United States Patent

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[54] **MERCURY COULOMETER HAVING AN ELECTRODE SPACER**

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[51] **Int. Cl.**.....**G01r 27/22**

[58] **Field of Search**.....324/94, 182

[56] **References Cited**

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[57] **ABSTRACT**

A mercury coulometer prepared by sealing in a bored capillary tube a pair of spatially disposed mercury columns with an electrolyte interposed therebetween and drawing out an electrode from said both mercury columns, characterized in that the coulometer has a spacing member placed in the electrolyte between the mercury columns to prevent them from being brought into mutual contact. The inner diameter of the bore is from 0.1 to 2 mm and the spacing member has a dimension of about 80 – 90 percent of the inner diameter of the bore in the direction of the diameter of the bore.

10 Claims, 2 Drawing Figures

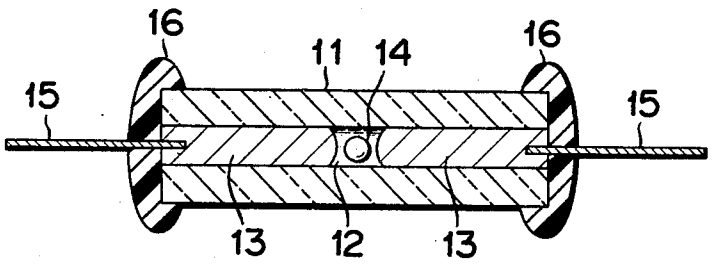


FIG. 1

PRIOR ART

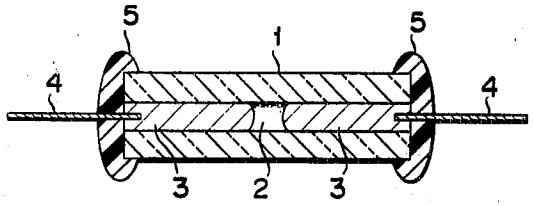
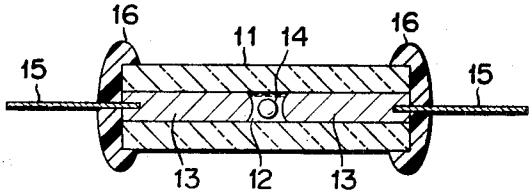


FIG. 2



MERCURY COULOMETER HAVING AN ELECTRODE SPACER

The present invention relates to improvements in a mercury coulometer, and more particularly to improved means for preventing malfunctions due to large shocks.

A conventional mercury coulometer constructed as illustrated in FIG. 1 has the following drawbacks. Referring to FIG. 1, numeral 1 represents a capillary tube, in which there are sealed a pair of spatially disposed mercury columns 3 with an electrolyte 2 interposed therebetween. From the outer ends of the mercury columns 3 are drawn out a pair of electrodes 4. Numeral 5 denotes a sealing member for sealing the capillary tube 1. When there is impressed a D.C. voltage across the electrodes of a mercury coulometer constructed as described above, one of the mercury columns contacting the electrolyte is partly electrolyzed and the mass thus electrolyzed deposits on the surface of the other mercury column, causing the electrolyte to flow through the capillary tube 1. Accordingly, measurement of the distance of displacement of gap indicates the amounts of electrical charge introduced. However, mercury generally has a characteristic whereby it is readily disintegrated by mechanical shocks. Moreover, the mercury has a specific gravity considerably greater than that of the electrolyte used in the coulometer. If the instrument is subjected to shocks, disintegrated parts of the mercury will be carried into the electrolyte, to disperse it, making it impossible to determine the amounts of electrical charge introduced.

It is accordingly the object of the present invention to provide a mercury coulometer of great practical value which, even under shocks, prevents disintegrated portions of the mercury from being carried into the electrolyte.

SUMMARY OF THE INVENTION

To attain this object, the mercury coulometer of the present invention has a spacing member disposed in the electrolyte between a pair of spatially positioned mercury columns. The spacing member has a dimension of about 80–90 percent of the inner diameter of the bore of the coulometer in the direction of the diameter of the bore.

The present invention can be more fully understood from the following detailed description when taken in connection with reference to the accompanying drawing, in which:

FIG. 1 is a sectional view of the conventional mercury coulometer; and

FIG. 2 is a sectional view of a mercury coulometer according to an embodiment of the present invention.

There will now be described by reference to FIG. 2 an embodiment of the present invention. Referring to FIG. 2, numeral 11 represents a capillary tube, in which there are sealed a pair of spatially set mercury columns 13 with an electrolyte interposed therebetween which consists of mercuric iodide, potassium iodide and demineralized water. The capillary tube 11 is preferably 0.1 to 2.0 mm in inner diameter and 10 to 50 mm long. Further in the electrolyte is placed a spherical spacing member 14 having a diameter approximating 80 to 90 percent of the inner diameter of the capillary tube 11. When the coulometer is subjected to shocks, the spacing member 14 contacts either or both inner ends of the paired mercury columns 13 so as to prevent said mercury columns from being broken in pieces. If, the spacing member 14 has too small a volume, it will undesirably fail to realize the aforesaid effect. The spacing member 14 need not assume a spherical form as described above, but may be prepared in any other form, for example, in the form of a rod. Further, the spacing member is preferred to have a such a specific gravity as allows it to travel easily through the capillary tube together with the electrolyte and to be made of, for example, plastics material which is not chemically affected by the electrolyte. To make the flow of the electrolyte easily visible, it is desired that the spacing member be suitably colored.

From the outer ends of the paired mercury columns 13 are drawn out a pair of electrodes 15. These electrodes 15 preferably consist of nickel or stainless steel wire. Numeral 16 denotes a member for sealing the capillary tube 11. To this end, there is used insulating plastics material such as epoxy resin. Where it does not contain a pulsating component, the direct current used in the present invention has its density limited to less than about 10 mA/mm^2. In the case of half wave rectification, however, this current density is limited to about 50 mA/mm^2 max.

To prove the effectiveness of the present invention, there was made the following experiment. With the conventional mercury coulometer prepared from a capillary tube 0.4 mm in inner diameter, the mercury column was disintegrated with shocks of about 30G 7m/sec. In contrast, with the mercury coulometer of the present invention prepared from a capillary tube having the same inner diameter, but with a spherical spacing member about 0.3 mm (0.33 mm to be exact) in diameter placed in the electrolyte, shocks of even 100G 7m/sec did not cause the mercury to be broken in pieces.

What is claimed is:

1. A mercury coulometer comprising a capillary member having a longitudinal bore of 0.1 to 2 mm in inner diameter;
   - a pair of mercury columns spatially placed in said bore and an electrolyte interposed therebetween;
   - a spacing member disposed in the electrolyte between the mercury columns to prevent them from being brought into mutual contact, said spacing member having a dimension of approximately 80 to 90 percent of said diameter of said bore in the direction of said diameter;
   - a pair of electrodes drawn out from the outer ends of said mercury columns; and
   - a member for sealing the capillary tube.

2. A mercury coulometer according to claim 1 wherein the spacing member has such a specific gravity as allows it to travel easily through the capillary tube together with the electrolyte and consists of such material as is not chemically affected by the electrolyte.

3. A mercury coulometer according to claim 2 wherein the spacing member is formed of plastics material.

4. A mercury coulometer according to claim 2 wherein the spacing member is colored.

5. A mercury coulometer according to claim 1 wherein the capillary tube is 10 to 50 mm long.

6. A mercury coulometer according to claim 1 wherein the electrolyte consists essentially of mercuric iodide, potassium iodide and demineralized water.

7. A mercury coulometer according to claim 1 wherein the electrodes are comprised of nickel wires.

8. A mercury coulometer according to claim 1 wherein the spacing member is formed of epoxy resin.

9. A mercury coulometer according to claim 1, wherein the electrodes are comprised of stainless steel wires.

10. A mercury coulometer according to claim 1, wherein said spacing member is a sphere having a diameter of approximately 80 to 90 percent of said diameter of said bore.

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