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4-bromobenzyl-sulfonic acid
4-chloronaphthalene-sulfonic acid-1
4,4'-dibromodiphenyl-disulfonic acid-2,2'

and the like. Thus, by modifying an acid nickel electroplating bath, for example, with a brightening agent according to the present invention as well as with a sulfonic acid substitution product of the type above described, the characteristics of nickel electrodeposits produced therefrom are considerably improved over those produced under similar conditions from electroplating baths modified with additives heretofore commonly used. In particular, such nickel electroplates are marked by their extraordinary smoothness, remarkable brightness, high ductility and complete freedom from porosity.

It is further advantageous to modify such electroplating baths in addition with polyvalent alcohols, such as glycerin, butanetriol, pentaerythrite, mannitol and the like, or with polymerization products of unsaturated carboxylic acids or their salts, such as the sodium salt of polyacrylic acid, for example. The addition of such compounds to electroplating baths modified in accordance with the present invention makes it possible to reduce the amount of brightening agent necessary to produce the desired brightening effect, and in some instances further to improve the characteristics of the metal electrodeposits.

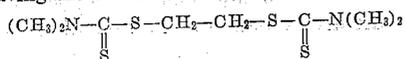
The amounts in which the brightening agents according to our invention or mixtures thereof are added to the electroplating bath depend largely upon the composition of the bath in question, but they range generally from 0.01 gm. to 20 gm. per liter of electroplating bath. As a rule, the best results are obtained if the metal is deposited from the modified bath at a temperature between room temperature and about 70° C., and at current densities from 0.5 to 10 amp./dm.².

The novel brighteners disclosed herein are, for all practical purposes, not consumed during the electroplating process and are chemically very stable compounds, so that electroplating baths modified therewith remain operative and effective for extremely long periods of time.

The following examples will further illustrate the present invention and enable others skilled in the art to understand our invention more completely. However, the recitation of these examples should not be construed as an intention on our part to limit our invention to the compounds and conditions mentioned in the examples.

Example I

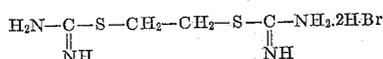
1 gm. of ethylene-bis-(dimethylamino-dithiocarbamate) having the structural formula



was added to each liter of an acid copper electroplating bath composed of water, 60 gm./liter sulfuric acid and 170 gm./liter crystalline copper sulfate. Sheet iron objects which had previously been provided with a copper base-coat in an alkaline copper cyanide bath, were then electroplated in the modified bath at room temperature and at current densities between 1 and 10 amp./dm.². They were provided with full-bright, firmly adhering copper deposits, even when highly profiled. The electrodeposits required no polishing, buffing or any other finishing treatment subsequent to rinsing.

Example II

1 gm. bromoethane-sodium sulfonate and 0.1 gm. ethylene-diisothiourea-hydrobromide having the structural formula



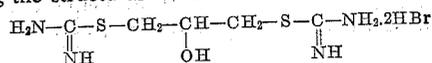
were added to each liter of an acid nickel electroplating bath composed of water, 60 gm./liter nickel chloride, 220 gm./liter crystalline nickel sulfate and 35 gm./liter boric acid. Sheet iron objects electroplated in this modified

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bath at a temperature of about 60° C. and a current density of 1 to 8 amp./dm.² were provided with very bright, firmly adhering nickel-plates which required no finishing treatment of any kind subsequent to rinsing.

Example III

0.2 gm. of 1,3-diisothiourea-propanol-2-hydrobromide having the structural formula



8 gm. 3-bromopropane-sodium sulfonate and 5 gm. glycerin were added to each liter of an acid nickel electroplating bath composed of water, 60 gm./liter nickel chloride, 220 gm./liter crystalline nickel sulfate and 35 gm./liter boric acid. Sheet iron objects electroplated in this modified bath at a temperature of about 60° C. and a current density between 1 and 8 amp./dm.² were provided with exceptionally bright, firmly adhering nickel electroplates which required no finishing treatment of any kind subsequent to rinsing.

Example IV

1 gm. of ethylene-bis-(thiourea) according to Formula 4 was used instead of the brightener in Example I. A full bright copper deposit was obtained.

Example V

1 gm. of ethylene-bis-(dithiomethylcarbaminate) according to Formula 5 was used instead of the first named brightener in Example II. A good nickel plating was obtained.

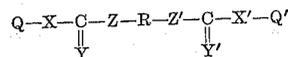
Example VI

1 gm. of ethylene-1-(methylxanthogenate)-2-(methylsulfthiocarbonate) according to Formula 6 was substituted for the first named brightener in Example III. A bright nickel deposit was formed.

While we have illustrated our invention with the aid of certain specific embodiments thereof, it will be apparent to persons skilled in the art that various changes and modifications may be made without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. An electroplating bath for producing bright deposits of metals selected from the group consisting of copper, zinc, silver, nickel, cadmium, bronze and brass comprising an aqueous acid solution of an inorganic salt of the metal to be deposited and from about 0.01 to about 20 grams/liter of an acyclic organic compound having the general structural formula



wherein R is a lower aliphatic radical, Q and Q' are selected from the group consisting of hydrogen, lower alkyl and lower hydroxy-alkyl, X, Y and Z are selected from the group consisting of oxygen, sulfur, nitrogen and the imino radical, and X', Y' and Z' are selected from the group consisting of oxygen, sulfur, nitrogen and the imino radical.

2. An electroplating bath as in claim 1, comprising in addition a compound selected from the group consisting of halogenated lower alkyl sulfonic acids, halogenated aryl sulfonic acids and salts of such sulfonic acids.

3. An electroplating bath as in claim 1, comprising in addition a compound selected from the group consisting of bromine-substituted lower alkyl and aryl sulfonic acids and salts of such sulfonic acids.

4. An electroplating bath as in claim 1, comprising in addition a compound selected from the group consisting of cyano- and thiocyno-substituted lower alkyl and aryl sulfonic acids and salts of such sulfonic acids.

5. An electroplating bath as in claim 1, which comprises in addition a compound selected from the group

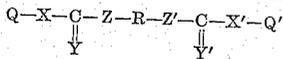
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consisting of polyvalent alcohols, polymerization products of unsaturated carboxylic acids, and salts of such polymerization products.

6. The electroplating bath of claim 1 wherein the aliphatic radical is substituted.

7. The electroplating bath of claim 1 wherein the aliphatic radical is interrupted by hetero atoms.

8. The process of producing bright and lustrous electrodeposits of metals selected from the group consisting of copper, zinc, silver, nickel, cadmium, bronze and brass, which comprises electrodepositing said metal from a bath containing said metal principally in the form of an aqueous acid solution of an inorganic salt of said metal in the presence of from about 0.01 to about 20 grams/liter of a brightener, said brightener being an organic acyclic compound having the general structural formula



wherein R is a lower aliphatic radical, Q and Q' are selected from the group consisting of hydrogen, lower alkyl and lower hydroxy-alkyl, X, Y and Z are selected from the group consisting of oxygen, sulfur, nitrogen and the imino radical, and X', Y' and Z' are selected from the group consisting of oxygen, sulfur, nitrogen and the imino radical.

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9. An electroplating process as in claim 8, comprising in addition a compound selected from the group consisting of halogenated lower alkyl sulfonic acids, halogenated aryl sulfonic acids and salts of such sulfonic acids.

10. An electroplating process as in claim 8, comprising in addition a compound selected from the group consisting of bromine-substituted lower alkyl and aryl sulfonic acids and salts of such sulfonic acids.

11. An electroplating process as in claim 8, comprising in addition a compound selected from the group consisting of cyano- and thiocyno-substituted lower alkyl and aryl sulfonic acids and salts of such sulfonic acids.

12. An electroplating process as in claim 8, which comprises in addition a compound selected from the group consisting of polyvalent alcohols, polymerization products of unsaturated carboxylic acids, and salts of such polymerization products.

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