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PROCESS OF MAKING METALLIC FILMS OR FLAKES.

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To all whom it may concern:

Be it known that I, THOMAS ALVA EDISON, a citizen of the United States, residing at Llewellyn Park, Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Processes of Making Metallic Films or Flakes, of which the following is a description.

In applications for Letters Patent filed concurrently herewith I describe certain improvements in storage-battery electrodes wherein the active mass, such as nickel hydroxid, is admixed with insoluble metallic scales or films for the purpose of insuring contact between the active particles themselves and between the active particles and the inclosing pockets or other metallic supports. As I have pointed out, these metallic scales or films are formed, preferably, of cobalt-nickel alloy, since by using this material the characteristically good contact obtained with cobalt is secured, while the presence of the nickel prevents the cobalt from suffering more than a mere surface oxidation.

My present invention relates to an improved process by which metallic scales or films can be obtained at low cost, either of cobalt or of nickel, or of a cobalt-nickel alloy.

To this end the invention in its preferred form is practiced substantially as follows:

I first obtain a plate of polished copper or nickel and deposit upon the same an extremely thin film of zinc, only a fraction of a thousandth of an inch in thickness and appearing practically as a mere blush upon the copper surface. This zinc is deposited on the copper or nickel in a solution of zinc sulfate or other zinc salt in the usual way. The cathode thus prepared is now washed and in a suitable electrolytic bath a film of the desired metal or metals is plated on the electrodeposited layer of zinc. When either cobalt or nickel is to be deposited, a suitable ammonium-sulfate solution of that metal and cobalt or nickel anodes are used. When both metals are to be simultaneously deposited, a cobalt-nickel ammonium-sulfate solution is employed with separate cobalt and nickel anodes. In the latter case the current from each anode will be so regulated as to secure the desired proportion of deposit thereof. I have found in practice that good results are secured when the deposited alloy is composed of about seventy per cent. of cobalt and thirty per cent. of nickel, although these proportions may be very widely varied. The cobalt or nickel or cobalt-nickel film thus deposited upon the superposed film of zinc is made extremely thin, generally about .0002 inch in thickness. The cathode is now immersed in a dilute acid (sulfuric, hydrochloride, or acetic) which does not sensibly attack the cobalt or nickel or cobalt-nickel film, but results in a relatively rapid dissolution of the zinc to thereby free the insoluble film from the metal base. The metallic zinc in being thus attacked by the weak acid solution results in the formation of hydrogen gas, which in escaping effects a separation or detachment of the nickel or cobalt or alloy film. I find, furthermore, that by carrying on the process described the film of cobalt or nickel or alloy thereof becomes detached in the form of small flakes or scales, which naturally assume a curved or curled shape—a phenomenon especially characteristic of cobalt—and which after breaking up and sizing by screens are therefore in the best condition for admixture with the active material. These films are now washed and annealed by heating them in a hydrogen atmosphere to a red heat, which treatment effects a very perfect cleaning of the surfaces. Films or scales obtained in this way may be applied to the active material in any suitable manner, examples of which are indicated in my concurrent applications for Letters Patent.

In order to facilitate the stripping of the deposited film of cobalt or nickel or alloy thereof, it may in some cases be desirable after the film or "blush" of zinc has been deposited on the copper plate to immerse the latter in a solution of wax or oil, (such as beeswax or castor-oil and alcohol or other solvent,) so that when dry the zinc will be covered with an extremely thin film of wax or oil, the latter being thin enough as not to prevent the proper deposition of the cobalt or nickel or alloy thereof by greatly facilitating the stripping operation.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. The process of making metallic films,

which consists in depositing a soluble metal on a cathode, then in electrodepositing a film of an insoluble metal or metals thereon, and in finally dissolving the soluble metal to detach the insoluble film, substantially as set forth.

2. The process of making metallic films, which consists in depositing a soluble metal on a cathode, then in electrodepositing a film of insoluble metal or metals thereon and finally immersing the plated cathode in an acid-bath to attack the soluble metal and separate the insoluble film, substantially as set forth.

3. The process of making metallic films, which consists in depositing a soluble metal on a suitable cathode, in electrodepositing an insoluble metallic film thereon, and in subjecting the plated cathode to the effect of the acid which dissolves the insoluble metal and results in the evolution of gas to separate and detach the insoluble film, substantially as set forth.

4. The process of making metallic films, which consists in depositing a thin film of zinc on a suitable cathode, in electrodepositing an insoluble film on the zinc, and in subjecting the plated cathode to dilute acid to dissolve the zinc and generate hydrogen gas, as and for the purposes set forth.

5. The process of making metallic films, which consists in depositing a soluble metallic film on a suitable cathode, in electrodepositing thereon a thin film of metallic cobalt or cobalt alloy and in dissolving the soluble metal to detach the insoluble film, substantially as set forth.

6. The process of making metallic films, which consists in depositing a thin film of zinc on a suitable cathode, in electrodepositing thereon a thin film of cobalt or cobalt alloy and in subjecting the plated cathode to dilute acid to thereby dissolve the zinc and effect the separation of the insoluble film, substantially as set forth.

7. The process of making metallic films, which consists in depositing a soluble metallic film on a suitable cathode, in electrodepositing thereon a thin film of metallic cobalt or cobalt alloy and in dissolving the soluble metal to detach the insoluble film, and in finally annealing the separated film in a hydrogen atmosphere, substantially as set forth.

8. The process of making metallic films, which consists in depositing a thin film of zinc on a suitable cathode, in electrodepositing thereon a thin film of cobalt or cobalt alloy and in subjecting the plated cathode to dilute acid to thereby dissolve the zinc and effect the separation of the insoluble film, and in finally annealing the separated film in a hydrogen atmosphere, as and for the purposes set forth.

This specification signed and witnessed this 29th day of March, 1905.

THOMAS A. EDISON.

Witnesses:

FRANK L. DYER,

ANNA R. KLEHM.