

April 24, 1956

A. F. BUJAN
ELECTROLYTIC CONDENSER

2,743,399

Filed May 29, 1951

2 Sheets-Sheet 1

Fig. 1

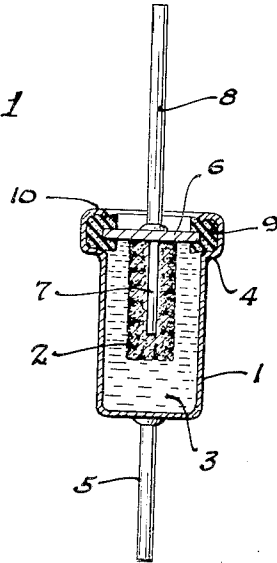


Fig. 2

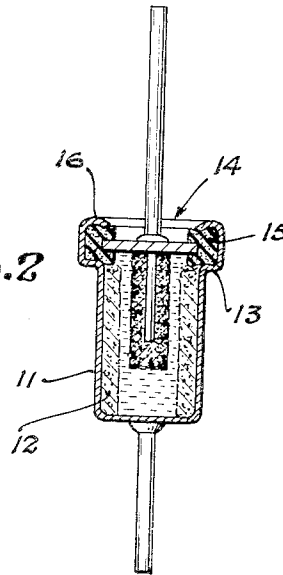
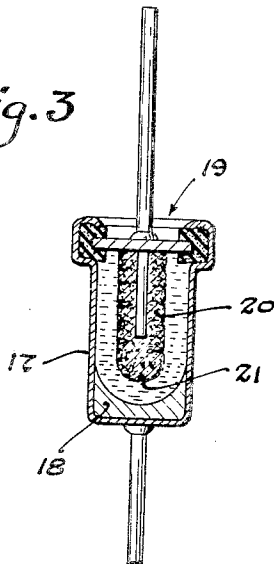


Fig. 3



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Fig. 4

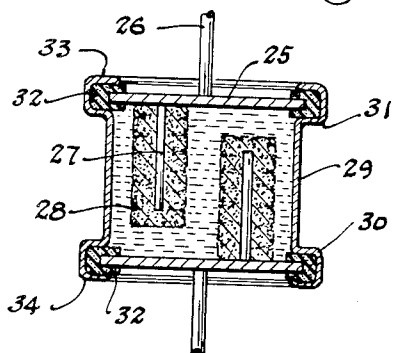


Fig. 5

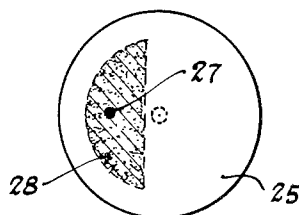


Fig. 6

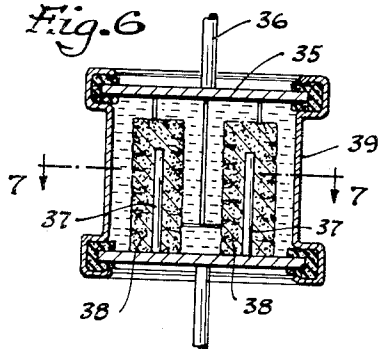


Fig. 7

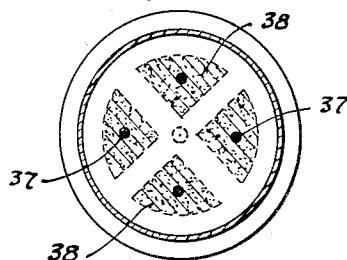


Fig. 8

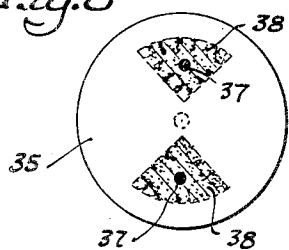
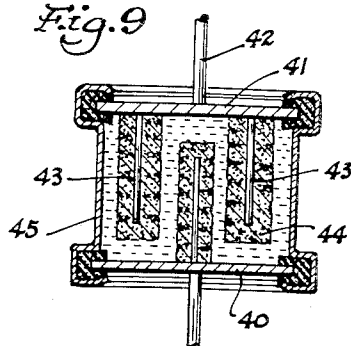


Fig. 9



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ELECTROLYTIC CONDENSER

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Application May 29, 1951, Serial No. 228,931

10 Claims. (Cl. 317—230)

This invention relates to electrolytic devices and specifically to electrolytic condensers.

Electrolytic condensers are commonly formed of aluminum or tantalum; the aluminum being the most commonly used metal because of its relatively low cost. Tantalum has been termed the ideal material for use in the fabrication of electrolytic condensers because of its extremely high resistance to chemical attack by a great number of electrolytes. Aluminum, on the other hand, is satisfactory for use with relatively few electrodes.

Where aluminum is employed as the anode material, the anode may be formed of a cast aluminum body, an etched aluminum foil or a sprayed aluminum mass. Etching of the foil and spraying of the aluminum are utilized so as to increase the active surface of the electrode and thereby obtain a greater capacity per unit weight of metal than is obtainable by the use of a solid body of the metal.

Where tantalum is employed as the anode material, the anode is advantageously formed of a porous mass or body of tantalum so as to provide a relatively large surface area per unit of weight of the metal. There is no method known whereby tantalum can be sprayed, and etching of the tantalum foil is not commercially feasible because of the metal's high resistance to chemical attack. The porous body may be formed by pressing the metal powder and sintering under such conditions that the powder particles become tacked or fritted together to form a porous coherent body without substantially reducing the porosity of the mass or body.

The principal purpose of the present invention is to provide an electrolytic condenser structure utilizing a porous tantalum element as at least one of the condenser electrodes.

A further object of this invention is to provide an electrolytic condenser structure which may be economically fabricated utilizing tantalum as at least one of the condenser electrodes.

Other objects and advantages of this invention will become apparent from the following description and claims. In the drawings:

Fig. 1 is a sectional elevation, at an enlarged scale, of the basic structure of the condensers of this invention.

Figs. 2 and 3 are sectional elevational views of modified structures of my condensers.

Fig. 4 is a sectional elevational view of a further modification of the structure of the condensers of this invention.

Fig. 5 is a sectional plain view of one of the electrodes of the condenser shown in Fig. 4.

Fig. 6 is a sectional elevational view of a further modification of the condenser structure of this invention.

Fig. 7 is a sectional view of the condenser of Fig. 6 taken on line 7—7.

Fig. 8 is a plain view of one of the electrodes of the condenser shown in Fig. 6.

Fig. 9 is a sectional view of a further form of condenser made in accordance with this invention.

The condenser as illustrated in Fig. 1 consists of a metal container 1 which serves as one of the electrodes, a porous tantalum electrode 2 and an electrolyte 3. The container 1 is provided with a shoulder 4 which is adapted to support the electrode 2. The container may be formed of any metal which is chemically resistant to the electrolyte. In the manufacture of polarized condensers, the container need not be a valve metal. In the manufacture of non-polarized condensers, the container is formed of tantalum. A connecting lead 5 may be secured to the container as by welding, soldering and the like.

The anode is formed of a tantalum disc 6 to which a tantalum supporting wire 7 has been welded to one face of the disc and a lead wire 8 welded to the other face of the disc. In forming the anode, the desired quantity of tantalum powder is pressed around the supporting wire 7 and then sintered to form a coherent porous body and to sinter the particles to the supporting wire 7. During the sintering treatment, the powder particles become fritted or welded together and the porous tantalum body is thereby secured integrally to the supporting wire. The dielectric film is formed on the electrode in the conventional manner by immersing the electrode in a suitable electrolyte and applying the desired potential, the ultimate or maximum potential being dependent upon the potential at which the condenser is to be employed.

A resilient insulating grommet 9 is provided with an internal annular groove which receives the peripheral portion of the disc 6. The grommet maintains the disc 6 and container 1 in spaced relationship and insulates the electrodes from each other. The grommet is preferably formed of a resilient insulating material such as rubber or a synthetic rubber and is selected with respect to its ability to tolerate the electrolyte. When the anode assembly is positioned in the container 1 the grommet centers the porous tantalum electrode within the container and also insulates the electrodes from each other. The assembly is completed by spinning or crimping the marginal edge of the container over the grommet to form a bead 10. Sufficient pressure is applied during the crimping operation so as to place the grommet under compression and effectively seal the condenser.

In Fig. 2 and Fig. 3, there are shown modifications of the condenser of this invention which may be employed in the production of higher capacity condensers and to improve the power factor, particularly for the production of non-polarized condensers. In these modifications the container is provided with a porous liner. In Fig. 2, the container 11 is provided with a porous cylindrical lining 12 which is of the same metal as the container. This lining member may be formed by pressing the desired quantity of metal powder against the walls of the container and heating the unit to sinter together the particles and to integrally secure the liner to the container. The anode element 14 is of the same structure as that shown in Fig. 1. The container is provided with a shoulder 13 which receives the resilient grommet 15 which in turn receives the periphery of the disc of the anode element 14. The condenser is sealed by spinning or crimping the open edge of the container to form a bead 16.

In Fig. 3, the container 17 is provided with a porous liner 18 integrally secured to the closed end of the container, the upper surface of the lining being concave. This electrode may be formed by pressing the metal powder in the container 17 and sintering, thereby integrally securing the liner to the container. The anode element 19 is formed of a porous body of tantalum 20 terminating in a convex or semispherical dome 21. This type of structure is particularly advantageous in that the

path between the two electrodes is uniform at all points and thereby reduces the internal resistance of the condenser. The condenser is sealed in the same manner as shown in Figs. 1 and 2.

The structures as shown in Figs. 4 through 8 are particularly advantageous in the production of non-polarized, large capacity units. The electrode elements of these structures are identical, thus requiring but a single set of manufacturing tools. The electrodes consist of a tantalum disc 25 to which a lead wire 26 is secured as by welding, preferably at the center of the disc. A tantalum supporting wire 27 is secured to the opposite face of the disc and is offset from the center of the disc. The porous tantalum body 28 is formed as a semicylindrical body about the supporting wire 27, the arcuate surface being concentric with respect to the disc and the plane surface terminating short of the center of the disc. It is obvious that a plurality of spaced supporting wires may be employed, if desired.

The container 29 is formed of any metal which is resistant to the electrolyte. The container is in the form of a tubular member having shoulders 30 and 31 spaced from each end of the member. A resilient grommet 32 is positioned about the periphery of each of the tantalum discs and serves to insulate the discs from the shoulder of the container. The condenser is sealed by crimping the ends of the tubular element to form beads 33 and 34.

For higher capacity condensers, the structure as shown in Figs. 6, 7, and 8 is advantageous, particularly in improving the power factor and providing a greater effective area. The electrodes consist of a tantalum disc 35 having a connecting lead 36 secured to the midpoint or center of the disc. Two supporting rods or wires 37 are secured to the opposite face of the disc and are offset diametrically with respect to the midpoint or center of the disc, as illustrated in Fig. 8. A porous quadrantal-cylindrical body 38 of tantalum is formed about each of the supporting rods or wires. The arcuate surfaces of the bodies are concentric with respect to the disc and the plane surfaces terminate short of diametric lines dividing the disc in quadrants. The condenser is formed of two like electrodes positioned within a tubular container 39 in the same manner as shown in Fig. 4.

The condenser of Fig. 9 utilizes one electrode 40 which may be substantially identical in structure to that shown in Figs. 1, 2 and 3. This electrode consists of a tantalum disc having a supporting wire secured to one face and a lead wire secured to the opposite face. A porous mass of tantalum is integrally secured to the supporting wire.

The other electrode consists of a tantalum disc 41 having a lead wire 42 secured to one face thereof. A plurality of supporting wires 43 are secured in spaced relationship to each other to the opposite face of the tantalum disc, all of the supporting wires being equidistant from the center of the disc. An annular ring 44 consisting of a porous tantalum body is integrally secured to the supporting wires and may be formed as described hereinbefore. The container 45 is a tubular body provided with shoulders adjacent each end thereof. The tantalum disc of each of the electrodes is provided with an annular spacing and insulating member or grommet which is placed upon the shoulders of the container and the outer ends of the container are crimped or rolled to seal the condenser.

It is apparent that the specific size of the condenser electrodes will be governed in accordance with the desired capacity. The relative size of the two electrodes of condensers of fixed capacity will be dictated by the particular application or proposed use of the condensers. Polarized condensers may include a cathode of non-film forming metal, the specified metal being selected for its ability to withstand the electrolyte without contaminating the electrolyte. Non-polarized condensers preferably are formed of two electrodes of substantially the same active surface area.

I claim:

1. An electrode for electrolytic condensers comprising a tantalum disc, connector and tantalum support wires welded respectively to the opposite faces of said disc and extending away from said disc, and a coherent, porous, elongated tantalum body welded to said disc and support wire, said support wire extending within said body for the major part of the length of said body, said body having a generally convex outer surface and lying wholly within the projection of said disc.

2. An electrode for electrolytic condensers comprising a tantalum disc, connector and tantalum support wires welded respectively to the opposite faces of said disc and extending away from said disc, and a coherent, porous, elongated tantalum body welded to said disc and a support wire, said support wire extending within said body for the major part of the length of said body, said body having a generally convex outer surface terminating in a convex dome and lying wholly within the projection of said disc.

3. The electrode, according to claim 1, wherein said support wire is eccentric to the disc and wherein said porous tantalum body has a semicylindrical shape.

4. The electrode, according to claim 1, wherein a pair of support wires are secured to a disc face and offset diametrically with respect to the center of the disc and wherein each support wire has a porous tantalum body with each body having a quadrantal-cylindrical shape.

5. An electrolytic condenser comprising a tubular metallic container open at least at one end thereof, a shoulder on the container near the open end, resilient insulating means having an internal annular groove resting on said shoulder, a tantalum disc having its marginal portion disposed in the annular groove, the open end of said container being turned over upon the resilient insulating means so that said tantalum disc and insulating means seal the end of said container, a connector welded to said tantalum disc at the outside face thereof and extending away therefrom, said connector constituting one terminal of the condenser with the container constituting the other terminal of the condenser, a porous, coherent, elongated tantalum body welded to the inner face of the tantalum disc and extending into said container, and an electrolyte in said container.

6. The condenser, according to claim 5, wherein said tantalum disc has a tantalum support wire welded to the disc at the inside face thereof and extending into said container and wherein said porous tantalum body is welded to said wire, said wire extending within the body for the major part of the length of said body, said body having a generally convex outer surface.

7. The condenser, according to claim 5, wherein said container is of tantalum and has a porous tantalum liner therein.

8. The condenser, according to claim 5, wherein said body has a rounded end and wherein said container has a liner having a corresponding cup shaped surface.

9. An electrolytic condenser comprising a tubular container open at both ends, a shoulder on the container adjacent each end, resilient insulating means positioned at each shoulder and including an annular groove for each insulating means, a tantalum disc having its marginal portion disposed within the annular groove at each end of said container, at least one tantalum support wire welded to each of the tantalum discs and projecting inwardly of the container, a coherent, porous tantalum body welded to said support wire and disc and projecting inwardly of the container, said support wire extending for the major part of the length of said body, said body having a generally convex outer surface, an electrolyte in the container, the ends of the container being crimped over the insulating means at the two ends to form a sealed construction and leads secured to said tantalum discs.

10. An electrode for electrolytic condensers comprising a tantalum disc, connector and tantalum support wires welded respectively to the opposite faces of said disc and extending away from said disc, and a coherent, porous tantalum body welded to said disc and support wire, said support wire extending within said porous tantalum body.

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