

DESCRIPTION

Title of Invention

METHOD FOR RECOVERING VALUABLE METAL FROM LIQUID CONTAINING
VALUABLE METAL, AND ELECTROLYTIC RECOVERY DEVICE

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Technical Field

The present invention relates to a method for recovering a valuable metal from a liquid containing the valuable metal and an electrolytic recovery unit.

10 Background Art

As a method for treating a cyanogen-containing liquid such as a plating solution and a plating stripping solution, there has conventionally been known, for example, a cyanogen decomposing method of decomposing cyanogen by adding an oxidant such as hypochlorous acid to the liquid. Such a cyanogen-containing liquid typically contains valuable metals such as Au, Ag, Cu, platinum, and rare metals. Such valuable metals are recovered from the liquid by adding a reducing agent such as sodium borohydride (SBH) and formalin and depositing the valuable metals in a granular state to thereby cause solid-liquid separation. When the liquid is a plating solution free from a stripping agent, valuable metals are recovered by electrolysis. However, an electrolysis process must be performed batch-wise, because it is difficult to control the additive amount of an oxidant. As a result, the oxidant must be added in an excessive amount, which would increase the costs. There is another problem that the recovery rate of the valuable metals would be inconstant and unstable.

25 On the other hand, a plating liquid containing a stripping agent is difficult to treat by electrolysis, and is treated by a cyanogen decomposing method. This is because in electrolysis, it is necessary to set the current density of the anode to a

high level, but when the current density of the anode is set to 200 A/m² or greater, there is a risk that stainless steel (SUS) material, which is the anode material, may be eluted. Therefore, a process for recovering valuable metals from a plating solution containing a stripping agent must include a step of decomposing cyanogen,
5 which has been bothersome and costly.

Hence, development of an efficient and low-cost method for recovering valuable metals such as gold from a cyanogen-containing liquid such as a plating solution and a plating stripping solution has been demanded.

Hence, the present applicant has previously proposed such a recovery unit 10 as shown in Fig. 1, which includes an electrolytic bath 3 housing a cyanogen-containing liquid containing valuable metals, and anodes 5 made of an insoluble material and a disk-shaped cathode 6, which are disposed in the electrolytic bath, and performs electrolysis by rotating the disk-shaped cathode 6 at a predetermined rotation speed with a rotation motor 7, to thereby deposit the
15 valuable metals on the disk-shaped cathode 6 (see PTL 1). The reference sign 4 in Fig. 1 denotes a rectifier. According to this proposal, it is possible to recover valuable metals from a cyanogen-containing liquid, which has been considered difficult to treat by electrolysis, and it is even possible to decompose cyanogen without adding any chemical. Therefore, it would be possible to improve the
20 recovery rate of the valuable metals and to save the processing costs.

However, with this proposal, the valuable metals tend to deposit in a granular state because the current density of the disk-shaped cathode is high, and the valuable metals deposited in the granular state would easily drop off from the disk-shaped cathode because the rotation speed of the disk-shaped cathode is high,
25 which leads to a problem that the recovery rate of the valuable metals would be low.

Therefore, currently, it is requested to provide a method for recovering a valuable metal from a liquid containing the valuable metal, which can recover a

valuable metal such as gold from a liquid containing the valuable metal at low costs, efficiently, and at a high recovery rate, and an electrolytic recovery unit.

Citation List

5 Patent Literature

PTL 1 Japanese Patent Application Laid-Open (JP-A) No. 2006-70364

Summary of Invention

Technical Problem

10 The present invention aims at achieving the following object. That is, an object of the present invention is to provide a method for recovering a valuable metal from a liquid containing the valuable metal, which can recover a valuable metal such as gold from a liquid containing the valuable metal at low costs, efficiently, and at a high recovery rate, and an electrolytic recovery unit.

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Solution to Problem

Means for solving the above problems are as follows.

<1> A method for recovering a valuable metal from a liquid containing the valuable metal, including:

20 performing electrolytic recovery by rotating a cylindrical cathode in an electrolytic bath including an anode and the cylindrical cathode and housing a liquid containing a valuable metal, to thereby deposit the valuable metal on a surface of the cylindrical cathode.

The method for recovering a valuable metal from a liquid containing the
25 valuable metal according to <1> performs electrolytic recovery such as electrowinning by rotating a cylindrical cathode in an electrolytic bath including an anode made of an insoluble material and the cylindrical cathode and housing a

liquid containing a valuable metal. This makes it possible to deposit the valuable metal on the surface of the cylindrical cathode efficiently, and to recover the valuable metal such as gold from the liquid containing the valuable metal at low costs, efficiently, and at a high recovery rate.

5 <2> The method for recovering a valuable metal from a liquid containing the valuable metal according to <1>,

 wherein the valuable metal is gold, and the liquid containing the valuable metal is a gold-containing cyanogen solution.

 <3> The method for recovering a valuable metal from a liquid containing the
10 valuable metal according to <1> or <2>,

 wherein rotation speed of the cylindrical cathode is from 50 rpm to 100 rpm.

 <4> An electrolytic recovery unit configured to electrolytically recover a valuable metal from a liquid containing the valuable metal, including:

 a tubular cathode; and

15 an actuating unit configured to rotate the tubular cathode,

 wherein the tubular cathode includes multiple through-holes in a rotational-direction circumferential sidewall thereof.

 The electrolytic recovery unit according to <4> includes a tubular cathode and an actuating unit configured to rotate the tubular cathode. The tubular
20 cathode includes multiple through-holes in the rotational-direction circumferential sidewall thereof. The electrolytic recovery unit performs electrolytic recovery such as electrowinning by rotating the tubular cathode by means of actuation with the actuating unit, to thereby deposit a valuable metal on the surface of the tubular cathode. In this way, it can recover a valuable metal such as gold from a liquid
25 containing the valuable metal at low costs, efficiently, and at a high recovery rate.

 <5> The electrolytic recovery unit according to <4>,

 wherein the tubular cathode is cylindrical and includes multiple

through-holes in the circumferential sidewall in a circumferential direction.

Advantageous Effects of Invention

The present invention can solve the conventional problems described above,
5 achieve the object, and provide a method for recovering a valuable metal from a liquid containing the valuable metal, which can recover a valuable metal such as gold from a liquid containing the valuable metal at low costs, efficiently, and at a high recovery rate, and an electrolytic recovery unit.

10 Brief Description of Drawings

Fig. 1 is a schematic diagram showing an example electrowinning unit as a conventional electrolytic recovery unit.

Fig. 2 is a schematic diagram showing an example electrowinning unit as an electrolytic recovery unit of the present invention.

15 Fig. 3A is a photograph showing an example cylindrical cathode.

Fig. 3B is an enlarged diagram showing a portion A of Fig. 3A.

Fig. 4 is a graph showing relationships between electrolysis time and gold concentration in a liquid containing a valuable metal in Example 1 and Comparative Example 1.

20 Description of Embodiments

(Method for Recovering Valuable Metal from Liquid Containing Valuable Metal and Electrolytic Recovery Unit)

A method for recovering a valuable metal from a liquid containing the
25 valuable metal according to the present invention performs electrolytic recovery such as electrowinning by rotating a cylindrical cathode in an electrolytic bath including an anode and the cylindrical cathode as a tubular cathode and housing a

liquid containing a valuable metal, to thereby deposit the valuable metal on the surface of the cylindrical cathode.

An electrolytic recovery unit of the present invention includes a tubular cathode and an actuating unit, and includes an electrolytic bath, an anode, and
5 further, other members according to necessity.

The method for recovering a valuable metal from a liquid containing the valuable metal and the electrolytic recovery unit will be explained below in detail.

<Electrolytic Bath>

The electrolytic bath is not particularly limited in terms of size shape,
10 structure, material, etc. and may be appropriately selected according to the purpose, as long as it includes an anode and a tubular cathode, houses a liquid containing a valuable metal, and can perform electrolytic recovery of depositing a metal by means of electrolysis such as electrowinning and electrolytic refining and recovering the metal.

15 Examples of the material of the electrolytic bath include stainless steel, aluminum, and iron. The shape and size (content) of the electrolytic bath are not particularly limited and may be appropriately selected according to the purpose. A commonly used shape is preferable.

It is preferable that a discharging port be provided at the height-direction
20 upper portion of the electrolytic bath, and that a liquid containing a valuable metal overflowing from the electrolytic bath be delivered to a circulating bath through a path.

The circulating bath and the electrolytic bath are connected to each other through a path, and a circulating pump and a valve are provided on the path. A
25 feeding port is provided at the height-direction lower portion of the electrolytic bath for feeding an aqueous solution into the bath, and the path is connected to this feeding port. It is preferable that the liquid containing the valuable metal that is

present in the circulating bath can be fed into the electrolytic bath with actuation of a pump, and that the liquid migrate in the electrolytic bath from the bottom upward.

<Liquid Containing Valuable Metal>

The liquid containing a valuable metal is not particularly limited and may be
5 appropriately selected according to the purpose. Examples thereof include a plating solution containing a valuable metal and cyanogen, a plating stripping solution containing a valuable metal and cyanogen, a waste plating solution, and a liquid after washing a plated product.

Examples of the valuable metal include gold (Au), silver (Ag), copper (Cu),
10 nickel (Ni), and platinoid elements. Among these, gold is particularly preferable.

The concentration of the valuable metal in the liquid containing the valuable metal is not particularly limited and may be appropriately selected according to the purpose. However, it is preferably from 10 mg/L to 100 g/L.

<Tubular Cathode>

15 The size, structure, material, etc. of the tubular cathode may be appropriately selected according to kind of the electrolytic solution and of the metal to be recovered. Examples of the material of the tubular cathode include iron, nickel, copper, chromium, stainless steel, aluminum, and titanium, or alloy of these.

The tubular cathode is most preferably cylindrical, in order to stably retain
20 an electrolyzed state. The tubular cathode may be a tubular cathode that is tubular while it is stationary and cylindrical while it is rotating.

It is preferable that the tubular cathode include a porous portion that includes multiple through-holes in a circumferential sidewall thereof. The multiple through-holes are not particularly limited and may be appropriately selected
25 according to the purpose. Examples thereof include through-holes formed in an expanded metal, a net mesh, and a punching metal. The through-holes need to be arranged round the circumferential sidewall in the rotational direction.

The opening area of the multiple through-holes (i.e., the aperture ratio of the through-holes) in the circumferential sidewall of the tubular cathode is preferably higher in the height-direction lower portion than in the height-direction upper portion, because the liquid containing the valuable metal will be efficiently discharged through the through-holes in the circumferential sidewall of the tubular cathode. Here, the height-direction upper portion means a portion of the tubular cathode that extends from a 70% height of the tubular cathode to the 100% height thereof, where the whole height of the tubular cathode is expressed as 100%. The height-direction lower portion means a portion of the tubular cathode that extends from the 0% height of the tubular cathode to a 30% height thereof, where the whole height of the tubular cathode is expressed as 100%. It is preferable that the liquid surface of the liquid containing the valuable metal be lower than the topmost through-holes. It is preferable that the circumferential sidewall of the tubular cathode be a continuous monolithic surface. It is more preferable that the circumferential sidewall have a quadrangular shape when developed, but it may have a trapezoidal shape or a parallelogram shape, or the developed figure of the circumferential sidewall may be nonlinear on one side thereof.

It is preferable that the tubular cathode be opened at the height-direction bottom thereof and be at least partially closed at the height-direction top thereof, because the liquid containing the valuable metal will flow through the tubular cathode efficiently.

During electrolytic recovery, it is possible to make the speed and rate of recovering the valuable metal high, by rotating the tubular cathode at a predetermined speed by means of actuation with an actuating unit described below.

A portion of the tubular cathode at which the tubular cathode is attached to the electrolytic bath is not immersed in the cyanogen-containing liquid containing the valuable metal. This is safe because a replacement personnel will not contact

the cyanogen when replacing tubular cathodes.

<Anode>

The anode is not particularly limited, and is preferably a cylindrical bar-shaped anode that does not interfere with application of electricity and stirring
5 of the liquid containing the valuable metal.

It is preferable that a plurality of anodes be provided around the tubular cathode.

For electrowinning, the material of the anode is preferably an insoluble material. The insoluble material is not particularly limited and may be
10 appropriately selected according to the purpose. Examples of the insoluble material include electrode materials including carbon, lead, lead alloy, ferrite, platinum-group metal oxide, or the like as an electrode catalyst. Among these, preferable are electrode materials, of which electrode substrate is made of anticorrosion metal such as titanium, niobium, zirconium, or an alloy of these, when
15 the electrode substrate is to be coated with an electrode catalyst.

<Actuating Unit>

Examples of the actuating unit include a rotation motor configured to rotate the tubular cathode.

The rotation speed at which the tubular cathode is rotated with the
20 actuating unit is not particularly limited and may be appropriately selected according to the purpose. However, it is preferably from 50 rpm to 100 rpm. By setting the rotation speed of the cylindrical cathode to from 50 rpm to 100 rpm, it is possible to obtain a stirring force that is weaker than conventional, and to prevent the valuable metal deposited on the surface of the tubular cathode from dropping off
25 therefrom. It is preferable to rotate the tubular cathode about an axis of rotation, which is set on the center of the circular cross-section of the cylindrical cathode. The rotation speed is variable, and may be constant or intermittent. The actuating

unit preferably includes a unit that enables electricity to be applied so as to generate an electric potential across from the tubular cathode to the anode. Such a unit is, for example, a rotary bearing electrode.

<Other Members>

5 The other members are not particularly limited and may be appropriately selected according to the purpose. Examples of the other members include a circulating bath, a circulating pump, and a rectifier.

 A method for recovering a valuable metal from a liquid containing the valuable metal according to the present invention deposits a valuable metal by using
10 the electrolytic recovery unit of the present invention described above.

 In the present invention by using the tubular cathode, particularly a cylindrical cathode, it is possible to reduce the current density to 1/3 that of the case when a conventional disk-shaped cathode is used. The current density of the tubular cathode is not particularly limited and may be appropriately selected
15 according to the purpose. However, it is preferably from 3 A/dm² to 10 A/dm². This makes it possible to prevent the valuable metal from being deposited in a granular state.

 It is possible to recover the valuable metal deposited on the surface of the tubular cathode by a publicly-known recovery method of scratching and chemically
20 stripping the valuable metal off from the tubular cathode.

 The method for recovering a valuable metal from a liquid containing the valuable metal and the electrolytic recovery unit of the present invention will now be explained with reference to the drawings. Fig. 2 is a schematic diagram showing an example electrowinning unit 100, as the electrolytic recovery unit of the present
25 invention.

 The electrowinning unit 100 of Fig. 2 includes an anode 15 and a cylindrical cathode 16 as a tubular cathode, and also includes an electrolytic bath 13 housing a

liquid containing a valuable metal, and an actuating unit 17 configured to rotate the cylindrical cathode 16.

Six anodes 15 and one cylindrical cathode 16, which are connected to a rectifier 14, are provided in the electrolytic bath 13.

5 Examples of the material of the cylindrical cathode 16 include iron, nickel, copper, chromium, stainless steel, aluminum, titanium, or alloy of these.

As shown in Fig. 3A, multiple through-holes 23 are formed in the circumferential sidewall of the cylindrical cathode 16 at regular intervals.

10 It is preferable that an interval P between adjoining through-holes 23, which is the shortest distance between the centers of the adjoining through-holes, be about 5 times or less as large as the diameter D of the through hole, and that the diameter D be from 3 mm to 10 mm, as shown in Fig. 3B.

15 The height-direction bottom of the cylindrical cathode 16 is opened, and the height-direction top of the cylindrical cathode 16 is at least partially closed. This makes it possible for the liquid containing the valuable metal to flow through the cylindrical cathode efficiently.

20 The cylindrical cathode 16 is configured to rotate by means of actuation with a rotation motor 17 as the actuating unit. The center of rotation is the center of a cross-section of the circumferential sidewall of the cylindrical cathode 16. The cylindrical cathode is rotated such that the porous surface of the circumferential sidewall is substantially parallel with the longer direction of the anodes. By rotating, the cylindrical cathode 16 can contact the liquid containing the valuable metal well and can improve the current efficiency.

25 Examples of the material of the anodes 15 include insoluble materials such as carbon, lead, Pt-Ti material, and ferrite.

A discharging port 13a is provided at the height-direction upper portion of the electrolytic bath 13, so that the liquid containing the valuable metal overflowing

from the electrolytic bath 13 may be delivered to a circulating bath 11 through a path 21.

The circulating bath 11 and the electrolytic bath 13 are connected to each other through a path 22, and a circulating pump 12 is provided on the path 22. A feeding port 13b is provided at the height-direction lower portion of the electrolytic bath 13, and through the feeding port, the liquid containing the valuable metal is fed. The path 22 is connected to the feeding port 13b.

The liquid containing the valuable metal that is present in the circulating bath 11 can be fed into the electrolytic bath 13 with actuation of the circulating pump 12, so that the liquid may migrate in the electrolytic bath 13 from the bottom upward.

The method for recovering a valuable metal from a liquid containing the valuable metal and the electrolytic recovery unit of the present invention have been described in detail. The present invention is not limited to the embodiment described above, and may be modified in various manners without departing from the spirit of the present invention.

Examples

Examples of the present invention will be specifically explained below with reference to the drawings. The present invention is not limited to these Examples by any means.

(Example 1)

Recovery of gold (Au) as a valuable metal in a cyanogen-containing liquid containing a valuable metal was performed with the electrowinning unit 100 shown in Fig. 2 as the electrolytic recovery unit of the present invention.

As a cathode, the cylindrical cathode 16 shown in Fig. 3A, which was 220 mm in diameter and 250 mm in height was used. This cylindrical cathode was made of

stainless steel (SUS309), and multiple through-holes 23 that were of a punching metal were formed in the circumferential sidewall of the cylindrical cathode. The interval P between the through-holes 23 of the cylindrical cathode 16 was 8 mm, and the diameter D of the through-holes 23 was 5 mm, as shown in Fig. 3B.

5 The cylindrical cathode 16 had a top plate at the top end thereof. The top plate was a disk-shaped plate having a bore, had the same diameter as that of the cross-section of the cylindrical cathode, and had the cylindrical cathode joined thereto. The cylindrical cathode was connected to the center of the top plate (the center of rotation of the cylindrical cathode) and to a shaft 18. The shaft 18 was
10 directly connected to the rotation motor 17, and the cylindrical cathode could rotate about the shaft 18 in the circumferential direction by means of actuation with the rotation motor 17.

As the anodes 15, bar-shaped ferrite electrode materials having a diameter of 30 mm were used. Six anodes 15 were provided between the outer circumference of
15 the cylindrical cathode 16 and the electrolytic bath 13.

The content of the electrolytic bath 13 was 20 liters. A discharging port 13a was provided at the height-direction upper portion of the electrolytic bath 13, and a cyanogen-containing liquid containing a valuable metal overflowing from the electrolytic bath 13 would be delivered to a circulating bath 11 through a path 21.

20 There was no stirrer for stirring the liquid, because none was necessary. The content of the circulating bath 11 was 1,000 liters.

The circulating bath 11 and the electrolytic bath 13 were connected to each other through a path 22. A circulating pump 12 was provided on the path 22. A feeding port 13b through which a cyanogen-containing liquid containing a valuable
25 metal was to be fed was provided at the height-direction lower portion of the electrolytic bath 13. The path 22 was connected to this feeding port 13b. The feeding port 13b was provided under the bottommost portion of the cylindrical

cathode.

A cyanogen-containing liquid containing a valuable metal that was present in the circulating bath 11 could be fed into the electrolytic bath 13 with actuation of the circulating pump 12, so that the liquid may migrate in the electrolytic bath 13 from the bottom upward.

First, a cyanogen-containing liquid containing gold (Au) (8 g/L) and cyanogen (CN) was stored in the circulating bath 11 and fed with the circulating pump 12 into the electrolytic bath 13 at a rate of 54 liters/hour, and under normal temperature, electrowinning was performed by setting the current density (DK) of the cathode to 5 A/dm² as the electrolysis condition, and by rotating the cylindrical cathode 16 at a rotation speed of 73 rpm by means of actuation with the rotation motor 17 as the actuating unit. When the electrowinning was terminated, deposition of plenty of gold was confirmed on the surface of the cylindrical cathode.

Next, the gold (Au) concentration in the cyanogen-containing liquid containing the valuable metal was measured when 10 hours, 40 hours, 60 hours, and 90 hours respectively passed from the start of the electrowinning, according to ICP emission spectrochemical analysis method using an ICP emission spectrophotometer. The results are shown in Fig. 4. From the results of Fig. 4, it was revealed that the gold (Au) concentration in the cyanogen-containing liquid had lowered to about 0.01 g/L from 8 g/L when 90 hours passed.

Further, the deposition rate of gold (Au), the current efficiency of gold (Au), and the recovery rate of gold (Au) were measured in the manner described below. The results are shown in Table 1.

<Deposition Rate of Gold (Au)>

The deposition rate of gold was expressed as the mass (g) of gold per electrolysis time.

<Current Efficiency of Gold (Au)>

Based on the mass (g) of recovered gold and a theoretical mass (g) of gold to be recovered calculated from the quantity of applied electricity (A·h) required for the recovery of gold, the current efficiency of gold was calculated by dividing the mass of recovered gold by the theoretical mass of gold to be recovered and expressed as a percentage (%).

<Recovery Rate of Gold (Au)>

Using the total amount of gold (g) contained in the electrolysis solution before electrowinning as a denominator, the difference in the total amount of gold (g) in the electrolysis solution before and after electrowinning was divided by the total amount of gold before electrowinning, and expressed as a percentage (%).

(Comparative Example 1)

Recovery of gold (Au) as a valuable metal in a cyanogen-containing liquid containing a valuable metal was performed with an electrowinning unit 10 shown in Fig. 1 as a conventional electrolytic recovery unit.

As a disk-shaped cathode, a plate made of stainless steel (SUS) having a diameter of 186 mm and a thickness of 3 mm was used.

As anodes, bar-shaped ferrite electrode materials having a diameter of 30 mm were used. Four anodes 5 were provided so as to sandwich the disk-shaped cathode 6 therebetween.

The content of an electrolytic bath 3 was 20 liters. A discharging port 3a was provided at the height-direction upper portion of the electrolytic bath 3, and a cyanogen-containing liquid containing a valuable metal overflowing from the electrolytic bath 3 would be delivered to a circulating bath 1 through a path 21. The content of the circulating bath 1 was 1,000 liters.

The circulating bath 1 and the electrolytic bath 3 were connected to each other through a path 22, and a pump 2 was provided on the path 22. A feeding port 3b through which a cyanogen-containing liquid containing a valuable metal was to

be fed was provided at the height-direction lower portion of the electrolytic bath 3. The path 22 was connected to this feeding port 3b.

A cyanogen-containing liquid containing a valuable metal that was present in the circulating bath 1 could be fed into the electrolytic bath 3 with actuation of the circulating pump 2, so that the liquid may migrate in the electrolytic bath 3 from the bottom upward.

First, a cyanogen-containing liquid containing gold (Au) (8 g/L) and cyanogen (CN) was stored in the circulating bath 1 and fed with the circulating pump 2 into the electrolytic bath 3 at a rate of 54 liters/hour, and under normal temperature, electrowinning was performed by setting the current density (DK) of the cathode to 17 A/dm² as the electrolysis condition, and by rotating the disk-shaped cathode 6 at a rotation speed of 110 rpm by means of actuation with the rotation motor 7 as the actuating unit.

The gold (Au) concentration in the cyanogen-containing liquid was measured in the same manner as Example 1, when 10 hours, 40 hours, 60 hours, and 90 hours respectively passed from the start of the electrowinning. The results are shown in Fig. 4. From the results of Fig. 4, it was revealed that the gold (Au) concentration in the cyanogen-containing liquid had lowered to 1 g/L from 8 g/L when 90 hours passed.

Further, the deposition rate of gold (Au), the current efficiency of gold (Au), and the recovery rate of gold (Au) were measured in the same manner as Example 1. The results are shown in Table 1.

Table 1

	Deposition rate of Au (g/h)	Current efficiency of Au (%)	Recovery rate of Au (%)
Ex. 1	190	51	99.8
Comp. Ex. 1	94	25	87.8

From the results of Fig. 4 and Table 1, it was revealed that the recovery

speed of gold and the recovery rate of gold were much better in Example 1 using the cylindrical cathode than in Comparative Example 1 using the disk-shaped cathode.

Industrial Applicability

5 The method for recovering a valuable metal from a liquid containing the valuable metal and the electrolytic recovery unit of the present invention can recover a valuable metal such as gold from a liquid containing the valuable metal at low costs, efficiently and at a high recovery rate. Therefore, this method is suitable as a method for recovering a valuable metal such as gold from a cyanogen-containing
10 liquid such as a plating solution and a plating stripping solution.

Reference Signs List

	1	circulating bath
	2	circulating pump
15	3	electrolytic bath
	4	rectifier
	5	anode
	6	disk-shaped cathode
	7	rotation motor
20	10	electrowinning unit
	11	circulating bath
	12	circulating pump
	13	electrolytic bath
	14	rectifier
25	15	anode
	16	cylindrical cathode
	17	rotation motor

	18	shaft
	21	path
	22	path
	23	through-hole
5	100	electrowinning unit

CLAIMS

1. A valuable metal recovering method, comprising:
performing electrolytic recovery by rotating a cylindrical cathode in an electrolytic bath including an anode and the cylindrical cathode and housing a liquid
5 containing a valuable metal; and
depositing the valuable metal on a surface of the cylindrical cathode.
2. The valuable metal recovering method according to claim 1,
wherein the valuable metal is gold, and the liquid containing the valuable metal is a gold-containing cyanogen solution.
- 10 3. The valuable metal recovering method according to claim 1 or 2,
wherein rotation speed of the cylindrical cathode is from 50 rpm to 100 rpm.
4. An electrolytic recovery unit configured to electrolytically recover a valuable metal from a liquid containing the valuable metal, comprising:
a tubular cathode; and
15 an actuating unit configured to rotate the tubular cathode,
wherein the tubular cathode comprises multiple through-holes in a rotation-direction circumferential sidewall thereof.
5. The electrolytic recovery unit according to claim 4,
wherein the tubular cathode is cylindrical and comprises multiple
20 through-holes in the circumferential sidewall in a circumferential direction.