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ELECTROLYTIC CELL

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Fig. 1

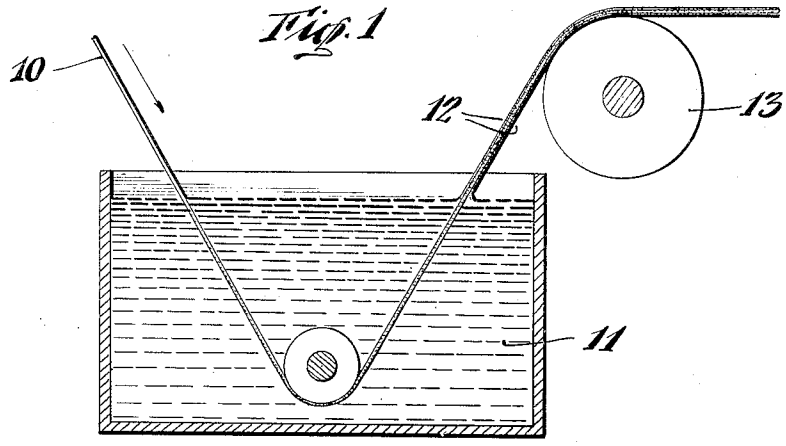


Fig. 2

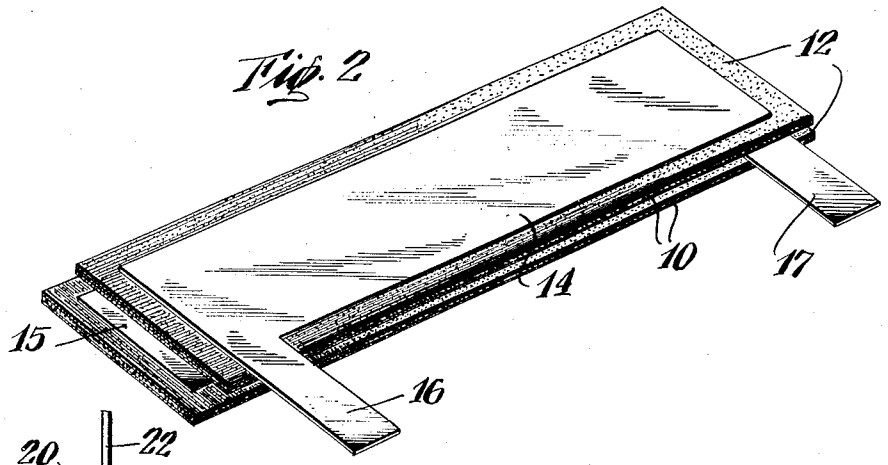
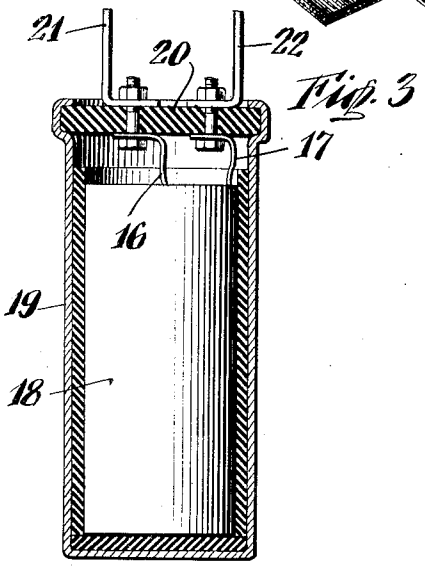


Fig. 3



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ELECTROLYTIC CELL

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4 Claims. (Cl. 175—315)

This invention concerns dry electrolytic condensers and like electrolytic cells.

An object is to provide an improved conductive spacer for use between the electrodes of such a device.

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

The present invention comprises the combination of elements, methods of manufacture, and the product thereof brought out and exemplified in the disclosure hereinafter set forth, the scope of the invention being indicated in the appended claims.

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 combination of elements without departing from the spirit of the invention.

In the drawing:

Figure 1 illustrates a step in making the spacers of the present invention;

Figure 2 illustrates a condenser assembly embodying the spacers of the invention; and

Figure 3 shows a completed condenser.

According to the invention this object is achieved by immersing a paper sheet, strip or the like in a liquid mixture formed by adding together a solution of a suitable cellulose derivative, at least one ionogen, and at least one high-boiling liquid which is not a solvent for the cellulose derivative and then drying this composition. The term "immersing" is to be taken to include both actual immersion of the paper in the liquid mixture, e. g. by passage of the paper through a bath, and deposition of the liquid mixture on to the paper. The amount of liquid mixture used is sufficient to allow liquid electrolyte to exude from the deposited film into the paper as the solvent for the cellulose derivative evaporates. Thus paper of .002" thickness may be provided with sufficient of the mixture to give a final thickness of from .003 to .005".

The paper used should be an absorbent paper with an open structure and should be of good purity. The thickness mentioned for the paper can be varied; thus a thinner paper may be used if care is taken to avoid damage in handling and in any event the thickness should not be so great as to prevent thorough saturation of the paper by the exuded electrolyte.

The conductive spacer prepared in this way is used without subsequent impregnation, thus avoiding the necessity for the usual impregnating paste and the usual impregnating operations. Due to the absence of impregnation the product is one which requires none of the usual cleansing operations following upon impregnation, particularly at the terminal tags, and the spacer is quickly made, easy to handle, and safe from the point of view of electrolyte seeping out of the cell and causing corrosion.

The spacer may be used immediately after manufacture if desired or stored for future use; it is readily reeled when in strip form.

The term "suitable cellulose derivative" is to be understood to exclude derivatives which produce corrosion of the electrodes upon decomposition, such as nitrocellulose, and those which contain free sulphates or chlorides. The preferred derivative is cellulose acetate but ethyl cellulose and cellulose aceto-butyrate may be mentioned as suitable alternatives. The solvent is preferably a low-boiling solvent such as acetone, methyl acetate or ethyl formate but a solvent of higher boiling point than these, such as ethylene glycol diacetate, may be used provided that it is one that evaporates more quickly from the mixture during casting than the high-boiling liquid; two or more of these solvents may, of course, be used simultaneously. In some cases the solvent, which is given off from the treated paper, may be recovered.

The ionogen may be one or more of the acids used in the formation of conductive compositions for electrolytic condensers, such as citric or boric acid, and/or one or more stable salts thereof, preferably ammonium salts.

Ethylene glycol, diethylene glycol, triethylene glycol and glycerine are suitable high-boiling liquids.

If desired the mixture may also include an organic borate compound such as amyl borate and/or a filler such as shellac or colophony resin.

It is preferable that the ionogen and the high-boiling liquid should be partially or wholly combined to give a reaction product since this increases the stability of the conductive mixture.

Example I.—A mixture is formed from the following ingredients:

(1)	Cellulose acetate	grs.	600
(2)	Acetone	litres	3
(3)	Ethylene glycol	grs.	350
(4)	Boric acid	grs.	250
(5)	Ethylene glycol	grs.	1,750
(6)	Boric acid	grs.	900
(7)	Aqueous ammonia (.9 specific gravity)	cc.	300

Ingredients 3 and 4 are mixed together and heated at 135° C. and ingredients 5, 6 and 7 are also mixed together, the latter mixture being heated for 14 hours at 155° C. to give a reaction product. The first mixture and the reaction product are then mixed together and added to the dope formed by dissolving ingredient 1 in ingredient 2. The final mixture is diluted with 6 litres of acetone, and is then preferably filtered and de-aerated, e. g. by heating or suction. In the mixing operations use should be made of stirring means which cause no reaction in the mixture and do not dissolve, e. g. of glass, aluminum or stainless steel.

The paper treated with the product thus obtained is fed on to the surface of a casting band or drum and maintained at an elevated temperature, e. g. 30° C. or more, the acetone being thus removed and, if desired, recovered. The speed of the paper is comparatively critical and in this Example should not depart appreciably from the value of 1.75 ft./min. The casting surface should be of aluminum, stainless steel, or other material having no detrimental effects on the mixture.

Example II.—Ingredient 4 of Example I is replaced by the same quantity of ammonium borate. In all other respects the manufacture is the same as that specified in Example I.

Referring to the drawing Figure 1 shows paper strip 10 being led through the mixture 11, which is one of the mixtures heretofore described, so as to coat and saturate the paper with the mixture, the coating 12 being shown exaggerated in the drawing. The treated paper is then fed onto the surface of casting drum 13 where the solvent is evaporated.

Figure 2 shows a condenser assembly comprising treated paper spacers 10 of the present invention assembled with electrodes 14 and 15 of film forming metal, at least one of which is film-formed, the electrodes being provided with tabs 16 and 17, respectively, for terminal connections.

Figure 3 shows a completed condenser in section, comprising the assembly of Figure 2 rolled into a roll 18 and enclosed in a container 19 provided with an insulating disc top 20 having terminals 21 and 22 connected respectively to tabs 16 and 17.

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. A film-maintaining spacer for dry electrolytic condensers comprising a paper base, a porous, non-tacky cellulose derivative selected from the group consisting of cellulose acetate, ethyl cellulose and cellulose aceto-butyrate embodied therein and thereon, and an ionogen and a high boiling liquid intimately embodied in the cellulose derivative, said ionogen being at least one of the materials selected from the group consisting of acids used in the formation of conductive compositions for electrolytic condensers and the stable salts thereof, and said high boiling liquid being selected from the group consisting of glycerine and the glycols.

2. A spacer for dry electrolytic condensers comprising a paper base, a cellulose derivative selected from the group consisting of cellulose acetate, ethyl cellulose and cellulose aceto-butyrate embodied therein and thereon, and an electroylte comprising an ionogen and a high boiling liquid embodied in the cellulose derivative, said cellulose derivative comprising a non-tacky, non-homogeneous, porous matrix carrying said electrolyte, said spacer being capable of maintaining a current-blocking film on a condenser electrode during operation of the condenser with said spacer interposed between the electrodes thereof.

3. The method of making a non-tacky, non-homogeneous, porous conductive film-maintaining spacer for dry electrolytic condensers which comprises dissolving a cellulose derivative selected from the group consisting of cellulose acetate, ethyl cellulose and cellulose aceto-butyrate, at least one ionogen and at least one high boiling liquid which is not a solvent for the cellulose derivative in a volatile solvent, immersing a strip of paper in the mixture thus produced and evaporating the volatile solvent from the treated paper.

4. The method of making a non-tacky, non-homogeneous, porous conductive film-maintaining spacer for dry electrolytic condensers which comprises dissolving the following ingredients in a common volatile solvent: (1) a cellulose derivative selected from the group consisting of cellulose acetate, ethyl cellulose and cellulose aceto-butyrate, (2) at least one ionogen selected from the group consisting of acids used in the formation of conductive compositions for electrolytic condensers and the stable salts thereof and (3) at least one high boiling liquid selected from the group consisting of glycerine and the glycols, immersing a strip of paper in the mixture thus produced and then evaporating the volatile solvent from the treated paper.

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