Aug. 19, 1930. J. A. FLANZER 1,773,135

METHOD OF SPOT ELECTROPLATING

Filed Oct. 1, 1927

Fig. 1.

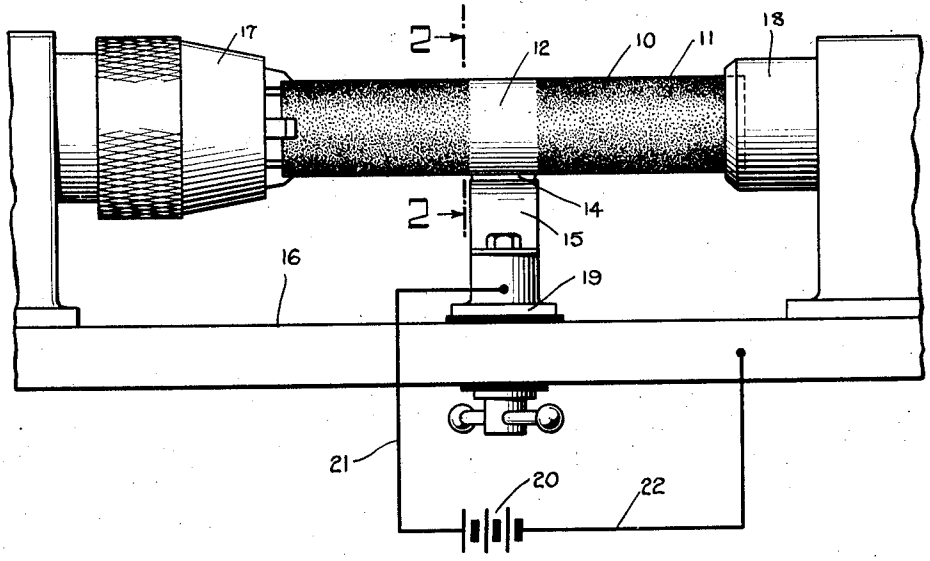


Fig. 2.

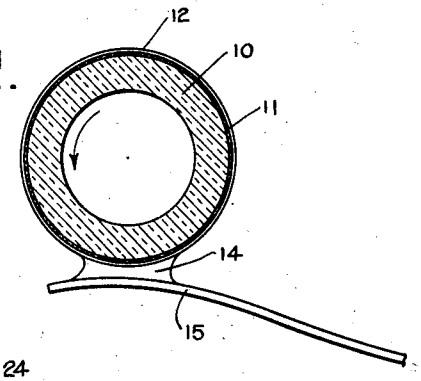
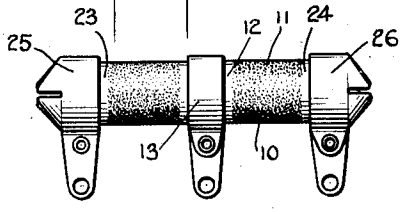


Fig. 3.



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UNITED STATES PATENT OFFICE

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METHOD OF SPOT ELECTROPLATING

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This invention relates to the art of electroplating, and relates more particularly to a method for spot-electroplating electrically conductive elements; and has special reference to the provision of a method for electroplating a local area or spot on high resistance surfaces.

The principles of my present invention may be applied in a variety of ways in the arts for securing what I term herein spot-electroplating; and the principles of my invention may be exemplified by showing the application of the same to the electroplating of local areas or bands on high resistance surfaces, especially of the cylindrical type such as is commonly used in compact high resistance units used in radio apparatus.

The manufacture of such high resistance units or elements is described, for example, in the copending application of Lester L. Jones and myself, Serial No. 61,326, filed October 8, 1925, such resistance elements comprising an insulating base provided with a thinly coated resistance film of a colloidal conductive material such as graphite in a suitable binder such as water glass. Improved high resistance elements of this nature are described and claimed in the copending applications of Lester L. Jones, Serial No. 168,471 filed February 15, 1927, and of Lester L. Jones et al., Serial No. 167,583, filed February 11, 1927, such improvements consisting in the employment of a resistance paint for producing the resistance coating consisting of a colloidal solution or finely divided conducting particles such as graphite or carbon held in a binder and vehicle of a metallic phosphate. As set forth in said copending applications, this improved paint or coating is relatively insoluble in sulphuric acid so that it becomes practical to electroplate copper, nickel or silver contacts at the terminals of the resistance units to which electroplated terminals terminal bands may be clamped to which conducting leads may be soldered, which terminal bands may be clamped to make efficient connecting means to the resistance paint or coating.

In electroplating the terminals of these resistance units, the method heretofore employed was the same as that heretofore practiced for arc-light carbons, that is, the ends of the resistance elements (usually of cylindrical form) were dipped into a tank or bath of an electrolytic plating solution, the element forming an electrode of an electroplating circuit. In such resistance units a relatively thin coating of plating material is desired, but such coatings in uniform thickness are difficult to obtain by this dipping method due to the variations in current density around the circumference of the resistance units, this being in turn due to initial variations in the high resistance coatings or layers of the units.

It is also desirable to have these resistance units electroplated at local areas or spots intermediate the ends thereof or to provide plated bands or annuli at intermediate points or sections of such resistance units or elements so as to make what are commonly termed, tapped resistances. The dipping process of the prior art is not applicable to electroplating such spots or local areas or to the making of electroplated bands intermediate the ends unless the remaining parts of the units are first coated with a protective layer which is unaffected by the plating solution. The application of such protective coatings, however, has proved to be too expensive and is further disadvantageous in that it is difficult to secure or obtain by the use of such methods uniform platings or coatings on account of the variation of current through the various sections to be plated.

The prime desideratum of my present invention centers about the provision of a method of electroplating especially applicable to resistance units of the nature described whereby intermediate points or sections of the units may be electroplated and whereby any section of the unit may be electroplated with a coating of uniform density or thickness. To accomplish this object I propose to depart from the prior art plating method of immersion in that instead of immersing the unit in a plating bath, I apply a confined amount of an electrolytic plating solution to the local area or spot of the unit to be plated, arranging such confined amount of plating

solution between an anode and said element, the anode and the element forming the electrodes of the electroplating circuit. By the use of this method I have found that spot-electroplating, as I term it, may be readily and economically effected. Where an area which is larger than the confined amount of plating solution is desired to be plated, I have found that the element or resistance unit may be slowly moved relatively to the plating solution; and where a plating band is desired to be produced, as is the case with cylindrical units, I have found that if the unit be slowly rotated, preferably on a horizontal axis, and the plating solution be applied to it through a short or confined layer of an electrolytically conductive path from the anode, all the metal to be plated with a layer of uniform density may be quickly deposited at any point along the cylindrical surface of the element.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention resides in the process and the steps thereof hereinafter more particularly described and sought to be defined in the appended claims, reference being had to the accompanying drawings showing a preferred method of applying my invention to resistance elements and in which

Fig. 1 is a view of apparatus which may be employed in the practice of the method,

Fig. 2 is a fragmentary enlarged cross-sectional view thereof shown partly in section and taken on the line 2—2 of Fig. 1, and

Fig. 3 is a view of a resistance unit or element having section electroplated by the process of my invention, to which electroplated sections terminal bands are clamped.

Referring now more in detail to the drawings, the resistance units or elements used in the process comprise a preferably cylindrical base 10 made of insulating material such as glass, porcelain or a phenolic condensation product, said base being provided with a high resistance coating or layer 11 composed, for example, of finely divided graphite or carbon mixed with a binder and vehicle consisting of a metallic phosphate, as described and claimed in the aforerelated copending applications. On this resistance coating or paint it is desired to plate a local area or band such as 12 of uniform thinness, which area or band in the illustration shown in Figs. 1 and 2 of the drawings, is arranged intermediate the ends of the resistance element 11, the said plated band to serve as a means to which a terminal contact band 13 is to be clamped.

I have found that my spot-plating method may be efficiently applied to the making of the electroplated band 12 by applying a confined amount of electroplating solution 14 to the spot of the element or unit to be plated, the said confined amount of plating solution being arranged between said spot and an anode 15 of the electroplating circuit. A preferred method of plating the band on the unit is to brush on the unit 10, which is slowly rotating in the direction of the arrow shown in Fig. 2 of the drawings, a band of electroplating solution, a strip 15 of the anode metal to be plated being placed underneath the rotating unit 10 at a distance of about $\frac{1}{32}$ to $\frac{1}{16}$ of an inch. Enough of the plating solution is brushed onto the rotating unit 10 to form a drop or confined amount 14 of the plating solution underneath the rotating unit which is large enough to fill up the gap between the anode 15 and the rotating electrode or unit 10. This drop acts as the localized plating bath. Although the total amount of the plating solution is small, it has been found practical to plate a band of metal about the unit in a comparatively short time, such as within one to two minutes. Constant agitation of the plating solution is accomplished by the rotation of the unit, and the temperature of the localized bath is prevented from rising by exposure of the rotating plating film to the atmosphere. The distance between the anode 15 and the rotating electrode or unit 10 is such that the localized bath is held securely in the position shown in Fig. 2 of the drawings by the surface tension of the solution.

The resistance unit 10 may be held and rotated in any suitable fashion and current connections to the unit may be made in any suitable way, and I have found the method diagrammatically shown in Fig. 1 of the drawings productive of very efficient results, obtained in a facile and economical way. In accordance with this method, the resistance element 10 is mounted in a lathe 16, the ends of the resistance element being held in the chuck 17 and in the tail-stock 18, the anode 15 being attached to or mounted on a movable tool holder 19. It will be manifest that by insulating the holder 19 as shown in Fig. 1 of the drawings, and by connecting said holder and the frame or bed of the lathe 16 to a battery 20 by means of the conductors 21 and 22, an electrolytic circuit is formed, the current dividing into the two paths provided by the resistance coatings of the resistance unit on opposite sides of the section 12, such coatings forming one electrode and the anode 15 the other electrode of the electroplating circuit.

In Fig. 3 of the drawings I show the electroplated unit with the terminal bands attached, and in said figure I show the ends 23 and 24 also electroplated and provided with the clamped terminal bands 25 and 26 respectively. The ends 23 and 24 may be electroplated in accordance with the prior art dipping methods, but I prefer to employ therefor the spot-plating method of my in-

vention for the reason that I am enabled to obtain thereby layers of uniform thickness not possible of attainment with prior art dipping methods.

The method of practicing my invention and the manner of making resistance units therewith will, in the main, be fully apparent from the above detailed description thereof. It will be further apparent that while I have shown and described a preferred method of applying the principles of my invention, many changes and modifications may be made therewith without departing from the spirit of the invention. For example, it will be apparent that the confined or localized amount of plating solution may be held in a constricted container which in turn is applied to the spot to be plated, the unit being arranged in suitable juxtaposition to the localized plating bath. Other equivalent methods will readily occur to those skilled in the art.

I claim:

1. The method of spot-electroplating electrically conductive elements which consists in locally applying a confined bath of an electrolytic plating solution directly to a spot of the element to be plated, arranging said confined bath of plating solution between an anode and said element, the anode and the element forming the electrodes of an electroplating circuit and being in contact with each other solely thru the medium of the said confined solution.

2. The method of spot-electroplating elements having high resistance surfaces which consists in locally applying a confined bath of an electrolytic plating solution directly to a spot of the high resistance surface to be plated, arranging said confined bath of plating solution between an anode and said surface, the anode and the surface of the element forming the electrodes of an electroplating circuit and being in contact with each other solely thru the medium of the said confined solution.

3. The method of spot-electroplating electrically conductive surfaces which consists in locally applying a confined bath of an electrolytic plating solution directly to an interior spaced local area or spot of the surface to be plated, arranging said confined bath of plating solution between an anode and said surface, the anode and the surface forming the electrodes of an electroplating circuit and being in contact with each other solely thru the medium of the said confined solution, said solution being held between the electrodes by surface tension.

4. The method of spot-electroplating electrically conductive elements which consists in locally applying a confined bath of an electrolytic plating solution directly to a spot of the element to be plated, the said confined bath of plating solution being arranged between an anode and said element, and in moving said element relative to said plating solution and anode in order to enlarge the spot to be plated, the anode and the element forming the electrodes of an electroplating circuit and being in contact with each other solely thru the medium of the said confined solution.

5. The method of spot electroplating electrical resistance elements which consists in locally applying a confined bath of an electrolytic plating solution directly to a spot of the element to be plated, the said spot being intermediate the ends of the element, the said confined bath of plating solution being arranged between an anode and said element, and in moving said element relative to said plating solution and anode in order to enlarge the spot to be plated, the anode and the element forming the electrodes of an electroplating circuit and being in contact with each other solely thru the medium of the said confined solution, said solution being held to the anode by surface tension.

6. The method of spot-electroplating electrically conductive cylindrically shaped elements which consists in applying an electrolytic plating solution directly to a spot of the element to be plated, the said electrolytic plating solution being arranged between an anode and said element, and in rotating the said element about its axis in said electrolytic plating solution to produce a plated band on said element, the anode and the element forming the electrodes of an electroplating circuit and being in contact with each other solely thru the medium of the said confined solution.

7. The method of plating surfaces with a uniformly thin layer of metal which consists in rotating the surface and an anode of a plating metal one relatively to the other with a confined bath of electrolytic plating solution held between the surface and the anode solely by surface tension.

8. The method of plating resistance units having a high resistance coating or surface with a uniformly thin layer of metal which consists in moving the high resistance surface of the unit past an anode of a plating metal having a confined bath of the electrolytic solution held between the resistance surface and the anode solely by surface tension, the resistance surface and the anode forming the electrodes of the electroplating circuit.

Signed at New York, in the county of New York and State of New York, this 29th day of September, A. D. 1927.

JOSEPH A. FLANZER.