Dec. 10, 1957 A. G. RUSSELL 2,816,066

METHODS OF PLATING ARTICLES

Filed May 14, 1956

FIG. 1

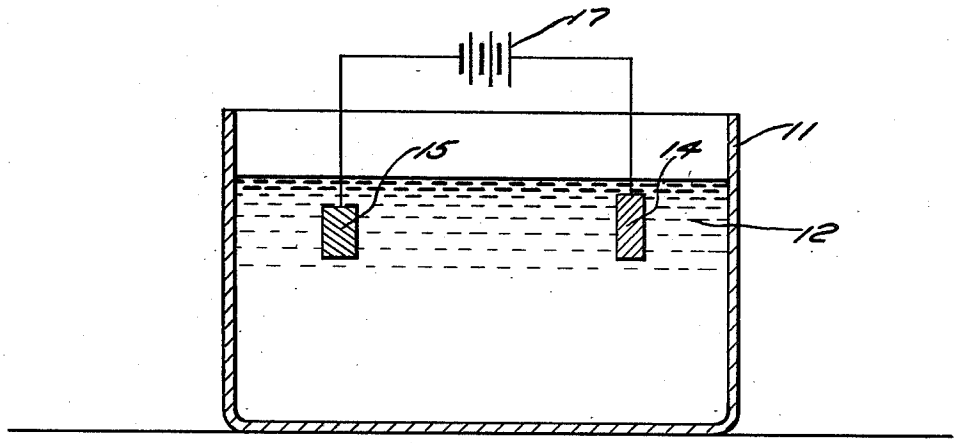


FIG. 2

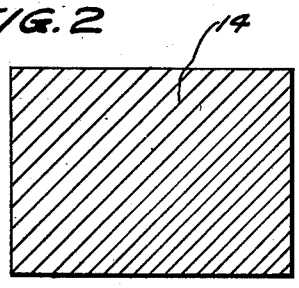


FIG. 3

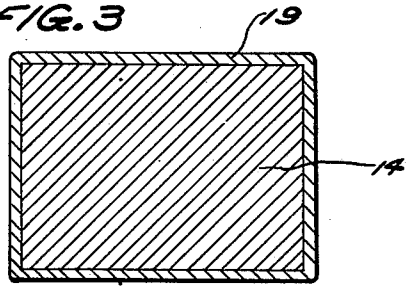


FIG. 4

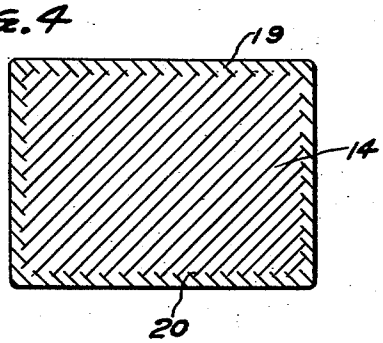
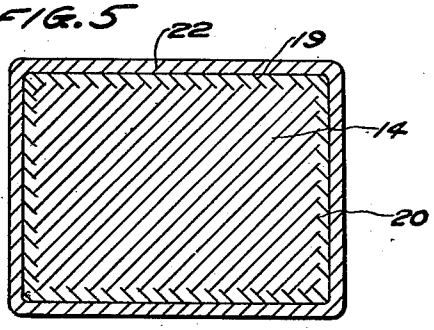


FIG. 5



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METHODS OF PLATING ARTICLES

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1 Claim. (Cl. 204—37)

This invention relates to methods of plating articles and more particularly to methods of electroplating articles made of metals which are normally difficult to electroplate.

An object of this invention is to provide methods of plating articles.

Another object of this invention is to provide methods of electroplating articles made of metals which are normally difficult to electroplate.

In a method illustrating features of the invention, a thin strike layer of metal is electroplated onto a metallic article and the article is then heat treated in a protective atmosphere to alloy the strike layer with the metallic article. A final layer of desirable metal is then electroplated onto the article to a desired thickness.

A complete understanding of the invention may be obtained from the following detailed description of a method forming a specific embodiment thereof, when read in conjunction with the appended drawing, in which

Fig. 1 is a cross-sectional view of a tank containing an electrolytic solution in which a metallic electrode and the article to be plated are submerged;

Fig. 2 is an enlarged cross-sectional view of an article to be plated;

Fig. 3 is the disclosure of Fig. 2 after a thin strike layer has been plated on the article;

Fig. 4 is the disclosure of Fig. 3 after the article has been heat treated to alloy the strike layer with the surface of the article; and

Fig. 5 is the disclosure of Fig. 4 after another layer of metal has been electroplated onto the article.

Referring now in detail to the drawing, a tank **11** is shown containing an electrolytic solution **12** in which an article **14** made of molybdenum and a gold electrode **15** are suspended in submerged positions. A suitable electrolytic solution may contain 3–3.5 ounces of potassium gold cyanide per gallon; 7–7.5 ounces of potassium cyanide per gallon; and 0.5–0.75 ounce of potassium hydroxide per gallon of solution. Current from a power source **17** connected to the article **14** and the gold electrode **15** flows therethrough to plate a thin strike layer **19** of gold on the article **14**, the cathode current density being 1–10 amperes per square foot. When this layer **19** is approximately 0.00001–0.0001 inch thick the article **14** is removed from the electrolytic solution **12**.

The plated article **14** is then placed in a heat treating furnace (not shown) of a well-known type utilizing a vacuum or other neutral or reducing atmosphere for the protection of the article during the heat treating operation. A suitable protective atmosphere may consist of thermally cracked ammonia which has the composition of approximately 75% hydrogen and 25% nitrogen by volume. The article **14** is heat treated at 2000–2500° F. for approximately five minutes to cause the strike layer

19 of gold to become alloyed or diffused with the surface of the article **14** whereby the strike layer adheres firmly to the article, this alloyed or diffused zone being represented in the drawing by the numeral **20**. The strike layer **19** is thin enough that it will not blister when heated, and is thick enough that it will not dissolve and disappear into the article **14** during the heat treating operation.

After the heat treating operation, the article **14** is removed from the furnace and replaced in the electrolytic solution **12**. The power source **17** is then connected to the article **14** and a final layer **22** of gold, or any other metal which can be electroplated onto gold, is electroplated on the article. This final layer **22** may be of any desirable thickness, and will be firmly bonded to the article **14**.

In the above-described example of a method illustrating features of the invention, a strike layer of either copper or nickel may be substituted for the gold strike layer **19**, and the final layer **22** may be of any metal or alloy which can be electroplated on copper or nickel. If a copper strike layer is used, the article is heat treated at approximately 1700–2000° F. for approximately five minutes. If a nickel strike layer is used, the article is heat treated at 2000°–2300° F. for approximately five minutes.

The above-described method can be also used to electroplate other difficult-to-plate metals and alloys such as tungsten, cobalt and nickel alloys. Another example of a method illustrating features of the invention may be as follows: a strike layer of nickel is electroplated to a depth of 0.00001"–0.0001", on an article made of an alloy consisting of 90% cobalt, 9.5% iron and 0.5% manganese, and the article is heat treated at approximately 2000°–2300° F. for approximately five minutes whereby the strike layer becomes alloyed with or partly diffused into the article and is thus firmly bonded to it. A final layer of a desirable metal is then electroplated on the nickel-plated article. This final layer may be of any desirable thickness, and will adhere firmly to the article.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of this invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

The method of plating articles made of metal of the group consisting of molybdenum, tungsten, cobalt, molybdenum-base alloys, tungsten-base alloys and cobalt-base alloys, comprising electroplating such an article with a strike layer of gold, said strike layer having a thickness within the range 0.00001" to 0.0001", heat treating the article to a temperature within the range of 2000° to 2500° F. for 3 to 10 minutes, and electroplating the heat treated article with another layer of gold.

References Cited in the file of this patent

UNITED STATES PATENTS

2,116,927	Germer	May 10, 1938
2,195,499	Schofield	Apr. 2, 1940
2,683,835	Freedman	July 13, 1954

FOREIGN PATENTS

283,288	Great Britain	Jan. 9, 1928
473,479	Great Britain	Oct. 11, 1937