NOTE.—*The application for a Patent has become void. This print shows the Specification as it became open to public inspection under Section 91 (3) (a) of the Acts.*

PATENT SPECIFICATION

Convention Date (Germany): Oct. 17, 1927. **298,950**

Application Date (in United Kingdom): Oct. 16, 1928. No. 29,915/28.

Complete not Accepted.

COMPLETE SPECIFICATION.

Improvements in or relating to Electric Condensers.

Dr. LEO SZILARD, of 95, Prinzregentenstrasse, Berlin-Wilmersdorf, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a condenser such as is frequently used for instance for weak currents as block condensers etc. and in which, as is now usual for condensers for low voltages, thin metallically conducting layers and thin non-metallic layers of solid structure (paper and the like) are arranged alternately. The invention has for its object to lower the alternating current resistance of such condensers, the condenser, or better the condenser set, remaining practically impassable for direct current below a given limit voltage. According to the invention, this lowering of the alternating current resistance of the condenser is effected by making the solid non-metallic layers (for instance paper) situated between the metal coverings or plates, electrolytically conducting, preferably by impregnating the porous or swelling intermediate layer with a suitable salt solution. The thickness of such intermediate layers such as are used at present in condensers for weak currents, is of the order of magnitude of $\frac{1}{2}$ thousandth of a centimeter and even much smaller. Care must be taken therefore in impregnating it, that it should not be softened too much. The choice of the electrolyte is made with due consideration of the nature of the metal which constitutes the plates (preferably tin-foil paper or aluminium foils) and is made in such a manner that a finite decomposition voltage (polarisation voltage) is opposed to the passage of direct current. The lowering of the alternating current resistance is then based partly on the fact that the dielectric constant of the impregnating solution (for instance of water) is large, but partly on the fact that the intermediate layer is a conductor of alternating current. Direct current, in conditions set forth below cannot bring about an electrolytic decomposition of the intermediate layer.

Solid thin electrolytically conducting intermediate layers could also be obtained by oxidising the surface of the metal plates (or converting them into sulphides) and thereupon pressing the metal plates direct on each other: the oxide, if properly prepared, forms then a solid thin electrolytically conducting intermediate layer.

For the impregnation of thin porous or swelling intermediate layers (paper) could be used water, alcohols, nitrobenzol and the like, or solutions in these liquids.

As long as the intermediate layers used are not extraordinarily thin, the conditions are such that the increase of the dielectric constant of the intermediate layer produced by the impregnation of the latter, plays the smaller part, and the electrolytic conductivity of the intermediate layer has the greater share in the lowering of the alternating current resistance. The latter is however generally much higher than would result from the ohmic resistance of the intermediate layers, and is determined in the first place by the polarisation phenomena (polarisation capacity), that is to say, in the case of the exceedingly low alternating voltages which are on the condenser in the most important applications, the passing alternating current is smaller than that which would correspond to the ohmic resistance.

Condensers according to the invention are used either connected in series and combined to a condenser cell, or a construction is used which differs from the ordinary condensers by the arrangement between two metal plates each of which leads to one junction terminal of the cell, of further metal plates (intermediate plates). The direct current would then

have to pass repeatedly between two metal plates connected each to a junction terminal of the cell into and out of these metallic intermediate plates. Consequently, below a given limit voltage which is given by the decomposition voltage (polarisation) and the number of intermediate plates, the direct current will be throttled by the cell, and the electrolyte will not be decomposed by the direct current.

Figure 1 shows diagrammatically a construction according to the invention. It shows the metallically conducting plates 1—7 which are separated from one another by thin paper layers 8—10 in the same way as in ordinary condensers. These paper layers are rendered conducting by impregnation with a salt solution but kept in insulating state at the edges by impregnation. The plate 2, in the same way as is the case for plates of condensers, is electrically connected to one junction terminal 15 of the cell, whilst the plate 6 is connected to the junction terminal 16. The further metal plates 3, 4 and 5 situated between these two metal plates, have no separate current supply.

Figure 2 shows a construction imitating a cylindrical condenser, in which the heavy single lines indicate the plates connected to the junction terminals, and the chain lines the metallic intermediate plates.

The manufacture of such cells is effected entirely as in the case of paper condensers, with the differences necessarily due to the presence of intermediate plates.

The alternating current resistance of such cells is smaller to tenth powers than that of the corresponding condensers. They can be used direct in practically all connections intended for freeing the voltage from its alternating component or for eliminating certain frequencies etc.

Figure 3 shows a simple example of application, such as can be used for sets for connection to the mains, for the elimination from the direct current of the alternating component contained in it. 17 is the primary winding, 18 the secondary winding of a transformer connected with the primary to the lighting mains. The junction terminal 19 is connected to the centre of the secondary winding, the terminal 20 to the cathode 21 of the rectifier 22, whilst the anodes 23 and 24 of the latter are connected to the two ends of the secondary winding of the transformer. Of the two terminals of the cell 25, the terminal 26 is directly connected to the terminal 19, whilst 27 is connected to the terminal 28 of the choking coil 29. Between the terminals 19 and 20 there is then a direct current voltage with a strong alternating current component of 50 periods and more. Owing to the low alternating current resistance of the cell, the whole alternating voltage is however applied to the choking coil 29, so that the voltage at the terminals of the cell 26 and 27 will be practically a direct one.

In the example of application just mentioned, the direct voltage component and the alternating current component are originally (between the terminals 19 and 21) of the same order of magnitude. At the terminals of the cell there is however an alternating voltage which is negligibly small compared to the direct voltage. The current density on the metal plates is accordingly exceedingly small. The total area of the metal plates is of an entirely different order of magnitude than in electrolytic cells which are not made like a paper condenser, but work with liquid electrolytes. Whilst in those cells, a weak decomposition of the electrolyte is effected by the alternating current (for instance formation of oxyhydrogen gas) in our cells there takes place catalytic recombination at the metal plates to such an extent that it balances further decomposition already at a very low concentration of the products of decomposition.

Figure 4 shows diagrammatically a condenser set which is constituted by five condensers according to the invention, which are connected together in series to form the set. The condensers singly do not possess any metallic intermediate plates like the condenser according to Figure 1. The direct voltage which is throttled by the set, is equal to the direct voltage which would be throttled by a corresponding condenser according to Figure 1 with four metallic intermediate plates.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An electrolytic condenser cell, characterised by metallically conducting plates being arranged therein alternately with electrolytically conducting layers of solid structure.

2. A condenser cell according to Claim 1, characterised by the intermediate layers being constituted by a porous or swelling material, more particularly paper, which is impregnated with an electrolyte.

3. A condenser cell according to claim 1, characterised by the electrolytically conducting intermediate layer being constituted by a solid compound of that metal itself which constitutes the metal plate.

4. A condenser cell according to Claims 1—3, characterised by the interposition between the metal plates connected to the junction terminals of the cell, of further metal plates.

5. A condenser cell according to claims 1—4, characterised by several condensers in series connection being combined in one cell.

Dated this 16th day of October, 1928.

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Fig. 1.

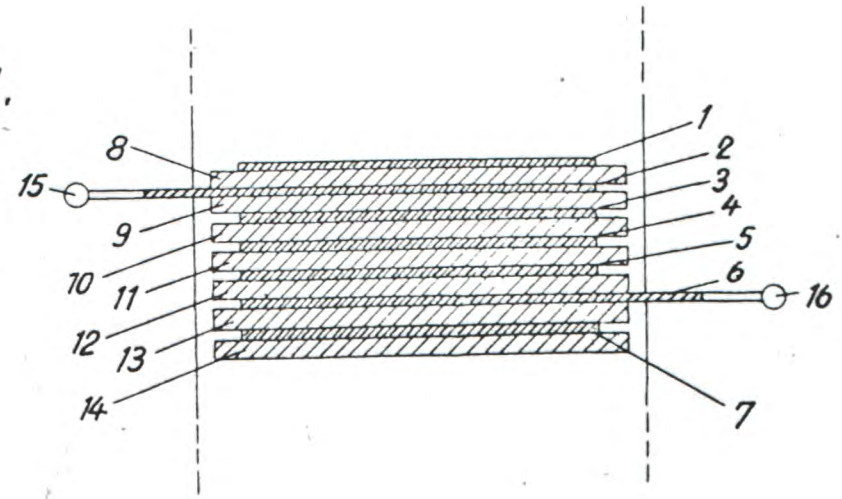


Fig. 2.

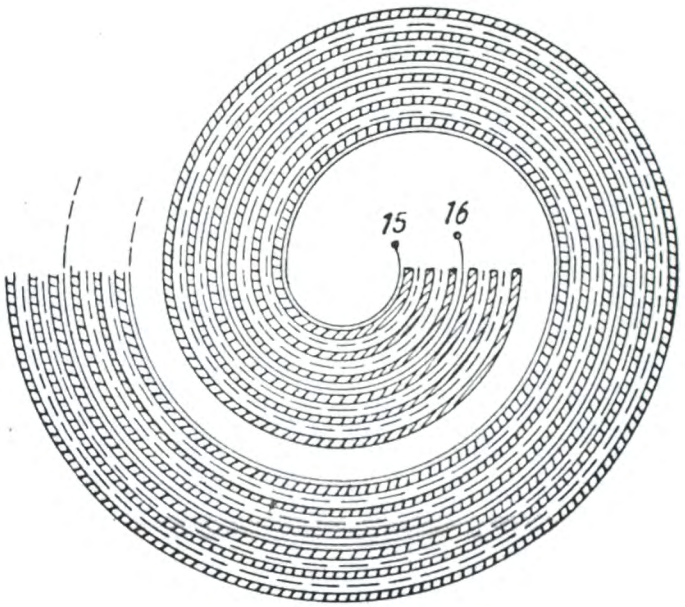


Fig. 3.

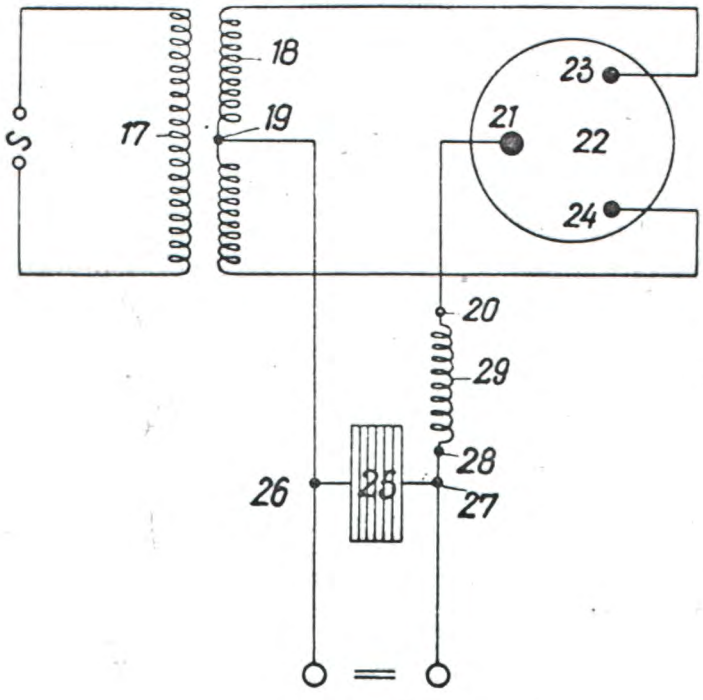
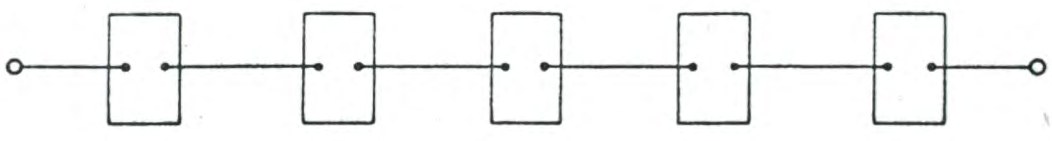


Fig. 4.



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