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[54] METHOD OF MANUFACTURING A MATING ELECTRICAL CONNECTOR

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[51] **Int. Cl.** **H02g 15/00**

[58] **Field of Search** .....29/629, 630 A, 627, 626, 527; 264/272

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[57] **ABSTRACT**

The disclosure describes a method of manufacturing in situs a mating electrical connector for a pre-existing installed connector. This is accomplished by installing wired mating connector contacts into engagement with corresponding connector contacts of the pre-existing connector. A strip of material, suitably Mylar, is then wrapped about the face of the pre-existing connector to form a reservoir which contains the installed connector contacts. The reservoir is subsequently filled with heated softened flowable thermoplastic material, suitably low density polyethylene, and the thermoplastic material is then allowed to harden which leaves remaining in the reservoir a hardened body of thermoplastic material in which the installed mating connector contacts are firmly anchored and the body is easily separated from the face of the pre-existing connector. The Mylar strip is then removed and the formed connector may be left in location or removed and reinserted as otherwise desired in the same manner as any other electrical connector.

19 Claims, 2 Drawing Figures

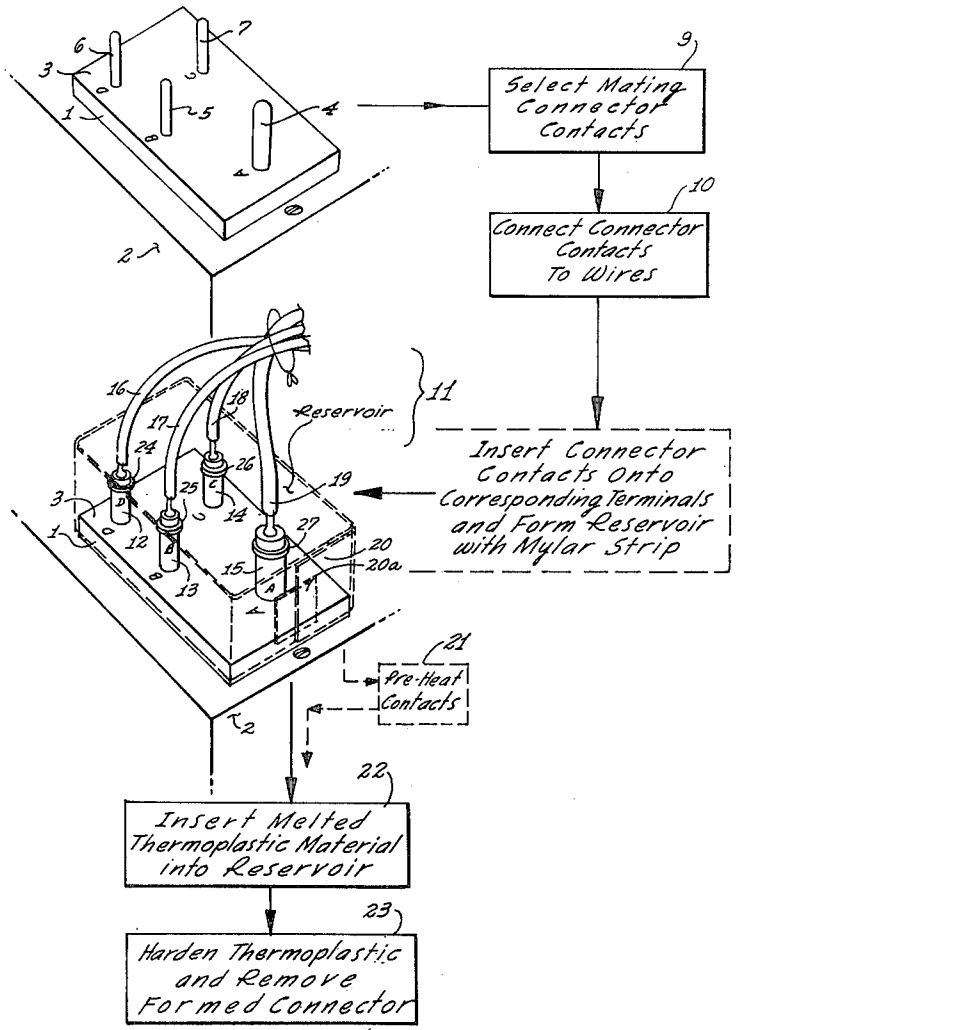


Fig. 1

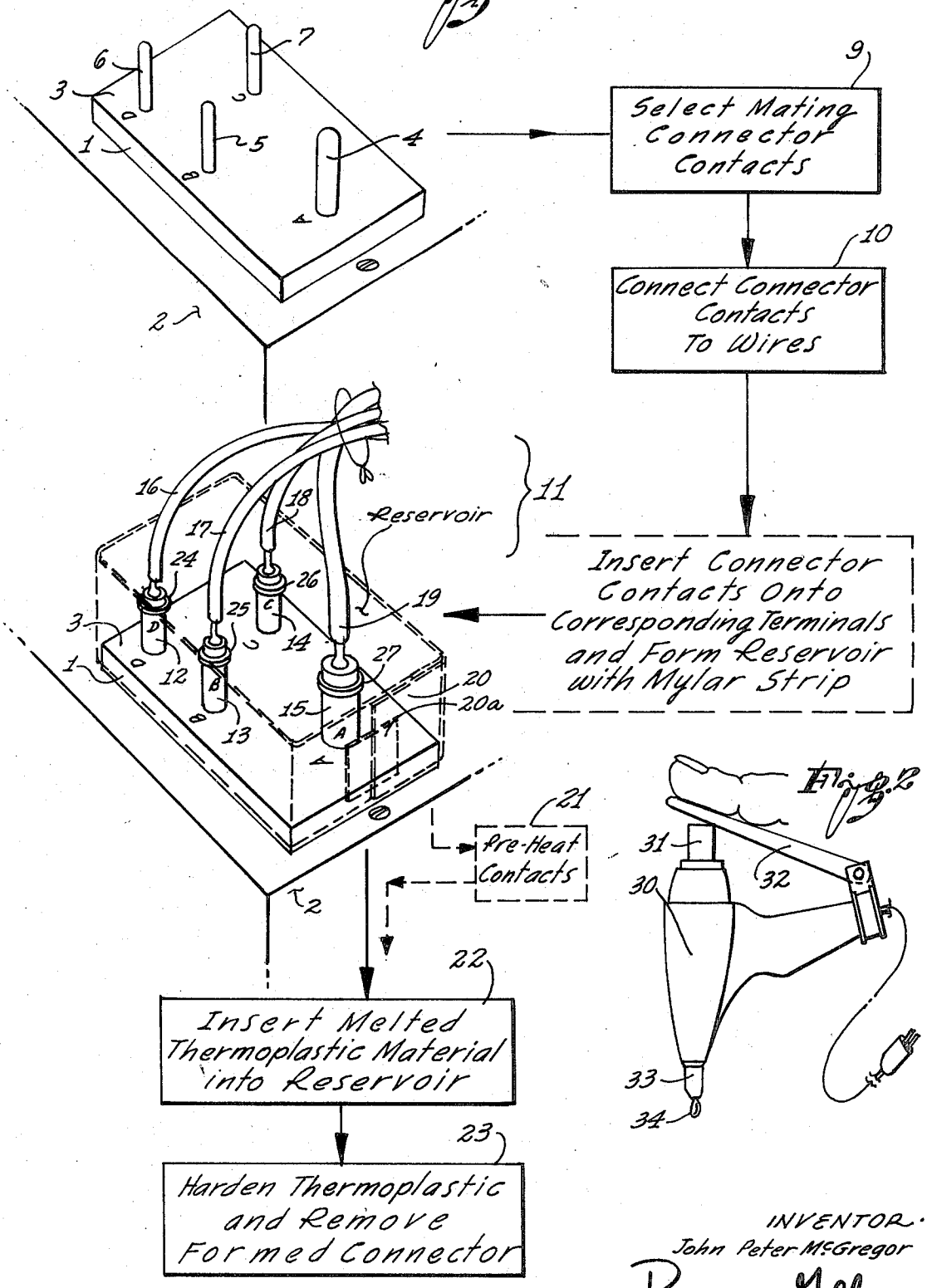


Fig. 2

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METHOD OF MANUFACTURING A MATING ELECTRICAL CONNECTOR

This invention relates to a method of manufacturing electrical connectors and, more particularly, to a quick and easy method of manufacturing a mating connector for an installed pre-existing connector in situs.

The common electrical connector provides the means by which a detachable connection is made in electrical circuits formed of electrical conductors or wires. In a conventional electrical connector the ends of each electrical wires are inserted into electrical contact or soldered to the corresponding connector contacts of the connector. A similar electrical cable or circuit is provided with a second electrical connector at an end and the latter connector mates with the former connector to complete the circuits therethrough. Where multiple circuits are coupled together by connectors the connectors contain at least a corresponding number of contacts spaced apart and supported by an insulator material. Those contacts that project beyond the face of the connector and which are inserted into hollow electrical connector contacts in the mating connector are termed the pin contacts while the latter contacts are referred to as the socket contacts. Suitably the connector which contains the pin contacts may be referred to as the male connector and that which contains the socket contacts may be referred to as the female connector. One type of connector or another is used in every piece of electrical apparatus and, generally, all necessary connectors are commonly provided with such electrical apparatus.

In many instances, however, electrical equipment is removed from its circuit connections with other electrical equipment for the sole purpose of being tested. Such disconnection is permitted by simply separating the mating connectors that join the circuits of the two together. Access or connection to the circuits within the electrical apparatus is available most conveniently at the connector contacts of the apparatus connector. As is familiar to technicians involved in testing electrical apparatus the most common methods of making such electrical connections to the connector contacts is by means of bent paper clips attached to wires or by alligator clips; at best tenuous, unsatisfactory and often unreliable techniques. Thus with connectors having connector contacts in excess of 10 these fashioned techniques are difficult to adopt without danger of short-circuiting between connector contacts or between paper clips. Despite such difficulties this haphazard method of gaining access to the circuits of an electrical apparatus for purposes of testing remains in common use because it avoids the long and unacceptable delays of the more polished approach.

Thus, in the more polished approach the technician orders a mating connector from a suitable supply house, assuming it is available. When the mating connector is supplied suitable electrical cabling is put together to form the connection between the test equipment and the electrical apparatus without danger of short-circuits or other improper connections. Disregarding those few instances where it may be impractical to obtain a mating connector, a more immediate problem is the frustrating delays of at least several days encountered in obtaining such an appropriate mating connector from an electrical supply house.

For larger operations a possible means to avoid those delays and continue to eliminate the propensity to fashion haphazard connections is to maintain inventories or spares of the most common forms of electrical connectors generally in use on electrical equipment. Ideally, the maintenance of an inventory provides a solution for the technician but creates in turn problems for others. Namely, such an inventory is expensive to maintain, takes up a large amount of space, and because of the constantly changing designs and varieties of electrical connectors on new equipment becomes obsolescent and must be maintained up to date by personnel.

Accordingly, it is an object of my invention to quickly produce a mating electrical connector in situs;

It is another object of my invention to avoid the delays inherent in procuring mating connectors from a supply house and eliminate any need to maintain an inventory of mating connectors;

It is an additional object of my invention to eliminate the inducement to use makeshift electrical connections to connector contacts;

It is a further object of my invention to manufacture in situs an electrical connector in a simple, expeditious and efficient manner; and

It is a still further object of my invention to provide an electrical connector when and where needed; to eliminate the delays inherent in selecting, ordering, and securing mating connectors from a supply house and to obviate the inducement to use makeshift electrical connections to connector contacts.

Accomplishing the foregoing objects by use of the invention envisions a set of circumstances in which a pre-existing electrical connector that is cabled to or installed in electrical apparatus requires a mating connector to permit a detachable connection between same and electrical testing circuits or other equipment. Briefly stated the inventive process comprises the steps of selecting mating contacts for each of the connector contacts in the pre-existing connector. The selected mating connector contacts are then attached to the corresponding electrical wires as desired by conventional means such as soldering. These selected connector contacts are then installed into engagement with the mating connector contacts of the pre-existing connector. A strip of Mylar of suitable width is then wrapped around bordering the connector and by its width the strip projects from the face of the pre-existing electrical connector to form a reservoir surrounding and including therein the selected installed mating connector contacts. The reservoir is then filled with a thermoplastic material, suitably low density polyethylene, in plastic or flowable form. After filling the reservoir the thermoplastic material is allowed to cool and consequently hardens. The Mylar strip is removed and leaves remaining an electrical connector installed in place in mating engagement with the pre-existing connector but which can be detached.

Due to the differences in the characteristics between the thermoplastic material and the face of the pre-existing electrical connector they do not bond together and it is thus possible to detach the formed connector as a unit from contact with the face of the pre-existing connector and the connector so formed in accordance with my invention can thereafter be removed and reinstalled as desired. Conveniently, the step of filling of the reservoir is accomplished in accordance with another aspect of the invention by means of cartridges of thermoplastic material which are inserted into a hand-held heat gun; the heat gun softens the plastic material and causes it to flow under pressure. A plunger arrangement is inserted in back of the cartridges and by means of pressure exerted by the operator's thumb or hand grip upon the plunger causes the plastic material to flow out the nozzle end of the heat gun into the reservoir.

The foregoing and other objects and advantages of my inventive process, together with its arrangement and form and possible modifications thereof, is better understood from a consideration of the following detailed description taken together with the figure of the drawing in which:

FIG. 1 illustrates the steps practiced in my invention for making a mating connector in situs; and

FIG. 2 illustrates a device used to introduce thermoplastic material into the reservoir in one of the steps of my process.

In FIG. 1 a connector 1 is illustrated installed in a chassis 2, only partially illustrated, of an electrical apparatus. The connector 1 includes a face portion 3 through which protruding electrical connector contacts or pin contacts 4, 5, 6 and 7 extend to form the contacts of a male connector. Preferably the chassis 2 is turned so that face 3 faces upright. As is common to most connectors, many of the electrical connector contacts are of different sizes because they are designed to carry different electrical currents. Thus in FIG. 1 connector pin contact 4 is illustrated as of a larger diameter than the other connector contacts.

From his supply box the installer selects a plurality of female connector contacts or socket contacts corresponding in number and fit to the connector terminals 4 through 7 of pre-existing connector 1 as is illustrated in block 9 of the drawing. As is apparent, connector 1 is a male connector in this illustration. Thus the mating connector contacts selected are socket contacts and comprise hollow cylinder portions into which the pin contacts of connector 1 are received. Each of the installed socket contacts includes a raised portion, lip, or rim portion, as variously termed, toward its rear end, as hereinafter discussed. The installer then as represented in block 10 connects each of the selected mating contacts to a corresponding wire, not illustrated in block 10, by conventional means such as solder or crimping. This forms a plurality of wires connected at their ends to the selected mating connector socket contacts and the wire may be formed as desired into a cable in a conventional manner. The socket contacts are then inserted over the corresponding pin contacts of the pre-existing connector 1. This step, for convenience, is illustrated more specifically in step 11 of FIG. 1 and includes the same identification for elements of the pre-existing connector illustrated in preceding steps of the process. Thus, in the figure the selected female mating electrical connector socket contacts 12, 13, 14, and 15, which include rim portions 24, 25, 26, and 27, are illustrated connected to corresponding electrical wires 16, 17, 18, and 19, and are installed over the pin contacts of the pre-existing connector.

Next I form a reservoir about the face 3 which includes therein at least a substantial portion of the connector contacts. A wide strip of material, suitably Mylar, of suitable thickness and length, is then wrapped around and borders the face 3 of pre-existing connector 1, as is illustrated for clarity by dashed lines 20. Strip 20 may consist of material that is nonabsorptive and nonporous and which can withstand any heat inherent in the subsequent steps of my method without collapsing or shriveling. Such materials can be of any known type such as plastic, nylon, or a metal. In the preferred embodiment I have found suitable for this purpose a 0.005 inch thick material referred to as "Mylar" which is available in rolls 1 inch in width. For esthetic reasons the material of the strip is desirably nonporous and nonabsorptive, since it is not desired to have the strip and the molding material hereinafter discussed permanently adhere to one another.

Pre-existing connector 1 illustrated in FIG. 1 projects slightly from the electrical chassis 2 exposing a convenient rim or lip, as variously termed, to which the edge of the Mylar strip is attached. Suitably Mylar strip 20 is wrapped tightly around and firmly grips this exposed rim. A piece of adhesive tape 20A, such as the cellophane type of adhesive tape, is used to secure the end of the strip to a preceding portion thereof in the turn. It is, of course, understood that the Mylar strip 20 itself can be entirely coated with a pressure sensitive adhesive material of the type normally used in cellophane type tapes so that the strip secures to itself and to the rim of the connector. Unfortunately, strips of the desired material with such an adhesive are not presently commercially available. Since Mylar strip 20 is wide relative to the dimensions of connector 1 it projects from connector face 3 a sufficient distance to form a surrounding wall or reservoir which encloses some or all portions of, as desired, the mating connector contacts 12 through 15. It may, of course, within the scope of my invention be of such depth as to include therein portions of wires 16 through 19 as desired.

It is understood that while I have described the formation of the reservoir with a Mylar strip subsequent to insertion of the selected socket contacts into position on the pin contacts in this step, the reservoir can be formed first and then the selected socket contacts are inserted into place, or both operations can be accomplished concurrently. In short, there is no rigid order for these manipulations and they are considered a single equivalent step in my method.

In the subsequent step illustrated by Box 22 the reservoir is filled to a predetermined height with a thermoplastic material that has been heated to place it in the flowable state. One thermoplastic material that I have found easy to work with and prefer is low density polyethylene, a polyethylene having a specific gravity of 0.910 to 0.925. One such low density polyethylene is available from the Eastman Kodak Company under the trade name "Epolene C–15".

The thermoplastic material at room temperature is normally in a solid or hardened state. By heating the material softens and with sufficient heat melts to form a flowable material. With low density polyethylene the temperatures used to provide melting are in the range of 300° to 400° F. which makes the material convenient to work with. Of course, other higher density polyethylenes are available but require higher temperatures to place the material in the flowable state, and therefore are less convenient to work with, although they, like other thermoplastics and other moldable materials, can be considered to be within the spirit and scope of my invention.

There are many convenient and obvious methods of filling the formed reservoir with hardenable dielectric material, suitably thermoplastic material. One device which has been found most convenient and desirable for this purpose is mentioned in connection with FIG. 2. A device known as a heat gun, 30, such as of the type illustrate in U.S. Pat. No. 3,204,828 to Paulsen, in which electrical currents are fed to a heater coil which produces heat in a cylindrical tube or chamber is illustrated in outline in FIG. 2. The low density polyethylene is supplied in the shape of small cylinders or cartridges. At one end the polyethylene cartridges are inserted into the cylinder one behind the other with the last cartridge 31 extending slightly out of the cylinder. A leverlike member 32 abuts cartridge 31. It is noted that the last cartridge 31 forms a plunger to exert pressure on cartridges previously inserted. The operator's thumb presses or by a strong hand-grip presses lever 32 against cartridge 31 which exerts pressure on the thermoplastic cartridges to push the last and the other first inserted cartridges down the tube. The heater coils in the heat gun produce temperatures in the ranges of 300° to 400° F. This heat softens the low density polyethylene cartridges located at the output end of the gun tube, which is of reduced diameter, termed the nozzel 33. In softening the material with heat the viscosity is lowered and the polyethylene can be made to flow, thus the pressure exerted by the thumb lever causes the softened flowable thermoplastic material 34 at the other end of the tube to squirt or flow out of the nozzle.

In the practice of the process of my invention I prefer to use this heat gun to direct the material in its flowable state onto each connector terminal and then allow the material to ooze into all remaining spaces.

Accordingly, the reservoir illustrated in FIG. 1 is filled by inserting the nozzle of the heat gun and squirting or ejecting the flowable low density polyethylene into the reservoir. In some instances it is desired to move the nozzle around to different locations in the reservoir to insure that the thermoplastic material flows to all corners.

After the thermoplastic material is installed it is allowed to cool and harden as represented in block 23 of FIG. 1. In the case of thermoplastic low density polyethylene the cure is accomplished by merely allowing the material to cool or stand in air. After filling the reservoir the polyethylene is allowed to stand at room temperature. Within five to ten minutes the polyethylene then solidifies into a hard solid mass which anchors the rims 24, 25, 26, and 27 of the electrical connector contacts, and thus prevents the contacts from pulling out. Because of the differences in the material characteristics on the face 3 of the pre-existing connector the polyethylene does not bond or adhere thereto. After the polyethylene has hardened the Mylar strip is simply removed since the polyethylene does not bond to it. This leaves the formed electrical connector in place in mating engagement with the pre-existing electrical connector 1. This formed connector may then be removed and reinserted and functions in the manner of any other electrical connector.

The pre-existing connector 1 illustrated in this description is of the male variety which contains the protruding pin contacts

4, 5, 6, and 7 and over which are fitted mating socket contacts 12, 13, 14, and 15. Obviously the pre-existing connector can within the scope of my invention be, instead, of the female variety in which the connector contacts are hollow cylinders or socket contacts which are recessed from face 3 into connector body 1. In that instance the selected mating pin contacts are inserted into place within the female connector with their back ends projecting out of face 3 and, of course, the attached wire. In this instance the thermoplastic material captures or anchors the rims on that projecting portion of the inserted mating male connector contact.

It is apparent that moldable materials other than thermoplastics and particularly the preferred low density polyethylene, can be used to fill the reservoir and form the body of the connector—the material must be flowable and must harden quickly to the solid state. With or without a release agent such as oil applied to the face of the pre-existing connector, the material should not during hardening bond to the face of the pre-existing connector. A good discussion of molding materials, including thermosetting materials which are placed in hardened form by curing with heat, is found on pages 66 through 95 of the May 24, 1969 issue of the magazine ELECTRONIC DESIGN. An additional less comprehensive description is described in U.S. Pat. No. 2,881,479 to Quackenbush, in which a process of molding pairs of connectors with thermoplastic and similar materials is described.

A further variation to the process of my invention would include the step of heating or "warming up" the installed contacts a predetermined number of degrees above room temperature, as depicted in FIG. 1 by the dashed lines of Box 21. This step can be accomplished conveniently with a suitable heat gun or soldering iron. Heating the contacts lowers the temperature differential between the contacts and the hot flowable polyethylene during the filling process. Thus the polyethylene does not harden as fast in this vicinity and allows the polyethylene to flow more evenly prior to hardening. This variation has the effect of minimizing further the formation of significant air bubbles between contacts in the formed connector.

While the foregoing embodiment of the process specifies a corresponding mating connector contact for each of the connector contacts in presently existing connector 1 and that these selected connector contacts be wired to a corresponding electrical wire prior to installation in the connector, it is apparent that there are many variations of this which are within the spirit and scope of my invention. For example, it is possible to use mating contacts for less than all of the pin contacts of the existing connector if less than all are to be used. As an additional example, where the presently existing connector 1 is of the female variety in which socket contacts terminate at face 3 and a male connector with pin contacts is to be formed, it is apparent that if it is desired to form a connector in which contacts are to be made only with certain specified ones of the plurality of socket contacts in the pre-existing connector, that additional mating contacts need not be used. However, in that instance if a mating pin contact is not inserted or, alternately, a dummy contact is not inserted into the socket contact it is possible during the filling process for the liquid thermoplastic to seep down into the socket contacts. Upon hardening and detaching of the formed connector the polyethylene may break off from the main connector and may remain within the socket contact. This could permanently disable that socket contact for future use. Accordingly, to avoid such a possibility it is preferred that dummy contacts are inserted in all of the unused socket contacts of a presently existing connector, even though those additional contacts are not soldered or otherwise connected to electrical wire, simply to prevent thermoplastic material from running into and being retained within the socket contact of the presently existing connector. A still further alternative is not to put in dummy contacts but to install some form of blocking pin or other material to act as a dummy contact and prevent seepage into the socket contact during the filling step. Accordingly, in stating that the corresponding mating connector contacts are presently wired to a corresponding electrical cable, as desired, it is intended within this definition to encompass the situation where additional contacts are included and installed in the formation process and which are included in the formed connector which are not connected to electrical wires because such is not desired. And in stating that desired corresponding mating connector contacts are selected and/or installed includes the situation as discussed where the desired number of such mating contacts are less than the number of contacts in the pre-existing connector.

The low density polyethylene is preferred for an additional reason. After softening with heat to the flowable state it hardens again completely within less than 10 minutes. Accordingly, by the practice of this invention a connector can be formed just shortly after the need for such a connector arises, with the whole task exclusive of soldering wires requiring no more than 10 to 20 minutes. Accordingly, it is apparent that the long delays of one or more days in selecting and ordering a mating connector from a supply house is eliminated, and the technician can continue on in his work in a more efficient manner without such substantial interruptions and delays.

Because of the availability and ease by which a mating connector is formed by my invention the old practices of using alligator clips and paper clips for attachment, a bad practice at best, becomes less attractive and is therefore avoided.

Lastly, an explanation of the terminology I have used is desirable: thermoplastics, which liquify or become flowable upon heating, solidify upon cooling, while thermosetting materials by contrast solidify or harden upon heating. Heating of thermosetts is commonly denoted by the term "curing" and, when hardened, thereafter the thermosett is referred to as "cured". Since the literature did not use the term "cure" in connection with thermoplastic material I have chosen the words "harden" and "hardening" and, alternatively, "changing the state" to describe, generically, the solidification of the material used to form the connector body from the flowable or fluid state, rather than to change misapplication of the word "cure".

While I have disclosed a preferred embodiment of my invention it is understood that the arrangements and details are intended to be illustrative of the principles of my invention and is not intended to limit the invention in any way, since numerous other equivalents which do not depart from the spirit and scope of my invention suggest themselves to those skilled in the art.

Accordingly, it is expressly understood that the invention is to be broadly construed within the spirit and scope of the appended claims.

I claim:

1. The method of producing a mating electrical connector for a pre-existing electrical connector; said pre-existing connector having a plurality of connector contacts comprising the steps of:

selecting a desired corresponding plurality of mating connector contacts from a supply of such contacts, with each of said contacts including an anchorable portion thereon;

attaching said selected connector contacts to corresponding wires as desired;

installing each one of said selected connector contacts into engagement with a corresponding one of the plurality of connector contacts in said pre-existing connector and

wrapping a wide strip of Mylar material about the face of said pre-existing connector to form therewith a reservoir, said reservoir surrounding and at least partially containing said installed selected mating connector contacts;

applying an adhesive tape to said strip to maintain said formed reservoir;

filling said reservoir to a predetermined depth above the anchorable portion of said installed mating contacts with heated low density polyethylene in the flowable state;

cooling said low density polyethylene at room temperature to the solid state by which said polyethylene hardens to

the solid state to define a connector body having said installed mating connector contacts anchored therewithin; and

removing said strip of Mylar material; whereby said formed connector remains in mating engagement with said pre-existing connector and is detachable therefrom.

2. The invention as defined in claim 1 wherein the step of filling said reservoir includes the steps of heating a cartridge of thermoplastic low density polyethylene to place said polyethylene in the flowable state, forcing said heated flowable polyethylene through a nozzle and directing the output from said nozzle into said reservoir.

3. The method as defined in claim 1 which includes the step, prior to filling said reservoir, of heating said installed selected mating connector contacts.

4. The method of producing a mating electrical connector for a pre-existing electrical connector, said pre-existing connector having a plurality of connector contacts, comprising the steps of:

selecting a desired corresponding plurality of mating connector contacts from a supply of such contacts, each of which includes an anchorable portion thereon;

attaching said selected connector contacts to corresponding wires as desired;

installing each one of said selected connector contact into engagement with a corresponding one of the plurality of connector contacts of said pre-existing connector;

wrapping a strip of Mylar material about the face of said pre-existing connector to form therewith a reservoir, said reservoir surrounding and at least partially containing said installed selected mating connector contacts;

filling said reservoir to a predetermined depth with thermoplastic material in the flowable state;

cooling said thermoplastic material at room temperature to the solid state by which said thermoplastic material hardens to the solid state to define a connector body having said installed mating connector contacts anchored therewithin; and

removing said strip of Mylar material, whereby said formed connector remains in mating engagement with said pre-existing connector and is detachable therefrom.

5. The method of forming a mating electrical connector for a pre-existing connector which comprises the steps of: installing desired selected mating connector contacts in engagement with corresponding connector contacts of a pre-existing connector, at least some of said selected connector contacts having attached thereto a predetermined length of electrical wire and each of said selected contacts having an anchorable portion, and wrapping a strip of flexible nonporous heat resistant material about the face of said pre-existing connector to form a reservoir about the face of said pre-existing connector; said reservoir surrounding and including therein at least portions of said installed selected connector contacts; filling said formed reservoir to a predetermined depth above the anchorable portion of said contacts with a thermoplastic material in the flowable state; cooling said thermoplastic material to form a solid mass, whereby said thermoplastic material forms a solid connector body which is detachable from said face of said pre-existing connector and which anchors therein each of said installed selected connector contacts.

6. The method defined in claim 5 wherein the step of wrapping said strip includes the step of abutting a portion of the width of said strip with the sides of said connector which surrounds said face of said pre-existing connector with the remaining width portion of said strip extending out from said connector face.

7. The method as defined in claim 6 wherein said step of filling said reservoir includes the steps of heating a thermoplastic cartridge from the solid state to the flowable state, forcing said heated flowable thermoplastic through a nozzle and directing the output from said nozzle into said reservoir.

8. The method as defined in claim 5 wherein said step of filling said reservoir includes the steps of heating a thermoplastic cartridge from the solid state to the flowable state, forcing said flowable thermoplastic through a nozzle and directing the output from said nozzle into said reservoir.

9. The method of forming a mating electrical connector for a pre-existing connector which comprises the steps of: wrapping a strip of flexible material about the face of said pre-existing connector to form a reservoir about the face of the pre-existing connector, said reservoir having said connector face as a bottom and extending outwardly therefrom a predetermined distance and installing selected mating connector contacts in engagement with corresponding connector contacts of said pre-existing connector, at least some of said selected connector contacts having attached thereto a predetermined length of electrical wire and all of said selected connector contacts having anchorable portions; filling said formed reservoir to a predetermined depth with a thermoplastic material in flowable form; hardening said thermoplastic material to the solid state to form a solid mass whereby said thermoplastic material forms a solid connector body which is detachable from said face of said pre-existing connector and which holds each of said installed selected connector terminals.

10. The method of forming a mating electrical connector for a pre-existing connector which comprises the steps of: installing selected mating connector terminals in engagement with corresponding connector terminals of a pre-existing installed connector and wrapping a strip of flexible material about the face of said pre-existing connector to form a reservoir about the face of said pre-existing connector, said reservoir surrounding and including therein at least portions of said installed selected connector terminals; filling said formed reservoir to a predetermined depth with a hardenable material in the flowable state; hardening said material to the solid state to form a solid mass, whereby said hardenable material forms a solid connected body which is detachable from said face of said pre-existing connector and which holds therein each of said installed selected connector terminals.

11. The method as defined in claim 10 wherein said step of wrapping said strip includes the step of abutting a portion of the width of said strip with the sides of said connector which surrounds said face of said pre-existing connector with the remaining substantial portion of the width of said strip extending outwardly from said face.

12. The method as defined in claim 11 wherein said hardenable material comprises a thermoplastic material and the steps of filling said reservoir include heating said thermoplastic material to the flowable plastic state, forcing said flowable material through a nozzle and directing the output from said nozzle into said reservoir.

13. The method as defined in claim 6 including the step, after cooling, of removing said strip.

14. The method as defined in claim 11 including the step, after hardening, of removing said strip.

15. The method as defined in claim 12 including the step, after hardening, of removing said strip.

16. The method as defined in claim 8 including the step, after cooling, of removing said strip.

17. The method as defined in claim 10 wherein said wide strip comprises: Mylar.

18. The method as defined in claim 5 wherein said thermoplastic material comprises low density polyethylene.

19. The method as defined in claim 2 which includes the step, prior to filling, of heating said selected mating connector contacts.

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