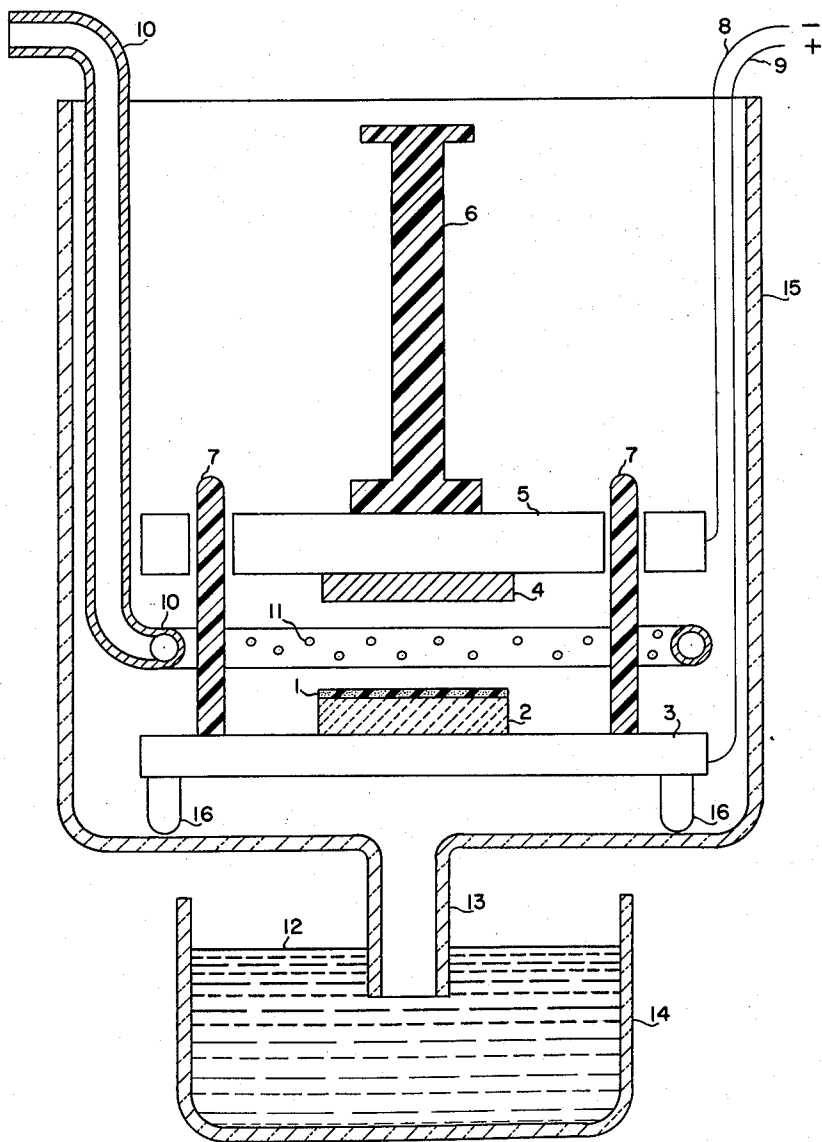


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APPARATUS AND METHOD FOR THE
ELECTRODEPOSITION OF
RARE METALS
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1

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APPARATUS AND METHOD FOR THE ELECTRO-DEPOSITION OF RARE METALS

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6 Claims. (Cl. 204—224)

Our invention relates to an apparatus and method for the electrodeposition of rare metals and in particular to the electrodeposition of radioactive metals.

According to usual electrodeposition procedures an aqueous plating bath is made of a water soluble salt of the metal and the metal is electroplated from this bath onto a suitable base by passing a suitable current through the bath. After a suitable thickness of the metal has been deposited the current is turned off and the plated base may then be washed.

These prior art methods have certain disadvantages particularly when applied to radioactive metals. For example there is considerable waste of the metal involved in the use of a plating bath. There is also considerable difficulty involved in obtaining a very thing uniform coating of the metal, and, when radioactive metals are used there is a particularly difficult problem of decontamination of the apparatus used and the safe storage or disposal of the plating bath.

A principal object of our invention is to provide an improved method and apparatus for the electrodeposition of rare or radioactive metals which eliminate the above-mentioned difficulties.

Another object of our invention is to provide a method and apparatus for the electrodeposition of radioactive materials that eliminates the dangers involved in the use of a plating bath containing radioactive materials.

A still further object of our invention is to provide an improved method and apparatus for the preparation of radioactive X-ray sources.

These and further objects of our invention will be apparent as the specification progresses.

In accordance with our invention a thin layer of the desired metal is deposited on an electrically conductive cathode base by placing an inert absorbent material wetted with an aqueous solution of a salt of the desired metal on an anode base, bringing the anode and cathode into sufficient proximity to each other to sandwich the wetted material between them, applying a potential between said cathode and anode of a sufficient strength and length of time to provide a coating of the desired metal on the cathode of a desired thickness and then washing the cathode, anode and wetted material while maintaining the potential between the anode and cathode.

More particularly, in accordance with our invention, we wet an inert absorbent material with an amount of an aqueous solution of a salt of a rare or radioactive metal just sufficient to wet the absorbent material. We then place the wetted absorbent material on a surface of a graphite or noble metal anode. Then we bring a cathode having an electrically conductive surface of the same dimensions as the wetted material and opposing said wetted material in contact with the wetted material. We then supply a potential between the cathode and anode of a strength and for a time sufficient to form a coating of desired thickness of the rare or radioactive metal on the cathode. After this predetermined period has

2

elapsed, the anode and cathode while still in contact with the wetted material, and with the potential still applied thereto, are washed with water. The electrodes are then separated from the wetted material and the washing continued.

The process of our invention may be used to form thin coatings of any rare metal such as Zr, Tc, Re and all the elements heavier than Bi; and is of particular advantage when used to form thin coatings of the group of rare metals which are radioactive such as Fe^{55} , Zn^{69} , Au^{195} , or enriched isotopes such as Fe^{54} , Cu^{65} and Ag^{109} which are used as target materials in nuclear transmutations. The process of our invention is of greatest advantage when used to form thin layers of Fe^{55} on a metal base such as are used as radioactive X-ray sources.

While we can use any inert absorbent material such as filter paper, asbestos sheets, porous sintered materials or fiberglass, as the absorbent material in our process, we prefer to use gels such as silica gel, pectin gel, hydrated starch, gelatine or gelatine containing materials, since the use of such gels provides a more uniform coating of the rare or radioactive metal. We may use the process of our invention to plate any material providing that material has at least one electrically conductive surface. For example we may plate metals such as iron, copper, tin, plastics such as polymethyl methacrylate, having at least one surface coated with an electrically conductive material such as silver and graphite.

Our invention will now be described in greater detail with reference to the accompanying diagram in which the sole figure is a perspective view of an apparatus employed in our invention.

As shown in the drawing, a layer of an inert absorbent material such as gelatine is wetted with a solution of a soluble salt of a radioactive metal for example, a solution of $\text{Fe}^{55}\text{Cl}_3$ in HCl. This wetted gelatine layer 1 is then placed on a graphite anode 2 which is secured to a metal electrode 3.

The copper plate 4, which is of the same surface dimensions as wetted material 1 and which is joined to cathode 5, is moved vertically by means of handle 6, made of an insulating material such as a urea-formaldehyde resin, along guide posts 7, similarly made of an insulating material such as that of the handle 6 or a different material, until copper plate 4 is in contact with the wetted gelatine layer 1. An open circuit potential of 3 volts is applied through conductors 8 and 9 to cathode 5 and the anode 2 for a period of two minutes. After this period, while the voltage is maintained the whole apparatus is flooded with jets of water from tube 10 which surrounds the apparatus, through openings 11. The contaminated waste water 12 is removed by way of drain 13 into a glass vessel 14. While maintaining the potential, the electrodes are separated and the washing is continued until the electrodes are completely washed. After the washing is completed the potential between the electrodes is cut off.

The resultant product is in the case of this illustrative example, a thin continuous coating of Fe^{55} on a copper metal base.

The entire electrode apparatus may be enclosed in a protective container 15, for example glass. The electrode apparatus is supported in this container by legs 16.

While we have described our invention in connection with specific embodiments and applications, other modifications thereof will be readily apparent to those skilled in this art without departing from the spirit and scope of the invention as defined in the appended claims.

What we claim is:

1. Apparatus for depositing a thin layer of a metal on an electrically conductive material base comprising an

anode having a surface covered with an inert absorbent material adapted to be wetted with a solution of said metal, a cathode having a surface constituted by said electrically conductive material opposed to and of the same shape as said absorbent material covered surface, two fixed spaced guide posts positioned to guide the cathode into contact with the absorbent material, means for moving said cathode into contact with said inert absorbent material, means for passing a current between said anode and said cathode of sufficient density and for sufficient time to effect electrodeposition of said metal on said cathode surface, spray means adjacent to said anode and cathode for applying a wash liquid to said cathode and said anode while maintaining said current after a sufficient thickness of said metal has been deposited on said cathode and exit means for removing said wash liquid from said anode and cathode.

2. Apparatus for depositing a thin layer of a metal on a metal base comprising an anode having a surface covered with an inert absorbent material adapted to be wetted with a solution of said metal, a cathode having a surface constituted by said metal base opposed to and of the same shape as said absorbent material covered surface, two fixed spaced guide posts positioned to guide the cathode into contact with the absorbent material, means for moving said cathode into contact with said inert absorbent material, means for passing a current between said anode and said cathode of sufficient density and for sufficient time to effect electrodeposition of said metal on said metal surface of said cathode, spray means adjacent to said anode and cathode for applying a wash liquid to said cathode and said anode while maintaining said current after a sufficient thickness of said metal has been deposited on said metal surface of said cathode and exit means for removing said wash liquid from said anode and cathode.

3. Apparatus for depositing a thin layer of a metal on an electrically conductive material base comprising an anode having a surface covered with an inert gel adapted to be wetted with a solution of said metal, a cathode having a surface constituted by a base of said electrically conductive material opposed to and of the same shape as said inert gel covered surface, two fixed spaced guide posts positioned to guide the cathode into contact with the inert gel, means for moving said cathode into contact with said inert gel, means for passing a current between said anode and said cathode of sufficient density and for sufficient time to effect electrodeposition of said metal on said cathode surface, spray means adjacent to said anode and cathode for applying a wash liquid to said cathode and said anode while maintaining said current after a sufficient thickness of said rare metal has been deposited on said cathode and exit means for removing said wash liquid from said anode and cathode.

4. Apparatus for depositing a thin layer of a metal on an electrically conductive material base comprising an anode having a surface covered with filter paper, a cathode having a surface constituted by said electrically conductive material opposed to and of the same shape as

said filter paper covered surface, two fixed spaced guide posts positioned to guide the cathode into contact with the filter paper, means for moving said cathode into contact with said filter paper, means for passing a current between said anode and said cathode of sufficient density and for sufficient time to effect electrodeposition of said metal on said cathode surface, spray means adjacent to said anode and cathode for applying a wash liquid to said cathode and said anode while maintaining said current after a sufficient thickness of said metal has been deposited on said cathode and exit means for removing said wash liquid from said anode and cathode.

5. Apparatus for depositing a thin layer of a metal on an electrically conductive material base comprising a noble metal anode having a surface covered with an inert absorbent material adapted to be wetted with a solution of said metal, a cathode having a surface constituted by said electrically conductive material opposed to and of the same shape as said absorbent material covered surface, two fixed spaced guide posts positioned to guide the cathode into contact with the absorbent material, means for moving said cathode into contact with said inert absorbent material, means for passing a current between said cathode and said noble metal anode of sufficient density and for sufficient time to effect electrodeposition of said metal on said surface, spray means adjacent to said anode and cathode for applying a wash liquid to said noble metal anode and said cathode while maintaining said current after a sufficient thickness of said metal has been deposited on said cathode and exit means for removing said wash liquid from said anode and cathode.

6. Apparatus for depositing a thin layer of a metal on an electrically conductive material base comprising a graphite anode having a surface covered with an inert absorbent material adapted to be wetted with a solution of said metal, a cathode having a surface constituted by said electrically conductive material opposed to and of the same shape as said absorbent material covered surface, two fixed spaced guide posts positioned to guide the cathode into contact with the absorbent material, means for moving said cathode into contact with said inert absorbent material, means for passing a current between said cathode and said graphite anode of sufficient density and for sufficient time to effect electrodeposition of said metal on said cathode surface, spray means adjacent to said anode and cathode for applying a wash liquid to said graphite anode and said cathode while maintaining said current after a sufficient thickness of said metal has been deposited on said cathode and exit means for removing said wash liquid from said anode and cathode.

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