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COMBINATION RESISTOR AND CAPACITOR
WITH BUILT-IN LIGHTNING ARRESTER
Filed April 13, 1959

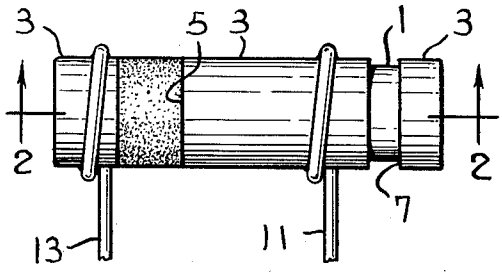


FIG. 1

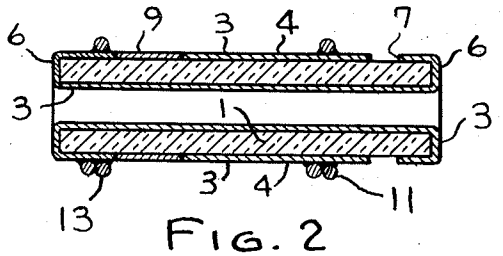


FIG. 2

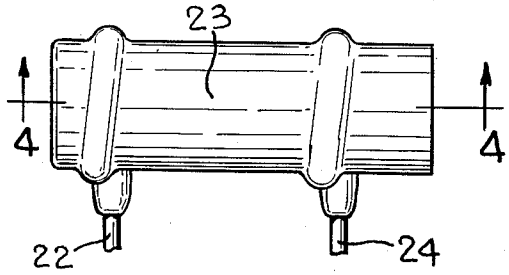


FIG. 3

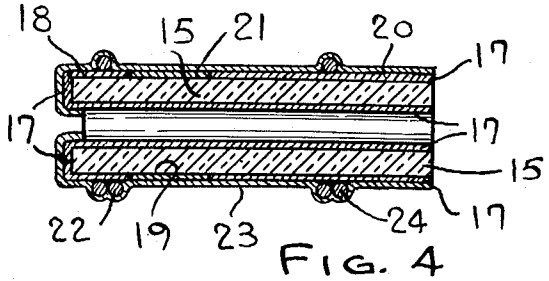


FIG. 4

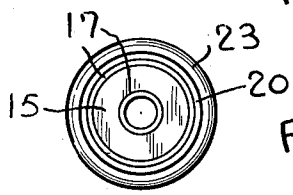


FIG. 5

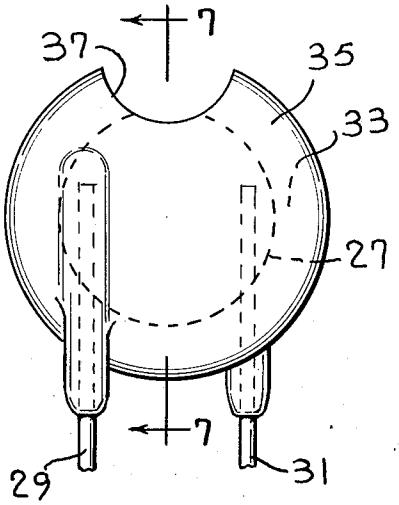


FIG. 6

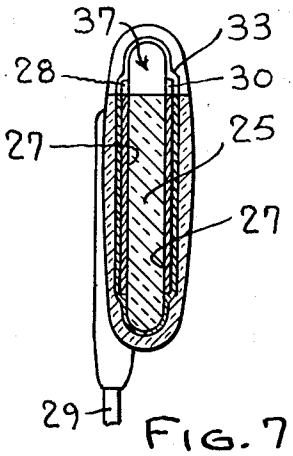


FIG. 7

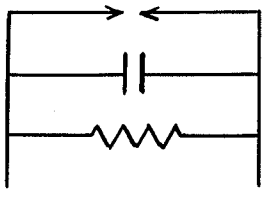


FIG. 8

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COMBINATION RESISTOR AND CAPACITOR WITH BUILT-IN LIGHTNING ARRESTER

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13 Claims. (Cl. 313—231)

This invention relates to improvements in electrical circuit units, and more particularly to a resistor-capacitor unit with surge protection constructed on a single dielectric base and especially adapted for connecting a television antenna to the RF circuit.

At present a television antenna is connected to the RF circuit through either a capacitor or capacitor-resistor electrical element. However, such devices are often destroyed by excessive surges caused by lightning.

One object of this invention is to provide a one-piece capacitor-resistor electrical device which is protected against such excessive static charges or other means.

Another object of this invention is to provide such a device which is inexpensive and capable of being made by a simple method of production.

These objects are attained by providing a capacitor-resistor device of the ceramic dielectric base type in which the resistor is formed by resistance material on the ceramic base in the normal gap between the electrodes with an exposed gap between the electrodes which exposes the surface of the ceramic base. The exposed gap is smaller than the normal gap filled by the resistance material and it permits excess surges of voltages to discharge between the electrodes over the exposed, very good, non-tracking ceramic surface. This gap does not affect the resistor-capacitor circuit and protects the device against damage from surges caused by lightning or other means. The exposed gap may be inexpensively formed by masking in the applying of the electrodes or by the additive step of grinding off all layers of resistance, conductive, and protective, coatings from a normal completed unit to expose the proper ceramic surface.

The novel features of this invention are set out particularly in the claims; however, the features of this invention can be seen readily from the drawings, in which:

Fig. 1 is a front view of a ceramic tube resistor-capacitor embodying this invention with the exposed ceramic surface arrester gap on the outer surface of the tube;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a front view of a ceramic tube resistor-capacitor embodying this invention coated with a suitable protective except for the exposed arrester gap on one end;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is an end view of the tube of Fig. 4 showing the right end of the tube after being ground to expose the ceramic surface;

Fig. 6 is a view of a ceramic disc resistor-capacitor embodying this invention with a protective coating except where a notch is ground down to expose the ceramic surface to form the arrester gap;

Fig. 7 is a sectional view taken on line 7—7 of Fig. 6; and

Fig. 8 is a schematic view of the electrical circuit diagram which is the same for all embodiments shown.

Referring to the drawings, three embodiments of the

present invention are shown. The first is a ceramic tubular-type resistor-capacitor with surge protection having the arrester or exposed gap formed by masking when the conductive paint is applied to the ceramic tube base. The second is a ceramic tubular-type resistor-capacitor with surge protection having the arrester or exposed gap provided by grinding an end off a completed protective coated shorted resistor-capacitor unit to expose the bare ceramic. The third is a protective coated ceramic disc-type resistor-capacitor with surge protection having the arrester or exposed gap formed by grinding an edge of the disc to the bare ceramic. However, the common characteristic of all embodiments is the exposed ceramic surface gap smaller than the normal resistance material filled gap. In all modifications the exposed ceramic surface provides a very good non-tracking surface for voltage discharge.

In the embodiment of Figs. 1–2, inclusive, the dielectric base is a ceramic tube 1 coated with a conductive material 3 except for masked areas which provide a normal gap 5 and an exposed gap 7 to form electrodes 4 and 6 of the capacitor. A coating of resistance material 9 is then applied (by spray or brush) to fill the gap 5 and form a resistor connected in parallel with the capacitor. A lead 11, adapted for antenna connection, is bonded to electrode 4, and a lead 13, adapted for RF circuit connection, is bonded to electrode 6. The exposed gap 7 is in parallel with the resistor-capacitor elements as seen in the circuit shown in Fig. 8. The arrester or exposed gap 7, therefore, has no effect upon the capacitor-resistor connection between the antenna and RF circuit of a television set unless a high voltage (excess surge) is created, as by lightning, at the antenna side of the set or by static charges or other means exterior of the unit. The arrester (exposed) gap is smaller than the resistor (normal) gap and offers less resistance to a voltage surge than either the capacitor or resistor element or the combination thereof. This unit is uninsulated (no protective coating) to provide a non-tracking surface for a voltage discharge. So, a high voltage surge will jump the arrester gap and thereby bypass the capacitor and resistor elements. This averts the burn-out problem found in present TV antenna-RF circuit connectors.

In the embodiment of Figs. 3 and 4, inclusive, the dielectric base is a ceramic tube 15 coated with a conductive material 17 except for a normal gap 19. The leads 22 and 24 are attached to the conductive coating in a well known way. In this embodiment a resistance coating 21 is applied by merely dipping the element in a suitable material and the part deposited on normal gap 19 forms the resistor. A suitable protective insulating coating 23 is applied over the entire outer surface of the unit. At this point the unit is a shorted resistor and capacitor. Then the shorted end of the unit is ground down through all layers of protective coating, resistance material, and conductive material to expose the ceramic base. This divides the conductive coating into electrodes 18 and 20. The grinding of this end provides a resistor, capacitor, and arrester gap all of which are in parallel with each other. This operation provides a tri-element unit on a single ceramic base at a very low cost. An advantage of this method is that the width of the exposed gap can be held to close tolerances defined by the thickness of the wall of the tube.

In the embodiment of Figs. 6 and 7, inclusive, the dielectric base is a ceramic disc 25. Each side of the disc is coated with a conductive material 27 to form electrodes 28 and 30. Then leads 29 and 31 are attached in a well known manner. Then a resistance material 33 is applied to the entire disc in a suitable manner as by spraying or dipping. The resistance material on the exposed surfaces (edges) of the disc forms a resistor in parallel with the

capacitor. A protective insulating coating 35 is next applied. An exposed gap 37 is then formed by grinding a notch in the protective coating, resistance coating and conductive coating to expose the ceramic base.

We claim:

1. An electrical circuit unit comprising a ceramic dielectric base, spaced electrodes coated on said base forming a capacitor, part of the surface of said ceramic dielectric base uncovered by said electrodes forming a normal gap having a coating of resistance material thereon engaging and connecting said electrodes and forming a resistor in parallel with said capacitor, the remaining part of such ceramic surface forming an exposed arrester gap in parallel with the said capacitor and resistor, the surface of said arrester gap being characterized by having good non-tracking voltage discharge characteristics.

2. An electrical circuit unit as set forth in claim 1 in which the area of said exposed arrester gap is less than the area of said normal gap of dielectric directly covered by said coating of resistance material.

3. An electrical circuit unit comprising a ceramic tube, a capacitor formed by an outer electrode coated on the outside of said tube and an inner electrode coated on the inner side of said tube, said inner electrode extending around one end of said tube and spaced from said outer electrode to form a normal gap therebetween, a coating of resistance material on the area of said tube defined by said normal gap engaging and connecting said electrodes to form a resistor in parallel with said capacitor, and a second exposed gap between said inner and outer electrodes exposing the surface of the ceramic tube to provide a non-tracking surface for voltage discharge across said exposed gap.

4. An electrical circuit unit as set forth in claim 3 in which said exposed gap is on the outer surface of said tube and is narrower than said normal gap.

5. An electrical circuit unit as set forth in claim 3 in which said exposed gap is on the end of said tube and is narrower than said normal gap.

6. An electrical circuit unit as set forth in claim 5 in which a protective coating covers the exterior of said unit except for said exposed gap.

7. An electrical circuit unit comprising a ceramic tube, inner and outer electrodes coated on said tube forming a capacitor, a normal gap on the outer surface of said tube between said electrodes, a coating of resistance material on the area of said tube formed by said gap engaging and connecting said electrodes to form a resistor in parallel with said capacitor, said electrodes being shorted on one end of said tube by a conducting coating, a protective coating of insulating material covering said unit, and an exposed arrester gap formed by grinding off an end of said protective coating and said conducting coating to expose said ceramic tube.

8. An electrical circuit unit according to claim 7 in which the normal gap is wider than the exposed gap on said end.

9. An electrical circuit unit comprising a disc of ceramic dielectric material, an electrode coated on each side of the disc forming a capacitor, a coat of resistance paint over the edges of said disc engaging and connecting said electrodes to provide a resistor in parallel with said capacitor, a protective coating covering the unit, and a groove cut through said protective coating and said resistance coating and an edge of said disc to form an exposed surface on said disc to provide a non-tracking surface for voltage discharge thereacross.

10. The method of making a single body resistor-capacitor-voltage surge arrester electric unit, having the resistor, capacitor and voltage surge protector all connected in parallel comprising, masking a normal gap and a voltage surge gap on the surface of a tubular ceramic dielectric base, coating the unmasked surfaces with conductive material, removing said masking, and applying resistance paint to said normal gap.

11. The method of constructing a resistor-capacitor-voltage surge arrester unit on a single ceramic tube comprising, masking a normal gap area on the outer surface of said tube, coating said tube with conductive material except for said normal gap to form a shorted capacitor, removing said masking, dipping said tube in resistance paint so that said gap is coated with resistance material to form a resistor in parallel with said shorted capacitor, dipping said tube in a protective insulating substance, and grinding off an end of said tube to remove the layer of protective coating, resistance coating and conductive coating to unshort said capacitor and provide a voltage surge arrester gap in parallel with the said resistance unit.

12. The method of constructing a resistor, capacitor, and voltage surge arrester, all in parallel, on a ceramic disc comprising, applying a conductive coating only to both sides of said disc to form a capacitor, dipping said disc in resistance paint so that said edge is coated to form a resistor connected in parallel with said capacitor, dipping said unit in a protective insulating coating, and grinding a groove in said unit to remove at said groove the protective coating, and the resistance coating to expose said conductive coating to form an exposed surface on said disc to provide a voltage surge arrester gap in parallel with said resistor and capacitor.

13. An electrical circuit unit comprising a ceramic dielectric base, spaced electrodes coated on said base forming a capacitor, part of the surface of said ceramic dielectric base uncovered by said electrodes having a coating of resistance material thereon engaging and connecting said electrodes and forming a resistor in parallel with said capacitor, another part of such ceramic surface smaller than that part of the surface covered by said coating of resistance material forming an exposed arrester gap in parallel with the said capacitor and resistor, the surface of said arrester gap being characterized by having good non-tracking voltage discharge characteristics.

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