July 12, 1932. H. O. SIEGMUND 1,866,604

ELECTROLYTIC DEVICE

Filed Oct. 25, 1926

Fig. 1.

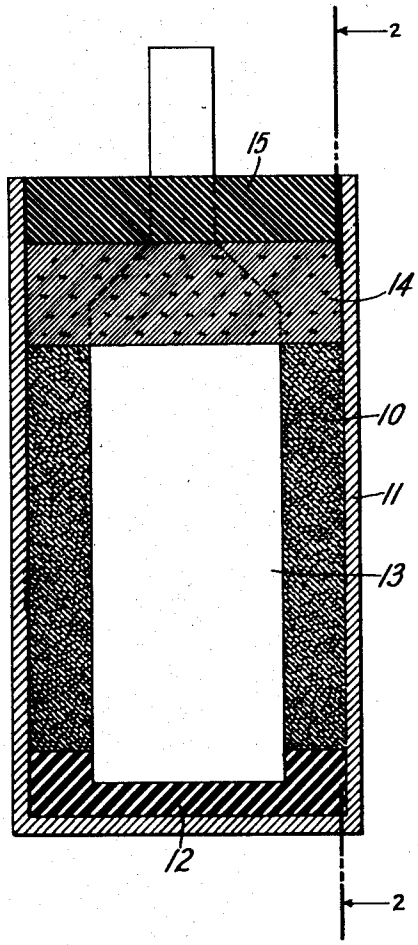
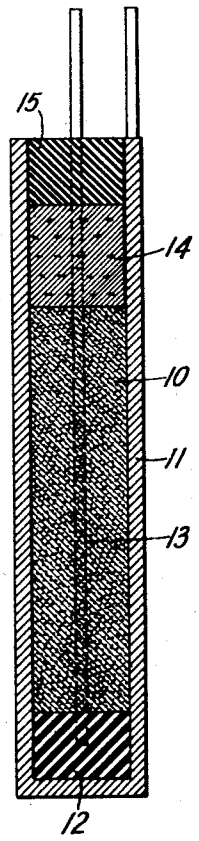


Fig. 2.



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UNITED STATES PATENT OFFICE

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ELECTROLYTIC DEVICE

Application filed October 25, 1926. Serial No. 144,000.

This invention relates to electrolytic condensers.

In accordance with this invention there is provided an electrolytic condenser which is small in size, which will operate satisfactorily even though not maintained in an upright position, one in which the period over which the electrical properties remain substantially constant is increased, and one from which the danger of damage from a broken container is small.

The invention in its preferred form is an electrolytic condenser the electrolyte of which is of jelly-like consistency and is composed of sodium silicate and a dilute solution of sulphuric acid in such proportions that the desired consistency is obtained. The film-forming electrode is of tantalum. The container is provided with a non-liquid seal which normally prevents the escape of vapor from the space above the surface of the electrolyte.

It has been found that by employing an electrolyte of the consistency mentioned above, several marked advantages are obtained, as explained below.

The electrolytes of electrolytic devices as ordinarily constructed are of such nature that slow evaporation of the electrolyte occurs, unless preventive means are provided. Such means commonly consists of a layer of oil or other liquid upon the surface of the electrolyte. This is fairly effective but inconvenient and adds to the likelihood of damage to surrounding apparatus and to the clothing of the operator if breakage of the container occurs, as often does. The prevention of slow concentration of the electrolyte due to evaporation becomes of importance in an electrolytic condenser, since changes in capacity and resistance vary the operation of the circuit in which the condenser is placed and frequent checks upon the electrical properties of the condenser may become necessary. Moreover, it may be necessary to replace the condenser after a time which is shorter than the life of a condenser of the solid dielectric form.

Again, if electrolytic condensers are to compete successfully with ordinary condensers of the solid dielectric type, the nuisance of spilled liquid resulting from broken or cracked containers must be eliminated. Moreover, it would be very desirable to have condensers of a kind to permit them to be used successfully in other than an upright position.

In accordance with this invention these requirements are satisfactorily met and it becomes feasible to substitute electrolytic condensers for some of those of the usual type in the telephone plant, for example, the three main requirements are simultaneously met by the use of an electrolyte which has the consistency of stiff jelly and which is otherwise suitable. Evaporation takes place very slowly from such an electrolyte, so that constancy of electrical characteristics is more nearly approached and the useful life period extended. Furthermore, by employing tantalum (or a metal of similar characteristics) as the film-forming electrode, the size of the condenser for a given capacity may be made small, which permits further reduction in the rate of evaporation and increase of useful life. A third feature tending toward the same end is the seal employed. This is preferably of the type disclosed in Patent 1,655,026 granted January 3, 1928 to H. O. Siegmund, et al. Such a seal is normally gas tight but opens to permit gases to escape when the gas pressure becomes great enough. This seal greatly assists in preventing escape of vapor resulting from evaporation and so keeps down the rate of evaporation. Nevertheless, some vapor necessarily escapes with the gas. Thus it is seen that the jelly-like electrolyte and the seal and the kind of electrode material employed all cooperate to effect the desired result. Moreover, an electrolyte of this type will retain its form for long periods under mild forces tending to deform it. When the space below the seal in a container is nearly although not quite filled with such an electrolyte, the container may be placed upon its side or in other positions without seriously affecting the operation of the condenser. If the container is broken, no spilling will occur.

The form of electrolyte which has been found to meet the above mentioned requirements most successfully is one comprising sodium silicate and dilute sulphuric acid in proportions to give the desired consistency.

A preferred embodiment of the invention is shown in the drawing in which:

Fig. 1 is a sectional view of a condenser in accordance with the present invention; and

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1.

The electrolyte 10, which, as stated above, consists preferably of sodium silicate and a solution of sulphuric acid in such proportions that a thick jelly-like substance is formed, is placed in a container 11 preferably of a material which does not readily react chemically with the constituents of the electrolyte and which is not a film forming metal. The positive or film forming electrode 13, preferably of tantalum, is held in position and is spaced from the container 11 by the separator 12 which is of an electrical insulating material not readily acted on by the electrolyte as, for instance, glass, porcelain or hard rubber. In condensers which are to be employed in direct current circuits, the container 11 may be made of a conducting material that is not attacked chemically by the electrolyte so that it may serve as the negative electrode of the device. For example, lead may be used with an electrolyte containing sulphuric acid and tin with many other electrolytes. A condenser for use in alternating current circuits may be made by employing two film forming electrodes preferably both of tantalum.

The cover for the device consists of the cork 14 which is preferably impregnated with paraffin, and a layer 15 of a sealing compound. In some cases it may be desirable to employ a sealing compound having a high melting point.

The resistance component of the condenser impedance may be made large, when desired, by employing an acid of low concentration in the electrolyte, widely spaced electrodes, a barrier of non-conducting material between the electrodes or any combination of these. A condenser the impedance of which has a high resistance component may be made by employing widely spaced electrodes and an electrolyte having a low acid concentration and conversely, a condenser the impedance of which has a low resistance component may be made by employing a highly concentrated acid in the electrolyte and positioning the electrodes in close proximity. For example, a condenser having a capacity of 1 microfarad and a resistance of approximately 40 ohms at a frequency of 1000 cycles per second may be made by employing a tantalum electrode having a surface area of approximately 0.65 sq. in. and spaced approximately 0.1″ from the negative electrode. The electrolyte for this condenser may be composed of equal parts of a 2% sulphuric acid solution and a 10% sodium silicate solution. Such a condenser occupies about one-twentieth of the volume of a condenser having similar electrical characteristics and employing a dielectric of paper or similar material.

What is claimed is:

1. An electrolytic condenser comprising an electrolyte of jelly-like consistency, containing sulphuric acid and sodium silicate, and a plurality of electrodes at least one of which is of tantalum.

2. An electrolytic condenser comprising an electrolyte containing sodium silicate and a solution of sulphuric acid and having the consistency of jelly, and a tantalum film forming electrode.

In witness whereof, I hereunto subscribe my name this 22nd day of October A. D., 1926.

HUMPHREYS O. SIEGMUND.