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ELECTROLYTIC CONDENSER

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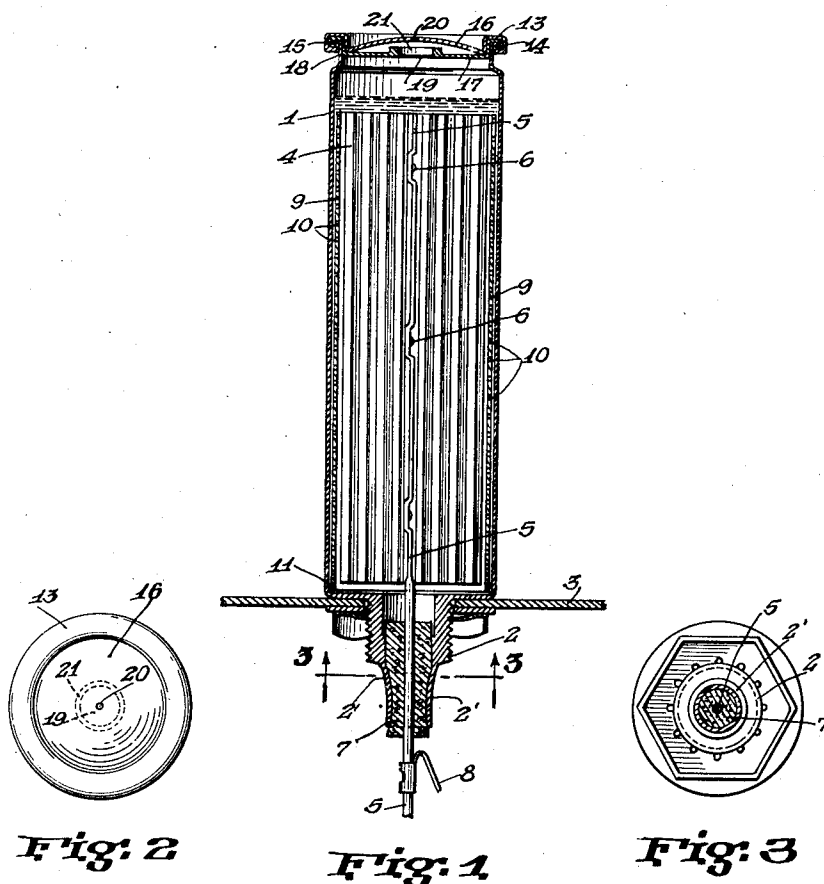


Fig. 2

Fig. 1

Fig. 3

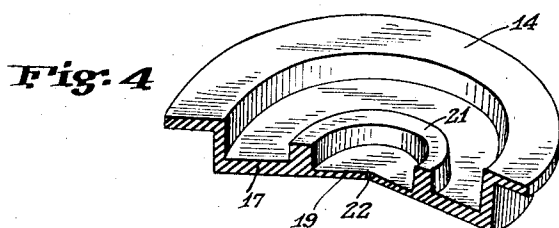


Fig. 4

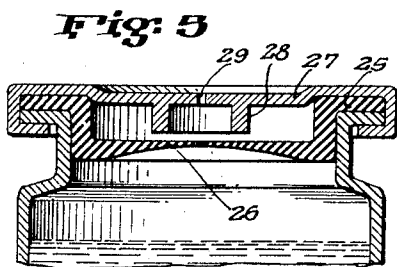


Fig. 5

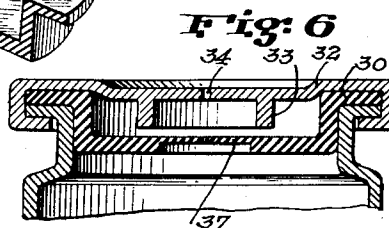


Fig. 6

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ELECTROLYTIC CONDENSER

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12 Claims. (Cl. 220—44)

The present invention relates to electrical condensers, more specifically to condensers of the electrolytic type, and to an efficient and reliable mechanical and electrical construction of such condensers.

In the construction of wet electrolytic condensers, reliable vents are desirable in connection with the liquid electrolyte where a suitable means is necessary for relieving the pressure of the interior of the container or casing caused by gases or vapors developed during the operation by the electric current passing through the condenser and likely to cause impairment of the function or complete destruction of the devices.

In my copending application, Serial No. 53,367, filed December 7, 1935, I have described a vent comprising a flexible diaphragm such as a rubber diaphragm spanning an opening in the container accommodating the electrolyte and the condenser elements and covered by an outwardly arched or vaulted cap. When excess gas pressure is developed within the container, the rubber diaphragm which has a thin mid portion provided with a normally closed puncture of pin-hole size is distended outwardly underneath the vaulted cover in such a manner that with a certain pressure the puncture is opened and the gas allowed to escape to the outside.

One of the features of the present invention relates to an improved construction of this general character allowing of a more accurate adjustment of the pressure at which the gases are released from the container and capable of operating at a substantially lower pressure and with increased liability as compared with known constructions such as described in my copending application above referred to.

Another feature is the method of holding the insulated terminal and the anode through an airtight, water-tight, mechanically strong and flexible arrangement which enables a very efficient construction acting both as a mechanical and electrically insulated structure.

Other important features are evident from the specification and drawing and will become more apparent from the following detailed description taken with reference to the accompanying drawing, in which

Fig. 1 is an elevational cross-sectional view of an electrolytic condenser provided with a vent structure according to the invention.

Fig. 2 is a top view of the condenser according to Fig. 1.

Fig. 3 is a cross-sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is an enlarged isometric detail view showing the rubber gasket and vent diaphragm in section.

Figs. 5 and 6 are enlarged partial cross-section views of a condenser of the type according to Fig. 1 illustrating modifications of the vent structure according to the invention.

Like reference numerals identify like parts in the different views of the drawing.

The condenser illustrated comprises a metallic container 1 of cylindrical shape consisting of a suitable material such as aluminum, copper, or commercial alloy, and accommodating a suitable electrolyte solution. The cylinder or container may be plated both inside and outside with chromium, nickel, copper, cadmium or any other suitable material, and it may be etched inside and outside if required. The container has a bottom wall 11 and a top wall 13, the latter having associated therewith a combined gasket and vent diaphragm consisting of rubber or other equivalent flexible material. The bottom wall is provided with a hollow screw threaded depending neck 2 serving for mounting the condenser on a support plate 3 in an inverted position in accordance with standard practice, or the container may be of the standard type with the depending neck but without screw threading. The anode or filmed electrode shown at 4 is supported by a rod of film forming material, such as aluminum, which in the example illustrated consists of a sheet or strip of film forming material preferably high purity aluminum of relatively small thickness folded back and forth in accordion fashion and riveted or otherwise secured to the rod 5. For this purpose the rod is shown swaged or flattened throughout its upper length adjoining the electrode 4 and provided with dish-shaped depressions to enable a simple and efficient connection with the central pleat of the anode 4 by means of rivets 6 or by a welding, or any other suitable connection. The pleats of the anode 4 may be of equal width or of gradually decreasing width towards the container wall similar as described in my copending application, or the anode may be wound concentrically with the riser rod 5 connected to the inside end of the anode, or the riser rod may be bent in such a manner as to be connected to the outside turn of the anode. Further details with regard to the material of rod 5, rivet 6, etc., may be substantially the same as described in said copending application. Alternatively, the anode may be cast or extruded with or without the riser rod being an integral part of the casting.

The rod 5 is further shown forced through a resilient plug 7 of flexible insulating material such as rubber placed inside the neck 2 of the container. The lower part of the neck 2 is pressed or spun inwardly against the rod 5 to compress the rubber plug 7 into a semi-cone shape with gradually decreasing pressure on the insulating material as the base of the cone is reached, uniformly in all directions to secure a liquid tight seal between the neck 2, plug 7 and rod 5. The lower end of the rod 5 projecting through the plug 7 constitutes the terminal of the anode and is provided with a suitable connecting means, such as clamping screw or soldering lug 8 having an integral sleeve forced over the rod 5 or otherwise connected thereto to secure close mechanical and electrical contact.

In order to prevent the anode 4 from coming in accidental contact with the wall of the container, a cylindrical spacer 9 of suitable material, such as hard rubber, Celluloid, gauze or the like is placed between the anode and the inner wall of the container. In order to allow free access of the electrolyte to both the container serving as the cathode and to the anode, the spacer 9 is provided with perforations 10 of suitable size and appropriate number.

The top of the container is hermetically closed by a pair of disc shaped cover members or caps 13 and 14, the latter consisting of flexible material, such as rubber, and serving as a combined sealing gasket and vent diaphragm, while the former preferably consists of metal and serves as a protection for the vent. In order to obtain a liquid-tight seal, the upper edge of the container is shown to be bent at first inwardly and then in an outward direction transversely to the axis of the container so as to provide a rim or flange shown at 15. Both the cover 13 and the rubber gasket 14 are provided with depressed mid-portion 16 and 17 snugly fitting one within each other and the container at 18.

The outer edges or shoulders of the vent-gasket 14 and the cover 13 are then rolled or spun over the flange 15 of the container as shown to effect a liquid tight seal between the container and cover 13. The center portion or cup-shaped depression 17 of the rubber gasket has a thinner mid-section than the remaining parts as shown more clearly at 19 in Figure 4. This section is provided with a central incision or puncture 22 of pin hole size closed under normal conditions and preventing leakage and exposure of the electrolyte in the container to the outside atmosphere. In order to enable the diaphragm 17 to distend under the influence of excess pressure developed in the container, I have shown in the example illustrated the mid-portion 16 of the cap or cover 13 of convex or outwardly arched shape to allow the diaphragm to curve up under the influence of the gas pressure in the container until the puncture 22 opens and the excess gas is allowed to escape to the outside through an escape hole or aperture 20 in the center of cap 16.

The vent diaphragm according to the present invention is of special construction enabling a very close and accurate adjustment of the gas pressure at which the puncture 22 is to open and relieve the interior of the condenser from excess gases. For this purpose, I have shown an annular rim 21 in the example illustrated integral with the diaphragm or otherwise connected thereto in any suitable manner and surrounding the thin punctured center section of the diaphragm. Alternatively, the rim 21 may be connected to the

cap 13 as shown in Figures 5 and 6. In a construction of this type it is seen that if the gas pressure is gradually increased, at first the entire diaphragm will distend or curve up until shortly before the critical pressure is reached, the rim 21 strikes the cover 16 preventing further distention of the outer diaphragm portion. If the pressure increases further, substantially only the thin center section 19 will be distended at a much greater rate due to its smaller thickness compared with the main section 17. Thus the puncture in the center section 18 will be opened by a slight pressure increase and release the excess gases. By properly designing the height of the annular rim 21 and its normal spacing from the cover 16, the critical operating pressure of the vent may be closely and accurately predetermined and adjusted for values substantially closer to the normal operating pressure as compared with vent constructions of the type heretofore known.

Thus it was found by experiment that with a vent of the type illustrated, release of excess gas could be obtained at a pressure of five pounds per square inch as compared with a minimum pressure of fifteen pounds per square inch required when using a vent construction of heretofore known type.

In Figures 5 and 6, I have shown modified constructions of a vent of the general character described. In the arrangement according to Figure 5, the intervening annular spacer 28 is shown integral with a substantially flat cover 27 provided with a central aperture or escape hole 29 similar as described before. The rubber diaphragm has an outer part or rim 25 and an inner depressed part 26 similar as shown in the previous figures. The inner or vent portion proper is shown to be of gradually varying thickness increasing from the center to the outside to secure the advantage and novel effects of an increasing degree of distension towards the center by the gas pressure analogous to the construction described by the previous figures.

Figure 6 also shows an annular spacer 33 being integral with the center portion of the cover or cap 32 or connected thereto in any other convenient manner. Item 34 represents a central escape hole similar as in the previous figures. The rubber diaphragm has an outer or gasket portion 30 and differs from the previous construction in that its central section 37 of less thickness is flush with the upper face of the diaphragm as compared with the construction shown in Figure 4 wherein the central section 19 is flush with the lower diaphragm surface.

With an improved vent construction as described by the present invention, it is possible to secure escape of excess gas an insure efficient and reliable operation of the vent with practical accuracy for any desired critical pressure in excess of the normal operating vapor pressure in the condenser.

As will be evident from the above, the invention is not limited to the specific construction shown in the drawing for illustration, but is susceptible of various modifications and variations coming under its broad scope as defined in the appended claims.

I claim:

1. A vent for a container subject to internal excess gas pressure comprising a flexible diaphragm, a cap covering said diaphragm, said diaphragm and cap being secured to the edge of an opening of said container with the outer por-

tion of said diaphragm forming a sealing gasket between said cap and the container, said diaphragm having a thin mid-section with a normally closed puncture therein, and an annular spacer surrounding said mid-section and arranged to project into the space between said diaphragm and said cap, the height of said spacer being less than the distance between said cap and said diaphragm in its normal non-distended condition whereby with increasing gas pressure developed within the container said diaphragm is caused to distend in its entirety towards said cap until checked by said spacer at a predetermined excess pressure, whereupon substantially only said punctured section is allowed to distend separately with continued pressure increase.

2. A vent for a container subject to internal excess gas pressure comprising a flexible diaphragm having a central section with a normally closed puncture therein, an apertured cap covering said diaphragm, said diaphragm and cap being secured to the edge of an opening of said container with the outer portion of said diaphragm forming a sealing gasket between said cap and the container, and a concentric annular spacer disposed between said diaphragm and said cap, the height of said spacer being less than the distance between said cap and said diaphragm in its normal non-distended condition whereby with increasing gas pressure developed within the container said diaphragm is caused to distend in its entirety towards said cap until checked by said spacer at a predetermined excess pressure, whereupon substantially only said punctured section is allowed to distend separately with continued pressure increase.

3. A vent for a container subject to internal excess gas pressure comprising a flexible diaphragm having a central section with a normally closed puncture therein, an apertured cap covering said diaphragm, said diaphragm and cap being secured to the edge of an opening of said container with the outer portion of said diaphragm forming a sealing gasket between said cap and the container, and an annular concentric spacer integral with said diaphragm and projecting into the space between said diaphragm and said cap, said spacer being normally spaced from said cap whereby with increasing gas pressure developed within the container said diaphragm is caused to distend in its entirety towards said cap until checked by said spacer at a predetermined excess pressure, whereupon substantially only said punctured section is allowed to distend separately with continued pressure increase.

4. A vent for a container subject to internal excess gas pressure comprising a rubber diaphragm, a cap with a central aperture covering said diaphragm, said diaphragm and cap being secured to the edge of an opening of said container with the outer portion of said diaphragm forming a sealing gasket between said cap and the container, said diaphragm having a thin mid-section with a normally closed puncture therein, and a concentric annular spacer integral with said diaphragm and projecting into the space between said diaphragm and said cap, said spacer being normally spaced from said cap whereby with increasing gas pressure developed within the container said diaphragm is caused to distend in its entirety toward said cap until opposed by said spacer at a predetermined excess pressure, whereupon substantially only said mid-

section is allowed to distend separately with continued pressure increase.

5. A vent for a container subject to internal excess gas pressure comprising a cap having an arched mid-section and an outer rim, a flexible diaphragm having an outer rim and a punctured center section, said diaphragm and cap being secured to an opening of said container with the rim of said diaphragm forming a gasket to effect a liquid tight seal between said cap and said container, and a concentric annular spacer surrounding said punctured section and projecting into the space between said diaphragm and said cap, the height of said spacer being less than the distance between said cap and said diaphragm in its non-distended condition, whereby with increasing gas pressure developed within said container said diaphragm is caused to distend in its entirety towards said cap until opposed by said spacer at a predetermined excess pressure, whereupon substantially only said punctured section is allowed to distend separately with continued pressure increase.

6. A vent for a container subject to internal excess gas pressure comprising an apertured cap having an arched mid-section and an outer rim, a flexible diaphragm having a thin punctured mid-section and a thicker outer rim, said diaphragm and cap being secured to an opening in said container with the rim of said diaphragm forming a gasket to effect a liquid tight seal between said cap and said container, and an annular spacer surrounding the mid-section of said diaphragm and projecting into the space between said diaphragm and said cap, the height of said spacer being less than the distance between said cap and said diaphragm in its non-distended condition whereby with increasing gas pressure developed within said container said diaphragm is caused to distend in its entirety towards said cap until opposed by said spacer at a predetermined excess pressure, whereupon substantially only said mid-section is allowed to distend separately with continued pressure increase.

7. A vent for a cylindrical container subject to internal excess gas pressure comprising an apertured cap having an arched mid-section and an outer rim, a rubber diaphragm having a normally flat punctured mid-section and an outer rim, said diaphragm and cap being secured to an open end of said container with the rim of said diaphragm forming a gasket to effect a liquid tight seal between said container and said cap, and an annular spacer integral with and surrounding said mid-section of said diaphragm, said spacer projecting into the space between said diaphragm and said cap and being normally spaced from said cap, whereby with increasing gas pressure developed within said container said diaphragm is caused to distend in its entirety towards said cap until opposed by said spacer at a predetermined excess pressure, whereupon substantially only said mid-section is allowed to distend separately with continued pressure increase.

8. A vent for a container subject to internal excess gas pressure comprising a cap having an apertured arched mid-section and an outer rim, a rubber diaphragm having a thin center section and an outer rim, said diaphragm and cap being secured to an opening in said container with the rim of said diaphragm forming a gasket to effect a liquid tight seal between said cap and said container, and an annular spacer integral with and surrounding said mid-section of said diaphragm, said spacer projecting into the space between said

diaphragm and said cap and being normally spaced from said cap, whereby with increasing gas pressure developed within said container said diaphragm is caused to distend in its entirety towards said cap until opposed by said spacer, whereupon substantially only said punctured section is allowed to distend separately with continued pressure increase.

9. A vent structure for a container subject to internal excess gas pressure comprising a flexible diaphragm spanning an opening of said container, an apertured cap spaced from and covering said diaphragm, said diaphragm and said cap being secured to said container, said diaphragm having a punctured mid-section of lesser thickness than its outer portion, and an annular separator integral with said diaphragm and surrounding the mid portion thereof and being normally spaced from said cap.

10. A vent structure for a container subject to internal excess gas pressure comprising a flexible diaphragm spanning an opening of said container, an apertured cap spaced from and covering said diaphragm, said diaphragm and said cap being secured to said container, said diaphragm having a punctured mid section of lesser thickness than its outer portion, and an annular separator integral with said cap and surrounding said mid section of an normally spaced from said diaphragm.

11. A vent for electrolytic condensers and the like having a cylindrical container subject to internal excess gas pressure comprising an apertured arched cap secured to an open end of said container, a flexible diaphragm having a thin punctured portion and a thicker edge portion, said edge portion serving as a sealing gasket between the container and said cap, an annular spacer surrounding the punctured portion of said diaphragm, said spacer projecting into the space between said diaphragm and said cap and having a lesser thickness than the normal distance between said diaphragm and said cap, thereby to stop the expansion of the diaphragm towards said cap at a predetermined excess pressure developed within the container but to allow said punctured portion to expand independently under continued pressure increase beyond said predetermined pressure.

12. In a vent as claimed in claim 11 wherein said spacer forms an integral part of said diaphragm.

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