April 14, 1931. S. R. MASON 1,800,947

METHOD OF COATING ARTICLES

Filed Nov. 30, 1927

Fig. 1.

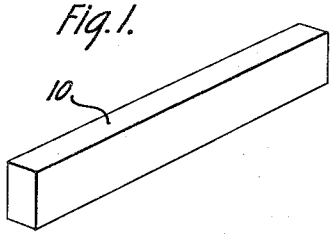


Fig. 2.

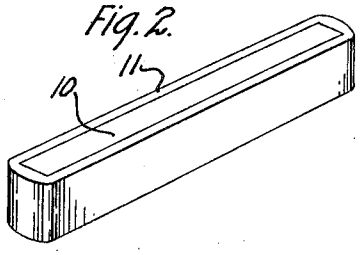


Fig. 3.

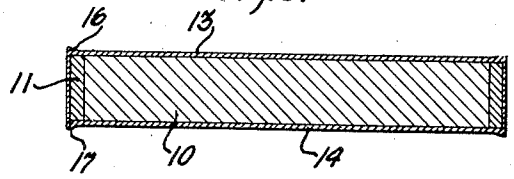


Fig. 4.

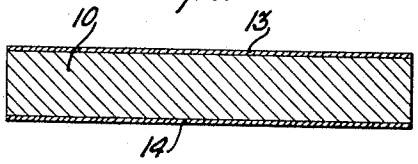


Fig. 5.



Fig. 6.

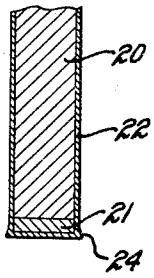
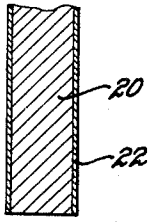


Fig. 7.



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UNITED STATES PATENT OFFICE

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METHOD OF COATING ARTICLES

Application filed November 30, 1927. Serial No. 238,640.

This invention relates to methods of coating articles, and more particularly to methods of coating articles by electro-deposition.

It is generally well known in the electroplating art that when metal deposits are placed on articles by electrochemical means, those portions of the articles which receive the most current, such as the edges, ends and protruding portions, also receive the greatest amount of the plated metal. This phenomenon is generally described by saying that those portions of an article upon which the current density (usually expressed in amperes per unit area) is highest obtain the greatest deposit and this phenomenon is sometimes spoken of as the edge and/or end effect. Because of this tendency it is difficult to obtain uniform deposits upon irregular shaped articles especially when the plating is being done with a metal, such as chromium, which requires a high current density for its deposition.

It is the object of the present invention to provide a method of coating articles by electro-deposition in which the difficulties resulting from edge and end effects are substantially eliminated and by means of which substantially uniform deposits of plated metals may be obtained.

In accordance with the general features of the invention, a piece of conducting metal is fixed in contact with the end or edge of a part which it is desired to electroplate, and the part and the affixed metal piece are connected as a cathode in an electroplating bath, the extremities of the affixed metal piece then forming the edges and ends of the composite cathode and the edge and end effects are dissipated thereon. After a deposit of the required thickness has been produced, the composite cathode is disconnected and the affixed metal piece may be removed if desired from the plated part leaving the latter with a uniform metal coating thereon.

It is believed that the invention will be clearly understood from the following detailed descriptions of embodiments thereof taken in connection with the accompanying drawing illustrating those embodiments, and in which

Fig. 1 is a perspective view of a part to be coated;

Fig. 2 is a perspective view of the part shown in Fig. 1 partially surrounded by a mass of a conductive metal;

Fig. 3 is a vertical, longitudinal, sectional view of the composite article shown in Fig. 2 after a coating has been placed thereon;

Fig. 4 is a view similar to Fig. 3 illustrating the part shown in Fig. 1 with the finished coating thereon;

Fig. 5 is a fragmentary, elevational view of a cylindrical part to be coated and a metal disk held thereon by a magnetic attraction;

Fig. 6 is a longitudinal, sectional view of the parts shown in Fig. 6 with a coating thereon, and

Fig. 7 is a view similar to Fig. 6 with the metal disk removed from the coated part.

In practicing one method embodying the invention, a part 10, such as shown in Fig. 1 which is to be plated upon its upper and lower surfaces with a uniform coating of a metal, such as chromium, is partially surrounded as shown in Fig. 2 with a mass 11 of a conducting material, such as a low fusion point alloy, which may be molded thereabout. The mass of metal 11 is so formed as to completely surround the surfaces of the part 10 upon which no metal is to be deposited, while the upper and lower surfaces of the mass of metal 11 are substantially in the same planes as the corresponding surfaces of the part 10 upon each of which it is desired to place a coating. The composite article produced by partially surrounding the part 10 with the metal 11 is then connected as a cathode in the bath of an electro plating cell of the usual type, such as a chromium plating cell, and the current flowing through

the cell is adjusted to a value which gives a cathode current density requisite for deposition of metal on the original part. The composite cathode is maintained in the electroplating cell until coatings 13 and 14 of the desired thickness have been deposited upon the original part when it is removed from the cell. An examination of the coated composite articles shows that the upper and lower surfaces of the part 10 have substantially uniform coatings 13 and 14 thereon, while the coatings upon the edges of the metal 11, which edges now form the extremities of the composite article, are built up, as is shown at 16 and 17, due to the higher current density upon those edges.

The coated composite article, such as is illustrated in Fig. 3, may find uses without further change, in which case the surrounding metal is retained upon the original part 10 and the coated portions of the part may be employed for various purposes, such as for surface gauges. However, if it is desired to remove the surrounding metal this may be readily done either by manually forcing the part out of the surrounding metal or by melting the surrounding mass of metal, in which case the article will look somewhat as is shown in Fig. 4 and will have uniform coatings upon its upper and lower surfaces.

In practicing another method embodying the invention, a cylindrical part 20 (Fig. 5) composed of a magnetic material is magnetized either temporarily or permanently and a small disk 21 of a magnetic material is secured upon the end thereof by magnetic attraction. The composite article thus formed is plated in a manner similar to that described in the foregoing description, whereupon a uniform coating 22 will be deposited upon the part 20, whereas the lower edge of the part 21 will receive a greater deposit, such as is shown at 24, due to the increased current density at that point. As in the method described hereinbefore, the affixed metal part 22 with its irregular coating may be retained upon the original part 20, if desired, or it may be removed by simply withdrawing it against the force of magnetic attraction, leaving the original cylindrical part 20 with a uniform coating 22 thereon. If the finished coated part is a permanent magnet it may be used for many purposes in its magnetized state, but for most purposes it is advantageous to demagnetize the part which may be accomplished by any suitable method well known in the art.

The methods described hereinbefore are merely convenient examples of embodiments of the invention and the invention is not limited to those embodiments, but embraces all methods of producing uniform coatings upon articles included within the scope of the appended claims. For example, the auxiliary pieces of conducting material are described in the foregoing methods as fixed in contact with the original parts by being molded therearound or retained thereagainst by magnetic attraction, but the auxiliary pieces of metal may be secured in operative relation with the parts to be coated by any suitable mechanical means, such as by clamps or bindings. Also the auxiliary material employed in the first described method need not necessarily be a low fusion point alloy, but may be any conducting metal or alloy, such as iron, copper, brass, etc., nor must the conducting material be a metal for non-metallic conducting materials, such as carbon or graphite, also may be employed with satisfactory results.

In general terms, where the article to be coated has a surface of moderate curvature such as the plane surface 10 or the cylindrical surface 20, terminating in a surface of relatively sharp curvature such as an edge or corner, an auxiliary piece is attached to the article in such relation as to form a continuation of the surface of moderate curvature, thereby eliminating the edge or end effect in so far as the surface of moderate curvature is concerned and making it possible to deposit a substantially uniform coating thereon.

The methods embodying the invention may be successfully practiced in connection with the usual electroplating baths for the deposition of metals, such as copper, nickel, silver, etc., which require comparatively low cathode current densities for their deposition, but the methods constituting the invention are particularly useful when practiced in connection with baths, such as those from which chromium may be deposited, which require a high cathode current density for metal deposition.

What is claimed is:

1. A method of producing uniform coatings on articles, which consists in fixing a piece of conducting material in contact with an article to be plated, connecting the resulting composite part as a cathode in an electroplating bath, maintaining the composite part therein until a coating of the desired thickness has been deposited upon the original article, and removing the piece of conducting material from the part thereby leaving a substantially uniform coating upon the part.

2. A method of coating articles with metals requiring high current densities for their deposition, which consists in affixing a piece of metal to an extremity of a part to be plated, connecting the resulting composite article as a cathode in an electroplating bath, adjusting the current to a value giving a current density requisite for deposition on the original part, depositing a coating of metal upon the composite article, and removing the piece of metal from the part thereby leav-

ing a substantially uniform coating upon the part.

3. A method of producing uniform coatings of chromium upon metal articles, which consists in affixing a piece of conducting metal to an extremity of a part to be plated, connecting the resulting composite article as a cathode in a chromium plating cell, depositing a coating of chromium thereon, and removing the piece of metal from the part thereby leaving a substantially uniform coating upon the part.

4. A method of producing uniform coatings on articles, which consists in surrounding a portion of an article to be plated with a conducting metal, connecting the resulting composite part as a cathode in an electroplating bath, maintaining the composite part therein until a coating of the desired thickness has been deposited upon the exposed portion of the original article, and removing the surrounding metal from the article thereby leaving a substantially uniform coating upon the article.

5. A method of producing uniform coatings on articles, which consists in molding a mass of a conducting metal around a portion of an article to be plated with a surface of the molded metal in the same plane as an exposed surface of the article to be plated, connecting the resulting composite part as a cathode in an electroplating bath, depositing a coating of metal upon the exposed surface of the original article, and removing the mass of conducting metal from the article thereby leaving a substantially uniform metallic coating upon the article.

6. A method of producing uniform coatings of chromium upon metal articles, which consists in surrounding a portion of an article to be plated with a conductive metal, connecting the resulting composite part as a cathode in a chromium plating cell, maintaining the composite part therein until a chromium coating of the desired thickness has been deposited upon the exposed portion of the original article, and removing the surrounding metal from the original article, thereby leaving a substantially uniform coating of chromium upon the article.

7. A method of coating an article having a surface of moderate curvature terminating in a surface of relatively sharp curvature, which consists in attaching to the article a conducting member shaped to form a continuation of the surface of moderate curvature, connecting the resulting composite article as a cathode in an electroplating bath, depositing a coating of metal thereon, and removing the conducting member from the article.

8. A method of producing a uniform coating upon a surface of an article having a surface of moderate curvature terminating in a surface of relatively sharp curvature, which consists in attaching to the article by magnetic attraction a conducting member shaped to form a continuation of the surface of moderate curvature, connecting the resulting composite article as a cathode in an electroplating bath, depositing a coating of metal thereon, and removing the conducting member from the article.

In witness whereof, I hereunto subscribe my name this 19th day of November, A. D. 1927.

SUMNER REDWAY MASON.