality of terminal-receiving grooves 171 which open to transversely extending external surfaces 172 and 173 thereof. The external grooves 171 each have a narrow terminal-receiving portion 174 for receiving the first leg 153 of one of the terminals 152—152 and a wider conductor-receiving portion 176 for receiving the conductors (not shown). The tangs 156—156 of the terminals 152—152 protrude into the conductor-receiving portions 176—176 of the grooves 171—171 to pierce the insulation of the conductors (not shown) and establish electrical contact between the conductors (not shown) and the terminals.

The conductor-receiving portions 176—176 of the grooves 171—171 extend from the surface 173 to a point spaced from the surface 163 of the main portion 169 of the housing 161. On the other hand, the terminal-receiving portions 174—174 extend from the surface 173 through a lip 177 to the surface 163. The rear wall 168 of the housing 161 is formed with a plurality of parallel spaced slotted openings (not shown) with each one of the slotted openings aligned with an associated one of the grooves 171—171. Finally, a surface of the main body portion 169 which faces into the cavity 162 is formed with a plurality of internal grooves 179—179 with the space between adjacent ones of the grooves aligned with associated ones of the slotted openings (not shown) and with associated ones of the grooves 171—171.

The grooves 171—171, the slotted openings (not shown) and the internal grooves 179—179 define a generally U-shaped conductor-receiving passage. The terminals 152—152 are mounted in the housing 161 with the first leg 153 of each of the terminals received

in the associated one of the terminal-receiving portions 174—174, the connecting portion 155 of each terminal is received in the associated one of the slotted openings (not shown), and an upper portion (as viewed in FIG. 15) of the second leg 154 of each terminal is received in an associated one of the grooves 179—179. The upstanding portions 167—167 are received in slotted grooves 178—178 which are continuations of the grooves 171—171 and which are cut through the lip 177.

It should be observed that the second leg 154 of each of the terminals 152—152 is cantilevered from the connecting portion 155 thereof into the cavity 162. The material defining the grooves 179—179 serves to insulate the second legs 154—154 from each other, and to limit the amount of lateral movement of the second legs. In this way, the second leg 154 may pivot or flex from the line of intersection with the connecting portion 155 thereof to facilitate insertion of the plug 34 into the cavity 162 with the accompanying receipt of the terminals 152—152 in associated ones of the terminal-receiving grooves 53—53 in the plug 34.

In this embodiment, the grooves which limit the lateral movement are formed in the internal face of the main body portion 169 whereas in the hereinabove described embodiment, the grooves were formed in the bottom wall 117 of the housing 111.

Also, in this embodiment, the housing 161 has a mounting lug 183 attached to and extending from each of the side walls 164 and 166. Moreover, the housing 161 has a guide slot 184 formed in the bottom wall 167 for receiving the tongue 92 on the lid portion 43 of the mating plug 34. As with the heretofore described embodiment, the alignment of the tongue 92 with the guide slot 184 aligns the plug 34 with the cavity 162 to permit the assembly of the plug with the jack 150. The housing 161 also includes a pair of spaced alignment keys 186—186 extending from the surface 172 thereof.

As can best be seen in FIG. 15, the bottom wall 167 of the housing has a strip 188 formed therearound so that when the plug 34 is received in the cavity 162 and the release tab 99 of the latch 95 is depressed and then biased away from the plug, the arm portions 98—98 lock behind the strip 188 to secure the plug within the jack 150.

Further, it can be seen in FIG. 15 that the jack 150 is provided with a cover 191 for engaging the top surface 172 of the housing 161. The cover 191 has a plurality of ribs 192—192 formed on the underside thereof and a pair of spaced alignment slots 193—193 for receiving the alignment keys 186—186. Also the cover 191 has energy guides (not shown) projecting therefrom for engaging the surface 172 to facilitate the welding ultrasonically of the cover to the housing 161. When the cover 191 is welded to the housing 161, the ribs 192—192 are received in associated ones of the grooves 171—171 to move the conductors (not shown) to the bottoms of the conductor-receiving portions 176—176. This causes the contact tangs 156—156 of the terminals 152—152 to pierce the insulation of the conductors (not shown) to establish electrical contact therebetween.

Still another embodiment of the invention is shown in FIG. 16 with a jack, designated generally by the numeral 200, mounted in a portion of a telephone handset 32. The jack 200 is adapted to be mated with the plug 34 which is universally connectable to all of the embodiments of the inventive jack.

As can best be seen in FIG. 17, the plug 200 includes at least one electrically conductive terminal, designated generally by the numeral 202, having a first leg 203 connected to a second leg 204. The first leg 203 includes a plurality of contact tangs 206—206 projecting laterally therefrom and an anchoring lug 207 projecting laterally from an opposite side thereof. The axes of the first and second legs 203 and 204, respectively, are at some angle to one another. Unlike the terminals 102—102 and the terminals 152—152, the terminals 202—202 are not U-shaped.

The second leg 204 of each of the terminals 202—202 includes a first crown 208 on one side thereof and a second crown 209 on the opposite side thereof. Finally, each of the terminals 202—202 has an enlarged portion 210 extending laterally of a free end thereof.

Referring again to FIG. 17, the at least one terminal 202 is shown mounted in a housing, designated generally by the numeral 211, of the jack 200. The housing 211 has a cavity 212 for receiving at least portions of the mating plug 34 and also includes a plurality of terminal-receiving grooves 213—213 for receiving the terminals 202—202. Each groove 213 has a wider portion for receiving an associated one of a plurality of insulated conductors 214—214. Moreover, when the terminals 202—202 are mounted in the terminal-receiving grooves 213—213 of the housing 211, the contact tangs 206—206 protrude into the wider portions of the grooves.

The housing 211 is also formed with a plurality of keyways 216—216 which open to the terminal-receiving grooves 213—213 for receiving the terminal anchoring lugs 207—207 when the terminals 202-202 are positioned in the grooves. In this way, the terminals 202—202 are anchored against unintended longitudinal movement thereof relative to the housing 211 when the plug 34 is mated with the jack 200.

The housing 211 is adapted to be mated with a cover 217 having a plurality of ribs 218—218 which are designed to be received in associated ones of the terminal-receiving grooves 213—213 to confine the individual conductors 214—214 and cause the contact tangs 206-206 to penetrate the insulation and establish electrical contact therewith. The cover 217 also includes a bridge 219 projecting therefrom to clamp the conductors between the cover and the housing to provide strain relief therefor.

In the previous two embodiments of the inventive jack, the contact or second leg 104 and 154 of each of the terminals 102 and 152, respectively, of the jack was received in the associated one of the internal grooves 129 and 179, respectively, formed in the housing and which opened into the cavity 112 and 162, respectively. In this embodiment, the terminal-receiving passage is completed by grooves 221—221 formed in the underside of the cover 217 and which face into the cavity 212. When the terminals 202—202 are received in the terminal-receiving grooves 213—213, the enlarged portions 210—210 thereof are received in associated ones of the internal grooves 221—221. The material between the grooves 221—221 serves to insulate ad-

jacent ones of the second legs **204—204** of the terminals and also limits the lateral movement thereof.

In mating the plug **34** with the jack **200**, the plug is inserted into the cavity **212**, so that the second legs **204—204** of the terminals **202—202** are received in associated ones of the terminal-receiving grooves **53—53** of the base portion **42** of the plug. As the free ends of the terminals **202—202** are moved into the flared entrances **56—56** and into the terminal-receiving grooves, the crown **209** engages the opposed wall of the terminal-receiving groove to urge the crown **208** on the opposite side of the terminal into engagement with the associated terminal **71** in the base portion **42** of the plug **34**. The plug **34** is moved slidably into the cavity **212** in a path of motion along the longitudinal axes of the terminals **202—202** until the plug engages a rear wall **222** of the housing **211**.

The principles of the present inventions greatly facilitate the installations of telephone sets. For example, the plug **34** hereinbefore described is designed to be used with all telephone sets. For example, the plug **34** hereinbefore described is attached to each end of all telephone cords, retractile and straight. The straight cords may be used to connect electrically the base portion **31** of the telephone set **30** with a wall terminal, (not shown). The retractile cords **33—33** are used to connect electrically the handset **32** with the base **31** of a telephone **30**.

Several different construction jacks which embody the principles of this invention are used in the different telephones **30—30** depending on the designs of the handset and base portions thereof. All of the different construction jacks are adapted to be mated with one of the universal plugs **34—34**. The installation of a cord by an installer or a replacement cord by an installer or a subscriber is greatly facilitated. Moreover, the universal adaptability of the plug **34** with any type jack makes possible the reduction of inventories required for cords having different plug ends.

The base portion **42** is made of a material which withstands prolonged exposure to high temperature atmosphere to which the cords **33—33** are exposed when the cords are rendered retractile. Hence, the plugs **34—34** may be attached to the retractile cords **33—33** before the cords are rendered retractile. The dielectric portion of the plug **34** is preferably molded from polycarbonate of an injection molding grade which remains distortion-free at temperatures up to a range of 280° to 290° F at atmospheric pressure. An example of such material is Lexan 2805–112, available from the General Electric Company of Pittsfield, Mass. The temperatures to which the cord **33** is exposed in order to set the retractile shape in the cord is 265° F. Thus the polycarbonate in the dielectric portions can readily tolerate the retractile-setting temperature of 265° F without suffering any undesired change of shape. Moreover, the material from which the plugs **34—34** are constructed may be pigmented to match the color of the telephone **30**.

It is to be understood that the above-described arrangements are simply illustrative of the principles of the invention. Other arrangements may be devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. A device for making an electrical connection, which comprises:

a plug assembly which includes,

mating dielectric parts having facilities for receiving a plurality of conductors to confine and separate the conductors, one of the mating parts having terminal-receiving facilities formed therein; and

a plurality of electrically conductive terminals received in associated ones of the terminal-receiving facilities of the one of the mating parts, each of the terminals having a portion thereof which extends into the associated one of the conductor-receiving facilities of the one part and which includes means for engaging electrically and for retaining engagement with associated ones of the conductors positioned in the assembly when the parts are mated;

the other one of the mating parts having means formed thereon for causing the engaging means of the portions of the terminals to engage electrically the associated ones of the conductors when the parts are mated, and

a jack assembly designed to be mated with the plug assembly which includes,

mating dielectric parts having facilities for receiving a plurality of conductors and confining individually the conductors, one of the mating parts having walls which define terminal-receiving passages, the walls of portions of the passages designed to permit a predetermined lateral deflection of the associated portions of the associated terminals, the jack assembly having a cavity complementary to at least portions of the plug assembly to permit insertion of at least portions of the plug assembly into the jack assembly, and

a plurality of electrically conductive terminals having at least portions thereof received in the terminal-receiving passages, each of the terminals of the jack assembly having a portion thereof which extends into the associated one of the conductor-receiving facilities and which includes means for engaging electrically and being retained in engagement with the conductors positioned therein when the parts of the jack assembly are mated,

the other one of the mating parts having means formed thereon for causing the engaging means of the portions of the terminals to engage electrically the associated ones of the conductors when the parts are mated, and

portions of the terminals of the jack assembly being received in the associated ones of the terminal-receiving facilities of the plug assembly and caused to engage electrically with associated terminals in the plug assembly when the plug assembly is inserted into the cavity of the jack assembly,

the terminals mounted in the jack assembly having at least a portion thereof anchored in the jack assembly and the portion thereof which engages the associated terminal in the plug assembly being received in the portions of the associated passage and designed to have a predetermined lateral deflection to facilitate the mating of the

plug and jack assemblies and to maintain the terminals of the jack assembly in electrical engagement with the associated terminals of the plug assembly.

2. The device for making an electrical connection as set forth in claim 1, wherein:

the mating dielectric parts of the plug assembly include means for providing strain relief for the plurality of conductors and for individual ones of the conductors positioned therein, and

the mating dielectric parts of the jack assembly includes facilities for providing strain relief for the conductors positioned therein.

3. An electrical connector as set forth in claim 1 wherein:

the one of the dielectric parts of the jack assembly is provided with means formed transversely of the associated terminals for supporting the associated terminals to prevent unintended relative longitudinal movement between the terminals and the one dielectric part of the jack assembly, and

each of the terminals associated with the jack assembly is configured to be seated in engagement with the associated supporting means to support the terminals against unintended longitudinal movement when the plug assembly is inserted into the cavity in the jack assembly.

4. The device for making an electrical connection of claim 1, which further comprises:

means formed on at least one of the parts of the plug assembly and on at least one of the parts of the jack assembly for concentrating bonding energy and facilitating the bonding together ultrasonically of parts of the plug assembly and the bonding together ultrasonically of the parts of the jack assembly.

5. The device for making an electrical connection of claim 1, which further comprises:

releasable latching means associated with the plug assembly and the jack assembly for securing together the plug and jack assemblies to prevent unintended uncoupling thereof.

6. A device for making an electrical connection, which comprises:

a first unit which includes,

a first dielectric part having a plurality of conductor-receiving troughs for receiving associated ones of a plurality of associated conductors and having a plurality of terminal-receiving grooves opening on a surface and communicating with the conductor-receiving troughs; and

a second dielectric part designed to be mated with the first part and having ribs extending from one surface thereof and received in associated ones of the conductor-receiving troughs of the first part when the second part is mated to the first part to confine the conductors positioned therein between the rib and first part;

a plurality of first terminals inserted into the terminal-receiving grooves of the first part, the first terminals having contact portions and having conductor-input portions extending into the associated one of the conductor-receiving troughs and which includes means for engaging electrically and for retaining engagement with the conductor positioned in the associated trough when the second part is mated to the first part;

the ribs on the second dielectric part of the first unit being effective to cause the engaging means of the portions of the terminals to engage electrically the associated ones of the conductors when the parts are mated, and

a second unit adapted to be mated with the first unit and which includes,

a first dielectric part having a cavity complementary to at least portions of the first unit designed to be received in the cavity, the first part of the second unit having a plurality of terminal-receiving grooves opening to an external surface thereof for receiving associated ones of a plurality of associated conductors, the first part also including a plurality of internal grooves aligned with the terminal-receiving grooves and facing into the cavity, the internal grooves cooperating with the terminal-receiving grooves to define terminal-receiving passages, and

a second dielectric part adapted to be mated with the first part of the second unit, and having ribs formed thereon which project into the associated ones of the terminal-receiving grooves to confine the conductors between the ribs and the first part of the second unit when the second part of the second unit is mated with the first part of the second unit; and

a plurality of second terminals designed to be positioned in the terminal-receiving passages and having conductor-engaging portions which terminate in the terminal-receiving grooves and which includes means for engaging electrically and for retaining in engagement with the conductors positioned in the terminal-receiving grooves when the second part of the second unit is mated to the first part thereof,

the ribs on the second dielectric part of the second unit being effective to cause the engaging means of the portions of the terminals to engage electrically the associated ones of the conductors when the parts are mated, and

each of the second terminals having a portion thereof anchored in the second unit when the second part of the second unit is mated with the first part of the second unit, and having a contact portion adapted to be received in the associated internal groove of the first part of the second unit and being capable of flexure, with the deflection of the contact portion of the second terminal being limited to within the associated internal groove,

at least portions of the first unit being insertable into the cavity of the second unit to cause the contact portion of the second terminal in the internal groove to be moved into the associated terminal-receiving groove of the first unit to engage the contact portion of the first terminal therein and establish and maintain electrical connection therebetween.

7. A device for making an electrical connection, which comprises:

a first assembly, which includes

a first subassembly which includes,

a first dielectric part having a passage formed therethrough with a plurality of parallel longitudinally formed partitions projecting into the passage to form a plurality of elongated conductor-receiving troughs for confining and separating associated individual conductors designed to be received therein against lateral movement in the passage and having a plurality of terminal-receiving grooves opening on a surface of the first part and communicating with associated ones of the conductor-receiving troughs, each of the terminal-receiving grooves having a flared entrance opening on the surface of the first part extending transverse to the other surface, each of the terminal-receiving grooves having a restriction at one end and a shoulder projecting transversely of and into the entrance at the other end; and

a second dielectric part having a plurality of ribs formed on one surface thereof, the second part designed to be mated with the first part with the ribs interposed between associated ones of the partitions and extending into associated ones of the conductor-receiving troughs for confining further transverse movement of associated conductors; and

a plurality of first electrically conductive terminals mounted in associated ones of the terminal-receiving grooves of the first part and having one end in engagement with the shoulder and the other end received in the restriction to confine the opposite ends of the terminal,

each of the first terminals having barbs formed integrally therewith on the ends thereof penetrating the material defining the groove to secure the first terminals within the first part, and having contact portions formed thereon protruding into the associated ones of the conductor-receiving troughs so that when the second part is mated with the first part and the ribs confine the conductors positioned in the associated ones of the troughs, the contact portions of the associated first terminals become engaged electrically with the conductors,

each of the first terminals having a crown formed thereon for engaging the opposed wall of the associated terminal-receiving groove to maintain the terminal in engagement with the adjacent wall of the associated terminal-receiving groove; and a second assembly which includes,

a second subassembly including

a first dielectric part having a cavity complementary to at least portions of the first subassembly designed to be received in the cavity, the first part of the second subassembly having a plurality of terminal-receiving grooves opening to an external surface thereof and adapted to receive insulated conductors, and having a plurality of internal grooves formed in one of the surfaces thereof which face into the cavity, are aligned with associated ones of the terminal-receiving grooves and extend transverse to the external surface to cooperate with the associated terminal-receiving grooves to define terminal-receiving passages, and

a second dielectric part, adapted to be mated with the first part of the second subassembly having a plurality of ribs formed on one surface thereof, the ribs being received in associated ones of the grooves when the second part of the second subassembly is mated with the first part of the second subassembly, and

a plurality of second electrically conductive terminals, each having first and second legs, and designed to be positioned in the terminal-receiving passages and having contact portions formed on the first legs thereof which extend laterally of the associated first legs and terminate in portions of the associated grooves designed to receive associated conductors so that when the conductors are positioned in the associated grooves and the second part of the second subassembly is mated with the first part of the second subassembly, the ribs confine the conductors and the contact portions become engaged electrically therewith,

the second legs of the second terminals extending into the cavity and being confined in associated ones of the internal grooves to engage the associated one of the first terminals when the first assembly is inserted into the cavity longitudinally of the associated second legs of the second terminals,

the second terminals being anchored in the first part of the second subassembly with the free ends of the second legs of the terminals extending into the cavity and being designed to be capable of deflection transversely, the transverse movement of the free ends of the second legs being restricted by the associated internal grooves to prevent misalignment of the second terminals and facilitate insertion of the contact portion of each of the second terminals into an associated one of the terminal-receiving grooves in the first part of the first subassembly,

each of the second terminals having first and second crowns projecting from opposite sides thereof the second crown being adapted to engage the opposed wall of the associated terminal-receiving groove in the first subassembly to urge the associated first crown projecting from the other side of the second terminal into engagement with the associated first terminal.

8. The device for making an electrical connection as set forth in claim 7, which further comprises:

complementary means formed on the first and second parts of the first subassembly transversely of the troughs for clamping a plurality of the conductors therebetween and for anchoring individual ones of the conductors to provide strain relief for the plurality of conductors and for the individual ones of the conductors; and

complementary means formed on the first and second parts of the second subassembly for providing strain relief for the conductors positioned therein.

9. The device for making an electrical connection as set forth in claim 7, which further includes

the first part of the second subassembly is provided with means formed transversely of the second terminals for supporting the second terminals to prevent unintended relative longitudinal movement between the terminals and the first part of the second subassembly; and

each of the second terminals is configured to be seated in engagement with the supporting means when the second terminals are inserted into the terminal-receiving passages so that when the first assembly is inserted into the second assembly, the second terminals are supported against unintended longitudinal movement.

10. The device for making an electrical connection as set forth in claim **7**, wherein:

the thickness of each of the first terminals plus the overall thickness of the second terminals, including the projecting dimensions of the first and second crowns, is greater than the width of the terminal-receiving groove of the first part of the first assembly to cause the second leg of each of the second terminals to assume a serpentine configuration when the second leg is caused to be moved into the associated one of the terminal-receiving grooves and insure that the second crown thereof presses into the opposed walls of the terminal-receiving groove and that the first crown engages the associated first terminal with sufficient pressure to establish adequate electrical contact therebetween.

11. The device for making an electrical connection as set forth in claim **7**, wherein:

the contact portions formed on the first and second electrically conductive terminals includes at least two tangs spaced along one edge of each of the terminals, each of the tangs being substantially wedge-shaped with a base thereof integral with the main body portion of the terminal and with an apex thereof external of the main body portion, each of the tangs being coined on one side thereof, with the distance between the apices of the tangs as measured orthogonally of the plane of the terminal being predetermined to insure penetration of insulated conductors positioned in the troughs and in the terminal-receiving grooves when the second parts of the first and second dielectric subassemblies are mated with the first parts of the first and second dielectric subassemblies respectively.

12. The device for making an electrical connection as set forth in claim **7**, wherein:

the second leg of each of the second electrically conductive terminals is formed with a portion thereof adjacent the free end being bent out of the plane of the terminal to bias the first crown thereof toward the first terminal in the associated terminal-receiving groove to pre-align the free end thereof with the flared entrance to facilitate the mating of the terminals with the first assembly and to urge the bent portions of the second legs toward the plane of the associated first terminals to create adequate pressure contact between the first and second terminals.

13. The device for making an electrical connection as set forth in claim **7**, which further comprises:

releasable latching means associated with the first and second subassemblies and rendered effective subsequent to the insertion of the at least portions of the first assembly into the cavity of the second assembly for securing together the first and second assemblies to prevent unintended uncoupling thereof.

14. The device for making an electrical connection, defined in claim **7**, and which further comprises:

the first part of the second subassembly having an overhanging portion extending into the cavity thereof and having a slot cut therein,

the second part of the first subassembly having a pair of spaced latch-receiving grooves opening to the one surface thereof, one of the ribs of the second part of the first subassembly having a lip formed integrally therewith and extending partially transversely of one of the latch-receiving grooves to overhang partially the one of the latch-receiving grooves, further, the second part of the first subassembly having a U-shaped slot formed in another surface opposed to the one surface opening to a free end of the second part and having a second slot connected to the U-shaped slot and opening to a conductor-input end of the second part,

the first part of the first subassembly having spaced apertures opening to said passage; and

a latch made of a resilient material and including a pair of securing fingers each having an upstanding portion at one end thereof, each of the securing fingers connected to a leg portion extending reversely angularly of the associated securing finger, each of the leg portions having a transversely extending arm portion, the arm portions projecting toward one another, each one of the arm portions connected to one end of a U-shaped release tab designed to be received in the slot in the overhanging portion, the latch being assembled to the second part of the first subassembly with one of the securing fingers being urged past the lip to seat the one securing finger in the associated one of the latch-receiving grooves between the lip and the bottom of the groove and with the other securing finger received in the other one of the latch-receiving grooves, the upstanding portions projecting externally of the second part, oriented toward the conductor-input end of the second part of the first subassembly and being received in the apertures of the first part to prevent unintended longitudinal movement of the latch, the connection of the securing fingers to the leg portions being oriented toward the end of the second part which is the leading end moved into the cavity of the second assembly, the release tab oriented toward the conductor-input end of the second part of the first subassembly, the device being assembled by depressing the release tab to move the leg portions and the arm portions into the U-shaped slot and the release tab into the second slot and causing relative movement between the first and second assemblies to move the first assembly into mating engagement with the second assembly whereafter the release tab is permitted to be returned resiliently to a normal position angled to the securing fingers to move the arm portions thereof be-

hind the overhanging portion to prevent unintended uncoupling of the assemblies and to protrude angularly the release tab through the slot in the overhanging portion.

15. The connector of claim 7, wherein the second electrically conductive terminals are terminals being substantially U-shaped in form and designed to be positioned in the grooves and having contact tangs formed on the legs thereof which extend laterally of the associated legs and terminate in portions of the associated grooves designed to receive associated conductors so that when the conductors are positioned in the associated grooves and the second part of the second dielectric subassembly is mated with the first part of the second dielectric subassembly, the ribs confine the conductors and the tangs pierce the insulation of the conductors and become engaged electrically therewith, the opposite legs of the second terminals extending into the cavity and being confined in associated ones of the internal grooves to engage the associated one of the first terminals when the first dielectric subassembly is inserted into the cavity longitudinally of the associated legs of the second terminals, the second terminals being anchored in the first part of the second dielectric subassembly with the free ends of the legs of the terminals extending into the cavity being free to be defected transversely, the transverse movement of the free ends of the leg portions being restricted by the associated internal grooves to prevent misalignment of the terminals and facilitate insertion of the contact portion of each of the second terminals into an associated one of the terminal-receiving grooves in the first part of the first dielectric subassembly, each of the second terminals having a first and a second crown projecting from opposite sides thereof, the second crown being adapted to engage the opposed wall of the associated terminal-receiving groove in the first dielectris subassembly to urge the associated first crown projecting from the other side of the second terminal into engagement with the associated first terminal.

16. The device for making an electrical connection as set forth in claim 7, wherein:

the first terminals are assembled to the first part of the first subassembly with the edges thereof which are adjacent the surface of the first part of the first dielectric subassembly being within the terminal-receiving grooves thereof,

the internal grooves in the first part of the second subassembly being defined by walls having edge surfaces which face into the cavity and which are transverse to side surfaces of the walls; and

the second terminals are assembled to the first part of the second subassembly with portions of the second legs thereof protruding beyond the edge surfaces of the walls of the internal grooves of the first part and into the cavity, the protruding portions being received in associated ones of the terminal receiving grooves of the first assembly when the first and second assemblies are mated together and the surface of the first part of the first subassembly engages the edge surfaces of the walls of the internal grooves.

17. The device for making an electrical connection as set forth in claim 16, wherein:

the first terminals are assembled to the first part of the first subassembly with the edges thereof which are adjacent the surface of the first part of the first dielectric subassembly being flush therewith.

18. An electrical connector, which comprises:

a first assembly which includes

a first dielectric subassembly which includes

a first part having a passage formed therethrough with a plurality of parallel longitudinally formed partitions projecting into the passage to form a plurality of elongated conductor-receiving troughs for confining associated individual conductors designed to be received therein against lateral movement in the passage and having a plurality of terminal-receiving grooves opening on a surface of the first part and communicating with associated ones of the conductor-receiving troughs, each of the terminal-receiving grooves having a flared entrance opening on the surface of the first part extending transverse to the other surface, each of the terminal-receiving grooves having a restriction at one end and a shoulder projecting transversely of and into the entrance at the other end, the first part having a raised portion formed transversely of the longitudinal axes of the passage and projecting into the passage, and having a transversely extending channel in the passage interposed between the raised portion and the troughs, and

a second part having a plurality of ribs formed on one surface thereof, the second part designed to be mated with the first part with the ribs interposed between associated ones of the partitions and extending into associated ones of the conductor-receiving troughs for confining further transverse movement of associated conductors, the second part also including a raised portion formed transversely of the part and to cooperate with the raised portion of the first part to clamp a plurality of the conductors therebetween when the second part is mated with the first part, and further having a ridge formed transversely of the ribs and interposed between the ribs and the raised portion thereof for cooperating with the channel of the first part to clamp the conductors between the ridge and the channel when the second part is mated with the first part to anchor the individual conductors; and

a plurality of first electrically conductive terminals mounted in associated ones of the terminal-receiving grooves of the first part of the first dielectric subassembly and having one end in engagement with the shoulder and the other end received in the restriction to confine the opposite ends of the terminal, each of the first terminals having barbs formed integrally therewith on the ends thereof penetrating the material defining the grooves to secure the first terminals within the first part, and having contact tangs formed thereon protruding into the associated ones of the conductor-receiving troughs so that when the second part is mated with the first part

and the ribs confine the conductors in the associated ones of the troughs, the contact tangs on the associated first terminals pierce the insulation of the associated conductors and become engaged electrically with the conductors, each of the first terminals having a crown formed thereon for engaging the opposed wall of the associated terminal-receiving groove to maintain the terminal in engagement with the adjacent wall of the associated terminal-receiving groove; and a second assembly which includes

a second dielectric subassembly including

a first part having a cavity complementary to at least portions of the first dielectric subassembly designed to be received in the cavity, the first part of the second dielectric subassembly having a plurality of terminal-receiving grooves opening to two adjacent transversely extending external surfaces thereof, the grooves adapted to receive insulated conductors, and a plurality of internal grooves formed in one of the surfaces thereof which face into the cavity, are aligned with associated ones of the terminal-receiving grooves on the transverse surfaces and extend parallel to one of the transverse surfaces and transverse to the other to cooperate with the associated terminal-receiving groove to define generally U-shaped terminal-receiving passages, and

a second part, adapted to be mated with the first part of the second dielectric subassembly having a plurality of ribs formed on one surface thereof, the ribs being received in associated ones of the grooves when the second part is mated with the first part of the second dielectric subassembly, and

a plurality of second electrically conductive terminals being substantially U-shaped in form and and designed to be positioned in the U-shaped passages and having contact tangs formed on the legs thereof which extend laterally of the associated legs and terminate in portions of the associated grooves designed to receive associated conductors so that when the conductors are positioned in the associated grooves and the second part of the second dielectric subassembly is mated with the first part of the second dielectric subassembly, the ribs confine the conductors and the tangs pierce the insulation of the conductors and become engaged electrically therewith, the opposite legs of the second terminals extending into the cavity and being confined in associated ones of the internal grooves to engage the associated one of the first terminals when the first dielectric subassembly is inserted into the cavity longitudinally of the associated legs of the U-shaped second terminals, the second terminals being anchored in the first part of the second dielectric subassembly with the free ends of the legs of the U-shaped terminals extending into the cavity being free to be defected transversely, the transverse movement of the free ends of the leg portions being restricted by the associated internal grooves to prevent misalignment of the terminals and facilitate insertion of the contact portion of each of the second terminals into an associated one of the terminal-receiving grooves in the first part of the first dielectric subassembly, each of the second terminals having a first and a second crown projecting from opposite sides thereof, the second crown being adapted to engage the opposed wall of the associated terminal-receiving groove in the first dielectric subassembly to urge the associated first crown projecting from the other side of the second terminal into engagement with the associated first terminal.

19. The connector of claim **18**, wherein the internal grooves formed in one of the surfaces which face into the cavity of the second dielectric subassembly of the second assembly are formed in that surface which is the least distance from the parallel external surface thereof having the terminal-receiving grooves formed therein.

20. The connector of claim **18**, wherein the internal grooves formed in one of the surfaces which face into the cavity of the second dielectric subassembly of the second assembly are formed in that surface which is most distant from the parallel external surface thereof having the terminal-receiving grooves formed therein.

21. An electrical connector, which comprises:

a first assembly which includes,

a first dielectric subassembly which includes,

a first part having a passage formed therethrough with a plurality of parallel longitudinally formed partitions projecting into the passage to form a plurality of elongated conductor-receiving troughs for confining associated individual conductors designed to be received therein against lateral movement in the passage and having a plurality of terminal-receiving grooves opening on a surface of the first part and communicating with associated ones of the conductor-receiving troughs, each of the terminal-receiving grooves having a flared entrance opening on the surface of the first part extending transverse to the other surface, each of the terminal-receiving grooves having a restriction at one end and a shoulder projecting transversely of and into the entrance at the other end, the first part having a raised portion formed transversely of the longitudinal axes of the passage and projecting into the passage, and having a transversely extending channel in the passage interposed between the raised portion and the troughs, and

a second part having a plurality of ribs formed on one surface thereof, the second part designed to be mated with the first part with the ribs interposed between associated ones of the partitions and extending into associated ones of the conductor-receiving troughs for confining further transverse movement of associated conductors, the second part also including a raised portion formed transversely of the part and to cooperate with the raised portion of the first part to clamp a plurality of the conductors therebetween when the second part is mated with the first part, and further having a ridge formed transversely of the

ribs and interposed between the ribs and the raised portion thereof for cooperating with the channel of the first part to clamp the conductors between the ridge and the channel when the second part is mated with the first part to anchor the individual conductors; and

a plurality of first electrically conductive terminals mounted in associated ones of the terminal-receiving grooves of the first part of the first dielectric subassembly and having one end in engagement with the shoulder and the other end received in the restriction to confine the opposite ends of the terminal, each of the first terminals having barbs formed integrally therewith on the ends thereof penetrating the material defining the groove to secure the first terminals within the first part, and having contact tangs formed thereon protruding into the associated ones of the conductor-receiving troughs so that when the second part is mated with the first part and the ribs confine the conductors in the associated ones of the troughs, the contact tangs on the associated first terminals pierce the insulation of the associated conductors and become engaged electrically with the conductors, each of the first terminals having a crown formed thereon for engaging the opposed wall of the associated terminal-receiving groove to maintain the terminal in engagement with the adjacent wall of the associated terminal-receiving groove; and

a second assembly which includes

a second dielectric subassembly including

a first part having a cavity complementary to at least portions of the first dielectric subassembly designed to be received in the cavity, the first part of the second dielectric subassembly having a plurality of terminal-receiving grooves opening to two adjacent transversely extending external surfaces thereof, the grooves adapted to receive insulated conductors and a plurality of internal grooves formed in one of the surfaces thereof which face into the cavity are aligned with associated ones of the terminal-receiving grooves, on the transverse surfaces and extend parallel to one of the transverse surfaces and transverse to the other to cooperate with the associated terminal-receiving groove to define generally U-shaped terminal-receiving passages, and

a second part, adapted to be mated with the first part of the second dielectric subassembly, having a plurality of ribs formed on one surface thereof, the ribs being received in associated ones of the grooves when the second part is mated with the first part of the second dielectric subassembly, and

a plurality of substantially U-shaped electrically conductive terminals designed to be positioned in the U-shaped passages and having contact tangs formed on the legs thereof which extend laterally of the associated legs and terminate in portions of the associated grooves designed to receive associated conductors so that when the conductors are positioned in the associated grooves and the second part of the second dielectric subassembly is mated with the first part of the second dielectric subassembly, the ribs confine the conductors and the tangs pierce the insulation of the conductors and become engaged electrically therewith, the opposite legs of the U-shaped terminals extending into the cavity and bring confined in associated ones of the internal grooves to engage the associated one of the first terminals when the first dielectric subassembly is inserted into the cavity longitudinally of the associated legs of the U-shaped terminals having the contact tangs formed thereon being anchored in the first part of the second dielectric subassembly, the portion of each of the U-shaped terminals connecting the legs thereof being free to be twisted about a joint with the leg having the tangs formed thereon and with the free ends of the opposite legs of the U-shaped terminals extending into the cavity being free to be defected transversely, the transverse movement of the free ends of the leg portions being restricted by the associated internal grooves to prevent misalignment of the terminals and facilitate insertion of the contact portion of each of the U-shaped terminals into an associated one of the terminal-receiving grooves in the first part of the first dielectric subassembly, each of the U-shaped terminals having first and second crowns projecting from opposite sides thereof the second crown being adapted to engage the opposed wall of the associated terminal-receiving groove in the first dielectric subassembly to urge the associated first crown projecting from the other side of the U-shaped terminal in engagement with the associated first terminal.

22. An electrical connector as set forth in claim 21, wherein:

the U-shaped terminals are made from a flat sheet of electrically conductive material having a thickness t and formed so that the thickness t is measured along a line perpendicular to the plane of the U, the dimensions of the terminals in the plane of the U being substantially greater than the thickness.

23. A plug assembly, which comprises:

a first dielectric part having a passage formed therethrough with a plurality of parallel longitudinally formed partitions projecting into the passage to form a plurality of elongated conductor-receiving troughs for confining associated individual conductors designed to be received therein against lateral movement in the passage and having a plurality of terminal-receiving grooves opening on a surface of the first part and communicating with associated ones of the conductor-receiving troughs, each of the terminal-receiving grooves having a flared entrance opening on the surface of the first part extending transverse to the other surface, each of the terminal-receiving grooves having a resstriction at one end and a shoulder projecting transversely of and into the entrance at the other end,

a second dielectric part having a plurality of ribs formed on one surface thereof, the second part designed to be mated with the first part with the

ribs interposed between associated ones of the partitions and extending into associated ones of the conductor-receiving troughs for confining further transverse movement of associated conductors; and

a plurality of electrically conductive terminals mounted in associated ones of the terminal-receiving grooves of the first part and having one end in engagement with the shoulder and the other end received in the restriction to confine the opposite ends of the terminal, each of the terminals having barbs formed integral therewith on the ends thereof penetrating the material defining the groove to secure the terminals within the first part, and having contact portions formed thereon protruding into the associated ones of the conductor-receiving troughs so that when the second part is mated with the first part, the ribs confine the conductors in the associated ones of the trough and cause the contact portions of the associated first terminals to become engaged electrically with the associated ones of the conductors, each of the terminals having a crown formed thereon engaging the opposed wall of the associated terminal-receiving groove to maintain the terminal in engagement with the adjacent wall of the associated terminal-receiving groove.

24. A plug assembly as defined in claim **23**, which includes:

complementary means formed on the first and second dielectric parts transversely of the troughs for clamping a plurality of the conductors therebetween and for anchoring individual ones of the conductors to provide strain relief for the plurality of conductors and for the individual ones of the conductors.

25. A plug assembly as defined in claim **23**, wherein:

the terminals are assembled to the first part with the edges thereof which are adjacent the surface of the first part being within the terminal-receiving grooves thereof.

26. A plug assembly as defined in claim **23**, wherein:

the contact portion formed on the terminals includes at least two tangs spaced along one edge of each of the terminals, each of the tangs being substantially wedge-shaped with a base thereof integral with the main body portion of the terminal and with an apex thereof external of the main body portion, each of the tangs being coined on one side thereof, with a distance between the apices of the tangs as measured orthogonally of the plane of the terminal being predetermined to insure penetration of insulated conductors positioned in the troughs when the second part is mated to the first part.

27. A jack assembly, which includes:

a first dielectric part having a cavity complementary to at least portions of a mating electrical connector designed to be received in the cavity, and having a plurality of terminal-receiving grooves opening to an external surface thereof and adapted to receive insulated conductors, and having a plurality of internal grooves formed in one of the surfaces thereof which face into the cavity, and are aligned with associated ones of the terminal-receiving grooves to cooperate with the associated terminal-receiving grooves to define terminal-receiving passages;

a second dielectric part, adapted to be mated with the first part and having a plurality of ribs formed on one surface thereof, the ribs being received in associated one of the grooves when the second part is mated with the first part; and

a plurality of electrically conductive terminals designed to be positioned in the terminal-receiving passages and having contact portions formed on first leg portions thereof which extend laterally of the associated leg portions and terminate in portions of the associated grooves designed to receive associated conductors so that when the conductors are positioned in the associated grooves and the second part is mated with the first part, the ribs confine the conductors and cause the contact portions to become engaged electrically with the associated conductors, the terminals having second leg portions, further the terminals being anchored in the first part with the free ends of the second leg portions of the terminals extending into the cavity and being free to be deflected transversely of the free ends of the second leg portions and being restricted by the associated internal grooves to prevent misalignment of the second terminals, each of the terminals having first and second crowns projecting from opposite sides thereof.

28. A jack assembly as set forth in claim **27**, which includes:

complementary means formed on the first and second parts to provide strain relief for the conductors positioned therein.

29. A jack assembly as set forth in claim **27**, wherein:

the first part is provided with means formed transversely of the terminals for supporting the terminals to prevent unintended relative longitudinal movement between the terminals and the first part; and

each of the terminals is configured to be seated in engagement with the supporting means to support the terminals against unintended longitudinal movement.

30. A jack assembly as defined in claim **27**, wherein:

the internal grooves in the first part are defined by walls having edge surfaces which face into the cavity and which are transverse to side surfaces of the walls; and

the terminals are assembled to the first part with portions of the second leg portions thereof protruding beyond the edge surfaces of the walls of the internal grooves and into the cavity.

31. A jack assembly as defined in claim **27**, wherein:

the contact portions formed on the terminals include at least two tangs spaced along one edge of each of the terminals, each of the tangs being substantially wedge-shaped with a base thereof integral with the main body portion of the terminal and with an apex thereof external of the main body portion, each of the tangs being coined on one side thereof with a distance between the apices of tangs as measured orthogonally of the plane of the terminal being predetermined to insure penetration of insulated conductors positioned in the first part when the second part is mated with the first part.

32. A jack assembly as set forth in claim **27**, wherein:

the second leg of each of the terminals is formed with a portion thereof adjacent the free end being bent out of the plane of the terminal to bias the first crown thereof toward the wall of the associated internal groove.

33. An electrical connector for terminating an insulated conductor and for engaging electrically a component external to the connector, which comprises:

a dielectric housing, which includes at least one conductor-receiving trough and at least one terminal-receiving opening, the terminal-receiving opening including a groove overlying and extending generally parallel to the at least one trough and a slot communicating with the at least one trough, the length of the groove being exposed to the exterior of the connector; and

at least one electrically conductive flat blade-like terminal positioned within the at least one terminal-receiving opening, which includes:

an internal contact portion positioned within the slot and having facilities for piercing the insulation of and making electrical engagement with the conductor in the at least one trough,

an external contact portion positioned within the groove of the terminal-receiving opening and having facilities for making electrical engagement with the component external to the connector to establish an electrical connection with the component.

34. An electrical connector for terminating a cord having a plurality of insulated conductors, and for making engagement with conductors external to the connector, which comprises:

a dielectric housing including a plurality of troughs, each trough receiving an individual insulated conductor therein, and a plurality of terminal-receiving openings, each opening comprising a groove overlying and extending generally parallel to an individual conductor-receiving trough and a slot extending groove and the associated trough between the groove length of the groove being exposed to the exterior of the connector; and

a plurality of electrically conducting terminals, each terminal being positioned within an associated individual terminal-receiving opening and comprising a flat blade-like member including:

an internal contact portion positioned within the slot of the associated opening and having facilities for piercing the insulation of and making electrical engagement with an individual conductor positioned within the associated conductor-receiving trough, and

an external contact portion positioned within the groove of the associated opening and having facilities for making engagement with conductors external to the connector.

35. The electrical connector of claim 34, wherein the juncture of the groove with the associated slot is of a size to permit the internal contact portion of the associated terminal to pass therethrough.

36. The electrical connector of claim 34, wherein each of the terminals is maintained within the associated terminal-receiving opening to expose an edge portion of the external contact portion to the external face of the connector.

37. The electrical connector of claim 34, wherein each terminal includes a plurality of barbs that penetrate the material defining the associated terminal-receiving opening when the terminal is inserted therein to secure the terminal within the housing.

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