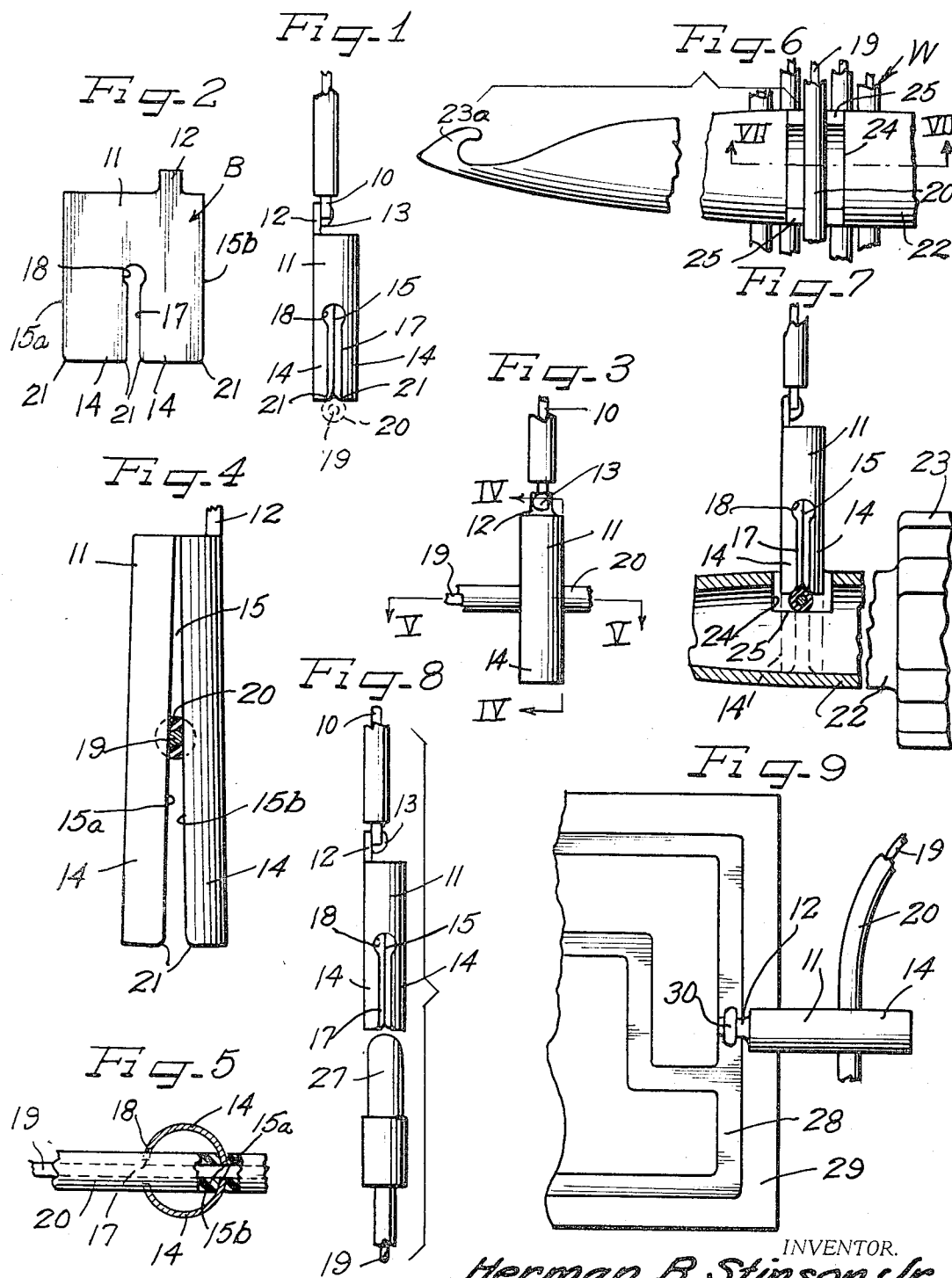


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METHOD OF MAKING ELECTRICAL CONNECTIONS AND THE
CONNECTIONS PRODUCED THEREBY
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METHOD OF MAKING ELECTRICAL CONNECTIONS AND THE CONNECTIONS PRODUCED THEREBY

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ABSTRACT OF THE DISCLOSURE

A tubular electrical conductor has a split throughout its length providing opposed insulation cutting and conductor gripping jaws, with a longitudinal generally key-hole slot diametrically opposite within which the conductor is engaged without cutting the insulation. To select a conductor from an insulated wire bundle the tip of an assembling tool is manipulated into engagement with the conductor and slid therealong until the conductor is supported on spaced abutments.

This invention relates to the art of making electrical connections, and more particularly concerns a new method of and means for making electrical connections and the connections produced thereby.

One of the problems in connecting the leads of a multiple circuit electrical device, such as may comprise an auxiliary or optional control unit attachment, operatively to the circuits of an apparatus or instrument with which used where no prior arrangement of separable connectors has been provided in the latter resides in the usual complexities involved in making the connections. For example, in electrically operated musical instruments, such as electric organs, and the like, various optional or auxiliary control and special effects attachments may be provided, sometimes subsequent to manufacture of the musical instrument or by someone other than the original manufacturer. Matching and joining of the numerous electrical conductors of the attachment and the insulated wire conductors of the instrument have heretofore generally been time-consuming, sometimes requiring special skill, and often at least some of the equipment may have to be dismantled for shop bench servicing. Furthermore, should it be desired to remove the electrically attached device, difficulties and disadvantages are inherent in the prior arrangements.

It is, therefore, an important object of the present invention to provide a new method of making electrical connections with insulated conductors by pressing on insulation-severing, self-gripping electrically conductive means, and which will overcome the foregoing and other prior difficulties and deficiencies.

Another object of the invention is to provide a new method of making press-on solderless connections with insulated wire conductors, according to which electrically conducting means are manipulated transversely across the insulated wire to penetrate the insulation thereof and electrically contact the wire.

A further object of the invention is to provide a new method of making a connection with an insulated electrical conductor which comprises forcing an insulation-severing edge of a jaw of electrically conductive means slidably transversely to the length of the conductor to sever the insulation and effect electrical contact therewith.

Still another object of the invention is to provide a new method of making an electrical connection with an insulated conductor which comprises pressing onto and across a limited portion of the length of the conductor electrically conductive means effecting severance of the insulation and electrical contact with the conductor between

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one pair of jaw edges and gripping of the insulation of the conductor by a second pair of jaw edges to assist in retaining the conductive means on the conductor.

Yet another object of the invention is to provide a new method of making an electrical connection which comprises bridging a longitudinal portion of an insulated conductor across supporting abutments defining a clearance space therebetween, and relatively moving the supported conductor and a self-gripping insulation severing and conductor engaging electrically conductive connector means onto the conductor and into said space.

A still further object of the invention is to provide a new method of making an electrical connection by selecting an insulated wire from a bundle by manipulating the tip of a selecting tool into engagement with a wire and sliding the wire along the surface of the tool onto spaced abutments defining clearance therebetween and applying a self-gripping insulation severing connector onto the supported section of the wire and into the clearance between the abutments.

A yet further object of the invention is to provide a new electrical connection in which an insulated electrical conductor has extending transversely thereacross electrically conductive means comprising a jaw having an elongated substantially straight edge penetrating the insulation and electrically engaging the conductor.

A yet further object of the invention is to provide a new electrical connection including a jaw connector applicable with equal facility into insulation-severing self-gripping relation with an electrical conductor or into frictional slide-on engagement with a pin terminal.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of an electrical connector embodying features of the invention;

FIGURE 2 is a developed sheet metal blank from which the electrical connector of FIGURE 1 is adapted to be produced;

FIGURE 3 is a side elevational view of the electrical connector of FIGURE 1 showing the same attached in self-gripping relation to an insulated wire conductor;

FIGURE 4 is an enlarged fragmentary sectional elevation view taken substantially along the line IV-IV of FIGURE 3;

FIGURE 5 is an enlarged fragmentary sectional detail view taken substantially along the line V-V of FIGURE 3;

FIGURE 6 is a fragmental plan view of means comprising a tool serving as an aid in effecting electrical connections with the connectors of the present invention;

FIGURE 7 is a sectional elevational view taken substantially along the line VII-VII of FIGURE 6 and showing how the tool is employed in making a self-gripping electrical connection;

FIGURE 8 is a side elevational view of the electrical connector and a jackpin or plug terminal adapted to be assembled therewith, and

FIGURE 9 illustrates a modification in the electrical connector assembly.

In making an electrical connection according to the present invention, a conductor wire 10 is secured in any suitable manner to one end of electrically conductive means comprising a connector 11 having a lug 12 to which the wire 10 is connected as by solder 13. At its opposite, tubular end, the connector 11 is constructed to engage in self-gripping electrical connection with a second conductor. For this purpose, it has such end split in an axial direction in a diametral plane to provide opposed gripping jaw portions 14. One split, identified as 15, extends

throughout the length of the tubular connector body and has confronting jaw edges 15a and 15b which are normally in substantial engagement with each other and have insulation severing capability which may include some saw-like roughness such as occurs at the edge of a metal stamping. The other split, identified as 17 is shorter, has the confronting jaw edges spaced apart a limited distance, and terminates at its inner end about midway the length of the tubular connector body, in a circularly enlarged end portion 18, affording a generally keyhole appearance.

Desirably, the connector 11 is made from conductive stiffly resilient material comprising a suitable sheet metal for this purpose which is readily stamped to provide a blank B (FIG. 2) and then shaped into the tubular form. By virtue of its resilient jaw construction, the connector 11 is adapted to be connected to a second conductor by aligning the second conductor with the tips of the jaws and effecting relative assembly movement of the connector and the second conductor. Where the second conductor comprises an electrical wire 19 having insulation 20, the wire 19 is aligned with its axis normal to the axis of the connector 11 and with the insulation 20 engaging flaringly related tapered leadin surfaces 21 on the outer ends of the pairs of opposing edges defining the splits 15 and 17 (FIG. 1). Then by relatively moving the connector 11 and the wire 19 toward one another, the jaws 14 are forced to spread apart resiliently to receive the wire between the edges defining the splits. Since the edges 15a and 15b are normally close together, they serve as cutting edges, cutting through the insulation 20 as the relative assembly movement progresses and making firm electrical contact with the wire 19 under the bias of the resilient jaws, as shown in FIGURES 4 and 5. By having the pair of edges defining the shorter split 17 wider than the diameter of the wire 19, but narrower than the outside diameter of the insulation 20, there is only a slight negative fit between the spaced edges and the insulation as the wire passes along the gap of the keyhole into the enlargement 18 which snugly receives and guards or holds the conductor through its insulation spaced from the point on which the insulation has been penetrated by the edges 15a and 15b. As thus held in the connector 11 by gripping of the wire 19 itself by the edges 15a and 15b and by engagement of insulation within the keyhole enlargement 18, the wire 19 and the connector are inseparable in the presence of vibrations and other service conditions which might tend to effect separation. However, if it is desired to separate the connector from the wire 19 that can readily be done by pulling the wire and connector apart longitudinally of the connector. Then, since the insulation has only been cut through and not removed by the edges 15a and 15b, the electrical conductivity of the wire 19 is not interfered with, nor is the wire exposed since the insulation tends to close back, or at least the cuts in it are so narrow as to preclude electrical contact with contiguous objects.

In order to assist in effecting connection of the wire 19 with the connector 11, especially where such wire is one of a number of several wires in a bundle W (FIG. 6), as where the circuits of an electrical control device are to be connected to corresponding circuits of an existing apparatus, a novel tool 22 is adapted to be utilized. This tool includes an elongated rod-like body which may, at least in part be tubular and desirably have a handle 23 at one end (FIG. 7) to facilitate manipulation. At its opposite end, the tool tapers to a crochet needle-like hooked tip 23a to facilitate selecting from the bundle W the particular wire identified by means such as color code as matching the conductor to which the connector 11 is permanently connected. After the selected wire from the bundle W has been engaged by the tip of the tool and, if necessary, withdrawn by the hook 23a for access to a suitable length thereof for reception of the connector, the tool is moved longitudinally under the wire which rides up the tapering point end portion until it drops into a transverse slot 24 opening in the tubular portion of the

tool body and providing respective spaced backup edges 25 across which the engaged portion of the wire 19 bridges. The width of the slot 24 and the spacing between the edges 25 are sufficiently greater than the diameter of the connector 11 so that the connector can be readily inserted endwise through the slot into assembly alignment and engagement of the leadin edge surfaces 21 with the insulation 20 of the wire. Then by effecting relative movement of the connector and the tool toward one another, the wire is forced into gripped engagement between the jaws 14 of the connector. Preferably, the trough between the backup edges 25 is of a depth related to the length of the shorter slot 17 to act as a gauge to stop the tip of the connector 11 as the wire enters the keyhole enlargement 18, thus avoiding overstressing the engaged portion of the wire 19.

Where the conductor comprising the wire 19 is provided with a jack-like terminal pin 27 (FIG. 8), the jaws 14 of the terminal 11 are adapted to grip the terminal 27 electrically in the manner of a receptacle by effecting relative coaxial longitudinal assembly movement between the terminal and the connector. Thus, it will be apparent that the connector 11 can be interchangeably used for self-gripping engagement directly with and across a wire conductor or with pin terminals provided on the wire with which a connection is to be made. This affords desirable versatility where, for example, an optional or auxiliary piece of equipment comprises an attachment to be connected to apparatus that is factory equipped with terminal pins to be received in the connector jaw sockets; or with apparatus which is not so equipped because it may have been manufactured not in contemplation of the attachment, such as before the attachment becomes available, and the connectors then pressed on across the matching conductors.

In FIGURE 9 is shown an arrangement wherein the connector 11 is permanently attached to a first conductor 28 comprising a printed circuit on a dielectric panel 29. In this arrangement the solder lug 12 is connected to the printed circuit as by means of solder 30. Where the connector 11 is part of a printed circuit, it may be utilized to effect self-gripping connection across the second conductor wire 19 or with terminal pin 27, as previously described.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. A method of making an electrical connection comprising:

applying to longitudinally spaced apart portions of an elongated insulated conductor the aligned ends of longitudinal jaws of a conductive member and in which one of said jaws is an insulation cutting and conductive gripping jaw and the other of said jaws is an insulation gripping wider jaw which will not cut through the insulation to the conductor;

and effecting relative movement of said member and said conductor transversely to the length of the conductor until said insulation severing jaw has severed the insulation and effected contact with the conductor through the severed insulation and said wider jaw has gripped the insulation and cooperates with the insulation severing jaw to hold the conductor.

2. The method of claim 1 in which said wider jaw has a terminal enlargement spaced from said first mentioned end, and continuing the relative movement of the member and the conductor until the conductor is received in said enlarged terminal.

3. A method of making an electrical connection comprising:

inserting a wire selecting tip of an assembling tool into an insulated-wire bundle including a selected conductor and manipulating the tool into engagement with the selected conductor and sliding such con-

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ductor along a surface of the tool until a peripheral portion of the insulated conductor is supported in bridging relation across abutments defining a clearance space therebetween on said tool;

placing electrically conductive insulation-severing means against said peripheral portion of the conductor;

applying insulation-severing force of said means while relatively moving said means and said conductor as supported by said abutments and receiving said conductive means in said space;

continuing such movement until said means have severed the insulation of the conductor and reached the conductor;

and placing said means into electrical contact with said conductor through the severed insulation.

4. A method according to claim 3 which comprises continuing the relative movement of the conductive means and the selected conductor as supported by the tool until the conductive means is stopped by a stop surface on the tool.

5. A method according to claim 4 in which said conductive means comprise a tubular member having an insulation-severing and conductor engaging jaw and a second jaw spaced therefrom and aligned with the insulation severing jaw and having edges which are wider than the conductor but narrower than the insulation to grip the insulation and also having a terminal enlargement, and substantially coincident with engagement of said member with the stop abutment on the tool engaging said conductor in said terminal enlargement.

6. A method according to claim 3 in which said tool includes a hook shape terminal, and engaging the selected conductor in the hook shape terminal and withdrawing the selected conductor from the bundle of conductors.

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7. An electrical connection comprising:

an electrical insulated conductor;

and an electrically conductive tubular member having a longitudinal split providing opposed jaw edges stiffly resiliently biased in closing direction and at least one of which is an insulation-severing edge adapted to penetrate conductor insulation, said edges extending transversely across the length of the conductor in electrically contacting gripping relation thereto;

and said tubular member having, diametrically opposite to said jaw edges, an insulation gripping jaw opening from one end of the member and of a width greater than the diameter of the conductor but of slightly smaller diameter than the diameter of insulation on the conductor and gripping the insulation of the conductor spaced from the jaw edges.

8. An electrical connection as defined in claim 7 in which said insulating gripping jaw has an enlarged terminal receptive of the insulated conductor.

References Cited

UNITED STATES PATENTS

2,668,279	2/1954	Epstein	339—103
3,147,058	9/1964	Zdanis	339—97
3,239,796	3/1966	Buchanan et al.	339—97
3,258,733	6/1966	Elm	339—98
3,259,874	7/1966	Esser	339—97
2,037,620	4/1936	Dewhurst et al.	339—258
2,969,521	1/1961	Scoville	339—220

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