July 21, 1942. J. B. BRENNAN 2,290,163

ELECTROLYTIC DEVICE

Filed Aug. 11, 1939

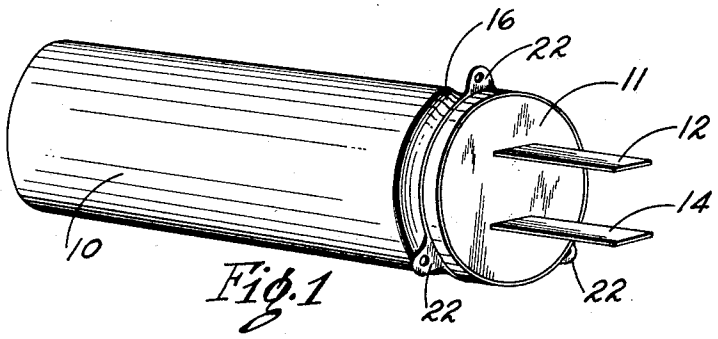


Fig. 1

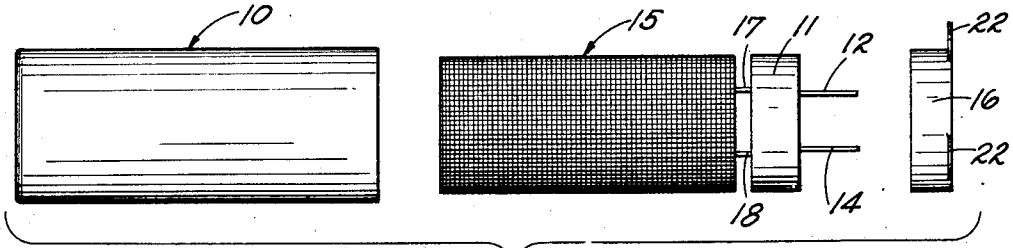


Fig. 2

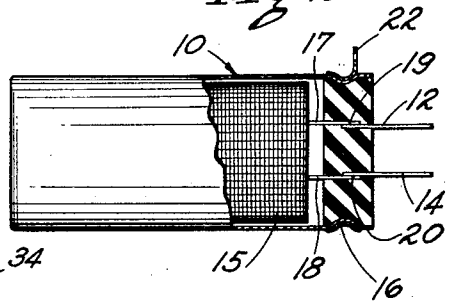


Fig. 3

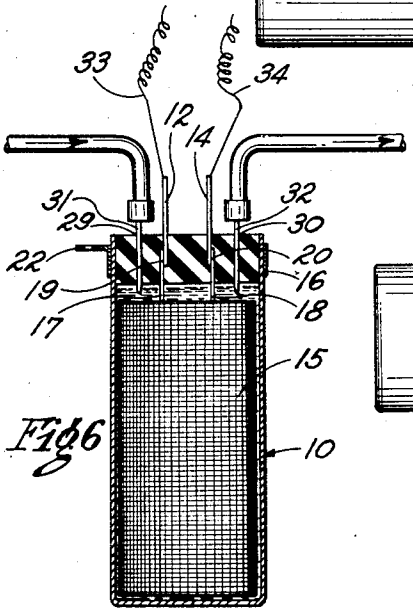


Fig. 6

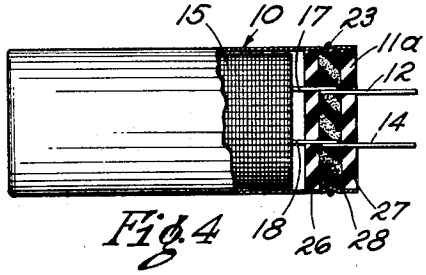


Fig. 4

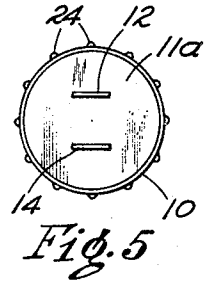


Fig. 5

INVENTOR.
JOSEPH B. BRENNAN

BY Richey & Watts

ATTORNEYS

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ELECTROLYTIC DEVICE

Joseph B. Brennan, Euclid, Ohio

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11 Claims. (Cl. 175—315)

This invention relates to electrolytic devices and more particularly to containers for electrolytic devices. The invention is described herein as applied to electrolytic condensers, but those skilled in the art will appreciate that the invention is useful in conjunction with other devices and other types of electrolytic devices such as, for example, lightning arrestors, rectifiers and the like.

It is among the objects of my invention to provide containers for electrolytic devices which will be durable and leak proof in service, and which can be manufactured and assembled at low cost. Another object is to provide an economical method for applying a closure to such container and a further object is to provide a method of aging condensers incorporating my container construction. Another object is to provide a construction whereby an effective fluid tight seal can be made between a thin walled metallic member and a resilient member disposed therewithin. A further object is to provide an economical method of making such a seal. Further objects and advantages of my invention will become apparent from the following description of preferred and modified forms thereof reference being made to the accompanying drawing wherein:

Figure 1 is a perspective view of a condenser made according to my invention,

Figure 2 is a view illustrating the component parts of the condenser shown in Figure 1 before the assembly has been completed,

Figure 3 is a side elevation partially in section showing the condenser of Figure 1,

Figure 4 is a side elevation partially in section of a modified form of condenser,

Figure 5 is an end elevation of the condenser shown in Figure 4, and

Figure 6 is a somewhat diagrammatic illustration showing my aging method as applied to a condenser of the type shown in Figure 1.

It has heretofore been the practice to enclose electrolytic condensers of the paste type in containers of a cardboard which must be tarred or waxed to prevent leakage and which in spite of all precautions frequently are found to be defective. Another type of container ordinarily used in conjunction with condensers of the wet type consists of a fairly heavy gauge aluminum can having a depending neck portion through which the anode terminal extends. These containers are generally satisfactory but are expensive to produce and require closures at both the top and bottom thereof.

According to my invention I eliminate the difficulties noted above and produce a low cost yet leak proof and durable container by employing a seal or closure construction which enables me to utilize an extruded, light gauge, tube of aluminum or other ductile metal having one closed end and having the other end open for substantially the full diameter of the tube. To close the open end I employ a plug composed of resilient rubber (the term "rubber" as used throughout the specification and claims is intended to include not only natural rubbers and rubber-like materials, but also various synthetic rubbers and rubber-like materials) through which the condenser terminals extend. The light gauge tube does not have sufficient strength of itself to engage the plug with sufficient force to create the necessary type of seal. To obviate this difficulty, I employ a seal which is useful and advantageous in other environments, and in which the rubber is compressed into leak proof engagement with the aluminum tube by deforming the tube inwardly and clamping it into deformed position by a clamping device such as a band of wire composed of a heavier or stronger material.

Such a construction is illustrated in the drawing wherein the container, which is preferably a light gauge, extruded aluminum tube having a wall thickness of about 0.005 inch for example, is indicated at 10. In the specification and claims the terms "light gauge" and "thin walled" are used with respect to the tube or container to define a material of such thinness that it does not of itself possess sufficient strength or rigidity to engage the resilient sealing member or plug with sufficient force to create the type of seal required by the service for which the device is intended. The open end of the container is closed by a plug 11 of resilient rubber through which pass the terminals 12 and 14 of the electrode assembly indicated generally at 15. The electrode assembly forms no part of the present invention as any ordinary type of condenser or electrolytic device may be utilized in conjunction with my container. The assembly illustrated at 15 may comprise, for example, two electrodes of film forming material rolled up together with suitable spacers to prevent contact between the electrodes, the whole being impregnated with a film maintaining electrolyte which is retained within the container 10.

As shown particularly in Figures 2 and 3 the component parts of a condenser embodying my invention may be assembled by merely inserting the electrode assembly 15 with the container 10, pushing the closure member 11 into the open end of the container, and slipping the ring 16 over the end of the container in the region adjacent the plug 11. Preferably the terminals 12 and 14 are passed through slits cut in the plug 11 before the parts are positioned in their assembled relationship. It is sometimes desirable to employ separately formed terminals 12 and 14 and weld or otherwise join them to electrode tabs or terminals 17 and 18 as indicated at 19 and 20 rather than to extend the terminals 12 and 14 into the electrode assembly. If such a construction is

employed as shown in the drawing then it is preferable to position the joints 19 and 20 within the resilient rubber plug 11, the result being that when the plug is compressed onto the terminals the joint is effectively sealed and protected against corrosion.

After positioning the parts as described above the ring 16, which may be composed of steel or other relatively strong metal, or may be of the same material as the tube, i. e., aluminum in the present case, only of heavier gauge, is deformed inwardly. This operation may be performed by spinning or rolling the ring into the arcuate shape shown in Figures 1 and 3 thus deforming the soft ductile metal of the container 10 into intimate sealing engagement with the plug, retaining the container in sealing engagement with the plug, and compressing the plug. By reason of the compression of the material of the plug, an effective seal is made between the electrode terminals 12 and 14 and the plug, thus preventing any possible leakage of electrolyte at these points. As illustrated in the drawing the ring 16 may be provided with means for mounting the device in a support such as, for example, the perforated ears 22 which extend radially outwardly from the ring.

In Figures 4 and 5 I have illustrated a modified form of my invention wherein instead of the flat ring 16, a wire ring or clamp 23 is employed to retain the plug 11a in the container 10. The wire may be crimped in a manner known to those skilled in the art to produce outwardly extending portions 24 thus reducing the diameter of the ring, deforming the container, compressing the plug, and firmly retaining the plug within the open end of the container 10.

The condenser shown in Figure 4 is further modified in the construction of the plug 11a. In this modification the plug is composed of three layers of rubber, the two outer layers 26 and 27 being composed of harder or firmer rubber than the inner layer 28, the three layers being vulcanized together to provide a structure in which the harder outer layers prevent buckling of the plug while the softer inner layer improves the sealing characteristics of the plug. Plugs of this sort may be produced by vulcanizing together three rubber sheets having the desired characteristics and then cutting the plugs from the sheets by means of a suitable die. Obviously the plug shown in Figures 4 and 5 may be utilized with the ring construction shown in Figures 1, 2 and 3; and similarly, the wire ring of Figures 4 and 5 may be used with the plugs of the type illustrated in Figures 1, 2 and 3.

In subjecting electrolytic condensers to their final film forming and aging process it is frequently desirable to circulate the electrolyte around and through the electrodes. This insures proper penetration of the electrolyte, and assists in dislodging gas bubbles thereby preventing defects from occurring in condensers when they are put in service. Also the temperature of the electrolyte may be maintained within the desired range. The circulation of the electrolyte may be accomplished very conveniently with condensers embodying my invention in the manner illustrated in Figure 6. As there shown the electrodes 15, terminals 12 and 14, plugs 11 and ring 16 may all be assembled with the container 10. Preferably, but not necessarily, prior to deforming the ring into clamping engagement with the container, small openings as at 29 and 30 are pierced through the plug 11, preferably without removing any material therefrom, and small tubes or needles 31 and 32 inserted through the openings into communication with the interior of the container 10. Electrolyte may then be pumped into the container through the tube 31, for example, while the electrolyte flows out through the tube 32. The terminals 12 and 14 may be connected to a suitable source of electromotive force as by the conductors 33 and 34 and in this manner the condenser or other electrolytic device may be subjected to the desired film forming and aging operations while electrolyte is being circulated through the condenser by means of the tubes 31 and 32 projecting through the plug 11.

After the aging process has been completed the condenser may be made ready for shipment and sale merely by removing the tubes 31 and 32 and then compressing the ring 16 inwardly to deform the container 10 into intimate engagement with the plug 11 and to compress the lug. Obviously, if the ring was compressed prior to forming the film, no further deformation will be necessary as the compressive stresses in the rubber will result in the immediate sealing of the openings as soon as the tubes are removed. The compression of the plug results in effectively sealing the openings 29 and 30 through which the tubes 31 and 32 were inserted. By this method, and with my construction the electrolyte can be circulated around the electrodes during the aging process which can be carried out with the condenser in its finally assembled form; and after the aging process has been completed the condenser can be sealed up without requiring any handling of the electrodes thus eliminating any possibility of contamination of the condenser.

In the foregoing it will be evident that I have provided a simple and economical construction for devices such as electrolytic condensers whereby light gauge metallic tubes can be utilized as containers. By my invention an effective seal can be produced between a light gauge tubular member and a resilient member disposed therewithin. By utilizing a clamping ring such as a wire or band of stronger or heavier material than the material of the tube, the tube is reinforced at the zone where strength is needed, thus permitting the use of tubes of lighter gauge than heretofore, and making possible the production of strong and fluid tight joints with light gauge tubular members. My construction lends itself to easy and economical assembly method and condensers made according to my invention can be aged with circulating electrolytes without requiring any additional handling of the electrodes, and in such a manner as to preclude the possibility of contamination of the electrolyte or electrode.

In the foregoing specification I have described preferred and modified forms of my invention merely by way of example and with no intention that my patent should be limited to the precise embodiments disclosed herein. Various modifications and changes can be made in the constructions and method shown and described herein, and the invention can be adapted to other devices without departing from the spirit and scope of my invention. Therefore it is to be understood that my patent is not limited to the forms illustrated and described herein or in any manner other than by the appended claims when given the range of equivalents to which my patent may be entitled.

I claim:

1. In an electrolytic device, a container comprising a thin walled metallic tube closed at one end and open at the other, an electrode within the container, a closure for the open end of the tube comprising a resilient rubber plug, the material of the tube being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the plug with sufficient force to create an adequate seal, a terminal for said electrode passing through said rubber plug, and an endless metallic ring contracted into engagement with the exterior of said tube for clamping the material of said tube into sealing engagement with said plug.

2. In an electrolytic device, a container comprising a thin walled metallic tube closed at one end and open at the other, an electrode within the container, a closure for the open end of the tube comprising a resilient rubber plug, a terminal for said electrode passing through said rubber plug said terminal comprising two pieces joined together, the joint being disposed within said plug, the material of the tube being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the plug with sufficient force to create an adequate seal, and an endless metallic ring deformed inwardly and clamping the material of said tube into sealing engagement with said plug and compressing said material against said terminal.

3. In an electrolytic device, a container comprising a thin walled aluminum tube closed at one end and open at the other, an electrode within the container, a closure for the open end of the tube comprising a resilient rubber plug, the material of the tube being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the plug with sufficient force to create an adequate seal, a terminal for said electrode passing through said rubber plug, and a steel ring having at least a portion thereof deformed inwardly into engagement with the exterior of said tube for clamping the material of said tube into sealing engagement with said plug.

4. In an electrolytic device, a container comprising a thin walled metallic tube closed at one end and open at the other, an electrode within the container, a closure for the open end of the tube comprising a resilient rubber plug, the material of the tube being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the plug with sufficient force to create an adequate seal, a terminal for said electrode passing through said rubber plug, and a wire ring having an initial diameter substantially the same as the exterior of said tube and crimped into engagement with the exterior of said tube for clamping the material of said tube into sealing engagement with said plug.

5. In combination, a container for electrolytic devices comprising a thin walled open ended tube of imperforate ductile material, a closure therefor comprising a resilient rubber plug, the material of the tube being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the plug with sufficient force to create an adequate seal, and a clamping ring surrounding said tube and crimped into engagement therewith to contract said tube into sealing engagement with said plug.

6. In an electrolytic device a container comprising a thin walled metallic tube open at one end, a closure for the open end of the tube comprising a resilient rubber plug, the material of the tube being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the plug with sufficient force to create an adequate seal, a ring of arcuate cross section engaging the exterior of the tube for clamping the material of said tube into sealing engagement with said plug, and mounting means associated with said ring.

7. The method of making electrolytic devices which includes the steps of making an electrode and terminal assembly, passing the terminal through a resilient rubber plug, inserting the electrode into a thin walled tubular container, the material of the container being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the plug with sufficient force to create an adequate seal, inserting said plug into one end of said container, positioning an endless clamping ring around said container adjacent the end thereof, and deforming said clamping ring inwardly to contract said container into sealing engagement with said plug and compress the material of said plug into sealing engagement with said terminal.

8. The method of making a fluid tight joint which includes the steps of inserting a resilient rubber member into one end of a thin walled tubular member, the material of the member being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the plug with sufficient force to create an adequate seal, positioning an endless clamping ring around said tubular member adjacent the end thereof, and deforming said clamping ring inwardly to contract said tubular member into sealing engagement with said rubber member.

9. The method of making electrolytic devices which includes the steps of making an electrode and terminal assembly, passing the terminal through a resilient rubber plug, inserting the electrode into a thin walled tubular container, inserting said plug into one end of said container, positioning a clamping ring around said container adjacent the end thereof, piercing an opening through said plug, inserting a tube into said opening, passing an electrolyte through said tube, thereafter withdrawing said tube and deforming said clamping ring to contract said container into sealing engagement with said plug, compress the material of said plug into sealing engagement with said terminal, and seal said pierced opening.

10. In combination, a thin walled tubular member of imperforate ductile material, a resilient rubber member disposed therewithin, the material of the tubular member being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the rubber member with sufficient force to create a fluid-tight seal, and an endless metallic ring surrounding said tubular member and deformed inwardly into engagement therewith to contract said tubular member into sealing engagement with said rubber member.

11. In combination, a container for electrolytic devices comprising a thin walled open ended tube of imperforate ductile material, a closure therefor comprising a resilient rubber plug, the material of the tube being of such thinness that it does not of itself possess sufficient strength or rigidity to engage the plug with sufficient force to create an adequate seal, and a clamping ring of arcuate cross section surrounding and engaging said tube to contract said tube into sealing engagement with said plug.

JOSEPH B. BRENNAN.