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PROCESS FOR CHROMIUM PLATING

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This invention relates generally to electro-plating and particularly to chromium plating.

In my co-pending application filed Oct. 15, 1928, Serial No. 312,746, (Div. 56), I have disclosed a process by means of which I have been able to electro-deposit chromium upon the working surfaces of various articles whereby an extremely hard wear resistance and temperature resistance surface has been obtained. During use the chromium plated surface becomes worn below predetermined minimum dimensions and in order that the article may be made of further use, the surface is re-treated to re-build the chromium plate or surface. After such re-building the chromium surface may be utilized in the form in which it is then available, or, if desired, it may be ground to the particular shape or size which may be desired.

In certain instances after a chromium plate has been worn through on some particular article, I have removed the remainder of the chromium plate by dissolving it with hydrochloric acid. The disadvantage of such treatment, however, is that after the base surface of the object has been subjected to the hydrochloric acid several times the surface becomes etched and roughened. Practically the chromium layer which is deposited thereon reproduces the etched or roughened surface and as the deposition of chromium is continued, this condition may become aggravated. Moreover, I have found that after the base surface has become so etched and roughened, it is somewhat more difficult to cause the chromium to take or deposit.

The above condition is particularly found in iron castings having an appreciable percentage of carbon. Results appear to indicate that the carbon is attacked by the constituents of the ionized plating solution and the surface of the iron roughened by the removal of the carbon.

Plating chromium directly on a chromium surface that has become worn or otherwise affected by external conditions such as temperature, appears to be unsatisfactory. Apparently the worn crystal surfaces are not in proper condition to receive or hold the new plate of chromium. If possible, howver, it is preferable to plate the chromium directly upon the previous chromium layer as a new base, rather than to remove the old or previous chromium layer and deposit the new chromium on the original surface of the article as a base. Such action obviates the possibility of spoiling the original base surface by etching of the hydrochloric acid and also provides the fine crystal structure of the bottom layer of chromium as a base for the newer layer of chromium.

The primary object of my invention is therefore to provide a process whereby a hard coherent layer of chromium may be deposited upon an old or worn layer of chromium.

Another object of my invention is to provide a process for depositing a layer of chromium generally upon another layer of chromium.

Another object of my invention is to provide a process which utilizes the electric cell action between two metals in solution whereby the surface of the desired metal may be prepared for a new metal deposit thereon.

In the operation of my process I take advantage of the fact that different metals have different solution pressures and that if two different metals in solution as electrodes are externally connected, electric cell action takes place and current is caused to flow through the circuit so established. When I speak here of different metals I also refer to the same metals which, because of their previous treatment, may have different solution pressures.

In ordinary chromium plating operation the article which is to be plated is immersed in a chromium plating solution, such as chromic acid, and is connected to be the cathode of the plating circuit. The anode may be the steel tank which contains the plating solution or the anode may consist of a lead or steel plate that is suspended in the solution but insulated from the tank itself. In order to establish plating action an external voltage is introduced into the plating circuit from a direct current generator of six to twelve volts and the plating action is established by the electrolysis of the chromic

acid solution. Any satisfactory chromic acid solution may be used, such as described, for example, in the Technologic Paper of the Bureau of Standards, No. 346, entitled "Electro deposition of chromium from chromic acid baths".

In the operation of my process, I immerse the article to be plated in the usual manner into the solution as the cathode of the plating circuit. However, instead of adjusting the generator voltage to normal plating voltage, I adjust it so that no voltage at all is impressed upon the solution from the generator itself. Since the plating circuit is otherwise established, the immersion of the article to be plated into the solution completely closes the plating circuit. Since no external voltage is impressed upon the plating circuit the article to be plated co-operates with the lead or steel anode to constitute an electric cell. The current in this case flows through the solution from the chromium of the original chromium plate to the anode. The result of this action is to dissolve the exposed crystal layer of chromium. The crystal body structure goes into solution faster than the interphases, thus giving a true etching effect on the surface of the old chromium layer.

After a short time, sufficient to effect the etching action, the generator voltage is adjusted to introduce the normal plating voltage into the plating circuit. Re-building of the crystal body then takes place until the partially dissolved crystals on the old layer are re-built and the crystal structure continues with the building of the new chromium layer upon the old chromium layer.

By means of this process the solid crystal structure is formed without weakening the lines or planes of demarcation between adjoining crystal layers, due to the surface of one crystal layer being in a condition that would not permit cohesion between that layer and the new crystal structure to be deposited. My invention therefore contemplates the conditioning of the chromium surface upon which a new layer of chromium is to be deposited, by utilizing the cell action which occurs in the solution when the article to be plated is connected as the cathode before the plating voltage is impressed upon the plating circuit.

I claim as my invention:

The method of depositing chromium upon a worn chromium surface, which consists in immersing the surface in a chromic acid plating solution as the cathode of a closed plating circuit including the solution, while no external voltage is impressed upon the plating circuit, leaving said surface so immersed for an interval at no voltage to permit primary electric cell action to take place which will establish current through the solution from the cathode surface to the anode, and then introducing an external voltage into the plating circuit to cause current to traverse the solution from the anode to the cathode.

In testimony whereof, I have hereunto subscribed my name this 1st day of November, 1928.

ROBERT J. PIERSOL.