

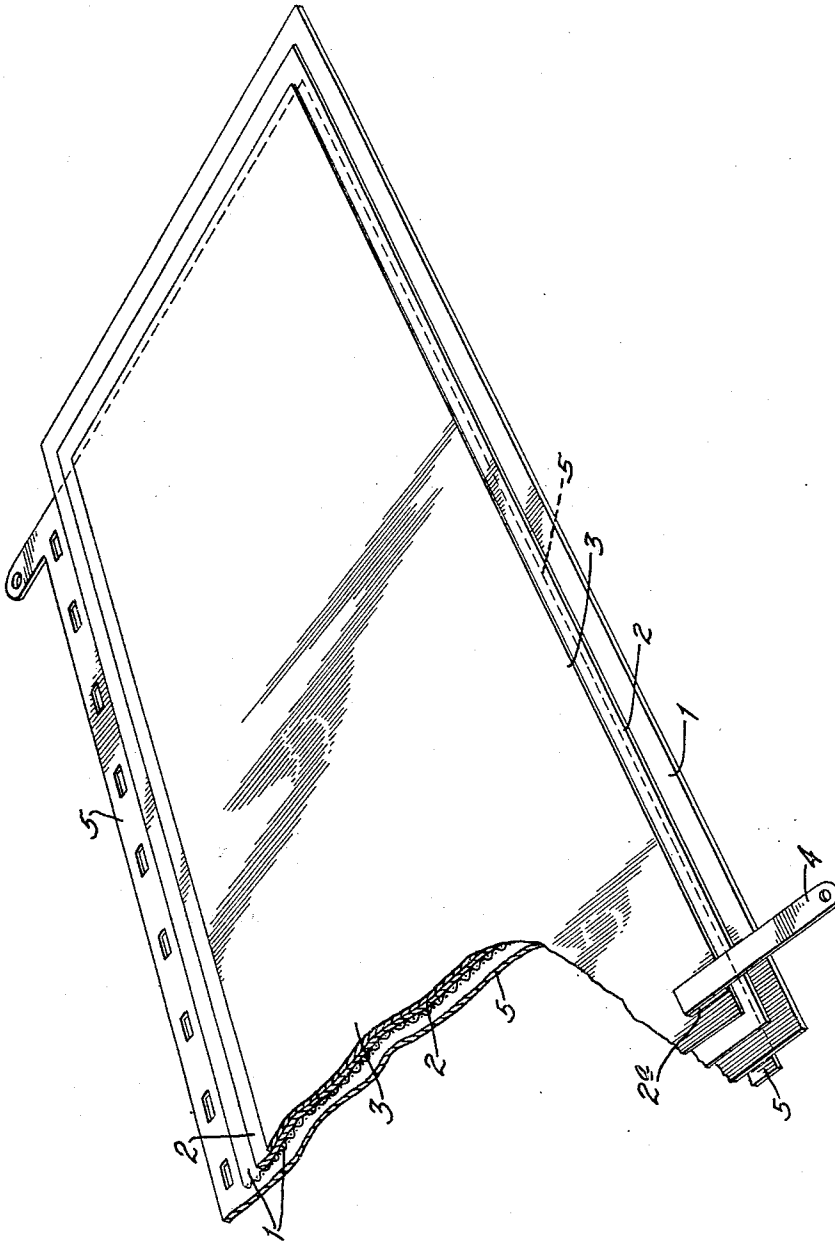
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ACOUSTIC CONDENSER DIAPHRAGM

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UNITED STATES PATENT OFFICE

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ACOUSTIC CONDENSER DIAPHRAGM

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This invention relates to condenser or acoustic diaphragms, and has for its object to provide an improved structure for an acoustic condenser diaphragm or like device.

A further object is to increase the dielectric strength of a diaphragm of this class, as well as to improve its flexibility and smoothness. A further object is to reduce the cost of a structure of this class.

These and other objects, as will presently appear, are accomplished by this invention which is fully described in the following specification and shown in the accompanying drawing, in which the figure is a perspective view of a diaphragm partially cut away to illustrate the structure.

There are various uses for my invention, an example being in connection with a condenser reproducer such as is disclosed in an application for Letters Patent of the United States, Serial No. 352,201, entitled, Acoustic condenser, filed April 3, 1929, by Philip E. Edelman, in which case my invention may be utilized in the dielectric diaphragm structure of the device therein described.

In such devices, a dielectric diaphragm consists of a flexible thin sheet of insulating material, such, for instance, as a fabric impregnated with insulation filler or oxidized linseed oil, or oil and asphaltum compound of the class known in the electrical trade as, empire cloth, to which a coating of thin metal foil or sprayed metal finely divided in a varnish base, is attached. It has been customary, heretofore, to employ sizing, lacquer, or varnish to cause the metal foil or finely divided metal to adhere to the insulating cloth. While this practice has been successful, it causes manufacturing difficulties, due to the fact that a solvent is necessarily used in the varnish size base.

If, for example, metal foil is applied over an empire cloth surface prepared with japan gold size varnish, the varnish tends to remain in liquid form for a long time, because, covered by the foil surface which keeps the varnish out of contact with the air. This permits the solvent of the varnish to physically attack the impregnated insulation of the empire cloth and dissolve or mix there-

with. In such case, the dielectric strength of the empire cloth becomes weakened, due to such dilution.

A further trouble is found in the divergent electrical characteristics of the adhesive varnish with respect to the impregnated cloth, in that the dielectric constant of the varnish is greater and causes unequal potential gradient distribution in the combined dielectric comprised by the empire cloth and the thin layer of varnish carried thereon. Furthermore, the varnish in slowly drying tends to somewhat stiffen the empire cloth after a time, destroying part of its desired flexibility. The trouble manifests itself in production, chiefly in the case where empire cloth is used which is slightly imperfect, or has its threads pulled with greater than normal spacing during manufacture. In the latter case, varnish tends to fill in the weakened portion of the cloth, but offers a different characteristic dielectric path, such that electrical rupture sometimes occurs.

The stated problem may be practically solved by a new and useful structure for a condenser dielectric, in which a wax having adhesive properties is employed instead of an adhesive varnish, and in conjunction with the new product thereby afforded, I have provided a suitable method for making same herein set forth. Generically I prefer to combine with an empire cloth or varnish impregnated cloth of commerce, a thin layer of insulating wax coated on one surface of the cloth, to which a metal foil is applied and fastened under the influence of sufficient heat to melt the wax coating. Or I may incorporate finely divided aluminum bronze in a pot of melted wax and spray same onto the cloth in a well known manner.

In either case, the melted wax tends to spread evenly and where necessary to fill in any defective areas of the insulating cloth with a good electrical insulator having approximately the same dielectric constant as the empire cloth itself affords. A further advantage arises from the fact that the wax solidifies promptly and it is not necessary to wait for a solvent to dry out or oxidize as in the case of a varnish adhesive material. In

general, I may use any wax for the purpose, that is to say, any of the known combinations of carbon, hydrogen and oxygen consisting chiefly of esters other than those of glycerine or of free fatty acids, such for example, as beeswax, spermaceti, Chinese wax, carnauba wax, or ceresin.

I prefer to employ a wax, such as cerowax, which has adhesive properties as well as flexibility in its solid state, as it does not become brittle, or crack, but tends to improve the flexible sound deadening characteristic of soft empire cloth. Such wax further tends to improve the weather-proof characteristic of empire cloth, and preserve its operating life for a period longer than normal by excluding moisture from the surface of the oiled cloth.

Referring to the illustration shown, my preferred structure for the condenser dielectric or diaphragm consists of a sheet of oiled insulating compound impregnated cloth or empire cloth, which may be stretched upon a frame (not shown) and upon one side of this cloth a thin layer of wax 2 is coated, while the metal foil 3 is attached to cloth 1 by means of the adhesive wax 2. A terminal 4 may be similarly fastened to the metal foil 3 by means of wax 2 coated on one side of the strip terminal 4, so that an electrical potential may be applied thereto. Any co-operating electrode 5 may be used to complete a condenser structure.

The preferred manner of applying wax 2 to dielectric fabric 1 is to rub a piece of solid wax 2 lightly over a heated flat iron and to rub the waxed flat iron evenly over one side of the cloth 1, while said cloth is held stretched lightly to remove wrinkles therefrom and flat on a work table. The wax coating becomes visible by its dull surface upon cooling. I may also draw one surface of cloth 1 continuously and under tension over a roller maintained in contact with a pot of molten wax.

The preferred manner of applying foil 3 to the waxed dielectric sheet 1, 2, is to lay the metal foil down on the waxed sheet, lay a thin sheet of fibrous material over the foil, and apply a warm iron with pressure over the fibrous top sheet, thereby causing the wax 2 to melt and the foil 3 to smoothen so that when the heat is removed the foil will be held against the cloth 1 by the wax 2. For continuous operation, I may employ rollers in a well known manner so that a hot roller presses the foil against the wax coated empire cloth moved with respect thereto. The drawing shows the dielectric structure on an exaggerated scale for purpose of illustration. Practical relative thicknesses, for example, are: for cloth 1, .003 to .005 inch; for wax layer 2, .00005 to .0001 inch; and for metal foil 3, aluminum foil .0001 to .0002 inch.

The composite dielectric diaphragm or laminated structure thus prepared has

permanent properties providing the result sought for, and the foil 3 adheres firmly to cloth 1 under working stresses of considerable magnitude applied when the same is used in a condenser reproducer. I am aware that the said new structure has other possible uses aside from service in an acoustic condenser, such for example, as in combinations intended for regular electrical condenser service, or in combinations intended for weatherproofing purposes.

While I have shown and described but a few embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made which do not depart from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. An acoustic condenser diaphragm consisting of a flexible impregnated fabric insulating sheet coated with wax and a metallic surface fastened to said sheet by said wax.

2. A dielectric diaphragm consisting of empire cloth coated with wax and carrying metal foil fastened thereto by said wax.

3. An acoustic diaphragm consisting of a dielectric impregnated fabric coated with a thin layer of insulating wax and a co-operating electrode surface therefor fastened to said fabric by said wax.

4. A dielectric diaphragm consisting of a flexible cloth impregnated with a dielectric insulator, a thin layer of adhesive wax coated on one surface of said cloth, and an electrically conductive coating attached to said cloth by said wax.

5. A dielectric diaphragm comprising a fabric impregnated with insulating compound, and a layer of flexible wax coated on said impregnated cloth.

6. An acoustic diaphragm comprising empire cloth coated with a flexible thin layer of a waxy substance containing oxygen, carbon, and hydrogen in the form chiefly of esters other than those of glycerine or of free fatty acids.

7. An acoustic diaphragm consisting of a thin layer of wax sandwiched between an empire cloth and metal foil in a laminated structure.

8. The method of fabricating a condenser diaphragm which consists in coating an impregnated insulating cloth with wax maintained in fluid condition by application of heat thereto.

9. The method of fabricating an acoustic condenser which consists in stretching empire cloth, and coating wax thereon under the influence of heat and pressure.

10. The method of making an acoustic condenser diaphragm which consists in applying melted wax to a sheet of empire cloth under the influence of heat and pressure, cooling

said wax, applying a layer of metal foil thereon, and fastening said foil to said cloth by means of said wax under the further influence of heat and pressure.

5 In testimony whereof, I have hereunto set my hand this 30th day of September, 1929.

EARL F. POTTER.

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