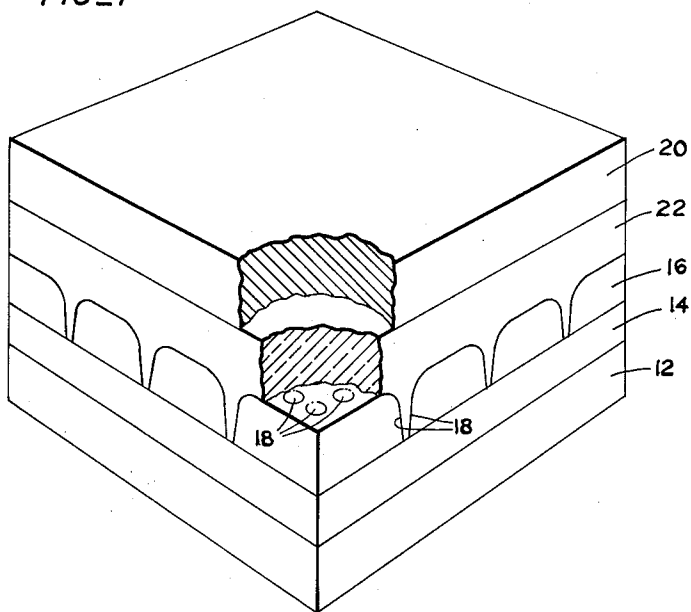


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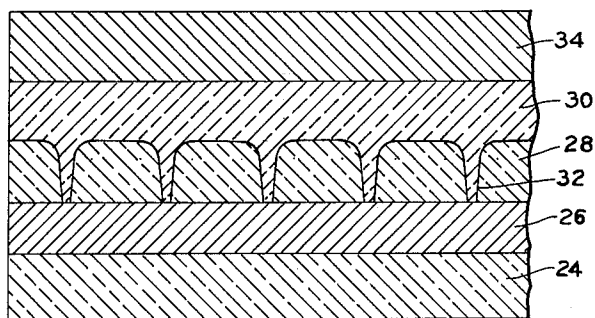
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METHOD OF MAKING MULTIPLE LAYER CONDENSERS BY
VAPOR DEPOSITION AND PRODUCT THEREOF
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FIG_1



FIG_2



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METHOD OF MAKING MULTIPLE LAYER CONDENSERS BY VAPOR DEPOSITION AND PRODUCT THEREOF

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2 Claims. (Cl. 317-258)

The present invention relates to a method of forming multiple layer electrical conductive objects separated by a film of dielectric, such as condensers, and also to the end product thereof.

In the art of forming such objects by vapor deposition a vaporized electro-conductive film is first deposited on a base or substratum, a film of dielectric material is next superimposed on the former film and a second film of vaporized, conductive material is deposited over the dielectric. In practice, the dielectric tends to disperse forming small apertures or pinholes in the stabilized film. Thus upon depositing the overlying layer of vaporized, conductive material, the latter in its vaporized condition enters the pinholes of the dielectric and condenses to form communication between the electro-conductive outer films sandwiching the dielectric. Upon impressing an electric charge across the condenser plates a short circuit is effected. Multiple layers of dielectric deposited one on the other are of no avail because the formed pinholes tend to register maintaining communication of the deposited and sandwiching outer walls.

In accordance with the present invention a film of semi-conductive material of low intrinsic conductivity and of high purity is deposited in the formation of the product to enter and close the pinholes and to separate the dielectric from at least one of the sandwiching electro-conductive films substantially preventing passage of electrical current through material deposited in the defined pinholes of the dielectric and thus preventing short circuiting of the end product.

A principal object of the present invention is to provide a method of forming a sandwiched dielectric through vapor deposition which formed structure will not result in short circuiting in use of the end product.

Another object resides in the utilization of an oxidizable high resistance material superimposed in a film over the dielectric. In this connection oxidation appears to occur in the high resistance material entering the pinholes, which may result from migration with the dielectric or from absorption of oxygen from the environment, and the high resistance material entering the pinholes thus appears to be converted at least in part from a non-dielectric to a dielectric.

The foregoing and other objects will be appreciated upon reading the following written description with reference to the accompanying drawings wherein:

FIG. 1 illustrates in exaggerated perspective a condenser formed in accordance with the present invention and showing certain films broken away to reveal the pinholes in the dielectric; and

FIG. 2 is an exaggerated cross section of a produced condenser similar to FIG. 1.

Briefly, the art of coating by vapor deposition comprises establishing a zone of vaporization within an evacuated chamber to vaporize material therein and thereafter

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depositing the vaporized material upon a substratum for condensation upon an article to be coated. For a detailed description of a preferred means of vapor deposition the reader is referred to Ora F. Kuhlman patent application, Serial No. 568,345 filed February 28, 1956, now Patent No. 2,960,457, for Method of Vaporizing Coating Materials.

In connection with the present invention a base material 12, which in a selected embodiment is glass, is deposited within a suitable chamber to receive vaporized material thereon. A vaporized film of electro-conductive material 14 such as metal is next deposited and condensed on base 12 to coat the latter.

In the illustrated condenser, the vaporized dielectric 16 has been deposited on metallic film 14. Due to certain factors presently unknown to applicant, the dielectric disperses to define small pinholes 18 which have been exaggerated for purposes of illustration. If the second metallic film 20 in vaporized form were deposited immediately on dielectric 16, film 20 in its vaporized condition would enter apertures 18 establishing, when condensed, electrical communication between metallic films 14 and 20 and effecting a short circuit in use of the formed condenser. According to the present invention a film of vaporized, semi-conductive material 22 of high purity is deposited on the dielectric to completely cover the latter and fill the apertures 18. When a film 20 of vaporized metal is thereafter deposited, resistance material 22 prevents electrical communication between the metal film 14 and metal film 20 and avoids the short circuiting in use of the end product.

FIG. 2 illustrates a preferred embodiment of a condenser formed with specific materials superimposed one on the other through vapor deposition. Base 24 has been covered by a layer of metal 26 which in turn is covered by dielectric 28 formed of silicon oxide. A film of silicon 30 of relatively high purity overlies dielectric 28 and has also entered the formed pinholes 32 in the dielectric. Finally a second film of metal 34 has been deposited on dielectric 30.

It will be readily apparent that a film of silicon 30 may be deposited on metal 26 with dielectric 28 overlying it and the dielectric may or may not be superimposed by additional resistance material 30 and still prevents short circuiting in the use of the end product. Where, however, an oxidizable material such as silicon is deposited upon dielectric 28 and permitted to enter pinholes 32, oxidation appears to occur, converting the silicon at least in part to a dielectric and eliminating the problem of leaking caused by pinholes in the dielectric.

The invention has been described for purposes of illustration with reference to condensers. It will be appreciated that the invention has utility in substantially any situation where two electro-conductive layers require an interposed insulating material. For example, the invention lends admirably to the insulation of circuits printed one on another.

Thus, although the foregoing invention has been described in some detail for purposes of clarity, it will be appreciated that certain modifications may be made within the spirit of the invention as limited only by the appended claims.

What is claimed is:

1. A method of forming multiple layer objects by vapor deposition on a base including the steps of depositing a

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first film of vaporized electro-conductive material on the base, depositing a film of vaporized silicon oxide upon said first film and permitting said film of silicon oxide to cure to define a plurality of pinholes, depositing a film of silicon on said film of silicon oxide to cover the latter and enter the defined pinholes, and then depositing a second vaporized electro-conductive film on said film of silicon.

2. A condenser formed by vapor deposition including a film of silicon oxide sandwiched by first and second electro-conductive films; said film of silicon oxide defining a plurality of pinholes, and a lamina of silicon disposed

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between said film of silicon oxide and one of said metallic films and penetrating said defined pinholes.

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