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METHOD OF MAKING ELECTRICAL COMPONENTS

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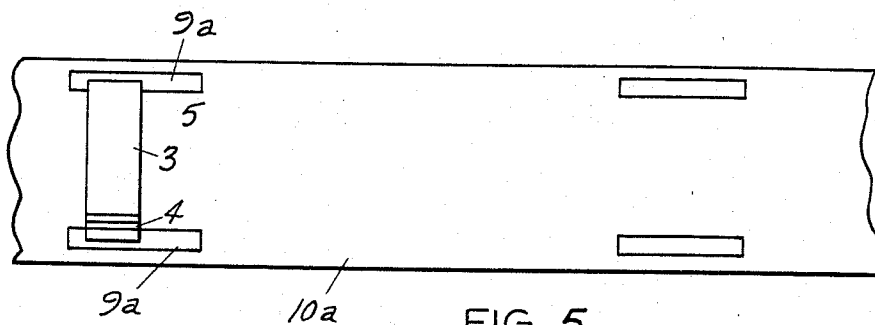
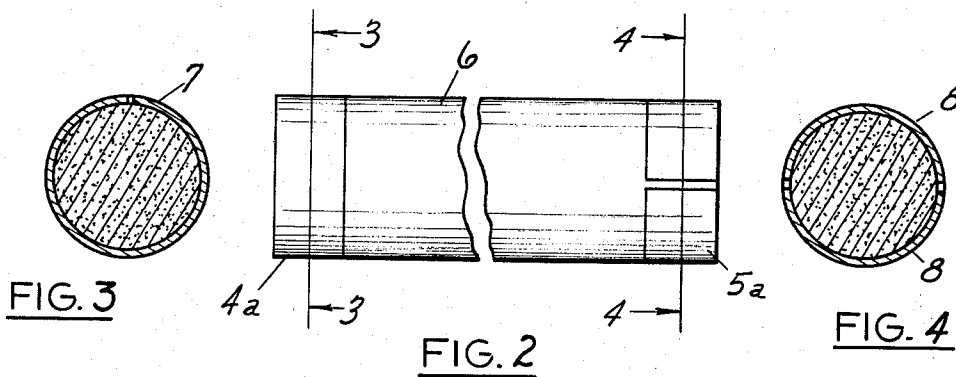
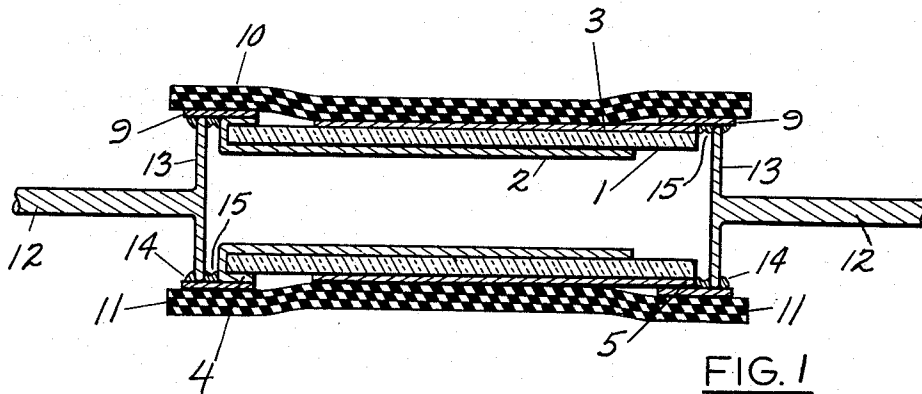


FIG. 5

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This invention is intended to provide circuit components such as resistors and capacitors with a wrapped plastic insulating case and with lead wires at each end having soldered connections to the terminal surfaces of the components.

In the accompanying drawing, FIG. 1 is a section through a capacitor with a wrapped plastic insulating case; FIG. 2 shows a resistor which could be substituted for the capacitor in FIG. 1; FIGS. 3 and 4 are sections on the correspondingly numbered lines in FIG. 2; and FIG. 5 is a plan view of one form of tape used for making the wrapped plastic case and the connections to the lead wires.

In FIG. 1 of the drawing there is shown a ceramic capacitor having a tubular ceramic dielectric 1 with an inner electrode coating 2 and an outer electrode coating 3. The inner electrode coating 2 is carried over one end of the tube and terminates in a terminal surface 4. The outer electrode coating terminates in a terminal surface 5 at the opposite end of the tube. The electrodes 2 and 3 of the terminal surfaces 4 and 5 can conveniently be applied by one of the silver paints used in the decoration of ceramics and when fired on the tubular ceramic body 1 produces a metallized coating which is securely attached to the ceramic. The construction so far described is common to ceramic capacitors and may vary substantially in appearance from the particular capacitor illustrated.

In FIGS. 2, 3, and 4 is shown a resistor having a cylindrical body 6 which may, for example, be carbon particles bonded together with a suitable plastic. At one end, the resistor has a terminal surface 4a which is formed by a metallic band 7 wrapped around and molded in place on the body 6 of resistance material. At the other end of the resistor is a terminal surface 5a which comprises two semi-cylindrical metal parts 8 likewise molded to the body of resistance material. Other expedients for providing terminal surfaces on the resistance body are known; for example, the metal spraying technique.

Either the capacitor of FIG. 1 or the resistor of FIGS. 2, 3, and 4 which may be considered as typical electric circuit components, require leads for making the circuit connections and a protective insulating case. In FIG. 1 is shown a construction for providing both the insulating case and the leads and in FIG. 5 is shown one form of plastic tape which can be utilized in the FIG. 1 construction. The construction of FIG. 1 is obviously usable with either of the electric circuit components.

Around each of the terminal surfaces 4 and 5 is wrapped a thin metallic cylinder 9 which may, for example, consist of a thin tinned copper ribbon. The cylinder 9 may be wrapped separately, or as shown in FIG. 5, the cylinder 9 may comprise two metal portions 9a on opposite edges of a strip of plastic tape 10a. The portions 9a may be metallized coatings on the tape. The

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length of the portions 9a is not important since only the first turn is used. It may be more economical to have the portions 9a in the form of continuous stripes extending the full length of the tape. As shown in FIG. 1, a plurality of layers of plastic tape 10 are wrapped around the body of the condenser and over the cylindrical metal parts 9. With the FIG. 5 tape, the first turn would form cylindrical parts 9a. The tape projects a slight distance beyond the ends of each of the metal members 9 as indicated at 11 thereby increasing the insulation leakage resistance path. The tape 10 may be resin impregnated paper, resin impregnated fabric, or straight plastic resin. If the tape has the property of bonding to itself, there is no need for using an additional adhesive. If the tape does not have the property of bonding to itself, an additional adhesive may be applied. The plastic may be thermosetting, or the plastic may be completely cured and the adherence between the different layers may be obtained by the adhesive. Suitable tapes are available under the trade name "Mylar Tape," which is a polyester resin tape, backed with a thermosetting adhesive; "Teflon Tape" in the cured state with a thermosetting adhesive; "Teflon Tape" with the resin in the "B," or partially cured stage, which requires no additional adhesive, but is self-adhering; "Kel-F Tape," which is adhesive-backed; "Plaskon 412 Putty" extruded in tape-form; glass cloth tape impregnated with a thermosetting resin such as an epoxy, silicone, or polyester resin of the solventless varnish type; or a polyester film similar to that used as an adhesive film for adhering foil to plastic in the printed circuit art. All these tapes provide the desired insulating case and, in addition, provide the desired firm contact between the metallic cylinders 9 and the terminal surfaces 4 and 5. The metallic cylinders 9 are quite thin since they are used only for making the connections to the terminal surfaces. After wrapping, the tape is cured or is set in place by heat. In some cases, the plastic itself is cured, while in other cases, only the adhesive between the plastic tape layers is cured. At the end of the curing operation, the wrapped tape will be consolidated and, in many cases, there will in addition be a shrinkage of the tape which brings it into intimate contact with the outside of the condenser. "Mylar" and "Kel-F" tapes have the property of shrinking upon curing so as to produce a compression grip on the circuit component which is desirable.

At each end of the component are lead wires 12, each having a flat, round head 13 telescoped within the cylindrical metal parts 9. The shape of the head is not critical. Although the head 13 is formed by upsetting, it could be formed by winding the end of the lead in a spiral. A solder connection is made, as indicated at 14, between the rim of the head 13 and the cylindrical part 9 and there is also a solder connection, as indicated at 15, between the cylindrical part 9 and the adjacent terminal surface 4 or 5, as the case may be. The solder for the connections 14 and 15 may come from a solder-coating applied to the cylindrical metal part 9 and the head 13, or it may come from dip-soldering or other available methods. When the soldering connection is completed, the solder seals the heads 13 into the ends of the plastic case and provides the lead wires 12 desirable for connecting the component into electric circuits.

It is obvious that the resistor of FIGS. 2, 3, and 4 can be substituted for the capacitor specifically illustrated

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in FIG. 1. In fact, any other electric circuit element can be substituted.

When the FIG. 5 tape is used, the initial layer of the wrapped tape provides the metal cylinders at each terminal surface with the lead-receiving pockets and the subsequent layers build up the insulating case to the desired thickness.

The ends of the case need not be perfectly sealed since the usual wax impregnant will provide the sealing.

What is claimed as new is:

1. The method of making an electrical circuit component having a cylindrical insulating case with leads projecting axially from opposite ends from an element having a rigid cylindrical body with an external terminal surface at each end of the body, which comprises wrapping a metal band over the terminal surface at one end of the body, wrapping another metal band over the terminal surface at the opposite end of the body, each of the bands having a part overhanging the end on which it is wrapped and providing an open ended pocket, wrapping a plurality of layers of adhesive tape of insulating material around the body and bands, positioning a pair of leads to project axially from opposite ends of the element with one end of each lead in one of the pockets, and soldering said one end of each lead to the pocket in which it is positioned.

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2. The method of claim 1 in which the metal bands are attached to the inner surface of that part of the tape forming the initial layer when wrapped around the body.

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