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D. A. VENN ET AL

3,249,910

ELECTRICAL CONNECTOR WITH SOLDER RESISTANT SURFACES

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FIG. 1

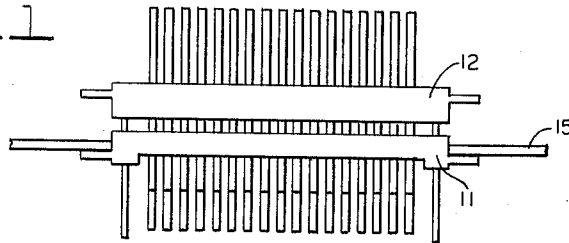


FIG. 2

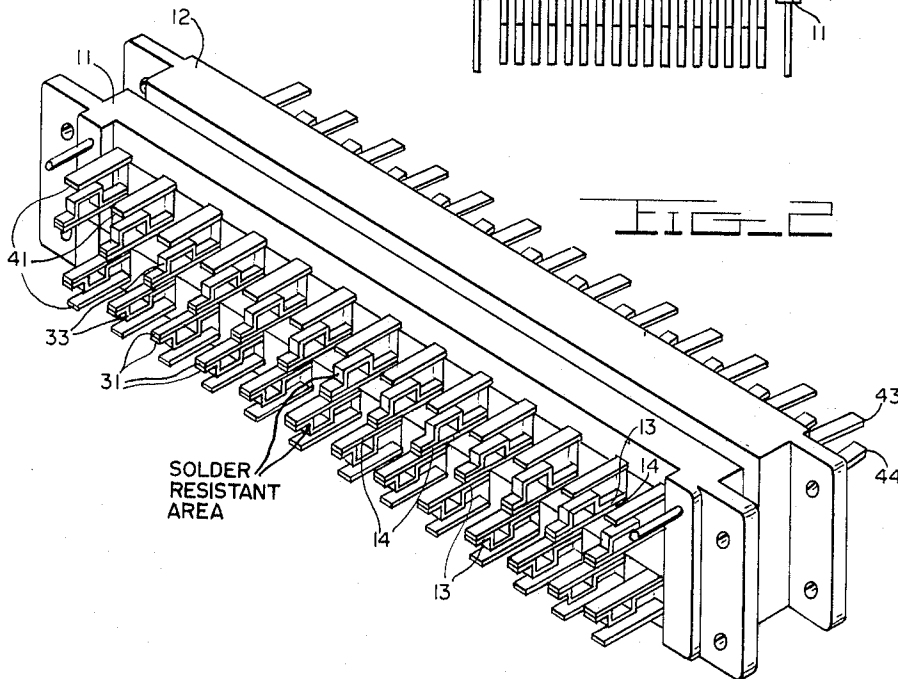


FIG. 3

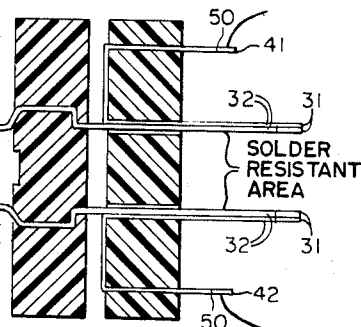
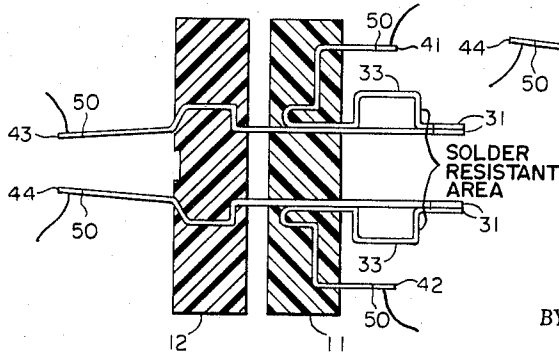


FIG. 4



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3 Claims. (Cl. 339-198)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates in general to multi-wire electronic systems and in particular to a connector assembly for electrical connection of two or more modules thereof.

Numerous multi-pin electrical connectors have been devised for a multitude of purposes, each peculiar to its intended environment. Generally, electrical connectors are employed to interconnect various portions of a system, which may be physically separated, to permit ready replacement of parts in the event of disablement or obsolescence. In most instances a positive electrical connection is vital, and long term reliability is equally important. In the more common multi-pin connectors, a positive electrical connection is obtained by use of spring loaded contacts, and long term reliability is established by mechanical design of the insulating body or the holder therefor.

It will be appreciated that simple spring loaded contacts do not insure a positive electrical connection under some ambient conditions, for example, the contacts may be immersed in a corrosive atmosphere or under extreme temperature conditions.

To alleviate this electrical contact problem, various other methods including welding and wire-wrap have been employed with varying degrees of success. The welding technique, however, has such inherent disadvantages as a dangerously high temperature requirement; indefinite contact resistance, a particularly important factor when welding is not done in oxygen-free atmosphere; partial destruction required to disconnect; etc., which, obviously, does not encourage its use in many applications. Likewise, the wire-wrap technique requires wide spacing between contact pairs and to some extent is subject to corrosive effects, which may disrupt electrical contact under selected ambient conditions. As a consequence, rewrap techniques are not generally acceptable in high reliability microminiature electronic applications.

There is, therefore, a need for an electrical connector which provides a satisfactory electrical connection for test purposes, permits a more reliable and permanent contact to be made after test, and further permits a non-destructive disconnect when necessary. The latter would enable reuse without limitation as needed and would be welcome as a substantial advancement of the art.

Accordingly, it is an object of this invention to provide an electrical connector which permits a permanent type assembly, plus nondestructive disassembly, such that the electrical connection or disconnection may be repeatedly accomplished as necessary.

It is another object of this invention to provide a highly reliable electrical connector adaptable to microminiature applications.

It is a further object of this invention to provide an electrical connector in which the mating contact surfaces make electrical contact without bonding, but may be bonded and unbonded by soldering techniques.

It is still another object of this invention to provide an electrical connector, adaptable for soldering, in which the solder is confined to a predetermined contact area.

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Other objects will become apparent upon comprehensive understanding of the invention for which reference is made to the following specifications and the drawings wherein:

FIG. 1 is a top view showing of one embodiment of an electrical connector in accordance with this invention, FIG. 2 is a more detailed pictorial showing of the embodiment of FIG. 1.

FIG. 3 is a side cross-sectional showing of one pin configuration in accordance with this invention.

FIG. 4 is a side cross-sectional showing of another pin configuration in accordance with this invention.

Functionally, this invention facilitates an operational test check and solder bond procedure, which affords easy disassembly in the event this is required. In accordance with a preferred use of this invention, a heating tool, adapted to heat a plurality of contacts at one time, is employed in the bonding and disassembly procedure.

The device of this invention is an electrical connector wherein the electrical contact mating surfaces may be soldered within a selected region, and means are provided for restricting solder flow to this selected region, such that by application of heat to this selected region, a disassembly may be readily accomplished.

Referring now to the drawings;

FIG. 1 is a top view showing a two-part electrical connector in operational assembly with the female portion 11 mounted in a wall section 15. As shown in more detail in FIGS. 2, 3 and 4, the contact pins 13 of the female portion 11, and the prong type pins 14 of the male portion 12 are adapted to extend through and beyond the female portion 11 such that they may be bonded in a manner to be discussed hereinafter by the use of a tool especially configured for the particular connector. It will be appreciated, of course, that the inline contact pin design shown in the drawings is not critical to the device of this invention, and that great latitude and design typical in the art is permissible. It is essential, of course, that the connector assembly be disposed such that access to the extended ends of the contact pins is provided, thereby to enable bonding by suitable heating means. Such heating means should enable concurrent heating of all contact pins simultaneously so as to permit easy assembly and disassembly, as will herein be described.

FIG. 3 is a cross-sectional showing of one contact pin assembly which may be employed in accordance with this invention. In the embodiment of FIG. 3, the tip end of each pin extension is indicated at 31 as a tinned area, that is, an area which has been pretinned by the application of solder to each individual pin, so as to allow the solder to flow freely in this contact area.

It will be appreciated that area 31 may be distorted or perforated in any conventional manner to provide a solder reservoir and to insure that there will be a controlled surplus of solder at all times. For purposes of simplification such alteration to area 31 is not shown in the drawing. Immediately adjacent to the tinned area 31 of each pin is a resistant area 32, which has been treated by conventional adhesion resistant means to deter the flow of solder. Area 32 may include the pin portion as far as 50, but would not include the end terminal portions 41, 42, 43 and 44 wherein the circuit wire connections are made. For example, the resistant area 32 might be coated by a simple oxidation process, plating process, or cladding process or the like. An example of the material used in the oxidation, plating, or cladding processes may be nickel on beryllium, Teflon on beryllium or any similar material which would inhibit the flow of solder to the resist area.

FIG. 4 is a cross-sectional showing of another contact assembly which may be employed in accordance with

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this invention. In the embodiment of FIG. 4, as in the embodiment of FIG. 3, the tip end of each pin extension includes a tinned area 31. Immediately adjacent to the tinned area 31 of the female portion pin is an area 33, wherein the pin is altered by conventional means such that the male and the female portion pins are not in contiguous relation within this area. It is recognized that that particular shape of pin distortion shown in FIG. 4, is not critical to the device of this invention so long as there is a distortion, and that the area 33 may include more than one distortion or disruption of the contiguous relation. Moreover, while there is shown the distortion of one pin, the female portion pin, it is within the purview of this disclosure to distort the other pin or both pins to deter solder flow, if desired. Likewise, it is understood that area 33 is FIG. 4 may be treated in the same manner and for the same purpose as the area 32 in FIG. 3.

In both FIGS. 3 and 4, the connector pins need be in contact only in the solder area 31, but as illustrated may be in contact along most of the contact pin length.

In operation, circuit wire connections are made to the sets of terminals 41, 42, 43 and 44, as shown in FIGS. 3 and 4. The male and female portions of the connector assembly are then positioned as shown, and all parts of the equipment in which the connectors are used are energized. A test may then be run a sufficient time to permit a compatibility and reliability determination of the equipment to be used. Following the test, and the determination that the equipment is functioning properly, heating means are applied simultaneously to the tinned areas of the pins to establish a permanent type soldered connection at points 31.

In the event any module of the equipment becomes defective or is considered obsolete and as a consequence needs replacement, disassembly is accomplished by the concurrent application of heating means to all the soldered pin connections simultaneously, wherein the solder returns to a plastic state allowing the disengagement of the male and female portions of the connector.

It has been found that the connector of this invention may be reused an unlimited number of times provided, of course, a high quality solder is utilized. It is understood, of course, that the device of this invention is not limited to the use of conventional solder, and that the use of any substitute for solder or solder means which is subject to flow in the presence of heat or other activation means, is within the purview of this disclosure.

Whereas no current flow through the contacts is necessary in accordance with the invention and a minimal amount of heat is required to produce a solder bond, the danger of equipment component damage is greatly reduced. Moreover, it has been found that the soldering technique employed in this invention affords a better bond as compared with the welding or wire-wrap techniques. This is in some measure due to the adaption of solder to contact pin irregularities.

It is understood, of course, that the flat mating surface of the contact pins as shown in the drawings is not critical to the device of this invention and that any configuration of mating surface may be employed. For example, a convex-concave mating surface may be employed to provide a greater contact area.

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Further, it is understood, that this invention is to be limited only by the scope of the claims appended hereto. What is claimed is:

1. An electrical connector, comprising:

a male and a female section detachably mated together; each of said sections having a plurality of contact elements;

each of said contact elements in said female section making electrical contact with the associated contact element of said male section;

each contact element in each of said sections being spaced closely to the adjacent contact element within the section;

the contact elements in said male section being elongated and passing through and extending beyond said female section with the end portions of the contact elements of said male and female sections being aligned and forming pairs of contact elements; said end portion of each contact element being pre-tinned with a coat of solder;

at least one of each pair of mated contact elements having a solder flow resistant region immediately adjacent said end portion to inhibit the flow of said solder along the length of said contact elements when said end portions are soldered together.

2. An electrical connector as recited in claim 1, wherein said solder flow resistant region is contiguous with the other contact element of said pair of contact elements and has its surface treated to resist the adherence of molten solder.

3. An electrical connector as recited in claim 1, wherein said solder flow resistant region is a deformed portion of said contact element discontinuous with the other contact element of said pair of contact elements.

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