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**"IMPROVEMENTS IN OR RELATING TO ELECTROLYTIC STRIPPING OF DEFECTIVE NICKEL ELECTRODEPOSITS FROM COPPER OR BRASS SUBSTRATES".**

**COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Rafi Marg, New Delhi-1, India, an Indian registered body incorporated under the Registration of Societies Act (Act XXI of 1860).**

**The following specification describes the nature of this invention:-**

**PRICE - Rs.2.00.**

This invention relates to improvements in ore relating to stripping of defective electrodeposits of nickel from copper or brass articles to enable reprocessing of the same..

Hitherto it has been proposed that nickel electrodeposits may be chemically stripped with solutions containing (i) ammonium thiocyanate and a phenol or (ii) a polyphosphate, an organic nitro compound and a Trisulphate, or electrochemically stripped with dilute sulphuric acid solutions containing organic nitro-compounds.

This is open to the objection that stripping of nickel is generally very slow and nonuniform or incomplete on different portions of the work piece being treated and there is the possibility of the same being attacked considerably, as the solutions contain pyrophosphate or acid.

The object of this invention is to obviate these disadvantages by using an electrolyte for reasonably fast removal of nickel by anodic treatment with minimal attack on copper or brass substrate so that the same can be used, after merely buffing, for electroplating of nickel again.

To these ends the invention broadly consists in anodically treating the defectively nickel plated copper or brass articles in a solution of 1-2 N hydrochloric acid with a small quantity (0.1g/l) of an organic compound having nitrogen and sulphur containing groups, for example, thiosemicarbazide. The latter constituent serves to minimise attack on the substrate metal. Copper or nickel plated copper is used as cathode in order to avoid introduction of metal ions other than nickel into the solution in significant amounts.

The completion of stripping is indicated by the accompanying reduction in the electrolytic current due to formation of an easily removable white film on the copper or brass substrate.

The following typical examples are given to illustrate the invention :

Example I

A nickel plated copper specimen is degreased and treated anodically in a solution of composition and under conditions as follows :

Hydrochloric acid approx 1N

Thiosemicarbazide 0.1 g/l

Temperature 25°C

Cathodes Copper or nickel plated copper.

Anodic current density  $6.2\text{A/dm}^2$

Duration for removing nickel deposit (about 15μ thick) from copper substrate 20 minutes.

The surface of the copper substrate is left smooth and is easily buffed to a high lustre.

## Example 2

A nickel plated brass specimen is degreased and treated anodically in a solution of composition and under conditions as follows :


Hydrochloric acid	approx 2N
Thiosemicarbazide	0.1 g/l
Temperature	26°C
Cathodes	Copper or nickel plated copper
Anodic current density	6.2A/dm <sup>2</sup>
Duration for removing nickel deposit (about 15 $\mu$ thick) from brass substrate : 20 minutes	

The surface of the specimen is left as smooth as before nickel plating and is easily buffed to a high lustre.

The following are among the main advantages of the invention :

1. The stripping bath is comparatively cheap, as its main constituent is hydrochloric acid.
2. The stripping of nickel deposits from copper and brass can be accomplished at a reasonably rapid rate.
3. The copper or brass substrate is left almost unattacked with the result that only buffing is required for achieving a bright surface prior to reprocessing. There is therefore much saving in time and labour.
4. The invention will be useful for quick reprocessing of defectively nickel plated copper or brass articles.

Dated this 13th day of August, 1974.



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**THE PATENT ACT, 1970**

**COMPLETE  
SPECIFICATION**

**Section 10**

**"IMPROVEMENTS IN OR RELATING TO ELECTROLYTIC STRIPPING  
OF DEFECTIVE NICKEL ELECTRODEPOSITS FROM COPPER OR BRASS  
SUBSTRATES".**

**COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Rafi Marg,  
New Delhi-1, India, an Indian Registered body incorporated under  
the Registration of Societies Act (Act XXI of 1860).**

**The following specification particularly describes and  
ascertains the nature of this invention and the manner in which  
it is to be performed:-**

The invention relates to a process for stripping of nickel deposits from rejects in the production of nickel plates with the least attack on copper or brass substrates so that they may be reprocessed immediately.

The hitherto known processes make use of solutions based on sulphuric acid for electrolytic stripping or of immersion stripping solutions based on sodium thiosulphate. The drawback of these processes is their inability to remove nickel uniformly or without substantial attack on the substrate.

The object of this invention is to obviate these disadvantages by making available a process which can remove defective nickel deposits on copper or brass substrates in a short time but with almost no attack on the substrate so that immediate reprocessing is possible.

We have found that the use of a dilute hydrochloric acid solution containing an organic compound with sulphur or amino group like thiosemi carbamide or o-phenylene diimine inhibits, on completion of stripping of nickel deposits from ~~the copper or brass substrates~~ the copper or brass substrates further dissolution. Consequently the articles require only to be buffed before reprocessing. With the hitherto known processes there is the possibility of considerable attack on the substrate, thus necessitating a longer polishing sequence. Because the main constituent of the solution is only hydrochloric acid, its cost is also low in comparison with that of solutions hitherto being used.

According to present invention there is provided a process for electrolytic anodic stripping of defective nickel deposits from copper or brass ~~sub~~<sup>a</sup> substrates<sup>e</sup> comprising using as electrolyte dilute hydrochloric acid containing an aliphatic or aromatic organic compound having sulphur or amino group like thiosemi carbamide or o-phenylene di<sup>a</sup>mine. The function of hydrochloric

acid is to make possible rapid anodic dissolution of nickel, apart from contributing to solution-conductivity. The sulphur or amine group containing organic compound helps in minimising attack on the substrate which results in ease of polishing the same for plating again.

The process makes possible removal of nickel at a very rapid rate, because high anodic current densities can be employed. Towards the end of dissolution of nickel, the current passing through the solution reaches a minimum value, indicating completion of stripping of nickel.

The process of removing nickel deposit from copper or brass substrate involves anodic treatment of the work piece in a solution containing 18-73 g/l hydrochloric acid and 0.05 - 0.25 g/l of an aliphatic or aromatic sulphur or nitrogen containing compound like thiosemicarbazide or o-phenylene diamine at 25-30°C and at a current density within the range of 620-3100 A/m<sup>2</sup>. The current passing through the solution reaches a minimum when the dissolution of nickel is complete. Nickel plated steel or copper is used as the cathode.

As electrolysis occurs, the nickel deposit dissolves, at a rate depending upon the anodic current density. With the exposure of copper or brass substrate, there is a fall in current, because the organic compound forms a protective film on the surface, and when the nickel has been completely removed there is only a very small current flowing through the solution. The work piece is then removed, dried and then buffed for being plated with nickel again. If any film is visible on the substrate, it may be removed by immersion in trichloroethylene.

The following typical examples illustrate how the invention can be useful in actual practice.

#### Example 1

Specimen treated: Copper with 15 micron thick nickel deposit

The specimen is treated anodically in a solution of the following composition under conditions indicated:

Hydrochloric acid	36.5 g/l
Thiosemicarbazide	0.5 g/l
Cathode	Nickel plated copper
Anodic current density	620 A/m <sup>2</sup>
Temperature	25°C
Duration for removing the nickel deposit	About 20 minutes

The surface of the copper substrate is left smooth and is easily buffed to a high lustre.

#### Example 2

Specimen treated: Brass substrate with 15 micron thick nickel deposit.

The specimen is treated anodically in a solution of composition and under conditions as indicated below:

Hydrochloric acid	70 g/l
Thiosemicarbazide	0.25 g/l
Cathode	Nickel plated copper
Temperature	26°C
Anodic current density	620 A/m <sup>2</sup>
Duration for removing the nickel deposit	About 20 minutes

The substrate which appears smooth becomes lustrous merely on buffing.

#### Example 3

Specimen: Copper substrate with 7 micron thick nickel deposit

Solution and conditions employed:

Hydrochloric acid	18 g/l
O-phenylene diamine	0.1 g/l
Temperature	27°C
Anodic current density	1550 A/m <sup>2</sup>

Cathode	Nickel plated steel
Duration for removal of nickel deposit	About 3 minutes

The substrate which appears smooth takes up a good polish merely on buffing.

#### Example 4

Specimen: Copper substrate with 7 micron thick nickel deposit

Solution and conditions employed:

Hydrochloric acid	18 g/l
O-phenylene diamine	0.1 g/l
Temperature	29°C
Anodic current density	775 A/m <sup>2</sup>
Cathode	Nickel plated steel
Duration for removal of nickel	About 6 minutes

The smooth substrate easily takes up a good polish on buffing.

#### Example 5

Specimen: Copper substrate with 21 micron thick nickel deposit

Solution and conditions employed:

Hydrochloric acid	18 g/l
O-phenylene diamine	0.1 g/l
Temperature	27°C
Anodic current density	3100 A/m <sup>2</sup>
Cathode	Nickel plated steel
Duration for nickel dissolution	About 4 minutes

Buffing gives rise to a bright finish.

### Example 6

**Specimens:** Copper substrate with 21 micron thick nickel deposit

**Solution and conditions used:**

Hydrochloric acid	36.5 g/l
O-phenylene diamine	0.1 g/l
Cathodes	Nickel plated steel
Temperature	29°C
Anodic current density	775 A/m <sup>2</sup>
Duration for removal of nickel deposit	About 15 minutes

The smooth copper takes up a bright finish on merely buffing.

### Example 7

**Specimens:** Brass substrate with 21 micron thick nickel deposit

**Solution and conditions employed:**

Hydrochloric acid	73.0 g/l
O-phenylene diamine	0.1 g/l
Cathode	Nickel plated steel
Temperature	30°C
Anodic current density	1550 A/m <sup>2</sup>
Duration for removal of nickel deposit	About 8 minutes

The smooth brass surface assumes a bright finish easily on buffing.

The main advantages of the invention are (1) the low cost of the stripping solution used; (2) the ease of stripping nickel deposits; and (3) the ease of buffing the substrate, as no roughness is caused while stripping.

### Summary:

The invention consists in making use of a solution based on hydrochloric acid and an organic sulphur or amino compound such as thiosemicarbazide or o-phenylene diamine

for anodic stripping of defective nickel deposits from copper or brass substrates such that they can be reprocessed after merely buffing. The organic additive prevents any appreciable surface inequalities being produced and therefore the substrate has to be only buffed for being replated. The polishing sequence will have to be prolonged if the surface is attacked, with the present composition, the process of stripping is, rapid and this makes possible immediate repressing.

#### WE CLAIM

1. A process for electrolytic anodic stripping of defective nickel deposits from copper on brass substrate<sup>~e</sup> comprises using as electrolyte dilute hydrochloric acid containing an aliphatic or aromatic organic compound having sulphur or amino groups like thiosemicarbazide or o-phenylene diamine.
2. A process as claimed in claim 1 wherein a solution containing 18-73 g/l of hydrochloric acid and 0.05-0.23 g/l of thiosemicarbazide or o-phenylene di<sup>a</sup>mine is used as the electrolyte.
3. A process as claimed in claim 1 or 2 wherein the substrate with nickel deposit is subjected to anodic treatment in the electrolytic solution at 23-30°C at a current density within the range of 620-3100 a/m<sup>2</sup>.
4. A process for anodic stripping of defective nickel deposits from copper or brass substrates substantially as herein before described.

Dated this 15th day of November, 1975.

  
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