Dec. 3, 1940. M. SANDER 2,223,833

ELECTRIC CONDENSER

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Fig. 1.

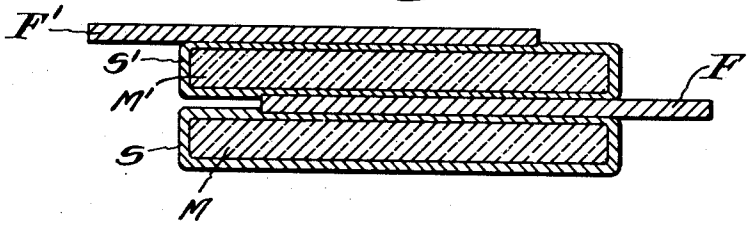
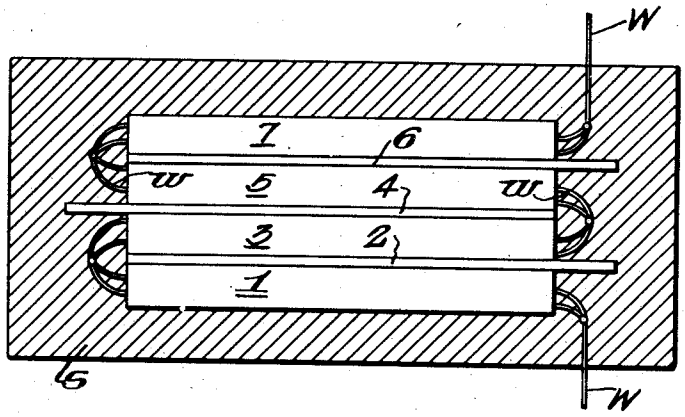


Fig. 2.



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ELECTRIC CONDENSER

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2 Claims. (Cl. 175—41)

My invention relates to electric condensers, particularly to "fixed" condensers, and has special reference to the provision of improvements in condensers formed of alternate sheets of mica and metal foil encased in an insulating protective material.

The principal object of my invention is to provide a mica condenser which shall exhibit a zero or some desired low positive or negatve temperature coefficient of capacitance, in addition to other desirable electrical and mechanical characteristics.

Another object of my invention is to provide an improved method of manufacturing mica condensers.

The invention will be better understood from the following description when considered in connection with the accompanying drawing and its scope is indicated by the appended claims.

In the drawing,

Figure 1 is a cross-sectional view of a section of a mica condenser constructed in accordance with the principle of my invention, and

Figure 2 is a view, partly in section, of a multi-section condenser embodying my invention.

My present invention is predicated upon my discovery that certain insulating materials heretofore used in making paper condensers possess certain novel and hitherto unsuspected properties when used in conjunction with mica sheets or plates. Specifically, I have discovered that styrol and the polymerization products thereof (hitherto used in the paper condensers as moisture-proofing impregnants) exhibit a change in dielectric constant, with temperature, which is opposite to that exhibited by mica, and I utilize this phenomenon to construct a mica condenser having any desired temperature coefficient of capacitance.

In carrying the invention into effect, the mica is first split to a desired thickness and the sheets are dipped in a solution of styrol, metastyrol, or polystyrol, or like styrol derivative, in toluol, or similar solvent. Thin films of the selected material are thus formed all over the mica sheets, the film thickness depending upon the proportion of styrol and solvent in the solution.

Alternatively, the styrol may be sprayed upon the mica. If heavier films of styrol are desired, the mica sheets are preferably dipped or sprayed several times, thorough drying taking place after each application of the styrol. The application of several thin films, rather than a single thick coat, obviates wrinkling.

The coated, dry, non-tacky, mica sheets may be stored until needed and may then, if necessary, be cut or punched to the desired dimensions and then stacked with metal armatures to form a section of a desired number of layers. These sections are then placed under mechanical pressure and raised to a temperature of about 100° C., preferably in vacuo. The styrol softens and flows under the pressure, slowly driving out the moisture and filling up all margins. The several metal and mica sheets or plates comprising a section are thus urged into firm and intimate contact and when dried form a rigid assembly free from voids and sealed against moisture.

Several sections, the exact number depending upon the ultimate capacitance desired, may then be assembled in a suitable casing and filled with a high melting point, low cost, low loss, insulating material, such for example, as sulphur, which, of itself, need not necessarily be moisture-proof. Alternatively, the auxiliary casing may be dispensed with and the entire capacitor encased in a mass of styrol.

The dielectric constant of mica increases with temperature. The dielectric constant of styrol (and its derivatives), decreases with temperature. Accordingly, when a mica sheet of a given thickness is encased in a film or coat of styrol, the change in dielectric constant of the coated mica will be that dictated by the relative thickness of the styrol coating, i. e., the thicker the styrol coating, the lower the overall change in the dielectric constant of the composite sheet. Accordingly, by proportioning the thickness of the styrol coating with respect to the thickness of the individual mica elements, I am able to construct a capacitor having substantially any desired low temperature coefficient of capacitance.

A further advantage of my invention resides in the fact that the power factor of the described styrol coated mica condenser is substantially constant, i. e., it does not increase when the condenser is subject to the maximum temperatures to which mica condensers have heretofore been subject. Consequently, the condensers of my invention may be used under conditions of temperature which would cause excessive power losses in analogous prior art condensers.

In the drawing, Fig. 1 shows so much of condenser section as is necessary for a clear understanding of my invention. Here M, M' designate sheets of mica coated with one or more layers S—S' of styrol, or the polymerization products thereof, and F, F' designate metal foil armatures arranged in the usual manner with

edge portions of each armature extending outwardly in opposite directions beyond the insulating layers. The section is shown at that stage of its construction whereat the pre-formed hard, non-tacky coatings of styrol have been resoftened by the application of heat and the metal armatures have been pressed down and embedded in the styrol to form an air and moisture-proof bond therewith.

Fig. 2 shows a number of capacitor sections, 1, 3, 5 and 7, separated by interposed spacers 2, 4 and 6, and series connected by short soldered leads *w*. The capacitor section, not here shown in detail, will be understood to comprise a suitable number of elemental capacitors formed of alternate layers of metal and styrol coated mica. The entire stack of sections is shown encased in a mass S of styrol of any desired thickness. Leads W from the outermost capacitor sections 1 and 7 extend outwardly in opposite directions through the casing material.

Certain modifications of my invention will suggest themselves to those skilled in the art. It is to be understood, therefore, that the foregoing is to be interpreted as illustrative and not in a limiting sense, except as required by the prior art and by the spirit of the dependent claims.

What is claimed is:

1. An electric condenser comprising alternate layers of metal and mica, said mica being provided with an insulating coating constituted substantially entirely of styrol, the thickness of the styrol coating being such that the temperature-capacity characteristic of the condenser is substantially constant.

2. An electric condenser comprising alternate layers of metal and mica, said mica being provided with an insulating coating constituted substantially of styrol, the thickness of the styrol coating being such that said condenser exhibits a desired temperature coefficent of capacitance.

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