

# ALIEN PROPERTY CUSTODIAN

## PROCESS FOR THE IMPROVEMENT OF THE ELECTRICAL PROPERTIES OF SOLUTIONS

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This invention relates to a process for the improvement of the electrical properties of solutions such as galvanic baths with the object of improving the properties in the direction rendered desirable by the use to which such bath is intended to be put in each case.

These improvements may consist, in particular, in an increase in the conductivity and therefore an increase in the yield of current and in the reduction of the amount of current consumed in galvanic baths, in addition to other properties such as adhesion of the product deposited, ductility, reflexive power, resistance to corrosion and the like of the metallic coatings precipitated from them and in the saving in metal thereby obtainable, the new process making it possible, by taking suitable steps, when carrying it out, for one or another or a number of these improvements to be effected simultaneously.

It was unexpectedly found that these results can be obtained, if to the solutions there be added a solution of an inorganic or organic substance produced by graduated dilution and thereby brought to a content of at the most 1:1000.

By this graduated dilution, which in practice goes so far as a rule, that when, if at all, only traces of a dissolved substance can be shown in the added solution, entirely new effects are obtained which are obviously no longer or, in any case, hardly of a material nature that is, are not due to a direct material action of the constituents of the solution on the substances in the main solution, but rather produce physical effects which may perhaps be regarded as due to the dispersive influence of the molecules of the main solution.

These effects depend, in respect to their quality, on the number of stages of dilution. It has been found that according to the number of stages of dilution, very greatly varying results can be obtained which can be empirically fixed at once, once and for all. Preferably a multiple, and in any case not less than three stages of dilution, are used in order to arrive at the final degree of solution which is necessary at the very least.

The production of the results to be obtained is also dependent upon the nature of the organic substances which contain the progressively highly diluted added solution. Substances which have shown themselves to be preferable are those which contain an active constituent of the ions which are similar to or of a kind related to those contained in the main solution, for example with radicles which are substantially the same or of a kind related to those contained in the salts which

are in the solution or of acids which are contained in the main solution and are substantially the same as they or of a kind related to them.

Particularly advantageous constituents of the highly diluted additional solution which can be used both by themselves alone and also as additions to other additional substances, are certain organic acids such as benzoic acids and the acids which belong to the fatty acid group.

If, as is advantageous in many cases, additional solutions are used which, for example, for the purpose of acting on the properties of the main solution in various directions, contain a number of substances simultaneously, the solution of each of the several substances may be effected with advantage by bearing in mind the number of stages of the dilution which is most suitable for this purpose, and then mixing these solutions with each other.

It is important that the dilute solutions be only added to the already complete main solution and not during the production of the main solution, i. e. simultaneously with the process of solution of the salts which form them.

The amount of the progressively highly diluted solutions to be added may vary according to conditions. In most cases it amounts only to a few, say 5 cubic centimetres per litre of the main solution.

Hereinafter are given a number of examples of the way in which the new process can be carried out, which best demonstrate the manifold adaptability thereof to the various purposes for which it may be used, without of course the invention being confined to the possible uses illustrated by the examples given. In particular, its sphere of application is not confined to the treatment of galvanic baths, but extends also to any desired kind of solution, the electrical properties of which are to be acted upon or improved.

### I

An electrolytic nickel bath which consists of:

	Kilograms
Nickel sulphate.....	17.5
Magnesium sulphate.....	6
Sodium sulphate.....	0.25
Ammonium chloride.....	0.7

has added to it a gradually highly dilute solution of shave grass (*Equisetum arvense*) in accordance with the above directions, 5 ccm. being added to each litre.

A considerable increase in the power of resistance of the nickel coating to corrosion results,

which per se is unfavourably affected by the necessary amount of ammonium chloride which is contained in the bath.

A similar result is obtained by the addition of some sodium hydroxide.

## II

To a galvanizing bath, which consists of

	Grams
Zinc sulphate.....	150
Ammonium sulphate.....	50

is added per litre of water, a progressively highly dilute solution of antimony sulphate.

An increase in the purity of the deposited zinc from 97.5% to 100% is obtained.

## III

To a sulphuric acid chromatising bath of the usual composition, is added a progressively highly diluted solution of benzoic acid.

This addition produces an increase in the yield of current from 17% to 22%.

## IV

To a nickel bath as in I is added common salt in a progressively highly diluted solution.

A considerable increase in conductivity and a reduction of polarisation are produced.

## V

To a potassium cyanide copper bath of the following composition:

	Kg.
Copper potassium cyanide.....	10
Potassium cyanide.....	0.42
Potassium tartrate dissolved in 100 litres of water.....	5

is added a progressively highly diluted solution of water glass.

A considerable increase in the density (ductility) of the copper coating is produced.

## VI

To a similar potassium cyanide copper bath is added an extract of Birch (Birch elixir) containing saccharine and boric acid in a progressively highly diluted solution.

An equalisation of the previous fluctuations in the content of free potassium cyanide is then obtained.

## VII

To a silver bath consisting of

33 g. of silver chloride per litre which is dissolved in

30.5 g. of potassium cyanide and contains 12-15 g. of free potassium cyanide

is added a progressively highly diluted solution of mercuric potassium cyanide.

A considerable acceleration of the silver precipitation is obtained under otherwise similar conditions.

## VIII

To an acid copper bath consisting of

	G. per litre
Copper sulphate.....	250
Pure sulphuric acid.....	5 to 7

is added a progressively highly diluted solution of carbonate of nickel.

Considerably harder precipitation of copper are then obtained.

## IX

To an acid tin bath consisting of

	Kg.
Tin sulphate.....	3
Concentrated sulphuric acid.....	7
Adhesive substance per 100 litres of water.....	1.5-2

is added a progressively highly diluted extract of fresh ox kidneys (which contain alkaline uric acid).

A considerable condensation and equalisation of the precipitate take place.

## X

To a lead bath consisting of lead acetate and the usual admixtures, is added a progressively highly diluted solution of copper carbonate.

The coating which, previously too spongy, becomes perfectly fixed.

## XI

To a warm gold bath consisting of

	Grams
Sodium phosphate.....	50
Neutral sodium sulphate.....	15
Potassium cyanide.....	1
Gold chloride per litre of water.....	1.5

is added a progressively highly diluted extract of fresh ash tree shoots containing saccharine and nitric acid.

A considerable acceleration and equalisation of the gold precipitate take place.

In all these cases the progressively highly diluted added solution may, for the purpose of further bringing about as required definite properties in one direction or another, contain, in addition to the aforementioned substances, also others of the class mentioned above as basic.

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