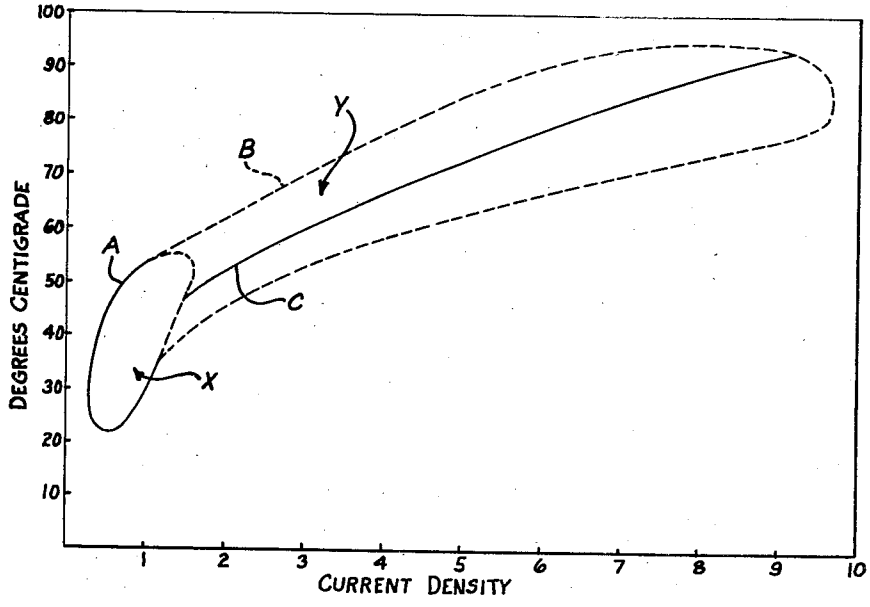
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METHOD OF CHROMIUM PLATING

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METHOD OF CHROMIUM PLATING

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3 Claims. (Cl. 204—1)

This invention relates to a method of chromium plating, and more particularly to a method of plating bright and heavy deposits of chromium.

Considerable research work has been done with the object of determining the most effective temperature of the chromium plating bath and the proper current density at which the bath should be operated, and it appears that the prevalent opinion is that the temperature of the bath ordinarily must not exceed 55° C. and that the current density should be maintained low in order to obtain good deposits.

An object of the present invention is to provide an effective and efficient method of chromium plating.

In accordance with one embodiment of the invention, the relationship between the temperature of the bath, the density of the plating current, and the ratio between cathode area and anode area are taken into consideration in applying the chromium plate.

A complete understanding of the invention may be had by reference to the following description taken in conjunction with the accompanying drawing, in which the single figure is a graphical illustration of the temperature-current density relationships of the bath.

The process is carried out in an aqueous chromic acid solution, such as a Sargent solution containing 1 to 5 grams of sulphate radical to 250 grams of chromic acid per liter of solution.

Referring now to the drawing in which the ordinates represent temperature in degrees centigrade and the abscissas represent current density at the cathode area, the total enclosed area is the area in which bright deposits of chromium may be obtained. In the lower left hand corner of this area there is a smaller area X delimited in part by a solid line A, and in part by the dash line B in which the relationship between the cathode area and anode area of the plating electrodes is unimportant and it was heretofore considered that chromium plating outside of this area was not practical. We have found, however, chromium plating may be carried out in a much larger area, utilizing plating bath temperatures as high as 90° C., by properly proportioning the areas of the cathode and anode. In some cases, it was customary in prior practice to employ an anode of approximately ten times the area of the cathode surface. While this ratio of electrode areas is satisfactory in the area X, it is wholly unsatisfactory in the area Y enclosed by the dash line B.

As an illustration of the optimum operating conditions, a temperature of 60° C. may be used at a current density of 3 amperes per square inch of cathode surface with a cathode anode area ratio of 1 to 3. The solid line C represents the optimum temperature-current density relationships although, as stated above, satisfactory results may be obtained within the area enclosed by the dash line B. Beneath the enclosed area the deposits tend to become milky in appearance, while above the enclosed area nodules are formed, and both above and below this area excessive evolution of gas takes place.

While no definite theory has been established as to why a relatively low anode area must be used at the higher temperatures, it appears that as the conductivity of the bath increases with increase of temperature, the decrease in anode area reestablishes the relationship existing at the lower temperatures with a larger anode area. The ratio of 1 to 3 between the cathode anode areas is not a fixed quantity and varies with the configuration of the parts which serve as cathodes during the plating operation as well as with the spacing of the parts, but the ratio is maintained under 1 to 5 for satisfactory results. It has been found that in some cases where nodules are formed during the plating operation, a closer spacing of the articles may overcome the defect. The most satisfactory way of determining the proper anode area for articles of a type which have not been plated before is to begin with a large number of removable anodes and then remove anodes until good plating conditions are arrived at. Once the anode area is established for a given number, size and configuration of parts, the same anode area may be used for subsequent similar operations, although it has been found at times that due to the change of the sulphate-chromic acid ratio of the bath, it becomes necessary to remove additional anodes after the bath has been in operation for some time.

Many conditions which are satisfactory for applying flash coatings of chromium of the order of .00001 inch in thickness are not practical for heavy deposits. The method of this invention has been found particularly efficacious for applying smooth and heavy chromium deposits of the order of .001" in thickness. Due to the porosity of chromium plating deposits, it is customary to undercoat chromium with a layer of copper and a layer of nickel to protect the surface against corrosion, after which a light or flash coating of chromium is deposited on the nickel undercoat. By means of the present invention, the chromium plate may be made sufficiently heavy to

protect the underlying surface. In coating zinc, or zinc base alloys, protection against corrosion is secondary, and a single coating of chromium will suffice, although it is desirable that such coating should be heavier than when a copper and nickel undercoating is used.

In chromium plating on zinc or zinc alloy parts, it has been found that the ratio of sulphate radical to chromic acid is much less critical when plating at a temperature of approximately 60° C. and a current density of approximately 3 amperes per square inch of cathode surface than when plating in the area X of the accompanying graph.

The luster of the article after plating will depend on the condition of the surface before plating, and if the luster is desired, the surface to be plated is first subjected to a buffing or brushing operation to provide a polished surface on which to deposit the chromium. In come cases it may also be desirable to buff and color the chromium deposit after the plating operation.

It will be understood that the embodiment of the invention herein described is merely illustrative and that many changes and modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. The process of electrodepositing a bright heavy coating of chromium on an article from an aqueous bath of the chromic acid type, containing about 250 grams of chromic acid and 1 to 5 grams of sulphate per liter, which comprises passing a current of at least 2 amperes per square inch to the article to be plated as a cathode, maintaining the temperature of the bath between 40° and 90° C. and adjusting the cathode-anode area ratio on the order of 1 to 3 to obtain a smooth deposit.

2. The process of plating a bright heavy coating of chromium on an article in an aqueous bath of the chromic acid type, containing about 250 grams of chromic acid and 1 to 5 grams of sulphate per liter, which comprises passing a current of sufficient intensity to produce a bright deposit to the article to be plated as a cathode, correlating the temperature of the bath, with the current density in a manner such that the current density and temperature vary together in the same sense and always within the area delimited by the line B in the accompanying graph for the given temperature, while maintaining the cathode-anode area ratio under 1–5.

3. The process of plating a bright heavy coating of chromium on an article in an aqueous bath of the chromic acid type containing about 250 grams of chromic acid and 1 to 5 grams of sulphate per liter, which comprises passing a current of sufficient intensity to produce a bright deposit to the articles to be plated as a cathode, and correlating the temperature of the bath in accordance with the current density in a manner such that the current density and temperature vary together in the same sense and always within the area delimited by the line B in the accompanying graph, while providing a cathode-anode area ratio on the order of 1 to 3, the exact ratio depending upon the configuration and spacing of the articles serving as cathodes.

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