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J. J. WILENTCHIK  
PLUG AND JACK RESISTOR

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2 Sheets-Sheet 2

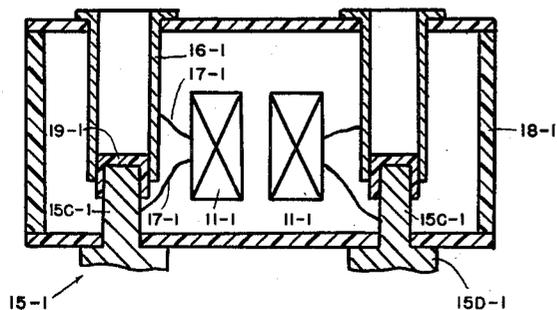


FIG.-8

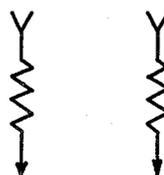


FIG.-9

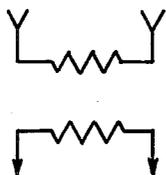


FIG.-10

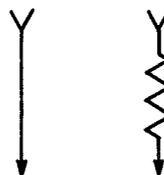


FIG.-11

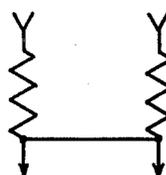


FIG.-12

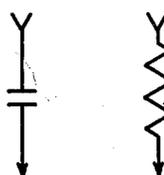


FIG.-13

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**PLUG AND JACK RESISTOR**

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My invention relates to improvements in the method of connecting electrical circuit elements into circuit and/or in shunt and/or in series one with another.

Although there are other methods of realizing electrical connections my invention offers many distinct advantages over the existing art, particularly when quick connecting and disconnecting of components is required.

An object of my invention is to provide electrical circuit components that can be readily connected or disconnected from circuit without use of auxiliary tools or ingredients, yet provide positive electrical connection.

Further object of my invention is to provide electrical circuit components adapted for quick connection one with another in shunt or in series.

Still another object of my invention is to provide both single and multicomponent assemblies adapted to be interconnected electrically by plugging one into another.

A still further object of my invention is to provide plastic molded plug-in circuit components having male and female plug-in members anchored rigidly within the mold so that they are an integral part of assembly.

Yet another object of my invention is to provide an economic method of manufacture of molded plug-in circuit components without recourse to expensive tools and/or molds.

Those and other objectives of my invention will become apparent through reference to the accompanying drawings and to the following specification in which preferred embodiments of my invention are described.

In the drawings:

FIG. 1 is a sectional view across axis of a radial banana plug and jack resistor according to my invention. FIG. 2 is a side view according to FIG. 1.

FIG. 3 is a perspective view of my invention according to FIG. 1.

FIG. 4 is a schematic presentation of my invention according to FIG. 1.

FIG. 5 is a sectional view along axis of an axial banana plug and jack resistor according to my invention.

FIG. 6 is a perspective presentation of my invention according to FIG. 5.

FIG. 7 is a schematic presentation of my invention according to FIG. 5.

FIG. 8 is a partly broken off, sectional view of a multiple element banana plug and jack assembly according to my invention.

FIG. 9 is a schematic presentation of arrangement in FIG. 8, with two resistance elements connected between respective plugs and jacks.

FIG. 10 is a schematic presentation of arrangement in FIG. 8 with a resistance element connected between respective plugs and another resistance element between respective jacks.

FIG. 11 is a schematic presentation of arrangement in FIG. 8 with one jack and plug shorted and a resistance element connected between the other plug and jack.

FIG. 12 is same as FIG. 9 except that the plugs are interconnected.

FIG. 13 is the same as FIG. 9 except for a capacitance element being substituted for one of the resistances.

Referring first to FIGS. 1, 2, 3 and 4 there is shown radial banana plug and jack resistor 10 comprising resistance element 11 of conventional design having center axial wire lead or lug terminals 17. The element 11 is disposed in the center of a plastic sleeve 12, the latter having a pair of radial holes 13 arrayed in the same plane as

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sleeve's center axis at a predetermined distance one from another and another pair of holes 14 directly opposite the holes 13. Brass bushings 16 are inserted in respective holes 14 up to their respective flanges 16A and respective banana plugs 15 are inserted in respective holes 13. Banana plug 15 comprises resilient metal enclosure 15A having slits 15B for effecting resiliency, flange 15D and stem 15C. Minor details of construction of banana plug 15 are omitted in this specification, because banana plugs of similar design are known and commercially available in the trade. In principle, banana plug 15 acts as male contact member and the bushing 16 as female contact member. The diameter of the banana enclosure 15A although slightly larger than the inside diameter of the bushing 16 will contract when forced into the bushing 16 while providing resilient conductive engagement with said bushing. The diameter of the stem 15C is slightly smaller than inside diameter of the bushing 16. Thus, in assembly, the stem 15C fits into the bottom part of the bushing 16. The inside diameter of the sleeve 12 and the longitudinal dimensions of the stem 15C and of the bushing 16 are so proportioned that the stem 15C extends part way into the bushing 16. This permits easy solder connection between respective stem 15C, bushing 16 and terminal 17. The solder connection alone, is, however, not adequate in order to provide adequate rigidity to bushings 16 and plugs 15. Therefore, subsequent to soldering operation, the sleeve 12 is either filled completely with a liquid plastic solidifying upon application such as epoxy resin, or only its face 18 and other openings are sealed off with such plastic material. In either way the epoxy seals off the element 11 and protects it from damaging humidity and physical injury. It will be apparent to any one skilled in the art that several plug and jack resistors 10 may be stacked one on top of another by plugging banana plugs 15 of one unit into jacks 16 of the next subsequent unit. FIG. 1 shows for that purpose one complete banana plug unit and another partly broken off unit plugged into it.

Referring now to FIGS. 5, 6 and 7 there is shown an axial banana plug and jack resistor 31 comprising resistance element 21 having axial off center wire lead terminals 27A and 27B and a center hole thru 29. So designed resistances are known and available in the trade. The terminal 27A is extended thru an opening in the flange 26A of the bushing 26 and is soldered thereto. The bushing 26 is essentially similar to bushing 16 seen in FIGS. 1, 2 and 3. The wire terminal 27B is soldered to flange 25D of a banana plug terminal 25 the latter being essentially similar to banana plug 15 except for a smaller diameter of its stem 25C. An insulator tubing 30 is mounted over the stem 25C to insulate it from the bushing 26. A plastic, non-conductive tubing 22 fits over the flange 26A, the resistance element 21 and the banana plug's flange 25D. Epoxy plastic 32 may be applied in liquid form into the space separating the tubing 22 and the flanges 25D and 26A. The epoxy solidifies upon application, retains all elements of assembly rigidly in place and seals hermetically the resistance 21 within the sleeve 22.

Several axial banana plug and jack resistors may be series connected by stacking them in tandem.

Referring now to FIG. 8, there is shown a dual impedance element banana plug and jack resistor that is generally similar to that seen in FIGS. 1, 2 and 3 except for the fact that it contains a pair of resistance element 11-1 and 11-2. Because of similarity of design same numerals were assigned to similar parts shown in FIGURES 1 and 8, except that the parts in FIG. 8 are provided a subscript "1." It will be noted that the stem 15C-1 is somewhat smaller in diameter than the stem 15C and that it is provided with an insulating cap 19-1.

The bottom section of the jack 16-1 fits over the cap 19-1. Thus, respective banana plugs 15-1 and jacks 16-1 that are located one opposite another remain separate members insulated one from the other at all times and may be soldered to respective terminals 17-1 of two internally disposed resistance elements 11-1 according to requirements. Other details of construction are essentially similar to those shown in reference to FIGS. 1, 2 and 3 and for their description reference should be had to the above figures.

Dual plug-in resistances are useful in voltage divider and/or resistance decade applications as follows: 5 dual plugs of the following resistance pattern may be provided in each decade: 0-9; 1-8; 2-7; 3-6; 4-5. It will be apparent to anyone skilled in the art that by stacking several dual plugs, one from each decade, one on top of another and by shorting the jack terminals of the last plug in stack, two strings of series connected resistors acting as two sections of the voltage divider are obtained. Resistance ratio adjustments are made by substituting one plug for another. The smallest possible adjustment of the divider is that of the lowest resistance in the lowest available order decade.

Single banana plug resistors of axial or of radial design are generally retained in place by jack receptacles available commercially in the trade. Since such receptacles are standard commercial items and are not needed for the understanding of my invention, their description was omitted in this specification. It is possible, however, to have radial or axial banana plug resistors such as described in the foregoing specification plug respectively not one into another and not into standard commercial jacks but as follows:

(A) Radial banana plug and jack units may be plugged into—

(1) Two separate but properly spaced radial banana plug and jack units and/or

(2) Two separates, properly spaced axial banana plug and jack units and/or

(3) One radial and one axial properly spaced banana plug and jack units.

(B) Two axial banana plug and jack units may be plugged into a single radial banana plug and jack unit.

The FIGURES 9 thru 13 are self explanatory and show only a few of the various patterns of electrical connection that are possible. It will be apparent to any one skilled in the art that resistance elements in the plugs may be substituted by other types of circuit components such as capacitors, diodes, etc., as individual circuit requirements may call for. Thus, infinite variety of circuit patterns and applications is possible.

While the invention has been described with reference to certain embodiments, it is to be understood that the same have been given merely by way of illustration and not as limitation upon the scope of invention.

I claim:

1. A plug-in electrical component unit for building up multiple circuit assemblies comprising a plastic case, an electric circuit element embedded in said case, a pair of terminal jacks in said case and projecting therewithin, a pair of plugs, one plug of said pair of plugs being disposed opposite to one of said jacks in coaxial relation therewith, and the other plug of said pair of plugs being disposed opposite the other of said jacks in coaxial relation therewith, each of said plugs having a portion projecting within said case and being joined to the jack which is opposite thereto by a shorting connection; each of said plugs having another portion projecting without said case, said element having two terminals; one of said terminals being connected to one of the said coaxially related jack and plug and the other of said terminals being connected to the other of said coaxially related jack and plug, said plugs being adapted to be inserted in jacks of a second electrical component unit.

2. A plug-in electrical component unit for building up multiple circuit assemblies comprising a plastic case, an electrical circuit element embedded in said case, a pair of terminal jacks in said case and projecting therewithin, a pair of plugs, one plug of said pair of plugs being disposed opposite to one of said jacks in coaxial relation therewith, and the other plug of said pair of plugs disposed opposite the other of said jacks in coaxial relation therewith, each of said plugs having a portion projecting within said case and forming an integral unit with the jack which is opposite thereto, each of said plugs having another portion projecting without said case, said element having two terminals, one of said terminals being connected to one of the said coaxially related jack and plug and the other of said terminals being connected to the other of said coaxially related jack and plug, said plugs being adapted to be inserted in jacks of a second electrical component unit.

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