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R. C. SANDERS, JR
ELECTRICAL COMPONENTS

2,876,392

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Fig. 1

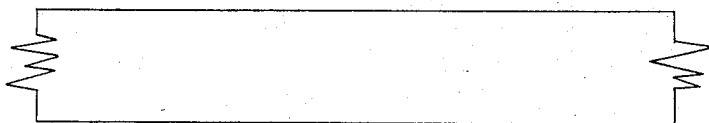


Fig. 2

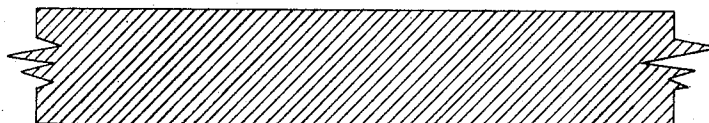


Fig. 3

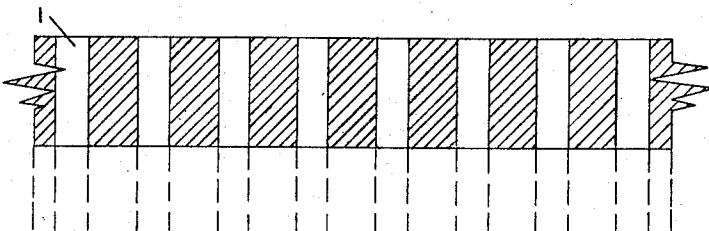


Fig. 4

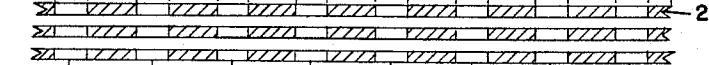


Fig. 5

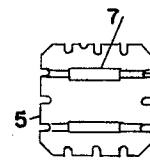


Fig. 6a

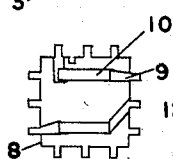


Fig. 6b

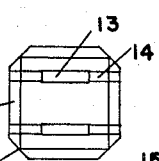


Fig. 6c

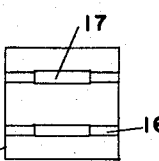


Fig. 6d

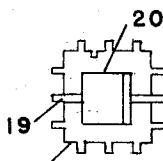


Fig. 7a

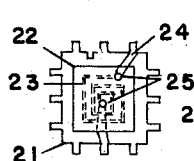


Fig. 7b

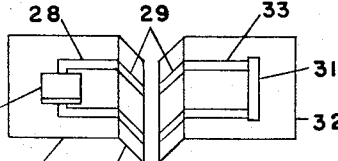


Fig. 7c

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ELECTRICAL COMPONENTS

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4 Claims. (Cl. 317—101)

This invention relates to components for electrical and electronic devices, and the manufacture and assembly thereof.

In conventional practice electronic components, such as are used in radio, radar, and like systems comprise various elements which are mechanically and electrically connected with other desired parts by soldered connections or mechanical pressure connections.

Briefly, the present system employs an improved electrical component embodying an electrical and mechanical connection which may be made in a single operation. The use of soldering and electrical contacts by mechanical joints is obviated thereby.

Moreover, components of this type heretofore have been usually connected by wires requiring pre-forming and soldering operations. By employing the present improved components, such wire connections as well as the necessity for soldering are eliminated.

An object of the present invention is to provide improved components of the type described that will permit substantial savings in manufacturing costs and assembly.

A further object of this invention is to provide an improved electrical component which has associated therewith an adhesive agent for effecting its assembly with the utmost facility.

Other objects of the invention will be apparent to those skilled in the art from the following description of typical embodiments thereof, taken in connection with the accompanying drawing.

In accordance with the invention, there is provided a substantially planar printed circuit electrical component for use in an electrical circuit. The electrical component comprises in combination a printed circuit panel having conductors affixed on a surface thereof with at least one pair of terminals in a predetermined spaced relation for receiving the electrical terminals of an impedance element. There is also provided a preformed, thin, planar flexible impedance element having a predetermined impedance and terminals extending therefrom. Conductive adhesive contacts are affixed to the terminals of the element and are disposed substantially in the plane of the element. The terminals are so spaced as to register with the panel conductor terminals in overlaying relation. The contacts are formed of a thin layer of adhesive plastic having conductive particles suspended therein in a predetermined density for simultaneously securing electrically and mechanically the elements to the printed circuit panel, thus providing the electrical component.

The invention will be more fully and better understood with reference to the preferred embodiment thereof described in the accompanying drawings.

In the drawings:

Fig. 1 is a plan view of portion of an asbestos-like tape of which components of the present invention are constructed; Fig. 2 is a similar view of the asbestos-like tape having resistive material affixed thereto; Fig. 3 is a similar view of the tape having contact and adhesive material affixed thereto; Fig. 4 is a plan view of a portion of typi-

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cal resistor strips obtained by cutting the tape of Fig. 3 longitudinally; Fig. 5 is a similar view of individual resistors obtained by cutting the longitudinal strips transversely; Fig. 6 is a similar view of a series of typical panel or module wafer resistor assemblies; and Fig. 7 is a plan view illustrating typical resistor, inductor and capacitor assemblies employing the present invention.

Referring now in more detail to the drawings, the development of an improved resistor embodying this invention is here illustrated. An asbestos tape, as shown in Fig. 1, is employed as a base for affixing electrically resistive material, illustrated in Fig. 2. Contacts 1 of conductive adhesive material such as a suitable mixture of powdered silver and epoxy resin derivative which is commercially available as Hysol 2530 and is manufactured in the United States, are applied to the tape as shown in Fig. 3. The tape is then cut longitudinally into continuous strips 2 of resistors, Fig. 4. Transverse cuts of the strips provide the resistors which may be multiple element resistors 3 and individual resistors 4. A number of resistors embodying the present invention are shown mounted on representative panel or module wafers in Fig. 6a to Fig. 6d, inclusive. The adhesive contact surfaces of resistors 7, Fig. 6a, are secured to the conductors 6 affixed on a surface of the ceramic wafer 5.

Resistors 10, Fig. 6b, embodying the present invention are secured to the conductors 9 which are affixed on a surface of the wafer 8. The conductors 9 have terminals in a predetermined spaced relation for receiving the electrical terminals of the resistor 10. Resistors 13, Fig. 6c, are similarly secured to the conductors 14 affixed on the surface of the paper-like wafer 11 which may have folding tabs 12 attached thereto. Resistors 17 are also similarly secured to conductors 16 affixed to the paper-like wafer 15.

In Fig. 7 there are illustrated various other component assemblies and inter-assembly connections embodying the present invention. The capacitor 20 shown in Fig. 7a has its plates staggered to permit the application of the adhesive contacts to its under side. It is affixed to electrical connections 19 of the panel or wafer 18 as shown.

An inductor 23 carried by base 22 is shown in Fig. 7b. The inductor is affixed to electrical connections 24 of module wafer 21. For preventing short circuiting the turns of the panel or inductor 23, the electrical connections may be covered with a layer of insulation excepting for the contact areas 25. Alternatively, the inductor 23 may be covered with insulation except for the areas thereof at the contacts.

Inter-assembly connections embodying this invention are illustrated in Fig. 7c. Capacitor 27 is affixed to electrical connections 28 carried by base 26. Resistor 31 is affixed to electrical connections 33 carried by base 32. Tabs 30 may then be folded effecting the mechanical contact of the electrically conductive and adhesive contacts 29. Tabs 30 may then be pressed together to complete the electrical and mechanical connections between the assemblies.

In the manufacture and assembly of an improved resistor embodying the present invention, an asbestos tape Fig. 1 is kept in continuous motion by means of a conveyor system. Electrically resistive materials are ground into a very fine powder which is mixed with a binding agent and, while in a liquid suspension, sprayed onto the moving tape. In order to obtain accurate control of the amount of the resistive powder, the suspension is sprayed onto the tape in a series of layers. The binding agent is dried by an air-drying process which may be accelerated by the use of a suitable heat source. After the tape is dried, it is cured by further heating in a conveyor oven. The tape which has the cured resistive material affixed thereto is illustrated in Fig. 2.

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Various suitable mechanisms are currently available for applying the electrically conductive adhesive to the resistive material. The conductive material, may, for example, be silver. It may be mixed with the adhesive and suitably printed onto the tape to form the contact surfaces 1 as shown in Fig. 3. This may be readily accomplished with facility by means of the well known rotary printing process. When desired, the conductive material, for example, silver, may be applied first to form an electrical contact surface and then the adhesive applied in a separate operation. The tape is cut into continuous longitudinal strips 2, Fig. 4, and the strips are then cut transversely into resistors as shown in Fig. 5. This process provides a preformed, thin, planar, flexible resistor having terminals extending therefrom with adhesive contacts affixed to the terminals substantially in the plane of the terminals. The terminals may be so spaced as to register with the terminals of conductors in any given circuit. The configuration may also be varied as is illustrated by multiple element resistors 3 and single resistors 4.

The present invention lends itself readily to modular assembly and construction techniques as outlined in applicant's copending applications relating thereto. The resistor assemblies of Fig. 6, capacitor assemblies of Fig. 7a and inductor assemblies of Fig. 7b embodying this invention, may be employed in combination with the connection techniques illustrated in Fig. 7c in the manufacture and assembly of many electrical and electronic systems.

Many adhesive agents are thermoplastic or thermosetting and require the application of heat to effect adhesion. This may be readily accomplished by use of a heating device or iron which is adapted to apply heat to the contact areas only. A timing device may be employed to control the amount of heat and amount of pressure applied. Other methods of assembly are outlined in aforesaid copending applications.

By utilizing groups of these component assemblies with printed circuits interconnecting them, complete circuit assemblies of great variety may be readily supplied. The precision, speed, and economy of manufacture and many other advantages provided by this system will be obvious to those skilled in the art.

While there has been hereinbefore described what is at present considered a preferred embodiment of the invention, it will be apparent to those skilled in the art that many and various changes and modifications may be made with respect to the embodiment illustrated without departing from the spirit of the invention. It will be understood, therefore, that all and any such changes and modifications as fall fairly within the scope of the present invention, as defined in the appended claims are to be considered as a part of the present invention.

What is claimed is:

1. A substantially planar printed circuit electrical component for use in an electrical circuit, comprising, in combination: a printed circuit panel having conductors affixed on a surface thereof with at least one pair of terminals in a predetermined, spaced relation for receiving the electrical terminals of an impedance element; a preformed, thin, planar, flexible, impedance element having a predetermined impedance and terminals extending therefrom; and conductive adhesive contacts affixed to the terminals of said element disposed substantially in the plane of said element and so spaced as to register with said panel conductor terminals in overlaying relation, said

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contacts being formed of a thin layer of adhesive plastic having conductive particles suspended therein in a predetermined density for simultaneously securing electrically and mechanically the element to said printed circuit panel and providing said electrical component.

2. A substantially planar printed circuit electrical component for use in an electrical circuit, comprising, in combination: a printed circuit panel having plane conductors affixed on a surface thereof, with at least one pair of terminals in a predetermined, spaced relation for receiving the electrical terminals of a resistance element; a preformed, thin, planar, flexible resistance element having a predetermined resistance and terminals extending therefrom; and conductive adhesive contacts affixed to the terminals of said element disposed substantially in the plane of said element and so spaced as to register with said panel conductor terminals in overlaying relation, said contacts being formed of a thin layer of adhesive plastic having conductive particles suspended therein in a predetermined density, for simultaneously securing electrically and mechanically the element to said printed circuit panel and providing said electrical component.

3. A substantially planar printed circuit electrical component for use in a module unit, comprising, in combination: a printed circuit module wafer having conductors affixed on a surface thereof with at least one pair of terminals in a predetermined spaced relation for receiving the electrical terminals of a resistance element; a preformed, thin, planar, flexible, resistance element having a predetermined resistance and terminals extending therefrom; and conductive adhesive contacts affixed to the terminals of said element disposed substantially in the plane of said element and so spaced as to register with said wafer conductor terminals in overlaying relation, said contacts being formed of a thin layer of adhesive plastic having conductive particles suspended therein in a predetermined density for simultaneously securing electrically and mechanically the element to said module wafer and providing said electrical component.

4. A substantially planar printed circuit electrical component for use in a module unit, comprising, in combination: a printed circuit module wafer having conductors affixed on a surface thereof with at least one pair of terminals in a predetermined spaced relation for receiving the electrical terminals of a resistance element; a preformed, thin, planar, flexible, resistance element having a predetermined resistance and terminals extending therefrom; and conductive adhesive contacts affixed to the terminals of said element disposed substantially in the plane of said element and so spaced as to register with said wafer conductor terminals in overlaying relation, said contacts being formed of a thin layer of epoxy resin having silver particles suspended therein in a predetermined density for simultaneously securing electrically and mechanically the element to said module wafer and providing said electrical component.

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