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ELECTROLYTIC CONDENSER

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Fig. 1.

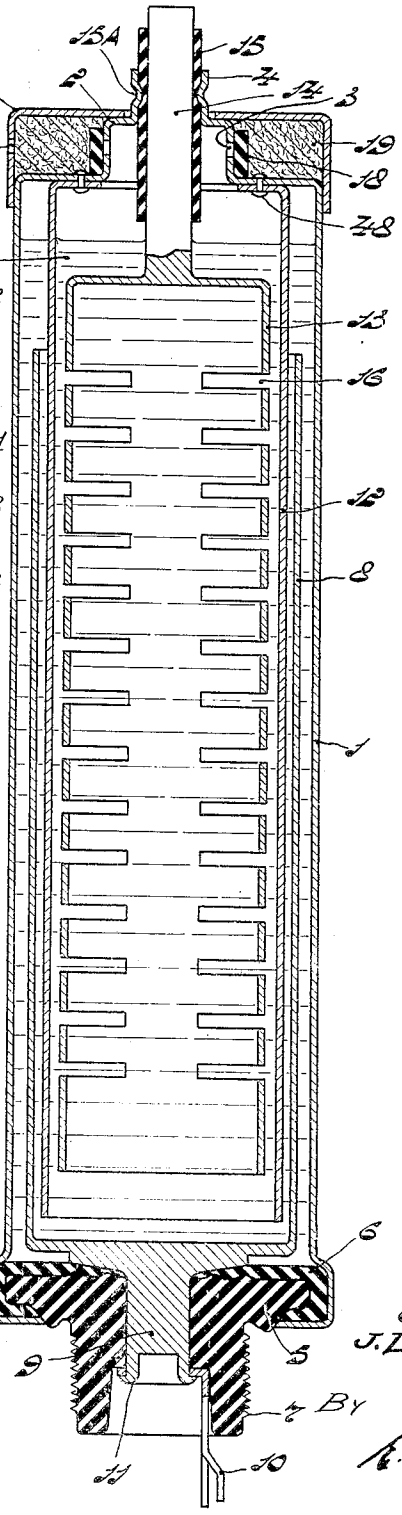
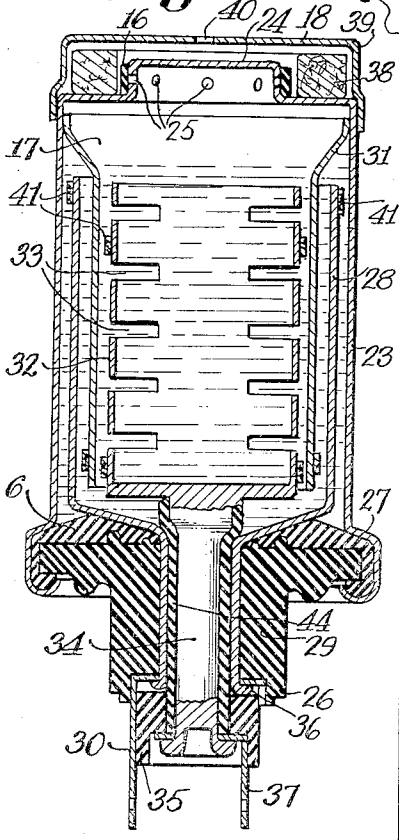


Fig. 2.



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ELECTROLYTIC CONDENSER

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In Germany May 30, 1938

1 Claim. (Cl. 175—315)

This invention relates to an electrolytic condenser having a cathode body located within a tubular anode, and more particularly to an electrolytic condenser comprising two condenser units.

The term "anode" as used herein is to be understood to mean an electrode which is provided with an oxide film serving as a dielectric, and the term "cathode" is to be understood to mean that part or parts which constitute a current supply conductor for the electrolyte.

It has been suggested, for example in the U. S. Patent 2,130,073 to de Lange et al., to give the anode of an electrolytic condenser a tubular shape and to house therein a second tubular member which is closed at the lower end and acts as a cathode. Although such a construction makes it possible to produce a condenser having the lowest possible series-resistance, there is a large amount of unused space inside the tubular cathode. In this patent it has also been proposed to utilize at least a major portion of this space by housing a second complete condenser unit therein, and thereby form a condenser comprising two units each having their own electrodes.

The main object of our invention is to produce a simpler and less expensive condenser assembly of the above general type.

A further object is to produce a condenser assembly which may be used in cases where two condenser units are required, for example, for smoothing the direct current supplied to the field coil of an electro-dynamic speaker.

A further object is to reduce the size of and the amount of material used in such condenser assemblies.

A still further object is to produce a multiple condenser of the above type in which the condenser units have a common cathode and electrolyte.

Further objects and advantages of the invention will appear as the description progresses.

In accordance with the invention we locate within the inner tubular cathode a second film-forming electrode which forms with said cathode a second condenser unit having a separate anode supply connection. In this manner the space within the first condenser unit is efficiently utilized, and the inner surface of the tubular cathode is also used. The film-forming electrode, or internal anode, is arranged with its surface close to the inner surface of the tubular cathode with the result that this second condenser unit has a low series resistance, and the series resistance can be further decreased by giving the film-forming electrode a shape corresponding to that of the cathode.

In one embodiment of the invention the internal anode is shaped as a hollow cylinder to reduce the weight as much as possible, and is provided with slots to form short paths for the flow of current through the electrolyte from the cathode to the inner surface of the internal anode.

The condenser according to the invention can be so constructed that the supply connection for the internal anode may be at either end of the condenser, and this connection as well as the connection for the first anode may be at the same end.

In order that the invention may be clearly understood and readily carried into effect, we shall describe the same in more detail with reference to the accompanying drawing in which:

Fig. 1 is a sectionized view of a condenser according to the invention, and

Fig. 2 is a sectionized view of a condenser according to another embodiment of the invention.

The condenser illustrated in Figure 1 comprises a cylindrical cathode-container 1 of aluminium whose upper end forms a dome 2 provided with several vent holes 3 and having a tubular extension 4. The bottom edge of container 1 is spun over the edge of a member 5 of insulating material, such as "Bakelite," with the interposition of a gasket 6, for instance of rubber. Member 5 has a threaded tubular portion 7 for securing the condenser to a support and its upper surface is corrugated.

Within the container 1 is a cup-shaped anode 8, for instance of aluminum, having a rod-shaped extension 9 passing through a bore in member 5. The end of the extension 9 is riveted over at 11 with the interposition of a terminal 10, whereby a liquid-tight seal is made between the bottom of anode 8 and the corrugated upper surface of member 5 by means of the gasket 6.

Secured to the top of container 1 by several rivets 48 is a cup-shaped cathode 12 which extends within the anode 8 with its outer surface parallel to the inner surface of the anode. Instead of being riveted, the cathode 12 may be spot welded to the container 1, and if the cathode 12 is made by extrusion, small projections may be formed on its upper surface and used as rivets.

Within cathode 12 is a second or internal anode 13 of cup-shape which has a rod-shaped extension 14 passing through the tubular pro-

jection 4. A tubular gasket 15, for instance of rubber, is placed over extension 14, and the projection 4 is grooved, for instance by rolling, at 15A to effect a liquid-tight seal and a supporting connection. If desired the extension 4 may be provided with a plurality of groovings 15A. The anode 13 is provided with a plurality of slots 16, for instance saw-cuts, to reduce the paths of the current flowing from the inner surface of cathode 12 to the inner surface of anode 13.

The vessel 1 is filled to a level above the anode 13 by a suitable electrolyte 17 for instance a mixture of 240 grams of boric acid (H_3BO_3), 1,000 grams of ethylene glycol, 30 c.c. of ammonia (NH_4OH) and 1,000 c.c. of water.

To prevent corrosion of the non-formed parts in contact with the electrolyte, both surfaces of cathode 12 and the inner surface of the container 1 may be chromium plated.

To increase the surface area and hence the capacity, the surfaces of anodes 8 and 13 are preferably etched by any of the methods known in the art.

A band 18 of flexible material, such as rubber, surrounds the dome 2 and normally closes the vent holes 3. During operation of the condenser the gases produced within the container 1 escape through holes 3 in known manner. To asorb any electrolyte which may be carried out through holes 3 by the escaping gases, a mass of absorbent material 19, such as saw-dust or cotton-wool, is located within a cover 20 secured, for instance welded, to container 1, and provided with an aperture 21.

A condenser of the construction shown is very compact and has extremely desirable electric properties.

When the two electrodes 8 and 13 are etched, they can supply an extremely large capacity. For example, if the external anode 8 has a diameter of 24.5 mm. and a height 80 mm., it will have a capacity of 16 microfarads at a working voltage of 450 volts, and if the internal anode 13 has a diameter of 17.5 mm. and a height of 80 mm. it will supply a capacity of 16 microfarads at a working voltage of 300 to 320 volts. Since the spacing between the active surfaces is very small, as appears from the diameters given above, the series resistance has a very low value and the alternating current load may be increased to a high value. If the condenser illustrated is used in a smoothing system and the external condenser unit is connected directly after the rectifier, i. e. the condenser unit which is calculated for the highest working voltage and has the electrode 8 as an anode, a superimposed alternating current voltage of at least 45 volts is admissible.

In the condenser illustrated in Figure 1 the connection for the external anode 8 leaves through the lower end of the assembly and the connection for the internal anode 13 leaves through the upper end. However, the invention can also be carried into effect with a construction in which the connections to both anodes leave at the same end, and such a construction is illustrated in Figure 2.

The condenser illustrated in Figure 2 comprises a cup-shaped cathode-container 23, for instance of aluminum, whose closed end is formed as a dome 24 provided with a plurality of vent holes 25. The bottom end of container 23 is spun over the edge of a tubular member 26 of insulating material, such as "Bakelite," with the interposition of a gasket 27, for instance of rubber, to form a liquid-tight joint.

Within container 23 is a cup-shaped external anode 28 of a film-forming metal, such as aluminum, which has a tubular extension 29 passing through the bore of member 26. The end of extension 29 riveted over upon a shoulder of member 26 with the interposition of a terminal 30.

A cathode 31 in the form of a cylinder of aluminum has a flared upper end which is secured, for instance welded, to the container 1.

A second or internal anode 32 in the form of a cylinder of aluminum provided with several saw-cuts 33, has a rod-shaped portion 34, extending through the bore of the extension 29 of anode 28. A bushing 44, for instance of rubber, is disposed between portion 34 and extension 29 and serves to provide a liquid-tight seal and also to insulate anode 32 from anode 28. The bottom end of portion 34 is riveted over upon a bushing 35, for instance of "Bakelite," which bears upon the end of anode 28 at 36. A terminal 37 for anode 32 is secured at this riveted joint.

As described in connection with Figure 1, a rubber band 16 normally closes the vent holes 25, and a ring 38 of liquid-absorbent material, such as cotton wool, located within a cover 39 secured to container 23, for instance by welding, serves to absorb any escaping electrolyte. Cover 39 is provided with a vent hole 40.

In order that possible displacement of the electrodes will not result in a short circuit, we prefer to provide anodes 28 and 32 and cathode 31 with bands 41 of insulating material, such as rubber.

We wish it to be understood that we do not wish to be limited to the exact details of construction shown and described, because obvious modifications will readily occur to one skilled in the art.

What we claim is:

An electrolytic condenser comprising a cup-shaped cathode-container, a cup-shaped cathode supported from said container and forming an annular space therewith, a cup-shaped anode having an active tubular portion extending into said space and forming a condenser unit with said cathode, means insulatingly supporting said anode from the open end of said container, a second cup-shaped anode having a tubular portion extending in closely-spaced relationship with the inner surface of said cathode to form a second condenser unit therewith, means insulatingly supporting said second anode from the closed end of the container, and an electrolyte within said container and common to both said condenser units.

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