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ANODE FOR ELECTROLYTIC CONDENSERS

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Fig. 1

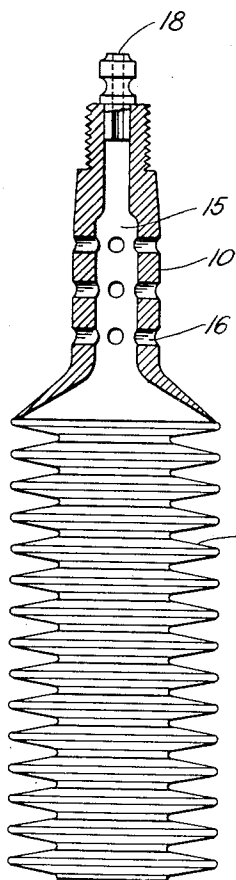


Fig. 2

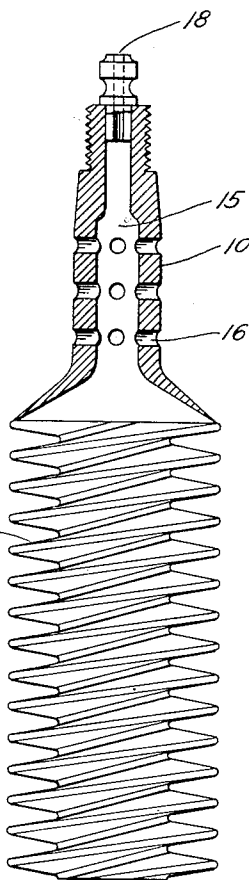
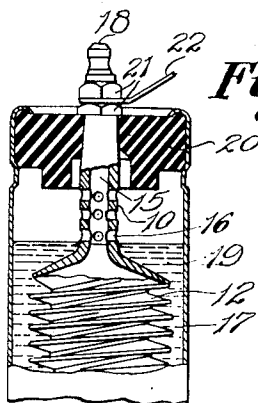


Fig. 3.

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ANODE FOR ELECTROLYTIC CONDENSERS

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9 Claims. (Cl. 175—315)

Our invention relates to a novel construction of an anode for use in electrolytic condensers and similar devices.

As is well known, the electrolytic condenser consists of an anode partially immersed in an electrolyte and connected out of the electrolyte to suitable terminals. The cathode is suitably connected in the circuit and may also be the container for the electrolyte. The electrolytic condenser is characterized by the fact that when an electric current is passed through, a film is built up on the part of the anode immersed in the electrolyte, which film possesses high dielectric capacity and high insulating properties, permitting only a very slight current to pass. The dielectric capacity of such a condenser is directly proportional to the area of the anode covered by the film and thus is directly proportional to the area of the anode immersed in the electrolyte. To obtain high capacity in a small volume it is therefore desirable to have this part of the anode with as large surface as possible. This has been accomplished in the prior art by crimping a piece of thin metal so as to obtain large area and bending up a narrow strip of thin metal which projects through the electrolyte to form a connection.

The passage of current through the condenser, however, causes oxygen to be liberated at the anode, which oxygen attacks the anode at the gas-electrolyte inter-face. If the anode be constructed of thin sheet metal the result of this attack is that the anode becomes weakened and in a short time fails mechanically.

The products of the attack, moreover, are substances which normally foul the electrolyte. To insure a minimum of corrosion, the anode, at the point of projection from the electrolyte, should be of as small surface as possible; and at the same time to insure strength, should be as substantial as possible.

A desirable anode is then one which combines the qualities of being of small surface at the point of projection from the electrolyte and of large surface where it is immersed in the electrolyte. In the prior art such construction has been attempted in anodes of two pieces, one of which, a narrow stem, projects from the electrolyte and the other consisting of rolled or crimped foil, is totally immersed in the electrolyte. The two pieces are joined together at points which after assembly are immersed in the electrolyte. This joining is habitually performed by riveting, welding, a combination of the two, or by other well-known means. Such construction is costly, involving as it does a multiplicity of operations. It is furthermore characteristic of such construction that adjacent to the joining points or contacts are found seams, cracks,

crevices and the like. In an electrolytic condenser assembled with such an anode the electrolyte has not free access to these seams and cracks and consequently when an electric current is passed, the film formed on the anode is irregular and of uncertain properties in the neighborhood of these seams and cracks. This is due to accumulation of gas in these seams which effectively retards the electrolytic formation of the film. Then when such a condenser is in operation, slight vibration or other motion may disturb the accumulated gas thus exposing a fresh anode surface to electric current. This may result in a possible short circuiting of the condenser.

The prior types of anodes also suffer from the fact that the ratio of edges to surfaces is unnecessarily high. To build a smooth film it is necessary to have on the anode a fairly smooth metal surface. This necessary smoothness is not to be obtained at a sharp edge or point and consequently poor films are formed in these regions. It is, moreover, characteristic of dielectrics such as these films are, that when charged, the charge tends to be concentrated in the sharp edges or points, so that when anodes are constructed with sharp-edged foil, a high concentration of charge accumulates in these edges which frequently results in flashovers, high leakage and the like. The open or free edges of the metal sheets forming the electrodes are invariably such sharp edges and therefore such free edges should be eliminated as much as possible.

We have found that these difficulties may be avoided and indeed in a practical, economic way, by constructing the anode entirely of one piece of metal. This type of construction produces an anode with no seams, cracks or crevices and to every immersed part of which, the electrolyte has free access. At the same time we have also been able to construct our anode so that it combines the properties of having large area below the surface of the electrolyte and small area at the point of projection above the surface of the electrolyte.

Figure 1 is a vertical view, partly in section, of an anode construction embodying our invention.

Figure 2 is a vertical view, partly in section, of another anode construction embodying our invention.

Figure 3 is a fragmentary view, on a smaller scale and partially in section, of an electrolytic condenser, using an anode constructed according to our invention.

Referring to the drawing, and first to Fig. 1, the anode comprises a hollow supporting neck, or rod-like extension, 10 and a lower, substantially cylindrical or tubular, thin walled portion 11. This latter portion comprises the anode proper and in order to get the maximum area in a mini-

mum of radial and longitudinal space, it is in the form of radial corrugations.

In addition to increasing greatly the surface area permissible within the aforementioned radial and longitudinal dimensional limitations, the forming of these radial corrugations results in an exceedingly strong and rigid structure, which when placed in a container such as 17 (Fig. 3), will be proof against any material displacement through vibration, bending, etc.

The supporting neck 10 contains an internal cavity 15, and is provided with radial bores 16. The anode carries on its top a perforated vent button 18. The object of this cellular construction is to permit free venting to the outside of gas generated during the operation of the condenser.

It is obvious that many modifications of the outlined structure are possible. For instance, instead of the parallel radial convolutions illustrated at 11 in Fig. 1, said corrugations may be alternatively in the form of a helical screw thread 12 as indicated in Fig. 2.

The mounting of the anode in the condenser is illustrated in Figure 3 in which the type of anode illustrated in Figure 2 is shown as assembled in the container 17. The container 17 of metal forms the cathode, and the corrugated portion of the anode is immersed in the electrolyte 19. The hollow supporting neck 10 extends from the electrolyte and passes with a suitably tight or sealed fit through a cover 20 of insulating material. The free edge of the container 17 may be spun around the cover to make an air and liquid tight seal between the cover and the container. The threaded end of the neck 10 is illustrated as carrying nuts 21 for securing in place the outside terminal 22 of the anode. The gases developed during operation of the condenser find egress through the holes 16, the cavity 15 of the supporting neck, and the vent 18.

It will be understood that the anodes of our invention may of course be used with other suitable condenser structures.

From the above it appears that our invention provides for an anode having a large exposed surface to the electrolyte, a small supporting neck at the point of emersion from the electrolyte, a large effective area, a minimum of sharp edges, great mechanical rigidity and cheap and compact construction.

It is also apparent that the only free edge in our electrode construction is that at the open bottom end of the electrode and corresponds to the circumference of the root of the corrugated tube. This is a further advantage of our construction over electrodes previously used, which possess extended free edges at the side, top and bottom edges of the electrode plates.

It is apparent that various modifications of our invention may be suggested within the scope of our invention, and we do not wish therefore to be limited to the above illustrations and description, but the claims should be construed as broadly as permissible in view of the prior art.

What we now claim as new and desire to secure by Letters Patent is:

1. A film-forming anode for an electrolytic condenser made in one piece, said piece having two portions, one being a thin walled tubular portion having crimps in planes substantially perpendicular to the axis of the tube, and adapted to be fully submerged in the electrolyte and the other forming a substantially hollow rod of small diameter and substantial wall thickness.

2. An anode for an electrolytic condenser made of aluminum and having two integral portions, one portion having a small surface, and the other being a tubular portion with helical crimps, said first portion adapted to be partly, and the second portion adapted to be fully submerged in the electrolyte.

3. An aluminum anode for an electrolytic condenser comprising a corrugated tubular member open at one end and provided with a hollow extension neck at the opposite end, said extension neck adapted to support the anode and to constitute a terminal therefor.

4. A film-forming anode for an electrolytic condenser, comprising a thin-walled tubular portion adapted to be submerged in the electrolyte and a second tubular portion of smaller diameter and greater thickness integral with said first portion and adapted to project from said electrolyte and to form a support for said anode.

5. A one-piece anode for an electrolytic condenser, comprising a thin-walled aluminum tube provided with corrugations in planes substantially perpendicular to the axis of said tube, said tube being open at one end and adapted to be contacted by the electrolyte both at its inner and outer surfaces, said tube having at its other end a rod-like extension integral with said tube, said extension partly immersing in the electrolyte and being in contact therewith and adapted to serve as a support for said anode.

6. A one-piece anode for an electrolytic condenser, comprising a corrugated thin-walled aluminum tube, said tube having an integral hollow rod-like extension coaxial with the tube, and which serves as a support for the anode, said extension partly immersing in the electrolyte and being of substantial thickness in its portion immersing in the electrolyte, the hollow rod-like extension being provided with lateral perforations.

7. A single-piece film-forming anode for an electrolytic condenser, comprising a substantially tubular and crimped portion of large area and adapted to be fully submerged in the electrolyte and to contact on both its inner and outer surface with the electrolyte, and a second portion integral with the first portion and adapted to project from the electrolyte for making the outside connection of the anode.

8. An anode of film-forming material for electrolytic condensers comprising a substantially tubular crimped portion of large area adapted to contact on both its inner and outer surface with the electrolyte, and an other portion integral with the first portion and forming a reduced diameter extension thereof, said second portion adapted to project from the electrolyte for making the outside connection of said first portion.

9. A film-forming anode for an electrolytic condenser comprising a thin-walled hollow cylindrical member adapted to submerge in the electrolyte and presenting inner and outer filmed surfaces to the electrolyte, and a second cylindrical portion of smaller diameter and larger thickness forming a continuation of said first portion and adapted to form a support for said anode.

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