

March 2, 1954

Filed Jan. 25, 1950

J. B. BRENNAN  
CLOSURE, TERMINAL, AND MOUNTING CONSTRUCTION  
FOR ELECTROLYTIC DEVICES

2,671,126

4 Sheets-Sheet 1

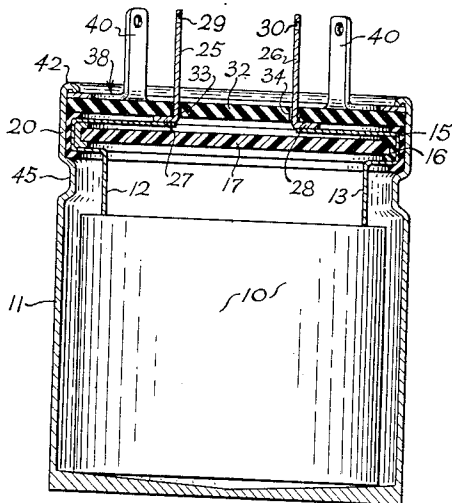


FIG. 1

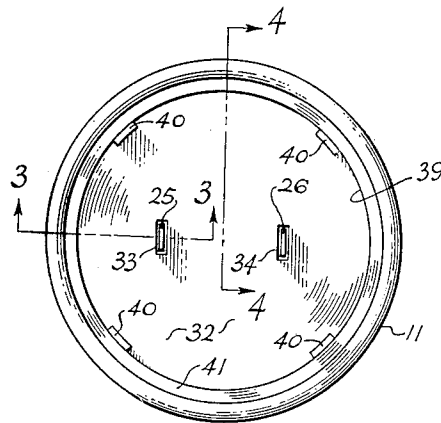


FIG. 2

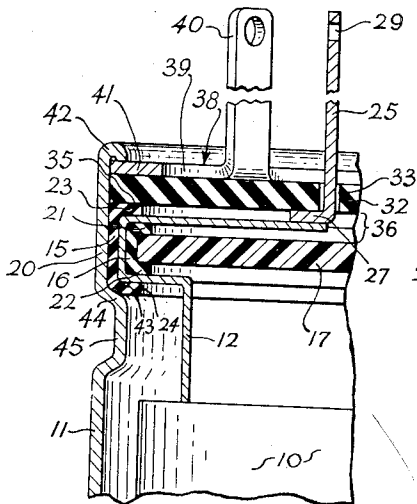


FIG. 3

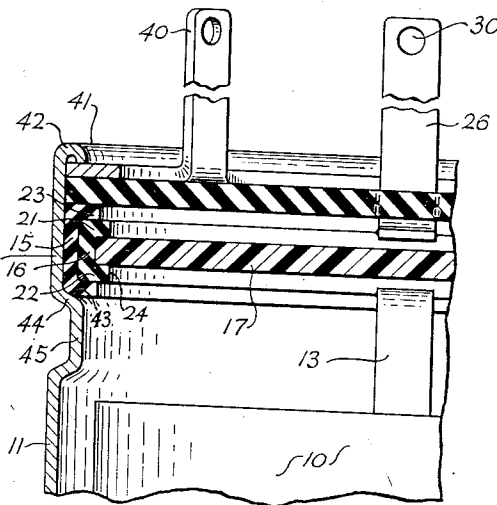


FIG. 4

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**2,671,126**

4 Sheets-Sheet 2

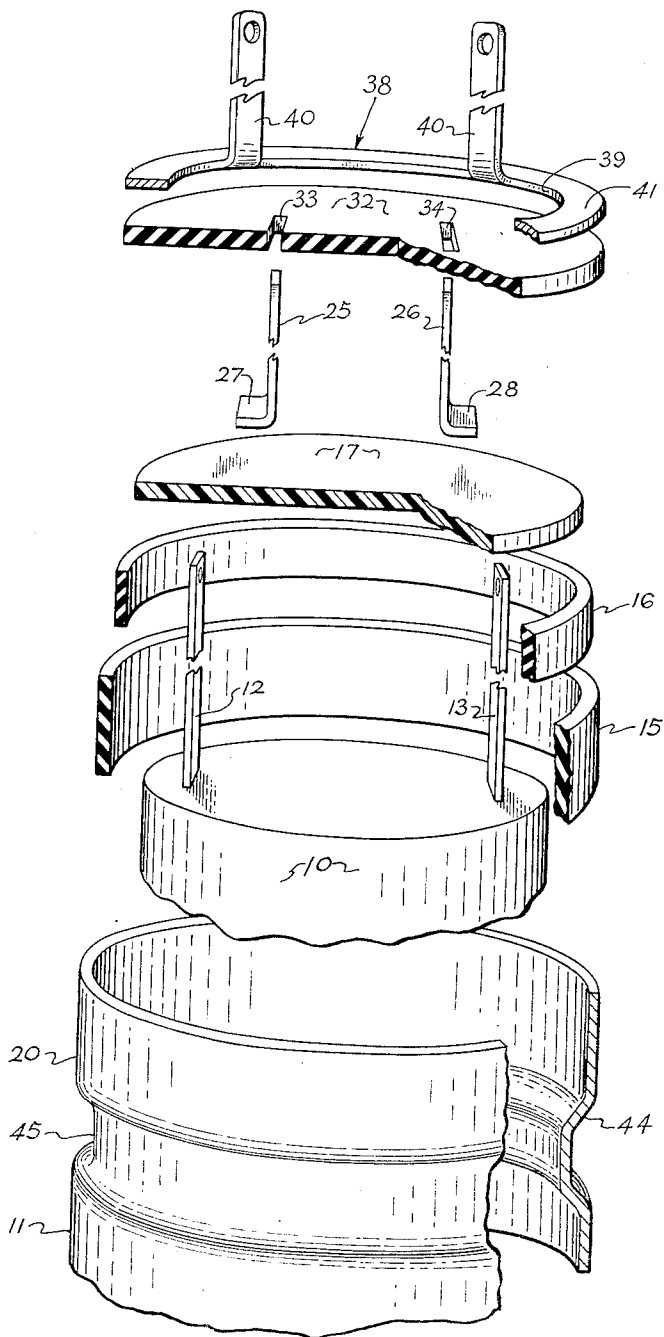


FIG. 5

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J. B. BRENNAN  
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2,671,126

Filed Jan. 25, 1950

4 Sheets-Sheet 3

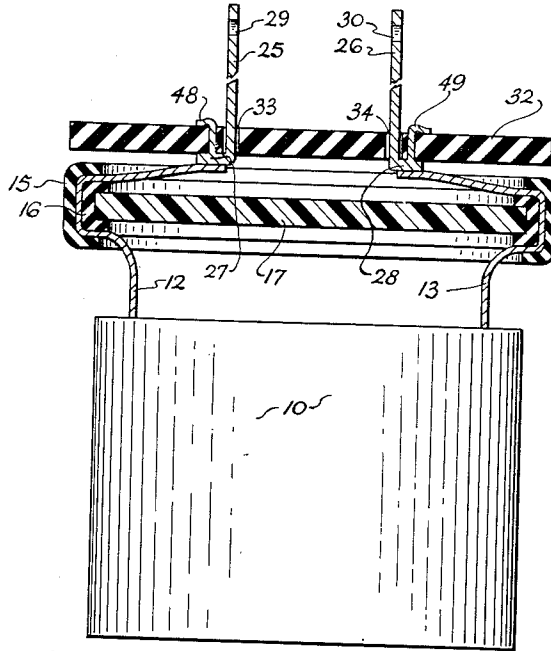


FIG. 6

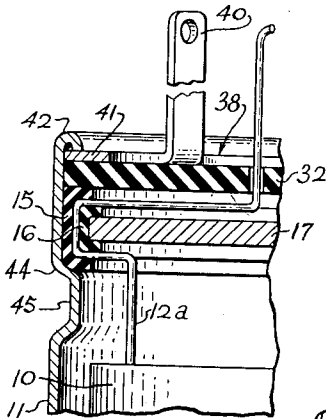


FIG. 7

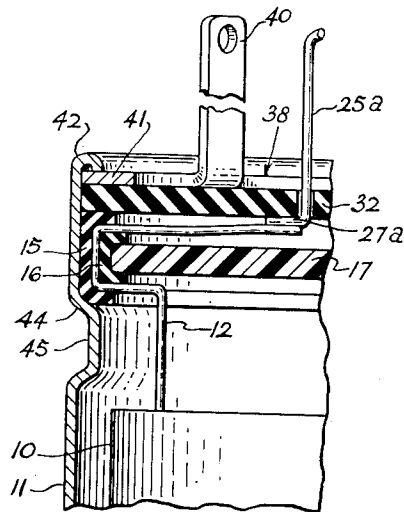


FIG. 8

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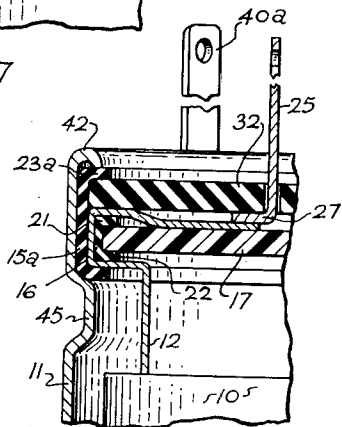


FIG. 9

March 2, 1954

J. B. BRENNAN  
CLOSURE, TERMINAL, AND MOUNTING CONSTRUCTION  
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2,671,126

4 Sheets-Sheet 4

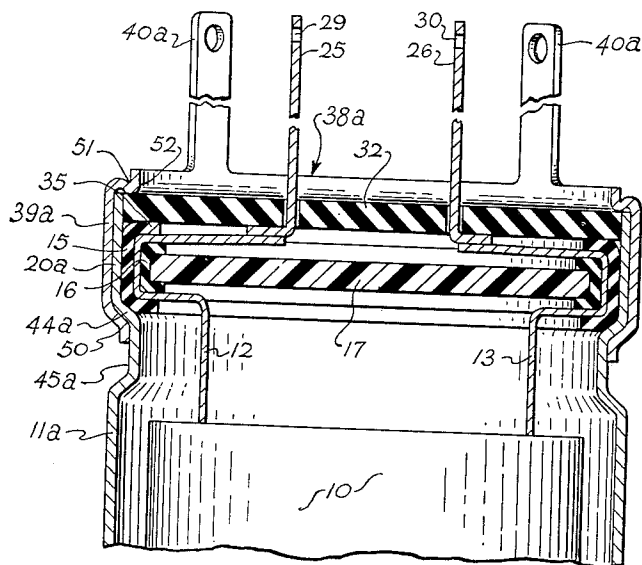


FIG. 10

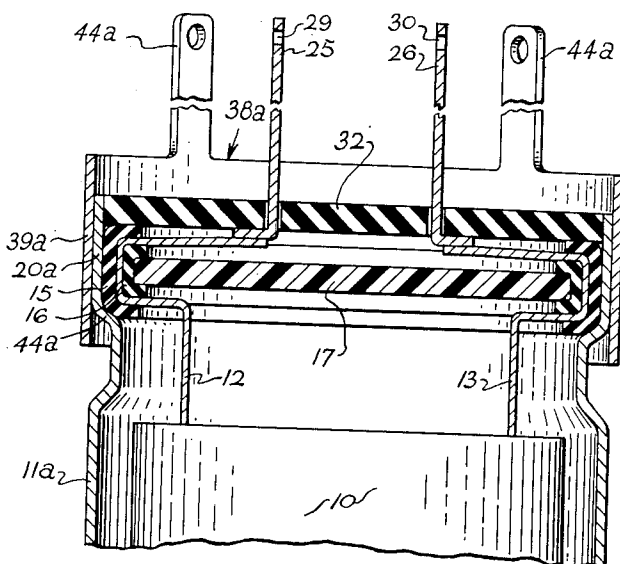


FIG. 11

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## UNITED STATES PATENT OFFICE

2,671,126

## CLOSURE, TERMINAL, AND MOUNTING CONSTRUCTION FOR ELECTROLYTIC DEVICES

Joseph B. Brennan, Cleveland, Ohio, assignor to  
Everett D. McCurdy, as trustee

Application January 25, 1950, Serial No. 140,513

3 Claims. (Cl. 174-50)

1

This invention relates to electrolytic devices and more particularly to closure, terminal and mounting constructions for electrolytic devices. The invention is described herein in connection with electrolytic condensers and the like. It is to be understood, however, that the invention is useful in connection with various other electrolytic devices. The present application is a continuation in part of my copending application Serial No. 733,970, filed March 11, 1947.

Electrolytic condensers ordinarily comprise a container in which the electrodes or plates of the condenser are disposed. The container serves to retain the electrolyte required for the operation of the condenser, the electrolyte ordinarily being a liquid or a viscous paste and also protects the condenser plates. In order to prevent loss of the electrolyte, it is necessary that the container be sealed, and it is also necessary that one or more terminals or leads be extended from the electrodes within the container to the exterior of the container.

A general object of the invention is the provision of a closure construction for electrolytic devices by means of which the container of the device can be sealed effectively and permanently, in which leads or terminals can be extended from the interior to the exterior of the device and firmly supported and insulated from each other and in which means for supporting the device can be incorporated if desired. Another object is the provision of such a construction which can be manufactured at a substantial saving in cost as compared to the cost of prior types of closure assemblies.

According to my application Serial No. 733,970 aforesaid, I provide an effective seal and closure for the container for an electrolytic device and a support for the terminals thereof by disposing within the open end of the container two members composed of resilient insulating material such as rubber (the term "rubber" as used herein includes both natural and synthetic rubber and rubber-like materials) and having opposed mating surfaces. One or more terminal members, preferably in the form of small wires or strips of thin metallic foil, extend from the exterior to the interior of the container between the opposed mating surfaces, and the resilient members are deformed to admit the terminal and to seal against the terminal and each other. According to the present invention, a seal of this type is employed and in conjunction with the seal, means are provided for giving additional support and separation to the terminal members and

2

also or alternatively means are provided for mounting the condenser or other electronic device in an apparatus.

Further objects and advantages of the invention will become apparent from the following description of preferred forms thereof, reference being made to the accompanying drawings in which Figure 1 is a vertical sectional view through an electrolytic condenser of the paste type embodying one form of my invention; Figure 2 is a plan view of the condenser shown in Figure 1; Figure 3 is an enlarged sectional detail taken as indicated by the line 3-3 of Figure 2; Figure 4 is an enlarged sectional detail taken in a plane at right angles to the plane of Figure 3 as indicated by the line 4-4 of Figure 2; Figure 5 is an exploded view illustrating the component parts of the condenser of Figure 1; Figure 6 illustrates a sub-assembly made up of some of the parts shown in Figure 5; Figures 7, 8 and 9 are sectional details similar to Figure 3 but showing modified forms of terminal constructions; Figure 10 is a vertical sectional view of a condenser embodying a modified form of container and mounting device; and Figure 11 is a vertical sectional view showing one stage in the assembly of the condenser shown in Figure 10. The thickness of various parts is exaggerated in the drawings for convenience of illustration.

Referring to Figures 1 to 5 of the drawings, a condenser embodying one form of my invention may comprise an electrode assembly 10 disposed within a container 11, the container being a thin-walled open-ended cup or can composed of aluminum or other suitable material. The electrode or plate assembly may be of any desired construction; this assembly per se forms no part of the present invention and will not be described further herein. Terminals or leads 12 and 13 project upwardly from the assembly 10, extend through the sealing means and provide means for connecting the assembly 10 to an external circuit. The terminals, which may be composed of fine wire or other suitable conductive material but which are shown herein as being composed of narrow strips of thin (0.030 inch for example) aluminum foil extend as described in my aforesaid application between resilient annular sealing rings 15 and 16, the inner ring 16 being supported by a closure disk 17 composed of a plastic insulating material such as a phenolic condensation product, hard rubber, or other material that will not contaminate or be damaged by the electrolyte. In a typical installation in a 10 m.f.d. condenser the disk may have a thick-

ness of about  $\frac{1}{16}$  inch. The sealing members are held in sealing engagement with the container, with the terminal members 12 and 13, with each other except where they are separated by the terminal members and with the closure disk 17 by being compressed between the closure disk 17 and the wall of the container 11 particularly in the region within the portion 20 of the container 11. The sealing rings may be composed of any suitable resilient insulating material which will not contaminate or be damaged by the electrolyte. Rubber of the sort used in ordinary small rubber bands is satisfactory; where the terminals are 0.030 inch thick, sealing members having a normal thickness of about  $\frac{1}{16}$  inch, for example, are satisfactory. Rubber strips or latex, as described in my aforesaid application may be employed. The thickness of the sealing members is not critical so long as there is sufficient resilience to permit the terminals to be embedded in and sealed against the sealing members with the sealing members sealed against each other except where they are separated by the terminals. Preferably, the sealing members are stretched over the periphery of the closure disk; the inner sealing member 16 has inwardly extending flanges 21 and 22 that engage the marginal edge portions of the upper and lower surfaces of the closure disk 17 and the outer sealing member 15 has flanges 23 and 24 that overlie flanges 21 and 22. Figure 3 illustrates the manner in which the sealing members are sealed against the portion 20 of the container 11, the disk 17 and the terminal 12. The same sealing action takes place adjacent the terminal 13. Figure 4 illustrates the manner in which the outer surface of the inner member 16 seals against the inner surface of the outer member 15 in the zones where the terminal members do not intervene. The sealing members 15 and 16 also make sealing engagement with the portion 20 of the container and the supporting disk 17, respectively, in these zones.

As described and illustrated in greater detail in my aforesaid application, the material of the rings 15 and 16 is soft and resilient enough to permit the terminal members to become embedded therein with the resilient rings 15 and 16 sealing not only against the lateral faces of the terminals but also against the narrow edges thereof, thus effectively sealing the container against leakage.

The seal and closure construction just described is generally similar to that described and claimed in my aforesaid application. According to the present invention, provision is made for incorporating in the closure and seal construction means for positively supporting and separating terminal members and means for mounting the condenser. These means can be used and preferably are used together but either one may be utilized without the other if desired.

In order to provide for ease of connection of the condenser to external circuits, the foil or wire terminals 12 and 13 are preferably welded and/or clinched to tinned steel external terminal members 25 and 26, respectively, see Figure 1. These are of the type conventionally used in electrolytic condensers and have foot portions 27 and 28 which are welded and/or clinched to the ends of terminals 12 and 13 and openings 29 and 30 near their upper ends, the openings being provided for convenient connection of the terminals to conductors forming part of an external circuit.

In order to retain the terminals 25 and 26 in proper position and also to separate them and insulate them from each other and to protect the terminals 12 and 13, a terminal-supporting disk 32 is disposed immediately above the closure disk 17. Disk 32 may be relatively thin (for example,  $\frac{1}{16}$  inch) and may be composed of any suitable insulating material such as hard fiber or the like; disk 32 does not come into contact with the electrolyte and therefore contamination of the electrolyte and damage to the disk by the electrolyte are not problems. The disk 32 has apertures 33 and 34 through which the shanks of terminals 25 and 26 extend. The outer marginal edges of the disk 32 engage and compress the upper annular edge of the sealing ring 15 as indicated at 35, the external diameter of the disk 32 approximating the internal diameter of the portion 20 of the container 11. The thickness of the rings 15 and 16 where they are disposed between the disks 17 and 32 is such that a space 36 is left between the disks 17 and 32 to accommodate the terminals 12 and 13 and the feet 27 and 28 of the terminals 25 and 26 where they are welded together. The depth of the space, however, is preferably slightly less than the combined thicknesses of the terminals 12 and 13 and feet 27 and 28. Thus, the feet are held tightly between the disks 17 and 32 which deflect slightly to accommodate them; the terminals 25 and 26 are thereby retained in position against any substantial amount of movement.

In order to provide for mounting of condensers in apparatus such as radios and the like, it is customary to employ a cathode and/or mounting ring. Such a cathode and/or mounting ring can readily be assembled with condensers embodying the present invention. As shown in Figures 1 to 5, such cathode and mounting ring 38 may have a short cylindrical portion 39 with mounting lugs 40 of the conventional type at its upper end and an external flange 41 at its lower end. The flange 41 is disposed immediately above and in contact with the upper marginal surface of the disk 32 and the mounting ring and entire seal and terminal assembly is held in place by spinning or otherwise turning in the upper edge of the portion 20 of the container 11 as indicated at 42. The spinning operation subjects the assembly to axial compression, compressing the rings 15 and 16 by the pressure exerted by the disk 32 in the zone 35 and the pressure exerted in the opposite direction in the zone 43 adjacent the shoulder 44 formed by the inwardly extending groove 45 immediately below the portion 20 of the container 11. When the ring is to be used as a cathode terminal any convenient means may be employed to connect the condenser cathode thereto.

The mode of assembly of the parts will be evident from a consideration of Figures 5 and 6. Initially, the container 11 is provided with the groove 45, the portion 20 of the container being straight to the end thereof. The terminal members 12 and 13 of the electrode assembly 10 may be welded and/or clinched to the terminals 25 and 26 at any convenient time during the assembly operation. The inner rubber ring 16, which is normally of smaller diameter than the disk 17 is for example stretched over the periphery of the disk 17. Then the terminal members 12 and 13 are disposed in contact with the outer surface of the ring 16. After the outer rubber ring 15 is stretched over the inner rubber ring 16 and the terminal members 12 and 13, the terminals 25 and 26 are then welded to terminals

12 and 13 unless the operation has previously been performed.

If desired, a sub-assembly such as shown in Figure 6 may be produced by slipping the terminals 25 and 26 into the openings in the disk 32 and clinching the feet 27 and 28 of the terminals to the disk 32 as shown at 48 and 49. Such a sub-assembly can be handled as a unit during subsequent operations; the sub-assembly is convenient where it is necessary to subject the electrode assembly 10 to additional aging or formation before it is sealed in the container or can 11.

Next, the electrode assembly 10 is disposed within the container 11; then the disk 17, with the rings 18 and 15 stretched over the periphery thereof and with the terminals 12 and 13 extending between the outer surface of the inner ring and the inner surface of the outer ring, is pressed into the portion 20 until the inwardly extending marginal portion 24 of ring 15 is firmly in engagement with shoulder 44 as shown at 43 in Figure 3. Thereafter, unless a sub-assembly as shown in Figure 6 has been made previously, the disk 32 is slipped over the terminals 25 and 26 and into the open end of portion 20; ordinarily it is not necessary to clinch the feet of the terminals to the disk when the sub-assembly is not required. The mounting and cathode ring 38 is placed in position and the end edge of portion 20 is turned over as at 42 by a spinning or pressing operation to firmly engage the flange 41 and exert pressure thereon to compress the seal assembly between the disk 32 and the shoulder 43, thus completing the assembly.

In Figure 7 a modified form of the invention is shown in which the terminals for the condenser assembly 10 are in the form of wire and are extended in one piece between the sealing members and through the openings in the disk 32. The terminal 12a only is shown in the drawing, the other terminal being substantially identical. The remaining parts of the structure function and are arranged in the manner previously described with reference to Figures 1 to 5, and the reference characters employed in Figures 1 to 5 have been applied to corresponding parts in Figure 7.

Figure 8 is a showing of another modification in which the external terminals take the form of wires welded and/or clinched to the terminals 12 and 13 of the condenser assembly 10. In this figure only the terminal 25a is shown, the portion 27a of the wire being welded to the terminal 12. A similar terminal, not shown, is welded to the terminal 13 here as in Figure 7. The remaining parts are constructed as previously described and are identified by the same reference characters.

Figure 9 illustrates another modification of the invention in which the outer resilient annular sealing ring 15a extends around the periphery of the terminal supporting disk 32; the inwardly extending flange 23a of the sealing ring extends over the marginal edge portion of the disk 32 and is engaged by the inwardly turned edge 42 of the container to provide the necessary sealing pressure. The ring 15a encompasses disk 32. In the embodiment shown in Figure 9, the mounting ring 38 is omitted, one or more cathode tabs 40a being welded to the container 11 if desired. Except for this and the arrangement of the outer sealing ring, the remaining parts of the assembly are constructed as previously described with respect to Figures 1 to 5 of the drawings and

are identified by the same reference characters. It will be understood that if desired the wire terminal arrangement of Figures 7 and 8 and/or the clinched terminals of Figure 6 may be used with this type of construction. A cathode and mounting ring such as shown in Figures 1 to 4 may be employed if desired, the ring being disposed either immediately below the upper flange 23a of the sealing ring 15a or between the flange 23a and the inwardly turned edge 42 of the container.

Figures 10 and 11 illustrate an adaptation of the invention to a container and mounting ring construction of a different type. In these figures the terminals, sealing rings and disks 17 and 32 function in the manner previously described and these and other identical parts are identified by the reference characters used in describing the modification of Figures 1 to 5. However, in this form of the invention, the container 11a is composed of water-proofed cardboard, plastic, thin metal or other material which does not of itself have great strength, and the mounting ring 38a is utilized to reinforce the container to provide the necessary strength for creating an effective seal by compression of the sealing rings 15 and 16. In this modification, the container 11a is initially provided with an inwardly extending groove 45a furnishing a shoulder 44a to act as a stop for the seal assembly. The upper portion 20a of the container is initially straight. The mounting ring 38a is preferably composed of aluminum, steel or other suitable material and comprises a straight tubular portion or sleeve 39a having sufficient strength to exert the necessary clamping force on the sealing rings 15 and 16 from which mounting lugs 40a project.

To assemble condensers embodying this construction, the parts are first disposed as shown in Figure 11, the disk 17 and sealing members 15 and 16 being pressed into the portion 20a of the container 11a after the mounting sleeve 39a has been positioned around the portion 20a to reinforce it. Then the sleeve 39a is spun or otherwise deformed inwardly immediately below the shoulder 44a as indicated at 50 in Figure 10 to support and reinforce the shoulder. The assembly is completed by spinning or otherwise forming the groove 51 immediately above the disk 32, thus providing an inwardly extending shoulder 52 above the disk 32. In practice, both grooves may be formed simultaneously. The spinning operation applies axial pressure to the seal assembly, pressure being exerted by the shoulder 52 to compress the disk 32 against the portion 35 of the outer ring 15 and to compress the outer ring against the shoulder 44a which is supported by the inwardly deformed portion 50 of the sleeve 39a. Thus, the operation of deforming the sleeve 39a secures the sleeve firmly to the container 11a, reinforces the container where such reinforcement is required in order to create sealing pressure and compresses the resilient sealing means to make the seal.

From the foregoing description of preferred forms of my invention, it will be evident that I have provided a closure and terminal construction for electrolytic condensers and other electrolytic devices in which the containers for the device are properly sealed against loss of electrolyte and the terminals are supported in desired positions and separated and insulated from each other. My invention lends itself to use with conventional terminals and conventional mounting means for the condensers. The construction

is such that the condensers can be manufactured and assembled at low cost, and by simple manufacturing operations the completed assembly is made leakproof and sturdy.

Those skilled in the art will appreciate that various changes and modifications can be made in the preferred forms of the invention described herein without departing from the spirit and scope of the invention. For example, the mounting ring may be omitted if it is not required. The invention may be adapted to different types of electrolytic devices and different materials may be employed. In the form of the invention shown in Figures 10 and 11, the sleeve 39a may be terminated in the region immediately above the groove 51 in instances where mounting lugs are not required. The modified terminal constructions of Figures 7 and 8 may be used with the container and mounting ring arrangement of Figures 10 and 11. Various other modifications of the invention will occur to those skilled in the art. Therefore, it is to be understood that the foregoing description of preferred forms of the invention is given by way of example and that the scope of the invention is defined by the appended claims.

I claim:

1. A closure and terminal support for an electrolytic device having an open-ended container, said closure and support comprising a rigid imperforate disk-like closure member composed of insulating material disposed within the open end of the container, two members composed of resilient insulating material disposed one within the other and having annular complementary mating surfaces, the inner of said resilient members engaging and being supported by the periphery of said insulating rigid imperforate disk-like member against the pressure exerted by the outer of said resilient members and having inwardly extending flanges engaging the marginal edge portion of the radial surfaces of said insulating imperforate closure member and the outer of said resilient members engaging the outer surface of said inner resilient member and having inwardly extending portions overlying the inwardly extending flanges of the inner resilient member and being supported by the interior surface of the open end of said container, a metallic terminal extending between said mating surfaces of said resilient members from the interior to the exterior of said closure member, said terminal being embedded in said resilient members and said resilient members being directly in contact with each other on either side of said terminal, the mating surfaces of said resilient members being in sealing engagement with each other and with said terminal, a terminal supporting disk overlying said closure member, said disk being composed of insulating material and having an opening through which said terminal extends, said disk engaging the inwardly extending flange of the outer resilient member.

2. A closure and terminal support for an electrolytic device having an open-ended container, said closure and support comprising a rigid insulating imperforate disk-like closure member

disposed within the open end of the container, two members composed of resilient insulating material disposed one within the other and having annular complementary mating surfaces, the inner of said resilient members engaging and being supported by the periphery of said rigid disk-like member against the pressure exerted by the outer of said resilient members and having inwardly extending flanges engaging the marginal edge portion of the radial surfaces of said rigid insulating imperforate closure member and the outer of said resilient members engaging the outer surface of said inner resilient member and being supported by the interior surface of the open end of said container, a metallic terminal extending between said mating surfaces of said resilient members from the interior to the exterior of said rigid insulating imperforate closure member, said terminal being embedded in said resilient members and said resilient members being directly in contact with each other on either side of said terminal, the mating surfaces of said resilient members being in sealing engagement with each other and with said terminal, a terminal supporting disk overlying said rigid insulating imperforate closure member, said disk being composed of insulating material and having an opening through which said terminal extends, said outer resilient member encompassing said disk.

3. In an electrolytic device having an open-ended container, a closure assembly for said container comprising a rigid insulating imperforate closure disk disposed in the open end of said container, means for creating a seal between said rigid insulating imperforate closure disk and said container, a terminal extending through said sealing means, the improvement which comprises a terminal supporting disk secured in the open end of said container exteriorly of said rigid insulating imperforate closure disk, said terminal supporting disk being composed of insulating material and having an opening therein through which said terminal extends, an external reinforcing ring disposed around the container near the open end thereof, said reinforcing ring and said container being deformed inwardly immediately adjacent said closure assembly on the side thereof opposite the open end of the container and also being deformed inwardly immediately adjacent the terminal supporting disk on the side thereof toward the open end of said container.

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