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Graham

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[54] **ELECTRICAL CONNECTOR**

[75] Inventor: **Cleve A. Graham,** Port Heuneme, Calif.

[73] Assignee: **Raytheon Company,** Lexington, Mass.

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[52] **U.S. Cl.** ..... **339/31 T,** 339/108 TP, 339/261

[51] **Int. Cl.** **H01r 7/06,** H01r 7/28

[58] **Field of Search** ..... 339/31, 108 R, 108 TP, 339/110, 261; 324/149

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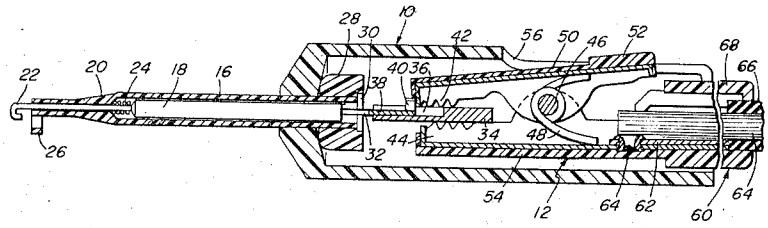
Primary Examiner—Werner H. Schroeder

Attorney, Agent, or Firm—Harold A. Murphy; Joseph D. Pannone; John T. Meaney

[57] **ABSTRACT**

An electrical connector which is comprised of a combination of two different types of clips mechanically and electrically interconnected without leads in a completely externally insulated fashion, specifically a hook- or probe-type clip having a tubular extension within which an alligator clip is removably connected with a slidable clip plate carried by the inner end of the first clip.

5 Claims, 5 Drawing Figures



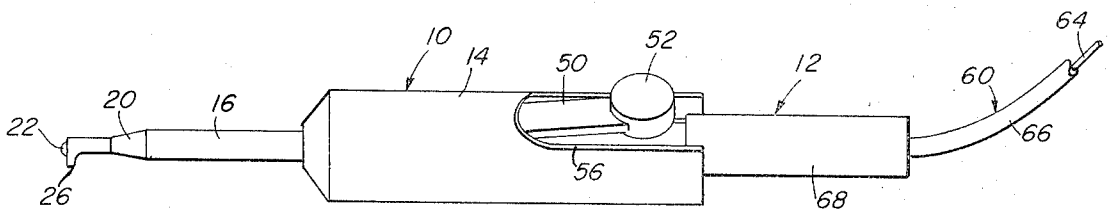


FIG. 1

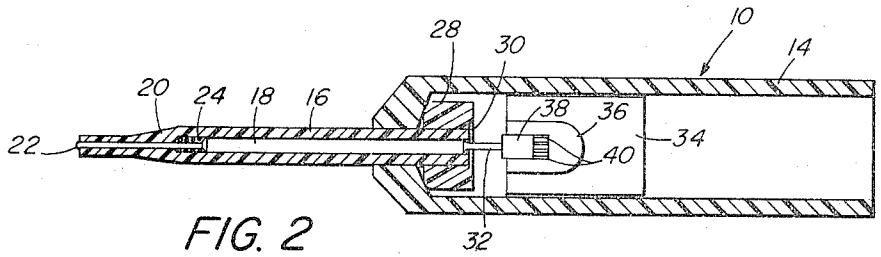


FIG. 2

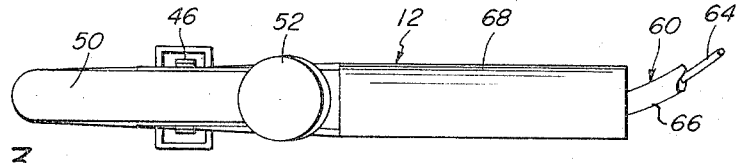


FIG. 3

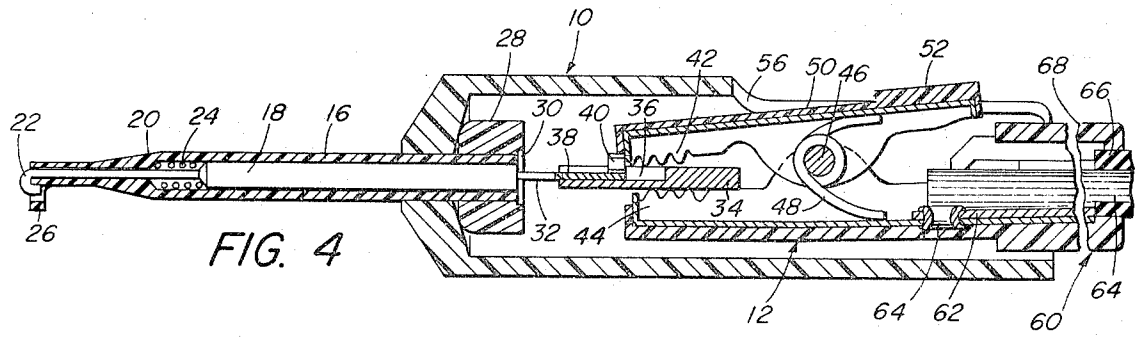


FIG. 4

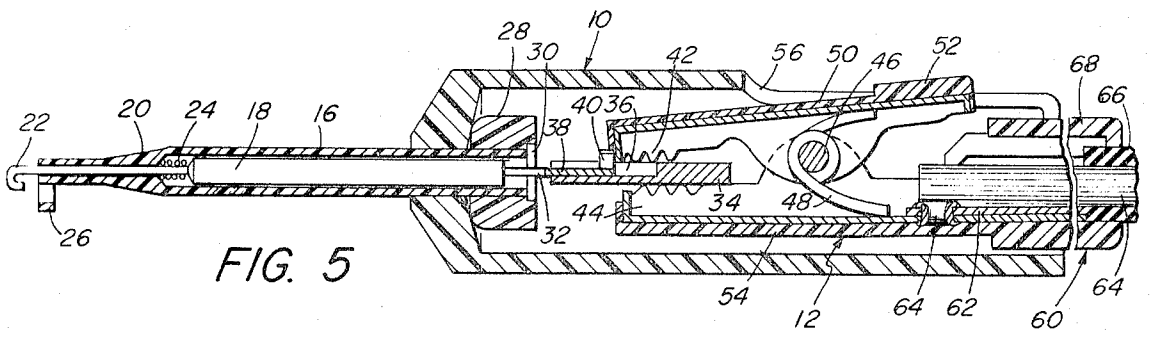


FIG. 5

ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

In the design, development, testing and possibly eventual repair of electrical equipment it is often necessary to provide a number of interconnecting interfaces between the equipment and other associated equipment. This is usually done by electrical connectors which may be attached to the respective equipments by terminal clips which may take one or more of several forms depending upon the physical characteristics of the components to which the clips are adapted to be attached. This requires the use of leads between the respective clips in each pair. In such cases it has often been found that metal portions of the connectors are exposed and become potential hazards in the way of electrical shorting or even personal shock.

Known procedures involve the use of ready-made leads fo each kind of clip required, thus making it necessary to change leads whenever a clip is changed. This means duplication of leads and produces storage and handling problems, as well as the inconvenience and time involved.

SUMMARY OF THE INVENTION

The above and other objections to the prior art are overcome by the present invention which relates to a novel electrical connector which does not present exposed conductive areas, is convenient to use, and reduces storage and handling problems by reducing the number of leads required. The device may be used as a probe or as a clip for connections to miniature wires and components and may be used in areas of limited access.

The foregoing objectives are achieved in a connector which comprises a novel first clip including a dielectric casing housing a longitudinally slidable shaft with a hook, probe or other selected terminal at one end. The shaft is slidable against the pressure of a spring so as to allow movement of the terminal outwardly away from the adjacent end of the casing. The means for moving the shaft and terminal includes a connecting plate or the like which is gripped by the jaws of a second clip of the type known as an alligator clip.

The second clip is connected at one end to a flexible lead and at its other end the jaws extend into the interior of the casing through an opening or slot provided therefor in the casing wall. The jaw lying outermost in the slot is provided with a dielectric thumb-operated actuator so that the entire exposed areas of the device are nonconductive, while the device is provided with separable characteristics and manual operability.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objectives of the invention will become apparent from the following description taken in connection with the accompanying drawings, wherein:

FIG. 1 is an elevational view of a connector embodying the invention;

FIG. 2 is a horizontal axial sectional view of one of the clip portions of the connector;

FIG. 3 is a plan view of a second clip portion;

FIG. 4 is a vertical axial sectional view through the assembled connector; and

FIG. 5 is a view similar to FIG. 4 showing the terminal of the first clip extended.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The connector of this invention, as shown in FIG. 1, comprises primarily two clips 10 and 12 which are adapted to be interconnected to form the connector, as will be described.

Clip 10 may be basically one of the types known as a probe, microprobe, test clip, or other term, and is shown herein as a test clip which comprises a shell 14 having an elongated extension 16 within which is located a hook supporting rod 18. Shell 14 and extension 16 are of plastic or other rigid dielectric material while rod 18 is electrically conductive. The extreme outer end portion 20 of extension 16 is tapered to a smaller diameter than the major portion thereof, and rod 18 is of a diameter which slidingly interfits within the major portion of the extension.

To the outer end of rod 18 is fixed one end of the shaft portion of a metal hook 22, probe, or other terminal, which portion is of a diameter smaller than the rod 18. A spring 24 encircles the inner end of hook 22 between the adjacent end of rod 18 and a shoulder formed by the tapered end portion 20. Thus, spring 24 retracts the hook 22 to the position shown in FIG. 4. The extreme outer end of the hook 22 is hook-shaped and interfits with an angled tip 26 formed on the end of tapered shell portion 20.

It will be apparent that when the rod 18 is moved longitudinally outwardly of the extension 16 against the tension of spring 24, the spring will be compressed by the adjacent end of the rod 18 and the hook 22 will be moved away from tip 26 as shown in FIG. 5. The hook then may be attached to a wire, lead or the like, whereupon when pressure is removed from the rod the spring will return it to the position shown in FIG. 4. In this position of the rod, the wire or lead will be held firmly by the hook 22 against the tip 24.

In one form of the device the inner end of the extension projects into the shell 14 and is encircled by a dielectric collar 28 which carries on one side an apertured retainer 30 which prevents retraction of the rod 18 inwardly of the shell 14. This is important particularly where the hook is replaced by a probe or the like which could be retracted into the extension 16.

Fixed by one end to the inner end of the rod 18 and extending through the aperture in the retainer 30 is a connector 32, such as a pin or the like, at the other end of which is a clip plate 34. Plate 34 carried by the adjacent end of connector 32. The lug 38 is soldered or otherwise fixed to plate 34, and carries an upwardly directed stop or stops 40 of a length which projects above the top surface of the clip plate 34.

The second clip 12 is of the type commonly known as an alligator clip having two toothed jaws 42 and 44 which are pivotally connected together by a pintle 46. A spring 48 between rear portions of the jaws functions to yieldably retain the jaws closed in the well-known manner. The upper jaw is covered on its outer surface with a layer 50 of relatively rigid dielectric material, such as a hard plastic, terminating in a thumbpiece 52. The opposed jaw 44 is likewise covered with dielectric material 54. Thus, a user can grasp the clip 12 and by depressing the thumbpiece 52 the jaws will be opened. The clip 12 is then inserted into the shell 14 through an opening 56 cut into the wall thereof, with the open jaws overlying respective upper and lower surfaces of the

clip plate **34,** as shown in FIGS. **4** and **5.** Upon release of pressure from the thumbpiece **52,** the jaws will clamp upon the adjacent opposed surfaces of the plate. Then, by sliding the clip **12** longitudinally within shell **14,** the plate **34,** pin **32,** and rod **18** will be correspondingly moved, thus manipulating the hook **22.** The end of one of the jaws will abut the tabs **40** and thus will be prevented from sliding uncontrollably along the surface of the plate **34.**

Clip **12** is connected to a lead **60** by means of a metal pinch clamp **62** which is fixed as by a rivet **64** to the lower jaw **44.** Lead **60** includes a metal core **64** having the usual dielectric covering **66** which is removed from the end portion of the lead so that the end portion of the core **64** is exposed. The clamp **62** has side portions which clamp around and firmly grip the exposed wire or core **64** and thus hold the lead in attached position. A cylindrical dielectric cylinder **68** forms a part of the clip and encloses the conductive lead and clamp.

Accordingly, when the second clip **12** is attached by the jaws **42-44** to the plate **34** of the first clip **10,** as described, there is formed an easily and safely handled connector.

In accordance with the objectives of this invention, this connector is safe to use, does not require additional leads between clips, and thereby reduces storage problems. Furthermore, such a connector achieves standardization by reducing the number of ready-made leads and clips previously required for a complete testing operation, for example.

It is to be understood, however, that various modifications and changes in the construction shown and described, such as changing from a hook to a probe in the first clip, for example, may be made by those skilled in the art without departing from the spirit of the invention as expressed in the accompanying claims. Therefore, all matter shown and described is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. An electrical connector comprising a first clip including a hollow elongated casing of dielectric material having a hollow extension of reduced diameter extending from one end thereof, a conductive member within said casing having an elongated portion extending longitudinally within said extension and further having a contact portion projecting outwardly through one end of said extension and a contact plate on the inner end within the casing, a removable second clip slidable longitudinally within said casing and carrying adjacent conductive gripping members thereon, said gripping members being relatively movable perpendicularly of the longitudinal axis of the casing into gripping engagement with opposite sides of said contact plate, one end of an electrical lead being connected to said gripping members, and manually operable means connected to said gripping members and extending through an aperture in the side of said casing for manually positioning said gripping members in gripping engagement with said contact plate within said casing.

2. A connector as set forth in claim **1** wherein said conductive member and elongated portion thereof are longitudinally movable within the casing and extension respectively, and spring means is positioned in engagement with said member for yieldably urging said member and elongated portion thereof into retracted position.

3. A connector as set forth in claim **2** wherein said contact plate is engaged on opposite sides by said gripping members and said second clip and conductive member are simultaneously slidable longitudinally within the casing in response to manual manipulation of said manually operable means.

4. A connector as set forth in claim **1** wherein stop means is carried by said contact plate for engagement by at least one said gripping members.

5. A connector as set forth in claim **1** wherein said gripping members are a pair of jaws which are movable in a direction toward and away from one another.

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