Jan. 2, 1923. 1,440,502.

J. SLEPIAN.

METHOD OF AND APPARATUS FOR MAKING FINE METALLIC POWDERS AND COLLOID SOLUTIONS.

FILED JAN. 8, 1920.

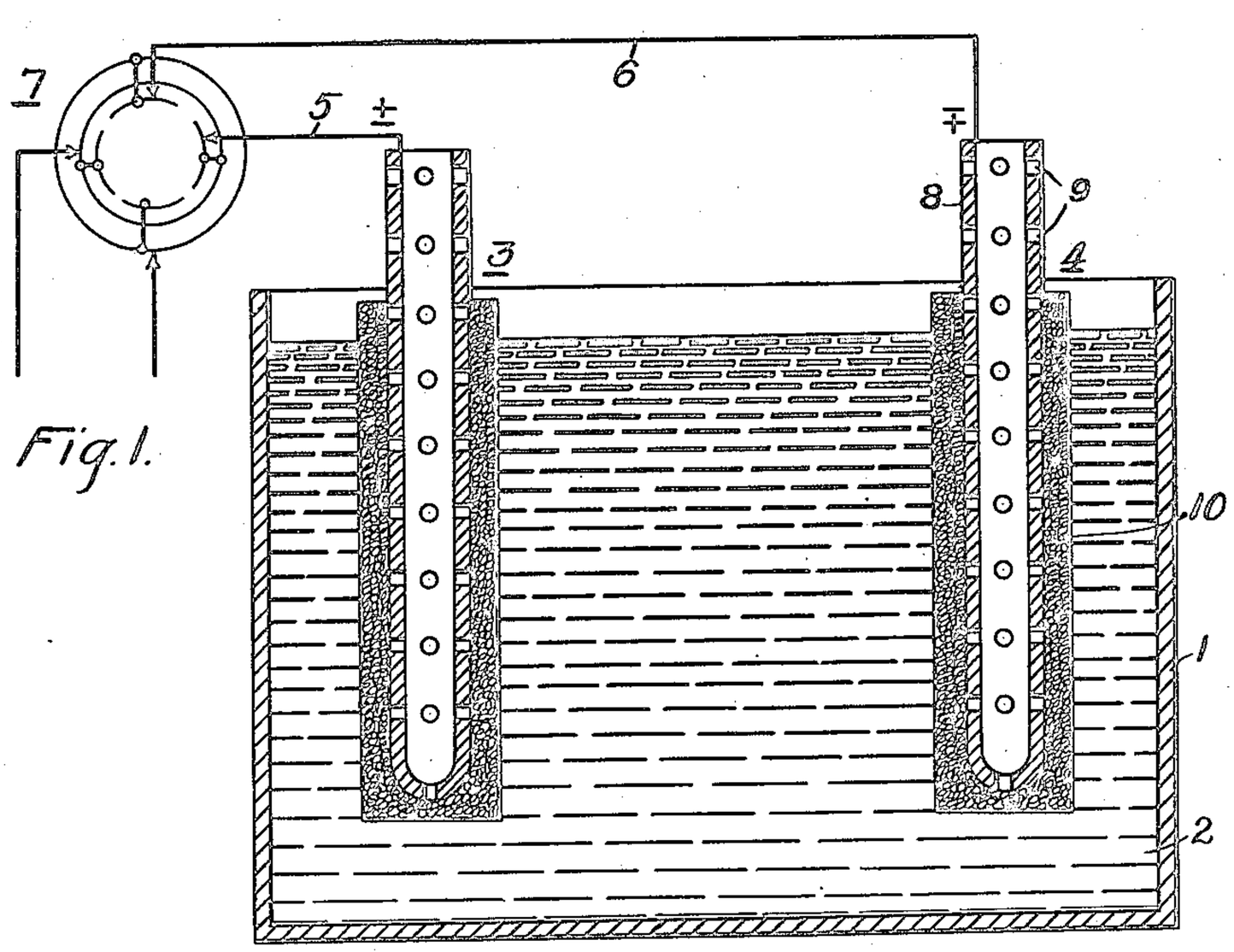


Fig. 1.

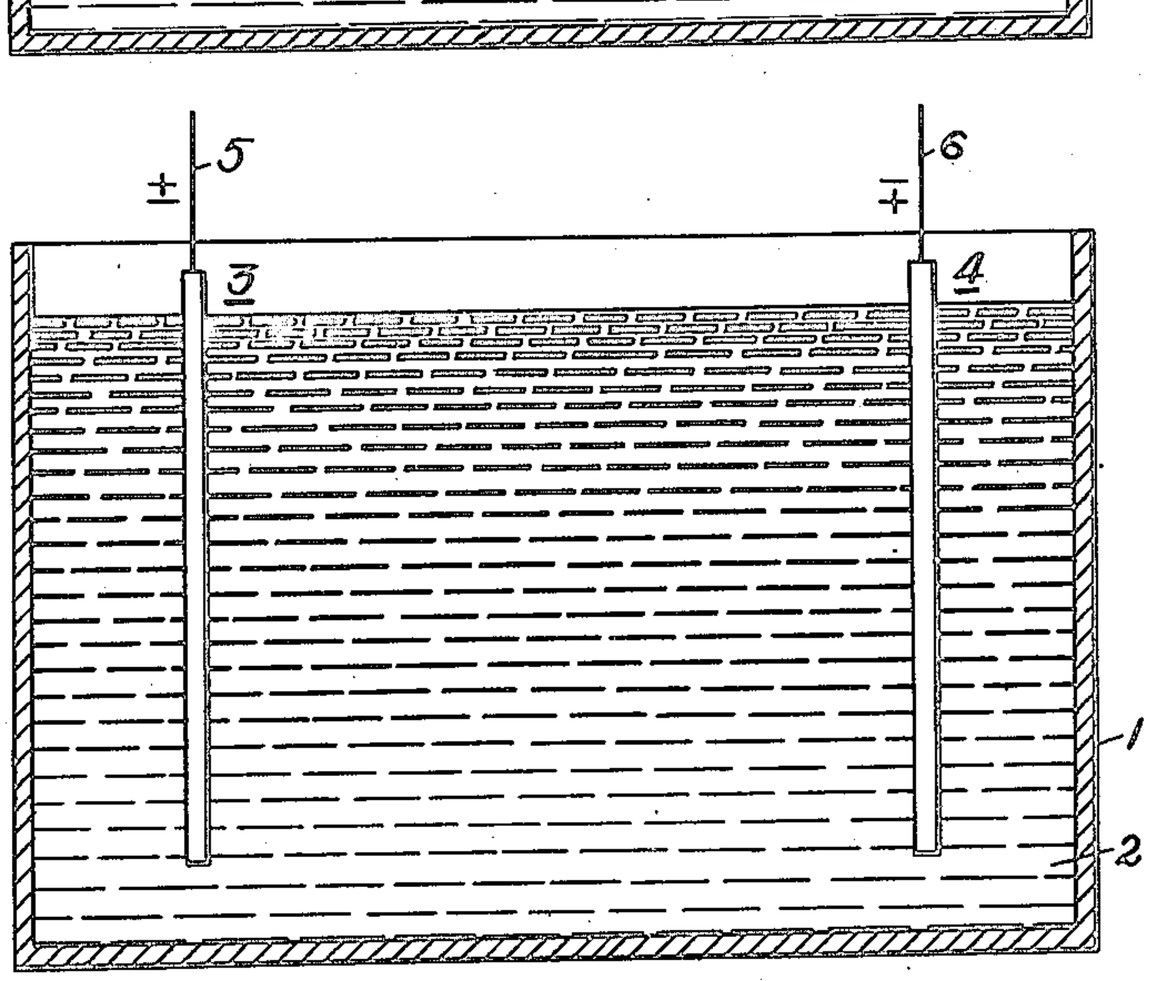
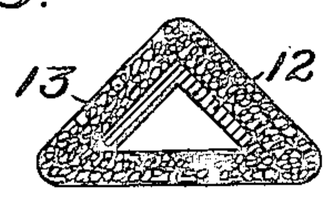


Fig. 2.

Fig. 3.



WITNESSES:

J. A. Helsel

W. H. Woodman.

INVENTOR

Joseph Slepian.

BY

Wesley G. Carr

ATTORNEY

Patented Jan. 2, 1923. 1,440,502

UNITED STATES PATENT OFFICE.

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

METHOD OF AND APPARATUS FOR MAKING FINE METALLIC POWDERS AND COLLOID SOLUTIONS.

Application filed January 8, 1920. Serial No. 350,187.

To all whom it may concern:

Be it known that I, JOSEPH SLEPIAN, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Methods of and Apparatus for Making Fine Metallic Powders and Colloid Solutions, of which the following is a specification.

My invention relates to methods of, and apparatus for, making fine metallic powders and colloid solutions, and it has, for its primary object, the provision of an electrolytic process particularly adapted to the formation of such products.

Heretofore, various methods have been practiced to obtain fine metallic powders and colloid solutions, as, for example, by grinding or otherwise finely dividing a metal by mechanical means. These methods have been unsatisfactory for various reasons, among them being the fact that certain impurities were almost always present, because of the abrasive action between the metal being divided and the instrumentalities employed in treating it.

According to my present invention, I may employ a suitable metal as electrodes in an electrolytic bath of proper character and I may pass a current between the electrodes through the bath, reversing the direction of the flow of current at suitable intervals in such manner that the metal passing into the solution from one electrode during the flow of current in one direction is re-deposited, as a non-adherent powder, during the flow of current in the opposite direction.

Various modifications may be resorted to in practising my invention, and electrodes of widely different characters may be employed. However, for the sake of clearness, I have illustrated in the drawings certain preferred structures particularly adapted for the purpose. In the several views of the drawings, in which similar reference numerals indicate corresponding parts, Figs. 1 and 2 are diagrammatic sectional views of electrolytic cells suitable for the carrying out of my invention, and Fig. 3 is a transverse sectional view of a modified electrode structure.

As will be appreciated from a more careful consideration of Fig. 1 of the drawings, I may provide a suitable container 1 for an electrolytic bath 2 in which are immersed electrodes 3 and 4. Supply conductors 5 and 6 may lead from the electrodes to any suitable source of direct current (not shown), and a commutator 7 of suitable type may be interposed in the conductors, in order that the direction of flow of current through the electrolytic bath between the electrodes may be intermittently reversed.

The electrodes may be of the metal, the powder or colloid solution of which it is desired to obtain, and any suitable solution may be employed for the electrolyte, the particular solution depending upon the metal constituting the electrodes. For example, I have prepared fine powders of copper and copper colloid solutions through the employment of copper electrodes immersed in an electrolytic bath of sodium chloride.

While bare metal electrodes may be employed, I prefer, in order to prevent concentration charges at the electrodes, caused by convection currents in the electrolyte, to screen or cover the electrodes with a suitable covering or coating of porous material, such as layers of cotton or asbestos tape.

For example, in Fig. 1 of the drawings, I have disclosed a suitable electrode construction comprising a tubular body 8 of copper, the wall of which may be perforated, as at 9, the portion of the body immersed within the electrolyte being provided with a porous covering 10.

In practising my invention with the type of electrodes disclosed in Fig. 1, a current of suitable density, which may approximate one ampere per square inch of electrode area, is passed between the electrodes, and its direction of flow is reversed at suitable intervals, such as from 4 to 5 seconds. Under these conditions, the copper passing into the electrolytic bath from an electrode during the flow of current in one direction will be deposited upon the electrode as a non-adherent powder during passage of the current in the opposite direction, and the resultant suspension or colloid solution may be withdrawn from the interior of the electrode by a pipette or equivalent device from time to time. This colloid solution may, obviously, be treated by filtration, evaporation or equivalent means to obtain a fine metallic powder, if such is the product desired.

While the electrode construction disclosed in Fig. 1 has been found to be desirable, other electrodes may be employed. For example, the electrodes may be bare, as indicated in Fig. 2, under which circumstances the metallic particles deposited will pass directly into the main body of the bath employed. In like manner, if it is inconvenient to obtain the desired metal in tubular form, a strip of the metal may be bent longitudinally, as indicated at 12, in Fig. 3, and a porous covering 13 may be wrapped about the strip to, in effect, provide a tubular electrode corresponding to those shown in Fig. 1.

Obviously, various metals may be employed in connection with suitable electrolytes without, in any way, departing from the spirit of my invention. Furthermore, the size of the deposited particles may be varied, within certain limits, by varying the density of the current or its frequency or both. Furthermore, various re-agents, which beneficially affect the colloid state, such as acids, bases, protective colloids and the like, may be introduced to the electrolyte at or near the electrodes to facilitate the formation of the desired fine metallic powder or deposit.

In view of these facts, it will be appreciated that my invention is capable of numerous modifications and, consequently, I do not wish to be, in any way, restricted except in such respects as are indicated in the appended claims.

I claim as my invention:—

1. The method of forming fine metallic powders and colloid solutions that comprises providing metallic electrodes, passing a low-frequency current between said metallic electrodes immersed in an electrolyte.

2. The method of making fine metallic powders and colloid solutions which comprises providing metallic electrodes with porous screens and passing a low-frequency current between the electrodes while they are immersed in an electrolyte.

3. The method of forming metallic powders and colloid solutions that comprises providing metallic electrodes with a porous covering, immersing the electrodes in an electrolyte, connecting the electrodes in circuit with a source of direct current and reversing the direction of flow of the current at intervals.

4. The method of forming fine metallic powders and colloid solutions which comprises providing metallic electrodes, passing a direct current between said metallic electrodes immersed in an electrolyte, reversing the flow of current at intervals, and regulating the current density.

5. An apparatus for use in the formation of metallic powders and colloid solutions that comprises an electrolytic bath and metallic electrodes provided with porous coverings immersed in the bath.

6. An apparatus for use in the formation of metallic powders and colloid solutions that comprises an electrolyte, and tubular metallic electrodes immersed therein, and provided with porous screens.

7. An apparatus for use in the forming of metallic powders and colloid solutions that comprises an electrolyte and electrodes immersed therein, each electrode including a tubular perforate body of metal provided with a porous covering.

In testimony whereof, I have hereunto subscribed my name this 31st day of December 1919.

JOSEPH SLEPIAN.