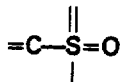


Description

Background of the invention

The present invention relates to a process of electrolytically producing a screen material by depositing in an electrolytic bath a metal upon a basic screen, said electrolytic bath comprising one or more brighteners, of which at least one consists of an organic compound comprising at least one unsaturated bond not belonging to a



group and presenting the properties of a second class brightener, in which the metal is deposited substantially on the lands of the basic screen material in an increase ratio greater than 1.

EP—A—38104 describes a process as indicated above in which, due to the presence of certain organic compounds which are known as materials presenting the properties of second class brighteners, metal is deposited substantially on the lands of a basic screen material when such a material is connected as a cathode in an electrolytic bath containing such a compound; of which butynediol and ethylene cyanohydrin may be mentioned. The increase or growth ratio obtained in said known process is generally greater than unity.

Summary of the invention:

The present invention aims to provide a process of abovementioned type in which the increase of deposited metal upon a screen skeleton is performed substantially solely in one direction perpendicular to the basic screen.

Said goal is attained according to the invention which is characterized in that the deposition is carried out with use of a pulsed current comprising pulse current durations separated by non-current pulse durations or successive reverse current pulse durations respectively and the increase ratio, having a value of at least 4.4 is controlled with use of the pulse parameters of the pulsed current T and T', in which T is the length of the alternate pulse current durations and T' the length of the non-current or reverse current pulse durations respectively, T and T' being adjusted independently between 0 and 9900 msec.

In the process according to the invention by proper setting of the pulse parameters used the increase ratio may be controlled so as to have values of at least 4.4.

In the process according to the invention, metal screens can more particularly be produced, comprising the basic screen material or not, which present a maximum passage combined with a maximum strength in practically any desired mesh size, the openings in the screen material being so formed that they substantially increase their dimensions only toward one side, so that any danger of clogging of the apertures when the screen is used for filtering procedures, is practically reduced, this contrary to processes in which a deposit growth all over the basic screen material occurs.

With regard to the method of the invention attention is called to Metal Finishing Vol. 77, No. 5, May 1979, pages 33—38 in which the effect of the use of pulsed current in the deposition of nickel from a Watt's nickel-bath, which is free from addition agents, is described.

It has been found that in a preferred embodiment extremely good results are obtained when the pulse current duration is sub-divided into small pulses comprising pulse current and non pulse current periods t and t' whereby the frequency

$$f = \frac{1}{t+t'}$$

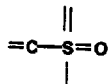
is selected between 10^{-2} and 10^{-4} Hz and the ratio

$$C = \frac{t}{t+t'} \times 100\%$$

is selected between 0 and 100%.

Preferably for depositing metal upon the basic screen material a pulsed current is applied comprising pulse current and pulse non-current durations, since increase ratios of 25 and higher are obtained hereby, without any disadvantageous influence of the original mesh openings in the basic screen material.

The invention also relates to a screen material obtained by depositing in an electrolytic bath a metal upon a basic screen material, said electrolytic bath containing at least one brightener comprising at least one unsaturated bond not belonging to a



group and presenting properties of a second class brightener, characterized in that said metal has been deposited only on the lands of the basic screen material by use of a pulsed current and adjustment of the pulse parameters, while controlling the increase ratio to have a value of at least 4.4.

More particularly said screen material according to the invention is characterized in that at least one of the following measures has been applied for forming the material:

a) the pulsed current was chosen from a current comprising pulse current durations separated by non-current pulse durations or successive reverse current pulse durations respectively, the pulse parameters being T and T', in which T is the length of the alternate pulse current durations and T' the length of the non-current or reverse current pulse durations respectively, T and T' each being adjusted between 0 and 9900 msec,

b) the pulse current is subdivided into small pulse and non-pulse current durations t and t', the frequency

$$f = \frac{1}{t+t'}$$

being selected between 10^{+2} and 10^{+4} Hz and the ratio

$$C = \frac{t}{t+t'} \times 100\%$$

between 0 and 100%.

Devices for generating a pulsed current are generally known (see e.g. Plating 1970; No. 5, page 1105; Design factors in Pulse plating; A. J. Avila; M. J. Brown).

Description of the drawings:

Fig. 1 is an apparatus for performing the process of the invention;

Fig. 2 is a section of a basic screen material;

Fig. 3 is a screen material obtained by applying the process according to the invention, starting from the basic screen material of Fig. 2;

Fig. 4 is a screen material, obtained by performing a modified process according to the invention while using the basic screen material of Fig. 2;

Fig. 5 is a diagram showing the data for plotting the deposit ratio;

Fig. 6a is a current (I)—duration (t) graph illustrating the various current changes between pulse current (T) and non-current pulse (T') periods; in the tests this method is indicated as current PP;

Fig. 6b is a current (I)—duration (t) graph, illustrating the various current changes between alternate pulse current durations T and reverse pulse current durations T'; this method is indicated as current PR;

Fig. 6c is a current (I)—duration (t) graph, illustrating the various current changes as in Fig. 6a but the pulse current durations T are each subdivided into alternate pulse current durations t and non-current pulse durations t', said process is illustrated in the tests as current PPP;

Fig. 6d is a current (I)—duration (t) graph illustrating current changes as in Fig. 6b, the pulse current durations T in one direction being subdivided into pulse current durations t₁ and non current pulse durations t'₁, the reverse pulse current periods T' being subdivided into pulse current durations t₂ and non current pulse durations t'₂; which process is illustrated in the tests as current PPR.

Description of the preferred embodiments:

Fig. 1 shows apparatus for electrolytically producing screen material by depositing in an electrolytic bath a metal upon a basic screen material, the electrolytic bath at least comprising one brightener.

Said apparatus comprises a vessel 9 for the receipt of an electrolytic bath 10, while it is further provided with a cathode retaining means 6 for retaining a basic screen material 1.

On the other hand an anode retaining means 7 is provided for retaining an anode material.

The cathode retaining means 6 and anode retaining means 7 are connected to a device 11 for generating a pulsed current said device 11 being connected to a D.C. source 12.

Starting from a basic screen material 1 comprising mesh openings 3 bounded by lands 2 with top sides 2a and lower sides 2b, a screen material according to Fig. 3 is obtained due to the use of a pulsed current consisting of alternate pulse current and non-current pulse durations, whereby the metal deposited during the electrolysis has substantially accumulated in the increase region 4, said increase region 4 substantially extending perpendicular to the basic screen material.

Only a slight quantity of metal is deposited upon the lower side 2b of the lands, said material being illustrated by means of the second increase region 5.

In order to illustrate the results obtained, the definition: increase ratio consisting of

$$\frac{A1+A2}{B1+B2}$$

$$B1+B2$$

is used, the magnitudes A1, A2, B1 and B2, being illustrated in Fig. 5.

The present invention will furthermore be elucidated with respect to a number of examples, wherein Example I is a comparison Example.

In a Watt's nickel bath, known in the art, comprising per liter of bath liquid at least 80 mg of 2-butyne 1,4-diol as brightener a nickel screen plate 1 covered with beeswax is installed in a vertical direction as a cathode. The used nickel bath comprises per liter 250 to 300 g $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$, 25 to 35 g $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ and 30 to 40 g H_3BO_3 and has a pH ranging from 3,5 to 4,5 while the temperature varies from 55 to 65°C. Said bath can be used for current amplitudes to 20 A/dm². The butynediol may be replaced by ethylene cyanohydrin.

The screen plate 1 is provided with slit-shaped openings 3, having a width of 120 µm, said openings being separated from one another by lands 2 bounded by land top sides 2a and land lower sides 2b.

The following table shows the varying circumstances during the tests and the ratio of metal increase.

TABLE A

	No.	Current type	Data rectifier	Data pulse device	Parameters			
					T (msec)	T' (msec)	f	C
I	DC1	DC	5,8A/5,5V	—	—	—	—	—
II	PP1A	PP	—	5,8A/7,1V	0,1	1	—	—
III	PP2AII ^{*)}	PP	2A/4,6V	2,1A/3,3V	0,1	3	—	—
IV	PP2BIII	PP	—	2,1A/3,3V	10	300	—	—
V	PPP1A	PPP	2,3A/15V	2,6A/3,3V	0,1	1	40	50
VI	PPP1B	PPP	2,2A/10V	2,6A/3,6V	10	100	0,4	50
VII	PP 3AII	PP	2,5A/16V	2,5A/2,3V	9900	0	9	10
								7,4

^{*)} Increase only on top, not on lower side (see Fig. 4).

From the above it appears that micro pulses having a magnitude of 0,1 to 1 msec are more active than macro pulses comprised between 10 to 100 msec.

From these results it follows that a pulsed current having alternate pulse current and non pulse current durations, gives very good results, while the use of a pulsed current duration comprising alternate pulse current periods in one given direction and a reverse pulse current period may provide equal results, although the current yield will decrease.

On comparing test results II and IV to test result I (table A) it will moreover be obvious that a pulsed current clearly influences the ratio of metal increase, provided that micro pulses are used. When macro pulses are used, said notable differences in the metal increase ratio will occur only to a lesser extent.

The use of longer non-current pulse periods separating the pulse current periods increases the ratio of metal deposit increase, while the use of pulse current periods built up from a great number of alternate small pulse current durations and non-current pulse durations, will not result in a higher ratio of metal deposit increase (see e.g. results II and VI in the table), although in the event of macro pulses there will yet be a positive effect.

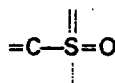
The effects of the above appear, however, to be strongly dependent upon the type of material as used.

The distance between the cathode 1 in the form of a nickel screen plate, and a nickel anode 8 amounts to 60 mm, whilst the amplitude of the switched on DC amounts to 5 A/dm², measured across the total surface of the cathode 1. The temperature of the bath liquid amounts to 60°C, and the results as illustrated in the table were obtained after an electrolytic procedure of 60 minutes. In view of the presence of beeswax upon the top side 2a of the lands 2, a ready-made nickel screen can be removed after the procedure, which screen is formed by lands consisting of metal deposits formed during the electrolysis. Obviously the lower side 2b of the lands can also be covered so that a ready made screen material comprising lands formed by the second increase region 5, can be removed.

It is evident that the final product of Fig. 3 can be used as such without applying stripping means such as beeswax upon the top side 2a and the lower side 2b of an initial nickel screen plate 11. The nickel screen base plate 1 conveniently has a thickness of 75 µm.

Claims

1. Method of electrolytically producing a screen material by depositing in an electrolytic bath a metal upon a basic screen, said electrolytic bath comprising one or more brighteners, of which at least one consists of an organic compound comprising at least one unsaturated bond not belonging to a



group and presenting the properties of a second class brightener, in which the metal is deposited substantially on the lands of the basic screen material in an increase ratio greater than 1 characterized in that the deposition is carried out with use of a pulsed current comprising pulse current durations separated by non-current pulse durations or successive reverse current pulse durations respectively and the increase ratio, having a value of at least 4,4, is controlled with use of the pulse parameters of the pulsed current T and T', in which T is the length of the alternate pulse current durations and T' the length of the non current or reverse current pulse durations respectively, T and T' being adjusted independently between 0 and 9900 msec.

2. Method according to claim 1, characterized in: a pulse current duration is subdivided into small pulse and non-current pulse durations t' and t, the frequency

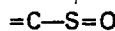
$$f = \frac{1}{t+t'}$$

being selected between 10⁻² and 10⁻⁴ Hz and the ratio

$$C = \frac{t}{t+t'} \times 100\%$$

between 0 and 100%.

3. Screen material obtained by depositing in an electrolytic bath a metal upon a basic screen material, said electrolytic bath containing at least one brightener comprising at least one unsaturated bond not belonging to a





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From the above it appears that micro pulses having a magnitude of 0,1 to 1 msec are more active than macro pulses comprised between 10 to 100 msec.

From these results it follows that a pulsed current having alternate pulse current and non pulse current durations, gives very good results, while the use of a pulsed current duration comprising alternate pulse current periods in one given direction and a reverse pulse current period may provide equal results, although the current yield will decrease.

On comparing test results II and IV to test result I (table A) it will moreover be obvious that a pulsed current clearly influences the ratio of metal increase, provided that micro pulses are used. When macro pulses are used, said notable differences in the metal increase ratio will occur only to a lesser extent.

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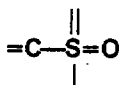
The effects of the above appear, however, to be strongly dependent upon the type of material as used.

The distance between the cathode 1 in the form of a nickel screen plate, and a nickel anode 8 amounts to 60 mm, whilst the amplitude of the switched on DC amounts to 5 A/dm², measured across the total surface of the cathode 1. The temperature of the bath liquid amounts to 60°C, and the results as illustrated in the table were obtained after an electrolytic procedure of 60 minutes. In view of the presence of beeswax upon the top side 2a of the lands 2, a ready-made nickel screen can be removed after the procedure, which screen is formed by lands consisting of metal deposits formed during the electrolysis. Obviously the lower side 2b of the lands can also be covered so that a ready made screen material comprising lands formed by the second increase region 5, can be removed.

It is evident that the final product of Fig. 3 can be used as such without applying stripping means such as beeswax upon the top side 2a and the lower side 2b of an initial nickel screen plate 11. The nickel screen base plate 1 conveniently has a thickness of 75 µm.

Claims

1. Method of electrolytically producing a screen material by depositing in an electrolytic bath a metal upon a basic screen, said electrolytic bath comprising one or more brighteners, of which at least one consists of an organic compound comprising at least one unsaturated bond not belonging to a



group and presenting the properties of a second class brightener, in which the metal is deposited substantially on the lands of the basic screen material in an increase ratio greater than 1 characterized in that the deposition is carried out with use of a pulsed current comprising pulse current durations separated by non-current pulse durations or successive reverse current pulse durations respectively and the increase ratio, having a value of at least 4.4, is controlled with use of the pulse parameters of the pulsed current T and T', in which T is the length of the alternate pulse current durations and T' the length of the non current or reverse current pulse durations respectively, T and T' being adjusted independently between 0 and 9900 msec.

2. Method according to claim 1, characterized in: a pulse current duration is subdivided into small pulse and non-current pulse durations t' and t, the frequency

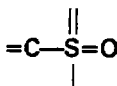
$$f = \frac{1}{t+t'}$$

being selected between 10⁺² and 10⁺⁴ Hz and the ratio

$$C = \frac{t}{t+t'} \times 100\%$$

between 0 and 100%.

3. Screen material obtained by depositing in an electrolytic bath a metal upon a basic screen material, said electrolytic bath containing at least one brightener comprising at least one unsaturated bond not belonging to a





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group and presenting properties of a second class brightener, characterized in that: said metal has been deposited only on the lands of the basic screen material by use of a pulsed current and adjustment of the pulse parameters, while controlling the increase ratio to have a value of at least 4,4.

4. Material as claimed in claim 3, characterized in that: at least one of the following measures have been applied for forming the material:

a) the pulsed current was chosen from a current comprising pulse current durations separated by non-current pulse durations or successive reverse current pulse durations respectively, the pulse parameters being T and T', in which T is the length of the alternate pulse current durations and T' the length of the non-current or reverse current pulse durations respectively, T and T' each being adjusted between 0 and 9900 msec,

b) the pulse current is subdivided into small pulse and non-pulse current durations t and t', the frequency

$$f = \frac{1}{t+t'}$$

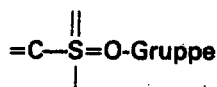
being selected between 10^{+2} and 10^{+4} Hz and the ratio

$$C = \frac{t}{t+t'} \times 100\%$$

between 0 and 100%.

25 Patentansprüche

1. Verfahren zur elektrolytischen Herstellung eines Siebmaterials durch elektrolytisches Abscheiden eines Metalls auf ein Grundsieb in einem galvanischen Bad, wobei das genannte galvanische Bad einen oder mehrere Glanzzusätze enthält, von denen wenigstens einer aus einer organischen Verbindung besteht, die mindestens eine ungesättigte Bindung einschließt, die nicht zu einer



gehört und die Eigenschaften eines Glanzzusatzes zweiter Klasse aufweist, wobei das Metall im wesentlichen auf die Stege des Grundsiebmaterials mit einem Zunahmeverhältnis über 1 aufgebracht wird; dadurch gekennzeichnet, daß das Abscheiden mit Hilfe eines Impulsstroms stattfindet, dessen Impulsstromzeiten durch stromimpulslose Zeiten bzw. aufeinanderfolgende Rückstromzeiten voneinander getrennt sind, und wobei das Zunahmeverhältnis mit einem Wert von mindestens 4,4 mittels der Impulsparameter des Impulsstromes T und T' gesteuert wird, wobei T die Länge der Wechselimpulsstromdauer und T' die Länge der stromlosen oder Rückstromimpulsdauer bezeichnet wobei T und T' unabhängig voneinander zwischen 0 und 9900 msec eingestellt sind.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß eine Impulsstromdauer in kleine Impulse und stromimpulsfreie Zeiten t' und t unterteilt ist, wobei die Frequenz

$$f = \frac{1}{t+t'}$$

zwischen 10^{+2} und 10^{+4} Hz und das Verhältnis

$$C = \frac{t}{t+t'} \times 100\%$$

zwischen 0 und 100% gewählt sind.

3. Siebmateriale, hergestellt durch Abscheiden eines Metalls auf ein Grundsiebmaterial in einem galvanischen Bad, wobei das genannte galvanische Bad wenigstens einen Glanzzusatz mit mindestens einer ungesättigten Bindung enthält, die nicht zu einer $=C-S=O$ -Gruppe gehört und Eigenschaften eines Glanzzusatzes zweiter Klasse aufweist, dadurch gekennzeichnet, daß das genannte Metall mittels eines Impulsstromes und Einstellung der Impulsparameter nur auf die Stege des Grundsiebmaterials aufgebracht sind, während das Zunahmeverhältnis auf einen Wert von wenigstens 4,4 geregelt wird.

4. Material nach Anspruch 3, dadurch gekennzeichnet, daß zur Ausbildung des Materials wenigstens eine der nachstehenden Maßnahmen getroffen wurden:



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a) der Impulsstrom wurde aus einem Strom gewählt, der Impulsstromzeiten enthält, welche durch stromimpulose Zeiten oder aufeinanderfolgende Rückstromimpulszeiten voneinander getrennt sind, wobei die Impulsparameter T und T' sind und T die Länge der Wechselimpulsstromzeiten und T' die Länge der stromlosen oder Rückstromimpulszeiten bezeichnet, wobei T und T' zwischen 0 und 9900 msec eingestellt sind;

b) der Impulsstrom ist in kleine Impulsstromzeiten und impulsstromfreie Zeiten t und t' unterteilt, wobei die Frequenz

$$f = \frac{1}{t+t'}$$

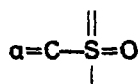
zwischen 10^{-2} und 10^{-4} und das Verhältnis

$$C = \frac{t}{t+t'} \times 100\%$$

zwischen 0 und 100% gewählt sind.

20 Revendications

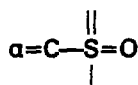
1. Procédé de production électrolytique d'un matériau de tamis par déposition dans un bain électrolytique d'un métal sur un matériau de base de tamis, ledit bain électrolytique comprenant un ou plusieurs agents de brillantage dont au moins un est constitué d'un composé organique comprenant au moins une liaison non saturée n'appartenant pas à un groupe



et présentant les propriétés d'un agent de brillantage de seconde classe, dans lequel le métal est déposé substantiellement sur les cloisons du matériau de tamis de base dans un rapport accru supérieur à 1, caractérisé en ce que le dépôt est réalisé en utilisant un courant pulsé comprenant des durées d'impulsion de courant séparées de durées d'impulsions de non-courant ou des durées successives d'impulsions de courants inverses respectivement, et le rapport accru ayant une valeur d'au moins 4,4 est contrôlé en utilisant les paramètres d'impulsion du courant pulsé T et T', dans lequel T est la longueur des durées de courant pulsé alterné et T' la longueur des durées d'impulsions du non-courant ou du courant inversé, respectivement, T et T' étant ajustées indépendamment entre 0 et 9900 msec.

2. Procédé selon la revendication 1, caractérisé en ce qu'une durée d'impulsion de courant est subdivisée en petites durées t et t' d'impulsions de courant et de non-courant, la fréquence $f = 1/t+t'$ étant choisie entre 10^{-2} et 10^{-4} Hz et le rapport $C = t/t+t' \times 100\%$ entre 0 et 100%.

3. Matériau de tamis obtenu par déposition dans un bain électrolytique d'un métal sur un matériau de base de tamis, ledit bain électrolytique contenant au moins un agent de brillantage comprenant au moins une liaison non saturée n'appartenant pas à un groupe



et présentant les propriétés d'un agent de brillantage de seconde classe, caractérisé en ce que ledit métal a été déposé seulement sur les cloisons du matériau de tamis de base par emploi d'un courant pulsé et ajustement des paramètres d'impulsion, en contrôlant le rapport d'accroissement pour avoir une valeur d'au moins 4,4.

4. Matériau selon la revendication 3, caractérisé en ce que au moins une des mesures suivantes a été mise en application pour former le matériau:

a) le courant pulsé a été choisi à partir d'un courant comprenant des durées d'impulsion de courant séparées par des durées d'impulsion de non courant ou des durées successives d'impulsion de courant inversé respectivement, les paramètres d'impulsion étant T et T', dans lesquels T est la longueur des durées d'impulsion de courant alterné et T' la longueur des durées d'impulsion de non courant ou de courant inversé respectivement, T et T' étant chacun ajustés entre 0 et 9900 msec;

b) l'impulsion de courant es subdivisée en petites durées t et t' d'impulsions de courant et de non courant, la fréquence $f = 1/t+t'$ étant choisie entre 10^{-2} et 10^{-4} Hz et le rapport $C = t/t+t' \times 100\%$ entre 0 et 100%.