Sept. 19, 1967 R. R. LEWIS 3,343,121

ELECTRICAL CONNECTOR AND CIRCUIT KIT

Filed Oct. 22, 1965

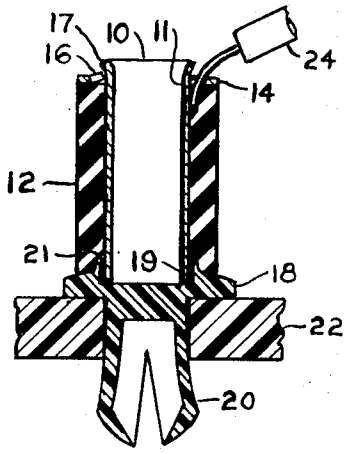


FIG. 1

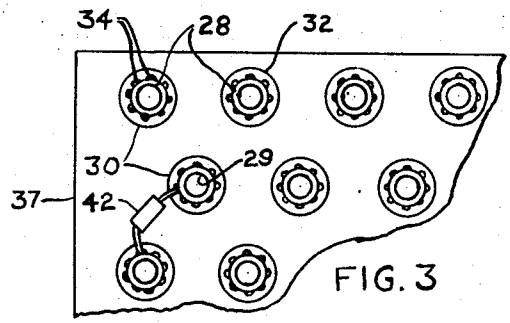


FIG. 3

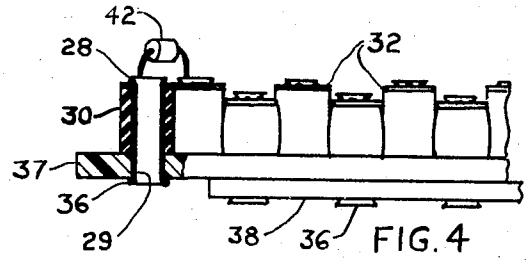


FIG. 4

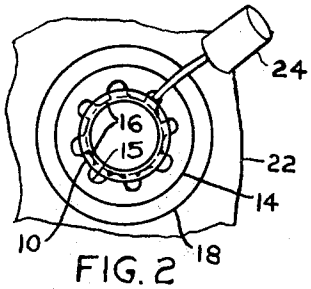


FIG. 2

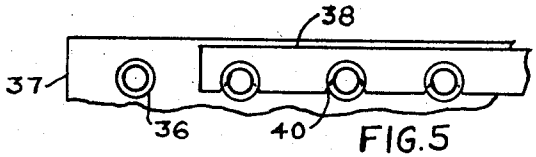


FIG. 5

FIG. 6

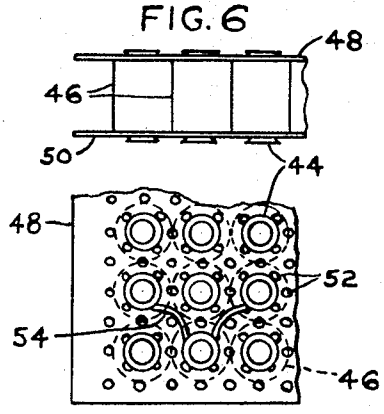
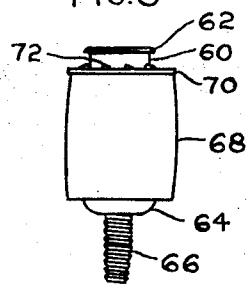


FIG. 7

FIG. 8



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ELECTRICAL CONNECTOR AND CIRCUIT KIT

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This invention relates to an improved electrical connector and to an experimental or educational circuit kit incorporating the improved connector.

For experimental work and the teaching of electrical principles, it is desirable to provide means for preparing electrical circuits without the use of solder or tools, so that a variety of circuits may be prepared and modified as desired, with the least possible loss of time. Previous connector kits provided for this purpose have generally comprised a series of coil spring devices mounted on a common base, with which connections are made by separating the coils and inserting the desired leads between them. An example of such a connector is disclosed and claimed in my U.S. Patent No. 3,093,431, issued June 11, 1963, and entitled, "Electrical Connector for Use in Experimental Circuit Kit." Some manual dexterity is needed to make sound multiple connections with a connector of that type; and inasmuch as the coil springs are conductive, there is some opportunity for accidental short-circuiting. These difficulties are especially pronounced where the connectors are closely and compactly arranged on the base.

It is the primary object of the present invention to provide an improved solderless connector in which sound multiple connections can more easily be made, and with a lower degree of manual dexterity. It is a further object of the invention to provide an improved electrical connector which affords increased protection against accidental short-circuiting. It is another object to provide an improved circuit kit incorporating the aforementioned advantages. It is still a further object to provide an improved circuit kit in which provision is made for more convenient bus connection between various connectors, and for holding the bus connections securely in place without the use of additional parts or tools. Further objects and advantages of the invention will become apparent as the following description proceeds.

Briefly stated, the invention may in part be embodied in a connector having a column of conductive material, about which is received a close-fitting collar of rubber or other elastomeric material. A base end of the column is provided with means for securing it on a base board; while an apical end of the column slidably receives a perforated element, which in one form comprises a castellated washer, in overlying relation to an end of the collar. This element is preferably retained in assembly by means of a peripheral flange formed about the apical end of the column, but is free to be depressed toward the base end, with accompanying compression of the elastomeric collar. In use, connections are made by inserting leads each through one of the perforations of the washer and into binding engagement between the collar and the wall of the conductive column, thus distorting the collar to apply a gripping pressure against the leads. No manipulation of the connector is ordinarily required, as the leads may simply be inserted and pushed into place; and the insertions are made at the top of the connector, where visibility is unimpeded. Both of these factors contribute to the facility with which circuits can be prepared. Another desirable feature is that the presence of the elastomeric collar about the conductive column insulates the connections against accidental short circuits, which might otherwise arise from lack of great care in wiring adjacent connectors.

In carrying the invention into practice in a circuit kit, a plurality of the connectors are mounted on a common base board. In one form, the castellated washers are replaced by a common sheet of insulating material having openings receiving all of the connector columns, and provided with perforations which serve the same function as the castellations of the washers. In this form, the conductive elements are almost totally enclosed.

In another form of circuit kit according to the invention, a plurality of the connectors protrude through the base board to its reverse face. Retaining means engage the reverse face to secure the connectors against withdrawal, but permit the columns to be depressed toward the base board with attendant compression of the collars. In a preferred form, the retaining means comprise peripheral flanges formed about tubular columns by spinning. A plurality of the columns may be interconnected by a bus bar or the like, which is inserted between the reverse face of the base board and the retaining means of the columns, while the latter are depressed, and is thereafter held securely in place by the compression of the collars. Bus connections can thus be made without additional parts or the use of any tools.

While specification concludes with claims particularly pointing out the subject matter which I regard as my invention, it is believed that a clearer understanding may be gained from the following description of preferred embodiments, with reference to the accompanying drawing, in which:

FIG. 1 is a cross-sectional view in elevation showing a first form of the improved connector;

FIG. 2 is a plan view of the connector of FIG. 1;

FIG. 3 is a fragmentary plan view of a circuit kit incorporating modified connectors;

FIG. 4 is a fragmentary view in elevation, and partially in section, of the kit of FIG. 3;

FIG. 5 is a fragmentary bottom plan view of the kit of FIG. 3;

FIG. 6 is a fragmentary view in elevation showing a modified kit;

FIG. 7 is a fragmentary plan view of the kit of FIG. 6; and

FIG. 8 is a view in elevation showing another form of the improved connector.

Referring to FIGS. 1 and 2, a first form of the improved connector incorporates a tubular column **10** of copper or other conductive material, a closely-fitting annular collar **12** of rubber or other elastomeric material, and a castellated washer **14** overlying the collar. The collar and washer are held in assembled relation with the column by a spun flange **17** formed about the apical end of the column. The circumferentially-spaced recesses **15** between the castellations **16** of the washer provide guide openings for the insertion of electrical leads downwardly into engagement between the collar **12** and column **10**, where the leads are held with adequate security by the inward pressure of the distorted rubber of the collar. The castellations preferably have rather sharp edges to scrape and clean any waxes or tarnish from the leads as they are inserted, thus contributing to improved contact. The spaced recesses **15** serve to separate various leads in a circumferential direction; thus, a tight grip is secured of leads of different diameters. If leads of varying thickness were allowed to be inserted in close circumferential juxtaposition, the smaller ones would not be gripped as tightly by the collar **12**. An illustrative resistor element **24** is shown inserted in place, and it will be apparent that various connections can be made in common by inserting additional leads in others of the recesses **15**. Ordinarily, it is sufficient simply to insert the lead in a recess and push downwardly. However, if the lead is blunt and the movement is resisted by interferences of the parts, the washer **14** may be manually depressed to facilitate entry.

To form a kit for the preparation of circuits, a series of the connectors are mounted on a common base **22** of plastic, fibre board, or other material, and are secured thereon by any suitable means. In the form shown, a flanged plastic insulating plug **18** is provided with a split deformable portion **20**, for attaching the connector simply by placing the plug into an opening of suitable size formed in the base. The column **10** is recessed into the upper surface of the plug **18**, and is secured in place by suitable means such as a layer of cement **21**, or by a spun flange (not shown) in the column captured by upsetting the plastic of the plung **18**. Preferably, the column **10** is if a cylindrical tubular form, providing a recess **19** into which a banana plug may be conveniently inserted to make an additional connection with the leads contacting the column exteriorly.

A kit incorporating modified connectors is shown in FIGS. 3–5. The conductive columns **28** pass through suitable openings in an insulating base **37**, and are spun to form flanges **36** which normally engage the reverse face of the base to secure the columns in assembly with elastomeric collars **30** and castellated washers **32**. In the form shown, the columns are arranged with equal spacings in equilateral triangular distributions; plug-boards or multiple-plug adapters (not shown) having corresponding plug spacing may therefore be utilized to make interchangeable multiple connections with the kit. However, any desired distribution or spacing of columns may be employed.

A number of the columns may be electrically interconnected by means of a bus bar **38**, having a series of notches **40** corresponding in width to the outside diameters of the columns, and in spacing to that of the connectors. Connection is made simply by depressing those columns which are to be interconnected, as illustrated in FIG. 4, sufficiently to permit insertion of the bus bar between the flanges **36** and the reverse face of the base. The deformed collars **30** thereafter provide a resilient grip which securely holds the bus connection in place. Other connections are made between columns as with the previously-described embodiment, by pressing the leads through perforations **34** of the castellated washers. An illustrative resistor **42** is shown in interconnected relation between two of the connectors.

Another modified kit is shown in FIGS. 6 and 7, in which the castellated washers of the previously-described embodiments are replaced by a common plate **48** of fibreboard or other insulating material, having a plurality of spaced perforations **52**. Fibre-board of this type is readily available commercially. A series of enlarged openings are formed in this board to receive the columns **44**. The perforations **52** are so spaced that a group of them falls adjacent to each column, and connections are made by inserting leads, such as illustrated at **54**, through appropriate perforations and into engagement between the collars **46** and the columns **44**. The kit is mounted upon an insulating base **50** which may conveniently be formed of fibre-board like that of the plate element **48**, with the various collars **46** closely packed and in contact with one another. The columns are attached by spinning flanges in each end, as before. The collars may be replaced by a single sheet of rubber or other elastomeric material, having a plurality of spaced openings receiving the various conductive columns.

A connector construction is shown in FIG. 8 in which the conductive column **60** terminates in a locating flange **64** and a screw tip **66**. The connector may be threaded into a base opening of suitable size, or may simply be attached by pressing the screw base into an opening of slightly larger size. The washer **70** is shown slightly depressed to more clearly illustrate the relationship between its spun flange **62** and the castellations **72** of the washer. It should be understood that the screw tip may be replaced by a solid, hollow or split tapered pin.

In some cases the user may be furnished with unassembled collars, washers, and columns; the latter may then have an attached solid, hollow, or split pin, plug, or screw, of a diameter which will permit the user to slip the collar and washer over the column from the base end.

While I have described several preferred embodiments of my invention by way of illustrations, it will be understood by those skilled in the art that various changes and modifications may be made therein without departing from the true spirit and scope of the invention, which I intend to define in the appended claims without limitation to the details of the foregoing embodiments.

What I claim is:

1. An electrical connector adapted for use in constructing circuits upon a mounting base, said connector comprising a column of conductive material terminating at a base end thereof in means for supporting said column on the mounting base, an elastomeric collar received in closely-fitting relation about said column, and an element having an opening receiving said column and overlying said collar at an apical end of said column, said column being provided with retaining means at the upper end thereof for retaining said collar and element in assembled relation thereon, and said element being formed with a plurality of perforations spaced apart about said opening whereby wires may be electrically connected by inserting them through the perforations of said element into binding engagement between said column and collar.

2. An electrical connector as recited in claim **1**, in which said column comprises a tube having a peripheral flange about said apical end thereof forming said means for retaining said collar and said element.

3. An electrical connector as recited in claim **1**, in which said perforations in said element form sharp edges for scraping foreign matter coatings from leads inserted therein.

4. An electrical connector as recited in claim **1**, said element comprising a washer having castellations recessed about said opening therethrough to define said perforations.

5. An electrical connector as recited in claim **1**, said element being depressible toward said base end of said column by compressing said collar, to facilitate connection of wires.

6. A kit for constructing electrical circuits, comprising: an insulating mounting base formed with a plurality of spaced holes; and a plurality of electrical connectors each comprising a column of conductive material terminating at a base end thereof in means for securing said column to said base, an elastomeric collar received in closely-fitting relation about said column, and an element having an opening receiving said column and overlying said collar at an apical end of said column, said column being provided with retaining means at said apical end thereof for retaining said collar and element in assembled relation thereon, and said element being formed with a plurality of perforations spaced about said opening therein whereby wires may be electrically connected by inserting them through the perforations of said element into binding engagement between said column and collar.

7. A kit as recited in claim **6**, in which said base is formed with a face engaging said connectors and with a reverse face; and each column is received through one of said holes in said mounting base, said base end of each column being provided with further retaining means engaging said reverse face to retain said connector in assembled relation with said base.

8. A kit as recited in claim **7**, in which each column is movable through the corresponding hole of said base from a normal extended position to a depressed position with attendant compression of the associated collar; said further retaining means being constructed and arranged to permit the movement while retaining the associated connector against withdrawal from said base beyond

the extended position; whereby a plurality of said columns may be depressed and electrically interconnected by inserting a bus connection in common between said reverse face and said further retaining means of each of the interconnected columns, the bus connection being secured in place by the resilient bias of the compressed collars of the interconnected columns.

9. A kit as recited in claim **8**, in which said further retaining means comprises a peripheral flange formed about the base end of said column.

10. A kit as recited in claim **6**, in which every said

element is united in a common plate member formed with each said opening and with said perforations.

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