June 13, 1933. P. H. ESTES 1,914,114

ELECTROLYTIC CELL

Filed Oct. 23, 1929

Fig. 1.

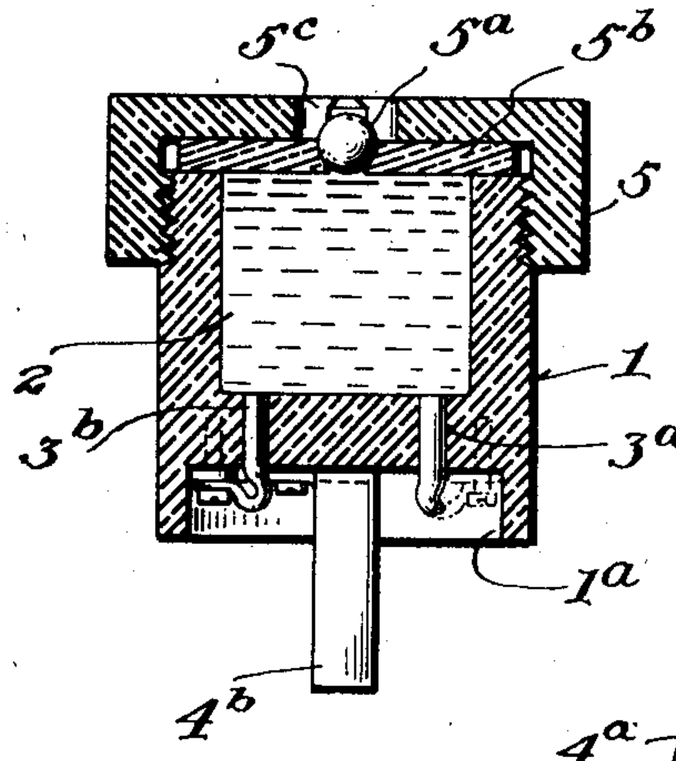


Fig. 2.

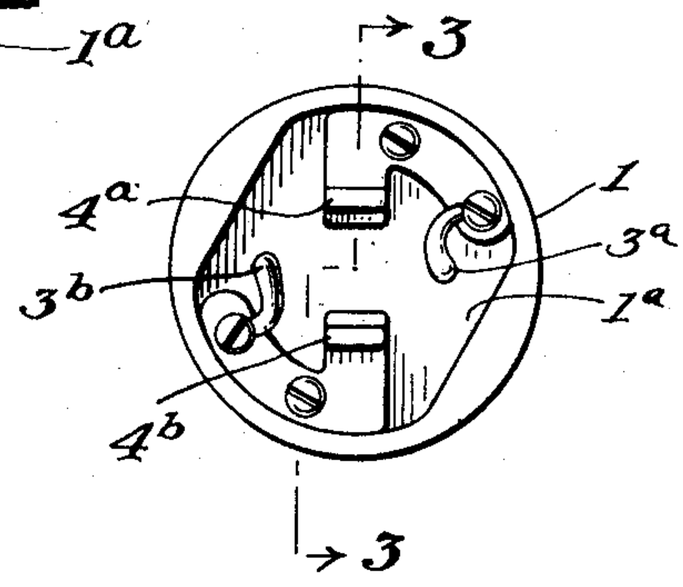
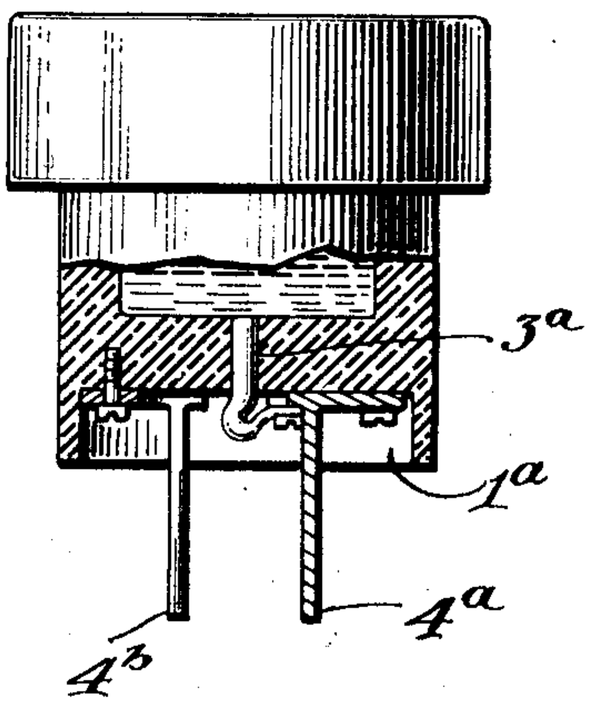


Fig. 3.



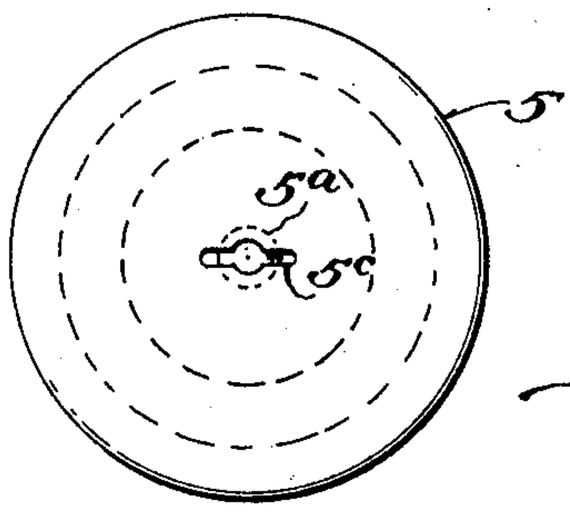


Fig. 4.

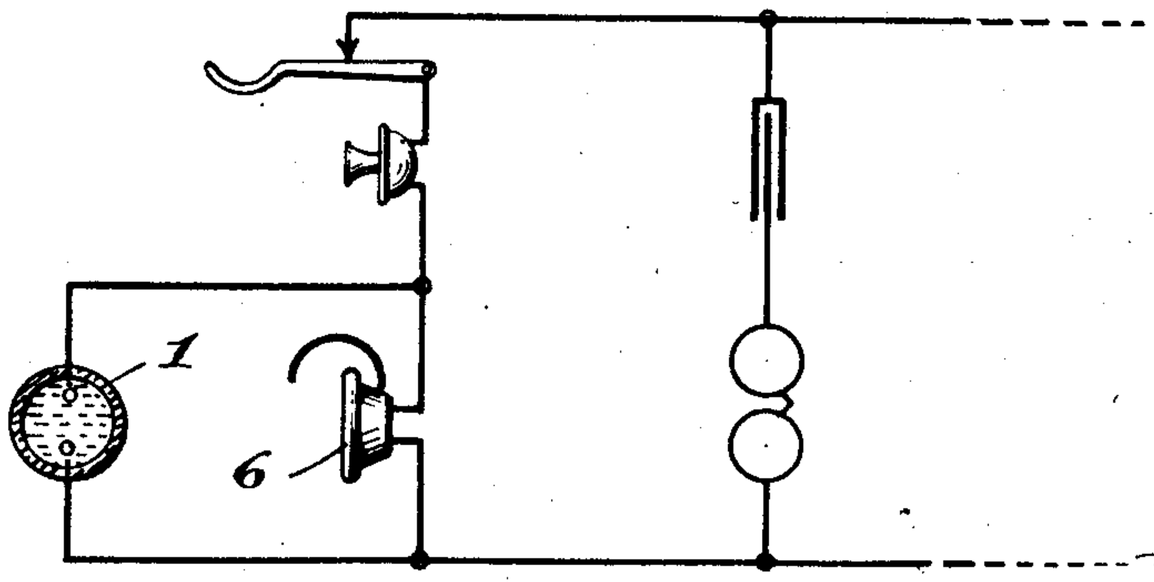


Fig. 5.

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UNITED STATES PATENT OFFICE

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ELECTROLYTIC CELL

Application filed October 23, 1929. Serial No. 401,783.

This invention relates to a device for protecting electrical acoustic elements from shock due to over-voltage impulses transmitted over the connecting circuits.

Heretofore, electrolytic cells consisting of one lead electrode and one tantalum electrode dipped into a solution of sulphuric acid have been employed for protection against acoustic shock impulses. Cells of this type have several disadvantages, namely: (1) The acid evaporates below the level of the ends of the electrodes, and, since in order to keep the electrolytic capacitance at a minimum it is necessary to have only a very short length of each electrode exposed to the acid, the evaporation of the solution is quite serious; (2) In time, a film of lead sulphate forms on both electrodes and changes the characteristics of the cell, sometimes entirely stopping its action; and (3) Due to the nature of the materials, it is necessary to employ two cells in each protector connected in opposite directions to obtain two-way operation.

An object of my invention is to devise an improved electrolytic cell in which evaporation of the electrolyte does not impair the operation of the cell until substantially all of the electrolyte is evaporated.

A further object of my invention is to devise an electrolytic cell in which the capacitance between the electrodes is reduced to a minimum.

Another object of my invention is to devise an electrolytic cell having only two electrodes and being capable of two-way operation as a voltage protector.

Still another object of my invention is to devise an electrolytic cell having a low over-voltage point at which the resistance of the cell changes from a high value to a relatively low value.

My invention is illustrated in the accompanying drawing in which:

Figure 1 is a sectional view illustrating one form of my invention in elevation;

Figure 2 is a view of the lower side of Figure 1;

Figure 3 is a sectional view of Figure 2 taken along the line 3—3;

Figure 4 is a plan view of Figure 1; and

Figure 5 is a circuit diagram illustrating the manner in which the cell is employed.

Referring to Figure 1, 1 indicates a cup of insulating material, such as hard rubber, containing a quantity of sulphuric acid 2. Embedded in the bottom wall of the cup 1 is a pair of spaced electrodes 3*a* and 3*b*, preferably made of platinum. The bottom of the cup is provided with a recess 1*a* in which are mounted two detachable connecting prongs 4*a* and 4*b*, the construction being similar to that of an ordinary electric light plug connector. Electrodes 3*a* and 3*b* are connected respectively to the prongs 4*a* and 4*b*, and the upper ends of electrodes are arranged flush with the inner surface of the bottom of the cup 1, thereby exposing a minimum area to the electrolyte and reducing the capacitance between the electrodes to a minimum. The cup 1 is provided with a screw cap 5 in which is located a ball valve 5*a*, which prevents the admission of dirt and extraneous matter, allows the escape of gases, and also prevents excess evaporation of the acid. The ball valve 5*a* is seated in a central aperture in a washer 5*b* carried by the cap 5, and extends into a slotted opening 5*c* formed in cap 5.

One application of my invention is illustrated in Figure 5, which shows the protector cell 1 connected in shunt to a telephone receiver 6 in an ordinary common battery telephone system. Operation of the cell in the arrangement shown in Figure 5 is as follows: The cell passes only a very minute current for impressed voltages less than two and one-half volts, but for potentials above this point, current passes through the cell very freely. Since both electrodes are made of platinum in contact with sulphuric acid, the cell will operate in both directions. For the weak incoming signals transmitted over the telephone line from a distant station, the resistance of the cell is very high, and substantially the entire signal current flows through the receiver 6, and substantially no current is absorbed by the cell 1. For incoming impulses having voltages greater than the over-voltage point of the cell, the resistance of the cell is lowered to substantially short-cir-

cuit the receiver and prevent acoustic shock to the user of the telephone. It will also be noted that in case the talking currents generated by the local transmitter exceed the over-voltage point of the cell, the cell will act to shunt these currents around the receiver and thereby prevent side tone noises in the receiver.

The improved cell which I have devised has an over-voltage point at two and one-half volts, whereas the commonly used lead-tantalum cell has an over-voltage point at substantially three and one-half volts. The underlying theory of the over-voltage point is that a certain voltage is necessary between an electrode and the electrolyte before electrons will commence to flow. This voltage varies with the chemical composition of both the electrode and the electrolyte. The combination of platinum electrode and sulphuric acid electrolyte employed in my improved cell produces a lower over-voltage than any prior cell and, therefore, affords better protection against over-voltage impulses. Furthermore, since platinum is a comparatively inert metal, the electrodes in my improved cell will not sulphate readily at ordinary temperatures. Thus, I obtain a cell which is practically free from changes due to the chemical action of the cell when not in operation. It will be noted that since the electrodes are inserted into the bottom of the cell, evaporation of the electrolyte will not affect the operation of the cell unless substantially all of the electrolyte is evaporated.

It will be obvious to those skilled in the art that changes in detail arrangement may be made without departing from my invention in its broadest aspect.

I claim:

1. An electrolytic cell comprising a cup of insulating material containing sulphuric acid, and a pair of spaced electrodes comprising platinum rods extending through the bottom of the cup with their upper ends flush with the inner surface of the bottom of the cup and in contact with the sulphuric acid.

2. An electrolytic cell comprising an electrolyte containing sulphuric acid and a pair of platinum electrodes having an exposed surface area coinciding substantially with a cross-section of the electrodes and spaced from each other to cause a break-down voltage at substantially two and one half volts therebetween.

3. An electrolytic cell comprising a cup of insulating material, and a pair of spaced platinum electrodes extending through the wall of the cup with their inner ends substantially flush with the inner surface of the wall.

In testimony whereof I affix my signature.

PHILLIP H. ESTES.