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J. SLEPIAN

ELECTROLYTIC CONDENSER

Filed Dec. 17, 1919

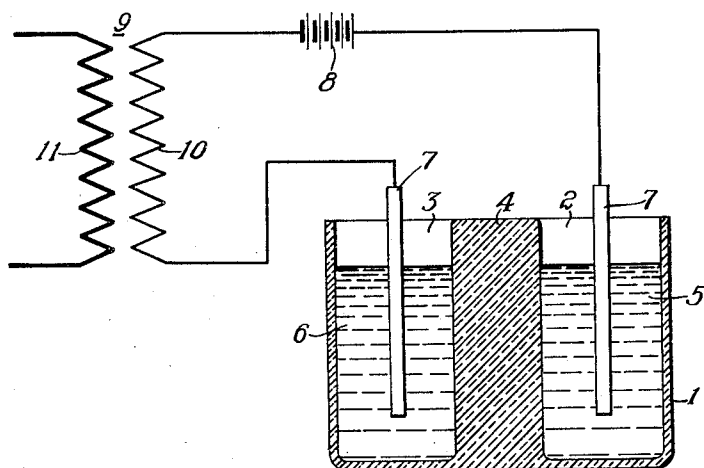


Fig. 1.

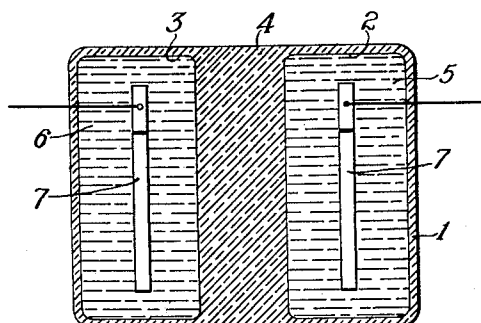


Fig. 2.

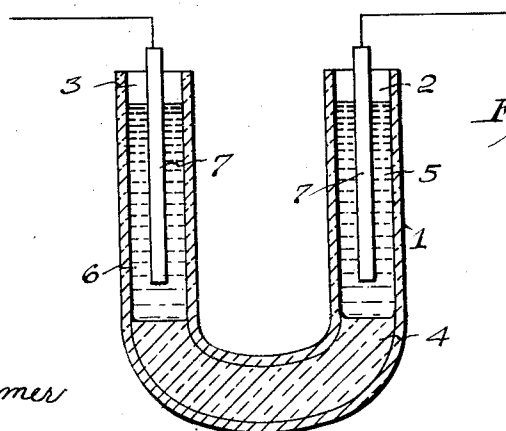


Fig. 3.

WITNESSES:
H. I. Shelhamer
O. E. Bee.

INVENTOR
Joseph Slepian
BY
Wesley E. Carr
ATTORNEY

UNITED STATES PATENT OFFICE.

JOSEPH SLEPIAN, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTROLYTIC CONDENSER.

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To all whom it may concern:

Be it known that I, JOSEPH SLEPIAN, a citizen of the United States, and a resident of Wilksburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electrolytic Condensers, of which the following is a specification.

My invention relates to electrolytic condensers, and, more particularly, to condensers of the type formed by employing electrodes, which are immersed in certain electrolytes and by passing an electric current between the electrodes to form a film thereon. This film subsequently acts as a dielectric and allows current to pass from the electrolyte to the electrode, but which offers a relatively high resistance to current flow in the opposite direction. The primary object of my invention is to provide condensers of the above described type in which a wider range of materials may be employed than has been considered possible heretofore.

It is well known that a condenser may be formed by employing, for example, aluminum electrodes immersed in a dilute solution of sulphuric acid. Electric current, preferably a direct current, may be impressed upon the electrodes and, after a certain period of time, a film will be formed on the electrodes which has a peculiar property of permitting current to flow from the electrolyte to the electrode but which offers a high opposition to current flow from the electrode to the electrolyte. Although various theories have been advanced as to the nature of the construction of the film upon the electrode, no conclusive evidence has been submitted which would definitely establish the construction of the film. A condenser formed in this manner is practical and satisfactory for a great many purposes, but it is open to the objection that only certain materials may be employed in its construction.

One object of my invention, therefore, resides in the construction of an electrolytic condenser formed by employing suit-

able electrolytes, preferably of different compositions and by interposing between the electrolytes a porous material, which shall permit of electrolytic conduction, but prevent intermingling of the electrolytes. Electrodes may be immersed in the electrolytes and a direct voltage may be impressed thereon to form a condenser.

The construction of my condenser follows, to a certain extent, the method employed in constructing condensers of the type in which a film is formed upon the electrode, but my method permits of a wider choice of materials which is, of course, an advantage from a commercial view point.

With these and other objects in view, my invention will be more fully described, illustrated in the drawings, in the several views of which corresponding numerals indicate like parts, and then particularly pointed out in the claims.

Fig. 1 is a sectional view of a condenser provided with electrical circuits which are connected thereto in accordance with my invention; Fig. 2 is a transverse sectional view of the condenser shown in Fig. 1, and Fig. 3 is a sectional view of a modified form of condenser.

In practising my invention, I may construct a condenser by employing a plurality of electrolytes, preferably of different compositions, which may be disposed in a suitable container, having separate chambers into which the different electrolytes may be placed. Suitable electrodes may be disposed in the electrolytes and a direct voltage may be impressed thereon. The above described procedure causes the formation of something which acts like a dielectric formed between the electrodes and which possesses the properties, to a certain extent, of a film formed upon aluminum electrodes immersed in an electrolyte and subjected to the action of a direct current.

In Fig. 1 is shown a condenser comprising a container 1 having a plurality of chambers 2 and 3 separated by a wall 4 of

porcelain, or other suitable material. An electrolyte 5 which may be an alkali, such as sodium hydroxide, may be disposed in the chamber 2 and another electrolyte 6, which may be an acid, such as sulphuric acid, may be disposed in the chamber 3. Electrodes 7 may be immersed in the electrolytes and a source of direct current 8 may be connected thereto for impressing a direct voltage upon the electrodes to form the condenser. A transformer 9 may have its secondary winding 10 connected to the source of current 8 and to one of the electrodes 7. An alternating voltage may be superimposed upon the electrodes by connecting the primary winding 11 to a suitable supply circuit (not shown).

The electrodes 7 may be of various materials, but they are preferably of a material which is unaffected by the electrolyte in which they are immersed. For example, the electrode immersed in the acid electrolyte may be lead, graphite, magnetite, or an electrode of any suitable material coated with another material which is unaffected by the acid. The electrode immersed in the alkaline electrolyte may be graphite, magnetite, a noble metal, such as gold or an electrode coated with a substance which is unaffected by the alkali.

I have found, by assembling materials in a container, of the above described character and by impressing a direct voltage upon the electrodes, immersed in the different electrolytes, for a certain period of time, that, if an alternating voltage is thereafter superimposed upon the electrodes, a capacity is indicated. I am not prepared to state the exact action that takes place when the direct voltage is impressed upon the electrodes, but the relatively high capacity that is subsequently shown by the condenser indicates that the phenomenon takes place in a very thin layer. The properties of this layer, formed in the condenser as above described, are similar to those of the film formed upon aluminum plates, or other film-forming electrodes, which are immersed in a suitable electrolyte and subjected to a direct voltage for a sufficient length of time to form the film thereon.

Although I have shown, in the drawings, a container having a central partition which provides a plurality of separate chambers to receive different electrolytes, it should be noted that containers may be otherwise constructed. For example, I have employed a U-tube (Fig. 3) in which I disposed a finely divided material, such as aluminum oxide (Al_2O_3). I have then disposed an alkaline electrolyte in one branch of the U-tube and an acid electrolyte in the other branch thereof and I have immersed a plurality of electrodes in the electrolytes. Condenser action was obtained after im-

pressing a direct voltage upon the electrodes. It will be appreciated from this test that the dividing wall or partition, separating the electrolytes of different compositions may be of various materials which possess the properties of permitting of electrolytic conduction and of preventing convection or intermingling of the liquids. For example, the material separating the electrolytes may be plaster of Paris, porcelain, magnesium-oxychloride cement, or other similar materials.

My invention contemplates a radical departure from the well recognized methods of forming electrolytic condensers by employing electrodes immersed in electrolytes and passing an electric current therebetween to form a suitable film on the electrodes. Although I am not prepared to state the exact changes which result from the assembly of materials above described and the action caused by the direct voltage impressed upon the electrodes, I have found, by tests, that a condenser formed in the above manner compares favorably with electrolytic condensers formed by methods known heretofore.

Although I have shown and specifically described a condenser formed in accordance with my invention, it is obvious that a wide range of materials may be employed to form condensers within the scope of my invention, and I desire, therefore, that no limitations shall be imposed except such as are indicated in the appended claims.

I claim as my invention:—

1. An electrolytic condenser comprising a container, an acid and an alkaline electrolyte disposed in the container, a porous material interposed between the electrolytes and electrodes immersed in the electrolytes.
2. An electrolytic condenser comprising a container having a plurality of chambers, an acid electrolyte disposed in one of the chambers, an alkaline electrolyte disposed in another of the chambers and electrodes immersed in the electrolytes.
3. An electrolytic condenser comprising a container, an acid and an alkaline electrolyte disposed in the container, a porous material interposed between the electrolytes and electrodes of inactive material immersed in the electrolytes.
4. An electrolytic condenser comprising a container having a plurality of chambers, an acid electrolyte disposed in one of the chambers, a lead electrode immersed in the acid electrolyte, an alkaline electrolyte disposed in another of the chambers and a graphite electrode immersed in the alkaline electrolyte.
5. An electrolytic condenser comprising a container having a plurality of chambers, a solution of sulphuric acid disposed in one of the chambers, a solution of sodium hy-

droxide disposed in another of the chambers and electrodes immersed in the solutions.

6. An electrolytic condenser comprising a container having a plurality of chambers, a solution of sulphuric acid disposed in one of the chambers, a lead electrode immersed in the sulphuric acid solution, a sodium hy-

droxide solution disposed in another of the chambers and a graphite electrode immersed in the sodium hydroxide solution.

In testimony whereof, I have hereunto subscribed my name this 18th day of November, 1919.

JOSEPH SLEPIAN.