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CARBON COATED CONTAINER FOR ELECTROLYTIC CONDENSERS

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Fig.1.

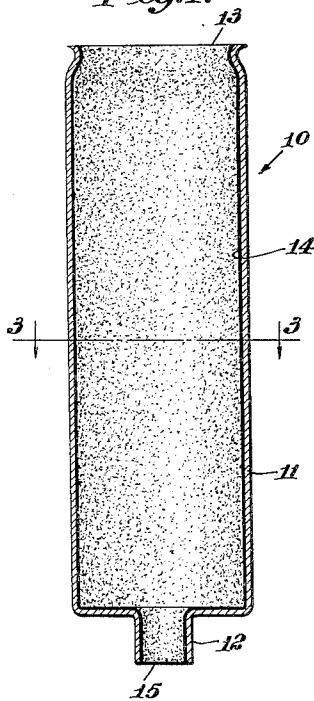


Fig.2.

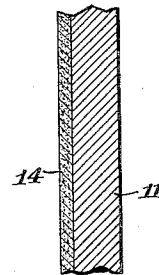
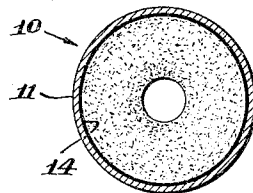


Fig.3.



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CARBON COATED CONTAINER FOR ELECTROLYTIC CONDENSERS

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10 Claims. (Cl. 175—315)

The present invention relates to electrolytic devices and, more particularly, to cathode structures for electrolytic condensers of the fluid electrolyte type and a method of producing the same.

5 In the manufacture of electrolytic condensers of the fluid electrolyte type, various known film forming metals are utilized in making the film forming anode. For example, metals such as tantalum, molybdenum, aluminum, and the like, 10 may be employed, although aluminum is preferable because it is readily obtainable, easy to work and relatively inexpensive.

While aluminum is, therefore, highly desirable for the anode of an electrolytic condenser of the character specified, it is not, ordinarily, suitable 15 for the cathode structure of an electrolytic condenser, such as the cathode-can or container, for the reason that in a filter circuit, the inverse current causes a non-conductive film to form on the interior surface of the cathode-can. When such 20 a film is formed on the cathode-can, the resistance of the condenser is increased and the capacity thereof is lowered to the point where the condenser may become unfit for further use.

25 In order to obtain the advantages in the use of aluminum and like metals for the cathode structure of an electrolytic condenser, various expedients have been proposed heretofore to overcome the results of such film formation on the cathode-can or container. Among such expedients 30 may be mentioned the short-circuiting means disclosed in Lilienfeld Patent 1,880,263, for example.

35 Likewise, cathode-cans or containers for electrolytic condensers of the fluid type, which are provided on their interior surface with an electrodeposited surface of chromium, nickel, copper, or the like, to prevent the oxidizing of the container proper, when in use, are known. Containers 40 formed entirely of copper, for example, are also known. However, containers of this character, while more satisfactory in use, are nevertheless subject to corrosion, are expensive to manufacture, and, when formed of copper, are more difficult 45 to draw into the desired shape.

Accordingly, it is an object of my invention to provide a cathode structure for an electrolytic condenser which permits of the use of desired metals without being subject to the above-noted 50 disadvantages and objections, and whereby an electrolytic condenser may be provided whose rated capacity will not change substantially over long periods of use through deterioration or change in the active cathode surface.

55 A further object of my invention is to provide

an electrolytic condenser container having an inert, non-film forming, cathodic surface which will not combine chemically with an electrolyte.

Another object of my invention is to provide a combined container and cathode electrode for an electrolytic condenser, the active surface of which is provided with a non-metallic coating, whereby 5 said container and electrode may be constituted wholly of aluminum or a similar metal which is easily worked, low in cost, and which will not 10 deteriorate when in contact with an electrolyte.

A further object of my invention is to provide an electrolytic condenser cathode-can or container and means whereby the formation of a non-conducting film on the cathode surface or 15 surfaces thereof is prevented, said surface or surfaces being non-corroding and non-oxidizing.

A further object of my invention is to provide an electrolytic condenser cathode structure having a non-metallic film of conductive material as a protective coating therefor, whereby the electrolyte is prevented from contacting with said 20 structure.

A further object of my invention is to provide an electrolytic condenser unit of the character specified having a non-corroding insoluble cathodic lining bonded to a surface thereof. 25

Another object of my invention is to provide an electrolytic condenser unit of the character specified wherein a low resistance, conductive film is 30 formed on a cathode-can or container surface, said film being of a character such that it will not crack, chip or become otherwise detached therefrom during the various operations performed in assembling and sealing all the elements 35 of a complete condenser.

A further object of my invention is to provide an electrolytic condenser unit comprising a cathode can or container having an inert lining of conductive material bonded to the interior surfaces 40 thereof.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, 45 however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a certain specific embodiment thereof, when read in connection with the accompanying drawing, in which 50

Fig. 1 is a vertical sectional view, substantially full-size, of a cathode-can or container embodying my invention,

Fig. 2 is a greatly enlarged fragmentary sec-

tional view of a wall of the cathode-can or container shown in Fig. 1,

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1 and on the same scale as Fig. 1.

Referring to the drawing, a cathode-can or container representing a cathode structure, and generally indicated at 10, comprises a cylindrical container 11, preferably of aluminum, having a reduced end portion 12, an open end portion 13, and a film or coating 14 of conductive material constituting the interior surface of the container 11.

In accordance with my invention, I first prepare a concentrated graphite suspension which consists, preferably, of the following ingredients, acetone 137.8 cc., amyl acetate 125 cc., phenol formaldehyde resin 39.9 grams, and 42.5 grams of 99% pure graphite, the acetone being the solvent for the resin and the amyl acetate constituting the thinner.

In order that the graphite may be intimately mixed with the acetone and amyl acetate, I have found that this may be done, preferably, by milling the solution in a suitable ball mill for an extended period of time, for example, 24 hours more or less.

In the application of the graphite solution to the cathode-can or container 10, after it has been suitably cleaned in a mild caustic solution, for example, the opening 15 in the reduced end portion 12 thereof is first suitably corked or otherwise closed. A quantity of the graphite suspension, sufficient to cover or coat the interior surface of the container 11 with a sufficient excess, is then spilled or poured into the container 11, or, the solution may be otherwise applied as by spraying the solution or by dipping the container into the solution.

Immediately after a sufficient quantity of the graphite solution has been placed in the container 11 and suitably distributed over its entire inner surface, the excess solution is drained off and the coating or film of the solution adhering to the container 11 permitted to dry.

The container 11 is then fired or baked, for example, for twenty-four hours at a temperature of substantially 100 degrees centigrade to harden the adhering graphite film or coating whereby a non-porous, low resistance conductive film or lining is formed within the container 11.

As hereinbefore stated, the container 11 with the graphite film or coating 14 applied to its entire interior surface, is first subjected to a temperature of 100 degrees centigrade so that the said film or coating will bake slowly to obviate blistering or cracking of the said film or coating.

After the film or coating has been baked slowly at substantially the temperature specified above, it is, preferably, subjected to a further baking temperature much higher than the first, for example 170 degrees centigrade for approximately two hours, whereby the resin in the graphite film or coating 14 is thoroughly polymerized or set.

While I have specified acetone as the solvent for the phenol formaldehyde resin, and amyl acetate as the medium for thinning the solution resulting from the admixture of the resin to the acetone, it is to be expressly understood that I may substitute, for example, ethyl alcohol for the acetone and butyl or ethyl acetate for the thinner. Similarly, I may also substitute other binders for the phenol formaldehyde resin as, for example, resin compounds such as shellac for

example, or, certain esters such as nitro-cellulose, for example, may also be employed.

From a consideration of the above, it will be readily apparent that my improved cathode-can or container for electrolytic condenser of the fluid type provides a low resistance path from the cathode-can or container 11 proper through the film or coating 14 to the electrolyte when a completed condenser, as herein specified, is in use. For example, if a cathode-can or container, constructed in accordance with my invention, is filled with mercury to test the resistance of a cathode-can or container formed in accordance with my invention, the total resistance across the coating from the container proper to the mercury would be less than 3 ohms for a container such as shown in Fig. 1. Moreover, the power factor and internal resistance of such a condenser is not changed by reason of the conductive film or coating on the interior surface of the container.

In carrying out my invention, the use of graphite is preferable because it is readily obtainable in very pure form. However, it is to be understood that a very pure lamp black or similar forms of low resistance carbon or, a colloidal graphite such as "Aquadag" mixed with a colloidal phenol formaldehyde resin suspension, may be readily substituted for the graphite with equally satisfactory results if such substitutes are free from traces of foreign materials.

The more common foreign materials to be guarded against are chlorides, sulphates, sulphides, nitrates, and similar acid ions, since the combination of such materials with aluminum gives rise to products which hydrolyze readily and cause disintegration of the anode and its aluminum oxide film. Hydrolysis of this character is typical of salts which may be formed by the reaction of a weak base (aluminum hydroxide) with a strong acid (HCl, H₂SO₄, HNO₃, etc.).

I claim as my invention:

1. A cathode structure for electrolytic condensers having a non-metallic imporous, hard conductive film on an active surface thereof.
2. A cathode structure for electrolytic condensers comprising a container having a film or coating of non-metallic conductive material bonded to the interior active surfaces thereof.
3. A cathode can container for electrolytic condensers having a film of inert non-metallic conductive material bonded to the interior surface thereof.
4. In combination, a container providing a cathode unit for an electrolytic condenser, and means providing an inert coating of low resistance non-metallic conductive material bonded to an active cathode surface of said container.
5. A cathode for an electrolytic condenser comprising a can having a smooth adherent film of imporous, hard non-metallic conducting material on the interior surface thereof.
6. As an article of manufacture, a cathode for an electrolytic condenser of the fluid electrolyte type comprising a can having a non-metallic, inert cathodic surface of imporous conductive material.
7. As an article of manufacture, a cathode for an electrolytic condenser of the fluid electrolyte type comprising a container can having an inert, non-metallic, non-frangible lining of imporous conductive material bonded to an interior surface of said container can.
8. As an article of manufacture, a cathode for

an electrolytic condenser of the fluid type comprising a container having an inert, insoluble film of non-metallic conductive material bonded to the interior surface of the container.

5 9. A cathode for an electrolytic condenser constituted by a container having a smooth adherent film of non-metallic conductive material on the interior surface thereof, said material compris-

ing substantially pure graphite and polymerized resin.

10. A cathode can container for electrolytic condensers having a film of inert conductive material bonded to the interior surface thereof, said film comprising substantially pure graphite and polymerized resin. 5

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