Oct. 31, 1939. J. M. BOOE ET AL 2,177,819

DRY ELECTROLYTIC CONDENSER

Filed Oct. 12, 1937

Fig. 1

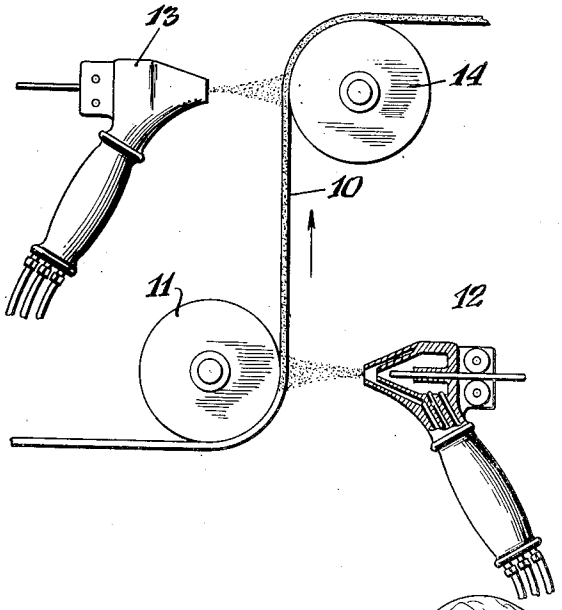


Fig. 2

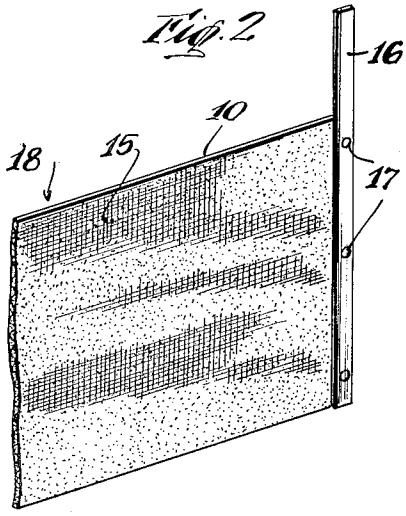


Fig. 3

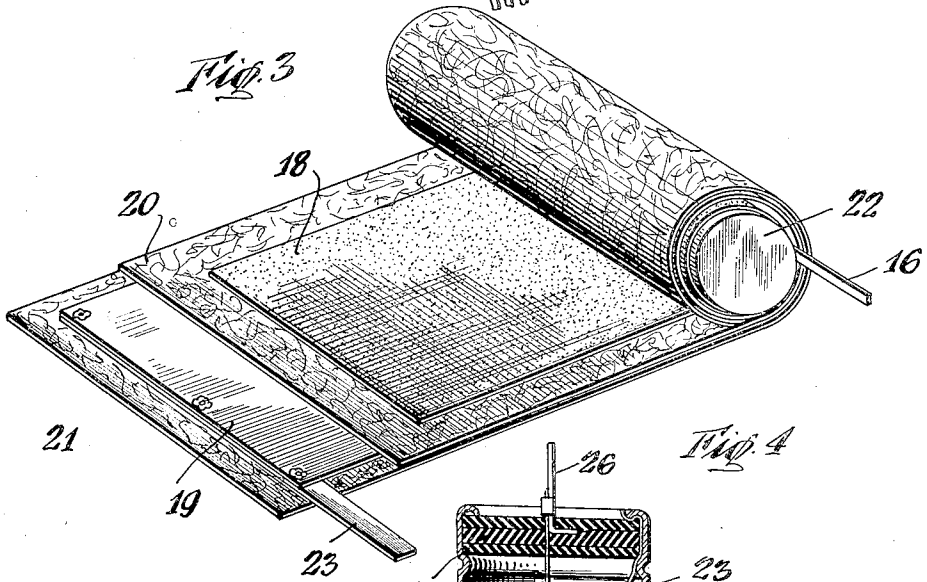
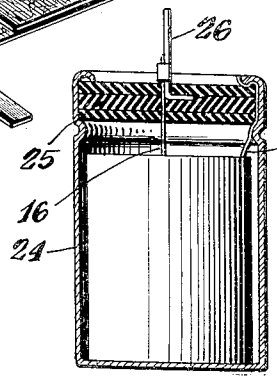


Fig. 4



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DRY ELECTROLYTIC CONDENSER

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Application October 12, 1937, Serial No. 168,542

4 Claims. (Cl. 175—315)

This invention relates to dry electrolytic condensers.

An object of the invention is to improve dry electrolytic condensers and electrodes therefor.

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 shows one method of preparing improved electrodes for dry electrolytic condensers;

Figure 2 illustrates a completed electrode;

Figure 3 shows a partly assembled dry electrolytic condenser embodying the electrode; and

Figure 4 shows a complete condenser assembly.

According to the present invention a dry electrolytic condenser is provided having a flexible electrode formed of cloth upon which a film-forming metal has been deposited in cohering finely divided form, by such a method as a metal spray process.

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.

Referring to the drawing Figure 1 shows a method of forming the flexible electrode which comprises leading a strip of cloth **10** over a roller **11** and simultaneously spraying a deposit of film-forming metal, such as aluminum, onto it by a Schoop spray gun **12**. If desired, but not necessarily, the cloth can then be sprayed on the opposite face by Schoop gun **13** as it is led over a second roller **14**.

The cloth used should preferably be a relatively loose woven open mesh fabric of loose-twisted threads so that the sprayed metal can penetrate between the threads and hence be distributed throughout a considerable proportion of the cloth layer. The surface area of the sprayed metal is made very great not only because of the inherent porous nature of sprayed metal consisting of finely divided particles bonded together but also because of the lattice work of the gauze or cloth and the contour and spacing of the cloth fibres among which the metal particles are interspersed.

Many varieties of cloth or gauze can be used. Muslin, cheesecloth, cotton gauze and the like are especially suitable in the various weights and thread spacing obtainable commercially. The cloth should preferably be bleached and unsized and free of impurities such as chlorides. An advantage of cloth as a base is that it is readily obtainable in pure form.

The spraying time and density are preferably regulated so as to produce a sheet which is porous and flexible enough to roll without cracking but in which the sprayed metal particles are bonded together sufficiently to conduct electricity throughout the sheet, even after film-formation. In the preferred embodiment it will be found desirable to use cloth of relatively open mesh and to regulate the spraying so as to leave quite a few pin-holes through which it is possible to perceive light when the electrode sheet is held up before a light source.

The film-formation may be carried out by conventional methods known to the electrolytic condenser art such as by passing the electrode through a solution of borax and boric acid and passing a uni-directional electric current between the electrode and the solution.

Figure 2 shows a completed electrode **18** comprising a length of cloth **10** sprayed with aluminum **15**, as described. A suitable terminal **16** is secured to the electrode by laying it along the edge and punching holes **17** through the assembly to provide interlocking portions.

Figure 3 shows a dry electrolytic condenser partly assembled and comprising electrode **18** as anode and a co-operating foil cathode **19** having a terminal **23** interspaced with electrolyte permeable sheet spacers **20** and **21**, such as paper, cloth, regenerated sheet cellulose or the like and wound on a mandrel **22**.

The condenser is impregnated with a viscous film-maintaining electrolyte of the type used in dry electrolytic condensers. A suitable electrolyte comprises:

Boric acid	ounces	20
Ammonium hydroxide	cc	135
Ethylene glycol	cc	640

boiled together until the boiling point of the composition reaches approximately 120° C. to 140° C. depending on the sparking voltage required. An electrolyte of fairly low viscosity and substantially

free from crystals at the time of impregnation is most suitable. The viscosity of the above electrolyte may, in most cases, be between 1 and 3 at 200° F. as compared with water at 60° F.

However, even more viscous electrolytes can be used. The high porosity of the electrode enables viscous electrolytes to be squeezed through the sheet and into the numerous pores and recesses during impregnation. In addition the wick-like nature of the electrode tends to draw up the electrolyte and hold it within its pores by capillarity.

If the condenser is intended for AC operation it is obvious that a second electrode similar to 18 can be used in place of foil 19.

Figure 4 shows a completed condenser comprising the assembly of Figure 3 inserted in a can 24 provided with a laminated insulating top 25 having a central terminal 26 attached to tab 16 of the condenser. Tab 23 is spun under the edge of the can so that the can serves as the other terminal.

As an indication of the advantages obtainable by the present invention it has been found that sprayed aluminum electrodes according to the invention may have from 10 to 20 times the capacity of plain aluminum foil electrodes of the prior art. The result is that condensers of a given capacity can be made in correspondingly smaller sizes or that correspondingly greater capacities can be obtained with the same sizes.

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 flexible sheet electrode for dry electrolytic condensers comprising a cloth base and finely divided film-forming metal deposited thereon, said metal particles cohering to provide a conductive path along the electrode layer and said electrode being sufficiently open-mesh and porous to permit light to pass through the electrode layer at a multiplicity of distributed points throughout its area.

2. A dry electrolytic condenser comprising two electrodes, a spacer and an electrolyte, one of said electrodes comprising a cloth base and finely divided film-forming metal deposited thereon, said electrode having recesses in the surface thereof resulting from the contours and lattice structure of said cloth base, said metal particles cohering to provide a conductive path along the electrode layer and said electrode being sufficiently open-mesh and porous to permit light to pass through the electrode layer at a multiplicity of distributed points throughout its area.

3. A dry electrolytic condenser comprising two electrodes and paper spacers in enrolled form impregnated with a viscous film forming electrolyte, one of said electrodes comprising a cloth base and finely-divided film-forming metal deposited thereon, said electrode having recesses in the surface thereof resulting from the contours and lattice structure of said cloth base, said metal particles cohering to provide a conductive path along the electrode layer and said electrode being sufficiently open-mesh and porous to permit light to pass through the electrode layer at a multiplicity of distributed points throughout its area.

4. A flexible sheet electrode for dry electrolytic condensers comprising a cloth base and finely divided aluminum deposited thereon, said electrode having recesses in the surface thereof resulting from the contours and lattice structure of said cloth base, said metal particles cohering to provide a conductive path along the electrode layer and said electrode being sufficiently open-mesh and porous to permit light to pass through the electrode layer at a multiplicity of distributed points throughout its area.

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