May 5, 1942. S. RUBEN 2,281,602

ELECTROSTATIC CONDENSER AND SPACER THEREFOR

Filed Dec. 9, 1938

Fig. 1

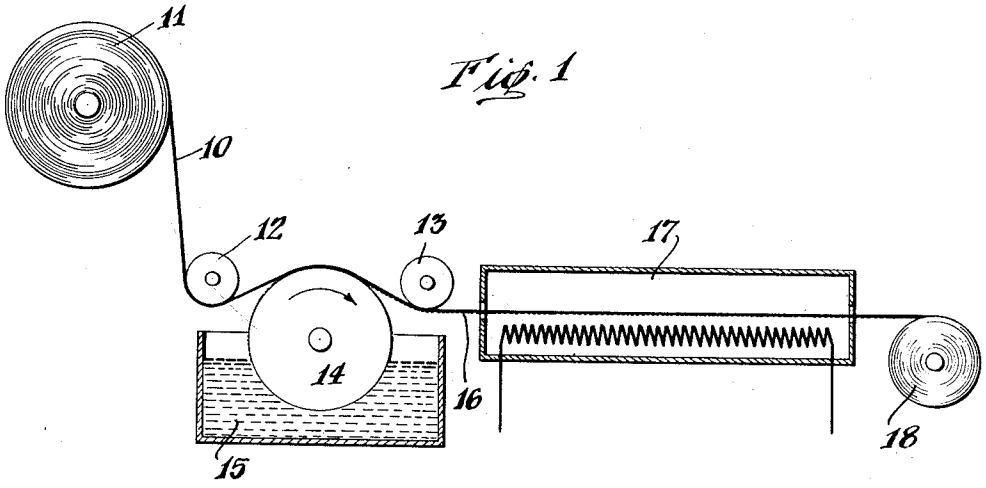


Fig. 2

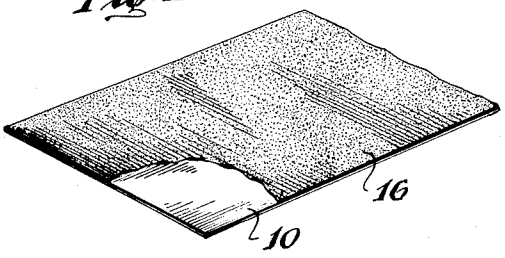


Fig. 4

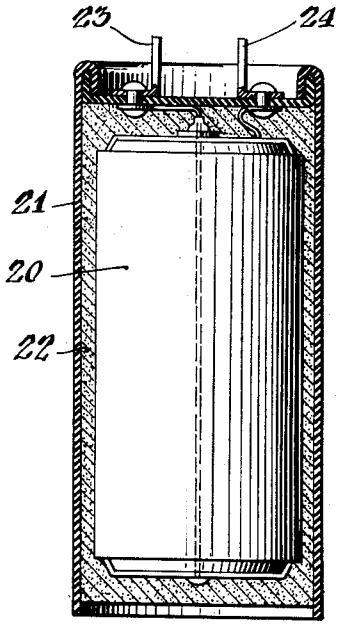
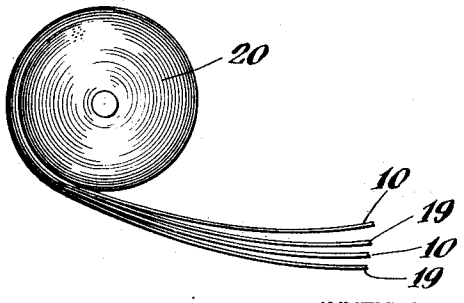


Fig. 3



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ELECTROSTATIC CONDENSER AND SPACER THEREFOR

Samuel Ruben, New Rochelle, N. Y.

Application December 9, 1938, Serial No. 244,755

6 Claims. (Cl. 175—41)

This invention relates to electrostatic condensers.

It is an object of the invention to improve the construction and operating characteristics of such condensers.

Other objects of the invention will be apparent from the following description and accompanying drawing taken in connection with the appended claims.

The invention comprises the features of construction, combination of elements, arrangement of parts, and methods of manufacture and operation referred to above or which will be brought out and exemplified in the disclosure hereinafter set forth, including the illustrations in the drawing.

In the drawing:

Figure 1 is a diagrammatical view illustrating one method of producing spacers for electrostatic condensers embodying the present invention;

Figure 2 illustrates a portion of a spacer produced by the apparatus;

Figure 3 is an end view of a condenser section partly assembled; and

Figure 4 is a sectional elevation of a completed condenser.

According to the present invention a coating is applied to the spacers for electrostatic condensers to improve their characteristics and use in such condensers.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure and the construction of parts without departing from the spirit of the invention. In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

In condensers of the prior art, where paper spacers have been used, it has been found necessary to use at least two sheets of paper between the condenser electrodes in order to insure that proper insulation is obtained. This is due to the fact that all commercial paper contains spots of conductive material such as small metal particles and the like which would provide conductive paths between the condenser electrodes if only one sheet were used. If it were not for the presence of such conductive particles it would be possible to use single thicknesses of paper or other sheet dielectric material with a consequent closer spacing of the electrodes and increased capacity of the condenser.

A somewhat similar problem is encountered where other sheet dielectric spacers are used such as plasticizer-free regenerated cellulose. Although regenerated cellulose may be free of conductive particles it appears to break down at spots under relatively low voltages, possibly due to some sort of ionic disassociation within the spacer material.

I have discovered that by coating the sheet dielectric material (for example, 0.3 mil kraft paper or 0.4 mil Cellophane) with a porous coating, preferably applied as a lacquer, that the above difficulties are overcome and a condenser spacer is obtained which will withstand much higher voltages even where a single spacer thickness is used. This makes possible condensers of higher capacity due to the closer spacing of the electrodes that is obtainable. Apparently the porous coating breaks the continuity of contact where a conductive particle is embodied in the paper and also performs a similar function with a Cellophane spacer.

Referring to the drawing the coating is applied by a printing method as illustrated in Figure 1. In this figure the dielectric sheet material 10 contained in roll 11 is unwound from the roll and passes under rollers 12 and 13 and over roller 14. Roller 14 is mounted so that the lower half of the roller dips into a bath 15 of the coating material suspended in a suitable solvent for the binder used.

I have found that it is preferable to use a coating of low binder content so as to produce a layer having a highly porous character which can be evacuated prior to impregnation of the condenser and which can then be impregnated with a suitable dielectric composition.

The bath 15 comprises a binder and a filler which are both good dielectric materials and preferably materials of low power factor loss. These materials are mixed with a suitable quantity of a solvent which dissolves the binder.

For the filler material I prefer to use pure titanium oxide which has been properly fired at high temperatures such as 1200° C. to form the desired crystal structure, and which has then been ground to a very fine powder. Titanium oxide is preferred because of its high dielectric constant, which allows a higher composite capacitance to be obtained than with most other materials. However, in some cases other finely powdered dielectric materials such as aluminum ox-

ide, silica and other insulating pigments may be used.

For the binder I prefer to use polystryrene because of its low dielectric losses. Other materials which are suitable as binders are urea-alkyd resins, combinations of polystyrene with urea-alkyd resins and combinations of polystyrene with poly-chlor-phenols.

A suitable solvent for polystyrene and the other materials is xylol. A suitable bath may contain for example, 200 grams of titanium oxide suspended in 1000 c. c. of a 1% to 5% solution of polystyrene in xylol. The percentage of binder may be varied with the porosity of the sheet material and the desired porosity of the coating. The dielectric sheet material 10 is drawn over the top surface of roller 14 which, in rotating, carries a layer of the coating material into contact with the under surface of the sheet 10, producing a porous coating 16 thereon. The sheet 10 carrying the coating 16 then passes through a drying oven 17 where the solvent is driven off leaving the binder and filler material adhering to the surface of the sheet, which is then rolled up into roll 18.

In some cases coating one side of the sheet is sufficient. However, if both sides are to be coated the sheet can be run through the apparatus of Figure 1 again with the sides reversed.

Figure 2 is a perspective view of a portion of the finished sheet 10 carrying a surface coating 16 of the binder and filler materials.

In producing an electrostatic condenser two strips of coated sheet dielectric material 10 are wound together with two foil strips 19 to form a wound condenser section 20, illustrated partly assembled in Figure 3.

Figure 4 illustrates a finished condenser comprising the condenser section 20, whose two electrodes 19 are connected respectively by a suitable contact arrangement with two terminals 23 and 24 which are riveted to the cap of cardboard tube 21 containing the condenser section 20. After assembly the condenser is preferably evacuated and then impregnated with a melted dielectric composition 22, which not only impregnates the spacer sheets 19 but also fills in extra space in tube 21 surrounding the section 20; thus completely enveloping the condenser section in dielectric, water proof material and also impregnating the cardboard tube 21.

The material 22 may preferably be a normally solid dielectric composition such as that described in my prior filed co-pending application, Serial Number 235,543, filed October 18, 1938.

The preferred dielectric material comprises the combination of a hydrocarbon resin such as solid hydrogenated naphthalene with a plasticizer such as mineral oil, castor oil or the like.

The present invention makes it possible to use a single sheet spacer for electrostatic condensers, whether the spacer be of paper or Cellophane or of other similar material, and greatly increases the breakdown strength of such condensers.

While the present invention, as to its objects and advantages, has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby but it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. An electrostatic condenser wherein a pair of foil electrodes are interwound with dielectric sheet spacers forming a roll and the roll is impregnated with a dielectric impregnating material, said spacers being subject to spot conductive breakdown under applied voltage, characterized by the fact that there is combined with each of said spacers a porous coating of finely divided granular crystalline dielectric material and a binder bonding said granular material to the surface of said spacer, whereby to prevent direct contact between said surface and the co-operating foil electrode.

2. An electrostatic condenser wherein a pair of foil electrodes are interwound with dielectric sheet spacers forming a roll and the roll is impregnated with a dielectric impregnating material, said spacers being subject to spot conductive breakdown under applied voltage, characterized by the fact that there is combined with each of said spacers a porous coating of finely divided granular crystalline inorganic dielectric material and a binder bonding said granular material to the surface of said spacer, whereby to prevent direct contact between said surface and the co-operating foil electrode.

3. An electrostatic condenser wherein a pair of foil electrodes are interwound with dielectric sheet spacers forming a roll and the roll is impregnated with a dielectric impregnating material, said spacers being subject to spot conductive breakdown under applied voltage, characterized by the fact that there is combined with each of said spacers a porous coating of finely divided granular crystalline titanium oxide and a binder bonding said granular oxide to the surface of said spacer, whereby to prevent direct contact between said surface and the co-operating foil electrode.

4. An electrostatic condenser wherein a pair of foil electrodes are interwound with plasticizer-free regenerated cellulose sheet spacers forming a roll and the roll is impregnated with a dielectric impregnating material, said spacers being subject to spot conductive breakdown under applied voltage, characterized by the fact that there is combined with each of said spacers a porous coating of finely divided granular crystalline inorganic dielectric material and a binder bonding said granular material to the surface of said spacer, whereby to prevent direct contact between said surface and the co-operating foil electrode.

5. An electrostatic condenser wherein a pair of foil electrodes are interwound with paper spacers forming a roll and the roll is impregnated with a dielectric impregnating material, said paper spacers having spots of conductive material therein, characterized by the fact that there is combined with each of said spacers a porous coating of finely divided granular crystalline inorganic dielectric material and a dielectric binder bonding said granular material to the surface of said spacer, whereby to prevent direct contact between said conductive spots and the co-operating foil electrode.

6. An electrostatic condenser of the wound foil type comprising foil electrodes and a single dielectric spacer therebetween, said spacer comprising a cellulose sheet characterized by the presence of conductive particles, a coating comprising finely divided inorganic insulating material on the surfaces of said sheet to prevent contact of said conductive particles with said electrodes, and a dielectric impregnating said paper and said porous coating.

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