July 30, 1946. J. M. BOOE 2,404,824

ELECTROLYTIC CONDENSER AND ELECTRODE THEREFOR

Filed Feb. 10, 1942

Fig. 1

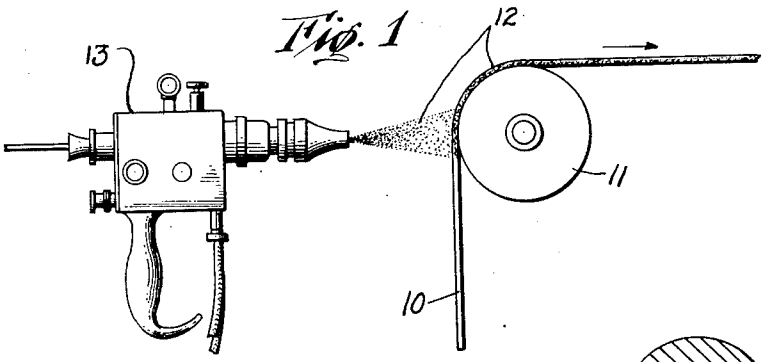


Fig. 2

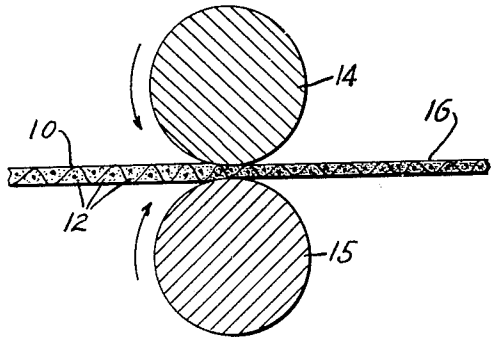


Fig. 3

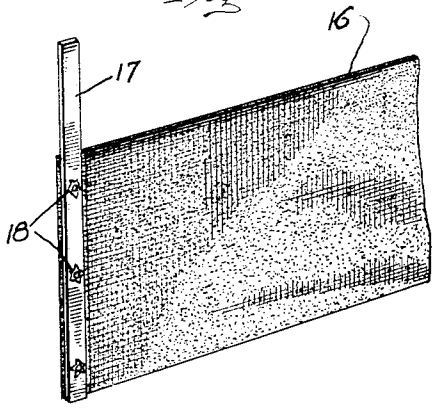


Fig. 5

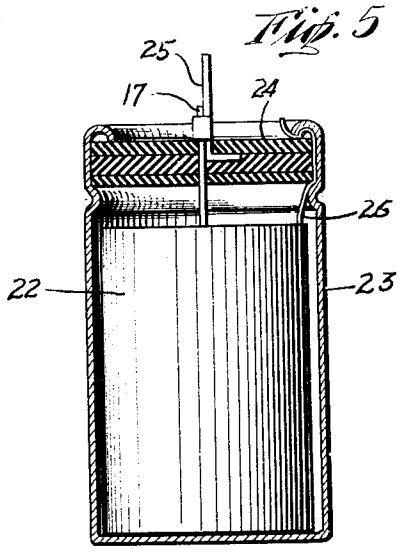
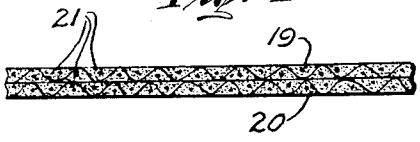


Fig. 4



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ELECTROLYTIC CONDENSER AND ELECTRODE THEREFOR

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7 Claims. (Cl. 175—315)

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This invention relates to electrolytic condensers.

An object of the invention is to improve electrolytic condensers and the electrodes therefor, and particularly to improve dry electrolytic 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 illustration in the drawing.

In the drawing:

Figure 1 shows the initial step in the method of preparing a condenser electrode;

Figure 2 illustrates a subsequent step which comprises rolling the electrode between pressure rolls;

Figure 3 illustrates a completed electrode;

Figure 4 is a section through a portion of a modified form of electrode; and

Figure 5 is a sectional view of a completed condenser.

This invention relates particularly to electrolytic condensers having at least one of their electrodes formed of a finely divided film-forming metal, such as aluminum, deposited in cohering finely divided form upon a porous flexible sheet base such as cloth or gauze. The film-forming metal is preferably deposited by a metal spray process using a metal spray gun wherein metal particles are sprayed and simultaneously heated or melted.

According to the present invention the electrode element comprising a porous or fibrous base carrying a coherent adhering layer of finely divided film-forming metal particles, is subjected to pressure to reduce its thickness and compress the porous electrode metal layer. This is preferably accomplished by rolling the electrode between cooperating calendering rolls of hardened steel or the like.

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

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generic in their application to similar parts as the art will permit.

Referring to the drawing, Figure 1 shows a method of producing the flexible electrode which comprises leading a strip of cloth 10 over a roller 11 and simultaneously spraying a deposit of film-forming metal 12, such as aluminum, onto the cloth by a Schoop spray gun 13 as it is led over the roller.

While a variety of porous or fibrous bases may be used, the preferred material is a relatively loose woven open-mesh cotton cloth of high purity. Muslin, cheesecloth, cotton gauze and the like are especially suitable in the various weights and thread spacings obtainable commercially. The cloth should preferably be bleached and unsized and free of impurities such as chlorides.

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, thereby forming a porous coherent and adherent layer of metal particles.

According to the present invention the electrode sheet or strip formed in this manner is compressed, as by rolling, as illustrated in Figure 2. It will usually be found desirable to chemically clean the sheet electrode, however, before rolling. This may preferably be done by boiling the sprayed electrode for a short time, such as two minutes, in a dilute borax solution, such as a 0.1% borax solution. It is found that this cleaning before rolling results in an increase in capacity of the finished condenser. Or the borax cleaning will permit a greater reduction in thickness without increasing the power factor or reducing the capacity of the condenser produced from the electrode. It also reduces the power and chemicals required for electrolytic film-formation, shortens the aging time of the condensers and results in a better shelf life and a longer operating life for the condensers.

The cloth layer 10 carrying spray deposited aluminum particles 12 is rolled and thereby reduced in thickness by passing it between a pair of cooperating steel rollers 14, 15 as shown in Figure 2, thereby resulting in a rolled electrode 16 which is thinner than the original sprayed cloth layer.

The rolls may be spaced so as to reduce the thickness of the electrode as much as 36%. Thus if the original thickness is .0165 inch on the

average, the final thickness may be .0105 inch representing a reduction of 36.4%.

After rolling, the electrode is film-formed in a well-known manner. If the electrode has been cleaned before rolling, as described, it is beneficial to dry the electrode after rolling and before film-formation. Whether the electrode is rolled wet or dry is not material but it is undesirable to allow it to remain wet for any extensive period after it has been cleaned in the borax cleaning operation.

Figure 3 shows a completed condenser electrode comprising the rolled electrode layer 16 and a terminal 17 secured thereto by punching the two parts together as indicated at 18.

The invention is also applicable to condenser electrodes formed of two cloth layers 19 and 20 cemented together by the film-forming metal spray deposit 21 as illustrated in Figure 4.

Figure 5 shows a completed condenser comprising a condenser section 22 produced by winding together alternate electrode layers 16 and spacer layers of porous paper, cloth, regenerated sheet cellulose or the like. The condenser section 22 is impregnated with a suitable film-maintaining electrolyte and inclosed in a container 23 having a laminated top 24. Terminal 17 passes through the laminated top and is connected to a soldering lug 25 mounted in the top. The opposite condenser electrode is connected to container 23 by a terminal strip 26 which is spun under the edge of the top.

The reduction in thickness brought about by rolling surprisingly does not reduce the capacity per unit area of the electrodes. In fact, in most cases an increase in capacity has been obtained, the increase frequently amounting to 10% or more.

The power factor and resistance of the condenser is not materially altered.

Due to the reduced thickness a smaller condenser section can be produced from the same area electrode making it possible to provide a smaller condenser unit for a given capacity. This also results in a saving in the amount of electrolyte used, this saving in some cases amounting to 15 or 20% of the electrolyte.

Life tests made on condensers using rolled electrodes are as good as or slightly better than those on condensers using sprayed electrodes which have not been rolled.

Rolling also insures better electrical conductivity throughout the electrode layer and increases the reliability of electrodes made from a single cloth layer sprayed with a relatively light coating of aluminum. While the rolling hardens the electrode layer slightly, it does not interfere with the winding of the electrode into a roll in producing a condenser.

The rolling step is simple and easy to perform and adds practically nothing to the cost of producing the electrodes.

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 electrolytic condenser comprising cooperating electrodes and an electrolyte in contact therewith, at least one of said electrodes comprising a compressed layer of finely divided cohering particles of film-forming metal.

2. An electrolytic condenser comprising cooperating electrodes and an electrolyte in contact therewith, at least one of said electrodes comprising a compressed layer of finely divided cohering particles of aluminum metal.

3. A dry electrolytic condenser comprising cooperating sheet electrodes wound together with porous sheet spacers impregnated with a film-maintaining electrolyte, at least one of said electrodes comprising a fibrous sheet base carrying a compressed adhering layer of cohering film-forming metal particles, said layer having a dielectric film thereon.

4. A dry electrolytic condenser comprising cooperating sheet electrodes wound together with porous sheet spacers impregnated with a film-maintaining electrolyte, at least one of said electrodes comprising a cloth base carrying a compressed adhering layer of cohering film-forming metal particles, said layer having a dielectric film thereon.

5. An electrode for electrolytic condensers comprising a cloth base carrying an adhering layer of film-forming metal, said layer comprising a compressed cohering spray deposit of aluminum.

6. A dry electrolytic condenser comprising cooperating sheet electrodes wound together with porous sheet spacers impregnated with a film-maintaining electrolyte, at least one of said electrodes comprising a cloth base carrying a chemically-cleaned and compressed adhering layer of cohering aluminum particles, said layer having a continuous dielectric film thereon.

7 A dry electrolytic condenser comprising cooperating sheet electrodes wound together with porous sheet spacers impregnated with a film-maintaining electrolyte, at least one of said electrodes comprising a double thickness of open-mesh cloth bonded together with a porous cohering spray-deposit of aluminum, said bonded electrode being uniformly compressed so that its thickness is less than that of said electrode in the "as sprayed" condition, said spray-deposit having a dielectric film thereon.

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