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METHOD OF FORMING FERROTYPING SURFACES

William M. Tucker, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y., a corporation of New Jersey

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1 Claim. (Cl. 204—36)

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This invention relates to forming ferrotyping surfaces on chromium plated articles and more particularly to a method by which the size and pattern of the maze of fine cracks of the ferrotyping surface can be controlled and can be easily produced.

Ferrotyping surfaces and the like preferably are formed by chromium plating articles of steel, nickel or copper, in the form of plates, drums or sheets, and the like.

Heretofore, it has been quite impossible initially to prepare a chromium plated ferrotyping surface which is as satisfactory as is the same surface after it has been used for some time. In this art, it has long been recognized that most chromium plated ferrotyping surfaces undergo an aging effect. All of the factors involved in this aging effect are not understood. However, on certain commercial chromium plated ferrotype dryers, the visual evidence of the change from a relatively poor ferrotyping surface to a good ferrotyping surface consists in the appearance of a maze of very fine cracks in the chromium plated surface. It is desirable that this maze of fine cracks in the chromium surface, which can be easily resolved at 40 or 50 diameters magnification, appears within a relatively short time after a ferrotyping surface is placed in service, otherwise considerable wastage results from poor ferrotyping. Sometimes the crack structure which forms in the chromium plate is too coarse and the cracks are visible to the naked eye when viewed from the proper lighting angle. In this case, the ferrotyping results are again poor because in many instances such coarse cracks can be discerned on the ferrotyped product.

The production of a chromium deposit which will quickly form a properly cracked structure and which will produce high quality ferrotyped products has, in the past, been in part a chance occurrence because the process controls were not well understood and did not in every instance yield a suitable product. Numerous efforts have been made before this invention to make these results more certain by control of the chromium plating bath composition.

It was found that copper shells so chromium plated could be over-buffed and the onset of the appearances of suitable cracks deferred for an

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undesirably long period. For this reason, it has been standard practice to buff the chromium plate as little as possible and still meet the surface requirements.

Even with these process conditions well standardized, poor results were sometimes obtained for which one could not account. Efforts have been made to accelerate crack formation by subjecting the chromium surface to violent heating and cooling effects, but without success. Efforts have also been made to attack the incipient cracks by exposure to hydrochloric acid of various strengths, but to no avail. Some fairly good results have been obtained in the past by subjecting the buffed chromium surface to anodic treatment for a few seconds in the same chromium bath employed for plating. This treatment was capable of "opening" an incipient crack structure but could not create cracks.

An object, therefore, of the present invention is an improved method of forming a maze of very fine cracks in a chromium ferrotyping surface.

Another object of the invention is a method of initially forming a maze of very fine cracks in a chromium ferrotyping surface which is superior to those obtained by previous methods including aging of the surface.

Still another object is a method by which a predetermined crack formation may be produced initially in a chromium ferrotype surface.

Other objects will appear hereinafter.

In accordance with the invention, these and other objects are attained by my novel procedure for producing a cracked structure of substantially the desired size and desired pattern on a chromium plated surface. The desired maze of cracks does not extend through the chromium plate to the underlying metal.

The selected metal drum or shell which may be composed, for example, of steel, nickel or copper (or any other metal or alloy which can be chromium plated) is immersed in a chromium plating bath containing 390 to 410 grams of CrO_3 per liter with sulfate ion maintained within the range of a ratio of CrO_3 to SO_4 ion of 104 to 110 to 1. With this bath control an operating temperature of 115 to 122° F. in preferably employed and the current density is preferably maintained in the range of 175 to 225 amperes per square foot.

The initial chromium plating may have a duration of as little as ½ hour or as much as 2 hours, with it being preferable to plate for one hour. The plated surface is washed free from plating solution and subjected to buffing after which the shell or drum is cleaned with a water slurry of levigated alumina until the chromium surface shows no water breaks. The plated surface is then reimmersed in the plating bath and after an interval of from 2 to 5 minutes in which it is allowed to come to the plating bath temperature, electrolysis is started at a current density of 0.25 A. S. I. The current density is increased at the end of five minute intervals by 0.25 A. S. I. until a current density of 1.25 A. S. I. is reached. Chromium plating is continued at this current density from thirty minutes to one hour. The chromium deposit so formed will comprise a maze of incipient cracks which remain even after the subsequent buffing operation. The buffing step after the second plating may be avoided by shortening the duration of the second chromium plating. The current density in this case is increased by 0.25 A. S. I. at intervals of 2.5 minutes until a current density of 1.25 A. S. I. is attained and plating is continued for five minutes. The lighter crack structure so produced does not require buffing. My improved method of crack production will produce desirable degrees of cracking on chromium-plated steel, nickel and copper and on other metals and alloys since the control is residual in the second chromium plating.

In accordance with another modification of the process the amount of crack formation may be varied by interrupting the second chromium plating operation either while the article being plated is in the plating bath, as by shutting off the current, or by removing the article and exposing it to the air. A lesser amount of cracking results in all such variants of the process than occurs when the second chromium plating follows a buffing operation. Hence, these alternate methods are not preferred although desirable and usable in some instances.

The following examples further illustrate my invention:

Example 1

A steel article such as a cylindrical surface is electroplated with copper by a standard process, buffed to an excellent highly polished surface, and then chromium plated in accordance with my invention to produce a cracked surface thereon. The chromium plating bath employed contained 390 grams of CrO_3 per liter and the sulfate ion was maintained at a ratio of CrO_3 to SO_4 ion of 104 to 1. The temperature of the bath was held at approximately 115° F. The copper plated article was chromium plated in this bath for one hour at 200 A. S. F. It is then color buffed and the surface cleaned for further plating. The chromium surface is cleaned with a water slurry of levigated alumina until the chromium surface shows no water breaks. The chromium plated article is then placed in a chromium plating bath having a composition similar to that described above, and made the cathode and current is applied in sequential steps beginning at 0.25 A. S. I. and increasing after each five minute interval by 0.25 A. S. I. until such time that a total current is reached of 1.25 A. S. I. Plating is continued at the rate of 1.25 A. S. I. for forty-five minutes. The plated article now containing a maze of fine cracks in its surface is then removed from the bath, washed free from plating solution and buffed to produce a surface ideally suited for glazing or ferrotyping photographic paper.

Example 2

A thin, flat plate of steel is electroplated with copper by a standard process, buffed to a highly polished surface, and then chromium plated in accordance with my novel process for producing a cracked surface thereon. The chromium plating bath employed contained 410 grams of CrO_3 per liter and the sulfate ion was maintained at a ratio of CrO_3 to SO_4 ion of 110 to 1. The temperature of the bath was held at approximately 122° F. The copper plated article was chromium plated in this bath for two hours at 225 A. S. F. The plated strip was then color buffed and the surface cleaned for further plating. The chromium surface is cleaned with a water slurry of levigated alumina until the chromium surface shows no water breaks. The chromium plated article is then placed in a chromium plating bath having a composition similar to that described above, and made the cathode and current is applied in sequential steps beginning at 0.25 A. S. I. and increasing after each five minute interval by 0.25 A. S. I. until such time that a total current is reached of 1.25 A. S. I. Plating is continued at the rate of 1.25 A. S. I. for one hour. The plated article now contains a maze of fine cracks in its surface and is then removed from the bath, washed free from plating solution and buffed to produce a surface ideally suited for ferrotyping photographic paper.

Example 3

A steel drum is electroplated with copper by a standard procedure, buffed to produce a highly polished surface thereon and then chromium plated. The chromium plating bath and conditions employed for the initial chromium plating are similar to that of Example 2. However, in this instance the buffing step following this first chromium plating was omitted and this omission was compensated for by shortening the duration of the second chromium plating. The steel drum was permitted to remain as the cathode in the same bath and the plating was begun again with a current density of 0.25 A. S. I. However, in this case the current density is increased by 0.25 A. S. I. at intervals of 2.5 minutes until a current density of 1.25 A. S. I. is attained and plating is continued for five minutes. The lighter crack structure so produced does not require buffing.

Example 4

The process of Example 2 was repeated on a steel drum except that the second chromium plating operation was interrupted by shutting off the current for ten minutes after a current density of 0.75 A. S. I. had been applied for five minutes. A lesser amount of cracking occurred than in Example 2.

Ferrotyping surfaces made in accordance with this invention give excellent results without requiring aging of their surfaces thereby overcoming the disadvantages encountered in present day ferrotyping equipment.

What I claim and desire to secure by Letters Patent of the United States is:

The method of producing a maze of fine cracks in a metal ferrotyping surface which comprises plating chromium on the metal comprising the

body of the ferrotype from a plating bath containing SO_4 ion and 390 to 410 grams per liter of CrO_3 while maintaining the SO_4 ion within a range of a ratio of CrO_3 to SO_4 ion of 104 to 110 to 1, and while maintaining the temperature of the bath within the range of 115 to 122° F. and while maintaining the current density in the range of 175 to 225 amperes per square foot for ½ to 2 hours, washing the plated surface free from plating solution, buffing the surface, then cleaning the surface with levigated alumina until it shows no water breaks, replating the chromium surface in a plating bath of the same composition as employed in the first plating operation at an initial current density of 0.25 ampere per square inch, and increasing the current density at intervals until a current density of 1.25 amperes per square inch is attained, and continuing the plating for 30 minutes to 1 hour, thereby producing a maze of incipient cracks in the second chromium plated surface.

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