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Description

Technical Field

This invention relates to a cathode assembly comprising an electrically conductive support structure having open areas therein and a current collecting portion, a method of making the cathode assembly and an electrolytic cell having a series of the cathode assemblies. The cathode assembly and the electrolytic cell are intended for electrowinning of metals from solutions containing ions of the metals.

Background of the Invention

It is well known that many metals can be recovered from solutions containing ions of the metals using electrolytic techniques. Generally, the solution containing the metals ions is contacted with an anode cathode pair in an electrolytic cell, the metal depositing from ionic solution on the cathode. Traditional concerns of electrolytic cell operations such as current efficiency and allowable current density at the cathode apply to such metal recovery cells. In addition, electrolytic recovery of the metals bring another concern; recapture of the metals from the cathode, particularly at a relatively low cost and with relative ease.

Traditionally, the metal recovery cathode was comprised of a substrate made from an electrically conductive plentiful metal upon which the metal ions in solution were plated. Separation normally entailed melting the electrodeposited metal and the substrate, and subsequently separating the two metals. In some cases it was possible to separate electrodeposit the substrate by physically cracking the electrodeposited metal from the substrate. Where the substrate metal and the electrodepositing metal were the same, often these problems associated with subsequent separation of the cathode substrate and recovered metal were eased. The surface area of these traditional cathodes often limited their capacity for holding recovered metal.

More recently it has been found that openly porous plastics, particularly polymers, have found use as reticulate electrodes in metal ion recovery, providing a greater surface area. In using these polymers for metal ion recovery it has been found essential that these plastics be both conductive and effectively rigid when placed in the electrolytic cell. Without conductivity, electrolytic recovery can become difficult. Without rigidity, maintenance of an effectively low anode cathode spacing within the electrolytic cell can become more complicated.

One past proposal for producing an openly porous reticulate form electrode that is both electrically conductive and relatively rigid has been deposition of a metal onto an openly porous polymeric foam or weave or non-woven fabric. Generally a preliminary metal deposition is made onto the polymer by treatment in a chemical bath and subsequent electroless deposition of a metal such as copper to the polymer. The electroless metal coated polymer, now somewhat conduc-

tive, is then subjected to electrodeposition of additional quantities of the metal to produce a relatively rigid, substantially conductive electrode structure for use in recovering metal ions from solution (A. Tentorio et al., Journ. Applied Electrochemistry 8 (1978) 195—205).

The combination of both electroless and electrolytic deposition of conductive metals onto the polymer can be economically burdensome in producing a cathode for use in recovering metals from solution. When fully loaded with recovered metal, these cathodes are generally destroyed in removing the metals being recovered. An entirely new cathode is therefore required at each replacement.

Particularly where a polymer structure is coated with a metal to make the polymer structure conductive and suitable for use as a cathode in an electrolyte cell, it is necessary to attach at least one current feeder.

Especially in an acidic solution where electric current is interrupted to cells using polymer cathode prepared by electroless and electrolytic plating thus removing cathodic protection generally enjoyed by the cathode during electrolyte operation, this attachment point as well as the conductive metal can be subject to corrosive attack. Electrical communication to the cathode can be weakened by such corrosive action resulting in decreased efficiency of electrolytic metal recovery from solution or an interruption in recovery.

DE—A—2 255 985 discloses a cathode for fuel cells and metal-air batteries comprising an electroconductive metal support and an active porous layer made of polyisobutylene and graphite or carbon black and a catalytically active carbon particles. The cathode is made by dissolving polyisobutylene in an organic solvent, adding carbon black or graphite and the catalytically active carbon to form a dispersion and finally applying the dispersion onto the metal support and evaporating the solvent.

DE—A—2 363 042 discloses a cathode starting blank comprising a flat electrically conductive metal section extending over the whole of the operative part of the blank and a layer of an electrically conductive polymer applied to each side of the metal section to form a composite laminate body. The conductive polymer is made conductive by mixing the polymer with an electrically conductive powder. The polymer disclosed is rubber and the conductive particles may be carbon or copper particles. The metal section may be in the form of net, grid or perforated plate.

US—A—4 235 696 discloses a mandrel for electroforming which comprises an electroconductive sheet, grid or mesh made of copper or steel sandwiched between two sheets of a polymeric material which form a non-conductive matrix. The mandrel on its surfaces has islands of a conductive resin. The conductive resin e.g. a polymer-carbon black mix contains a polymer which is the same as or compatible with the polymer of the non-conductive matrix.

US—A—4 158 612 discloses a mandrel for electroforming which comprises a metal substrate (e.g. nickel) sandwiched between two sheets of an electrically conductive polymer. The mandrel is prepared by hot pressing the conductive polymer sheets onto the metal substrate. A non-conductive polymer sheet is placed around the edge of the sandwich and the structure thus obtained hot pressed in place to complete the mandrel.

Disclosure of the Invention

It is an object of the present invention to provide a reticulate type cathode for use in recovering metal ions from a solution containing the ions.

It is a further object of the invention to provide a readily replaceable polymer cathode member not requiring electroless and/or electrolytic application of a conductive metal to the polymeric material to provide electrical conductivity and rigidity.

It is a still further object of the invention to provide a cathode configuration or assembly including a separable electrical current distributing and rigidity imparting member and at least one polymeric cathode member.

The present invention therefore provides a cathode assembly for electrodeposition of metals from solutions containing metal ions. The assembly comprises an electrically conductive support structure having open areas therein and an outwardly extending electrical current connecting portion. The feature of the assembly is that the metal deposition surface is an openly porous, carbon impregnated polymeric layer attached to at least one face of the supporting structure. The layer is in electrical contact with the supporting structure and covers at least a portion of its surface including open areas therein. The invention also provides a method for making the cathode assembly for use in electrodeposition of metals from solutions containing the metal ions as set forth in claim 7. Specific embodiments are set forth in dependant claims 8—10.

The polymeric cathode layer can be attached to the supporting structure using a conductive adhesive or with fasteners such as staples.

These cathode assemblies are utilized to form anode-cathode pairs contained in an electrolytic metal recovery cell. Generally a plurality of the cathode assemblies are arranged along the length of an electrolytic cell; metal ion containing solution being introduced at one end of the cell, and traversing a cell length by passing successively through the several cathode assemblies, including the openly porous polymeric cathode layers. Thus the electrolytic cell for electrodeposition of metals from solutions according to the invention has a series of reticulated cathode assemblies and alternating parallel anodes arranged in line in the cell, the cathodes comprising openly porous, carbon impregnated polymeric cathode layers attached to and in electrical contact with at least one face of the electrically conducting, reticulated supporting base

structure of each cathode. The cathode layers cover at least a portion of the surface of the base including the open areas therein.

Use of the openly porous polymeric cathode layer of the instant invention provides a relatively low cost cathode assembly having a substantial available surface for electrodeposition of metal ions from the solution. The supporting structure provides a relatively rigid cathode assembly assisting in the maintenance of anode-cathode spacing within the cell, and thereby assisting in maintaining desirably low electrical power consumption in operation of the electrolytic cell.

The cathode assemblies of the instant invention are readily assembled by covering at least one face of the reticulate structure with the polymeric layer. Once assembled, their unitized construction allows ready changeout as the openly porous structure becomes plugged with accumulating metal deposits. In one preferred embodiment, a portion of the supporting structure extending above the normal level of solution within the electrolytic cell is left uncovered by the polymeric material. When pluggage of the polymeric cathode layer occurs metal laden solution flowing through the cell overflows the plugged polymeric cathode layer and passes the opening in the portion of the supporting structure above the normal or usual metal laden solution level within the cell, providing a visual indication of cathode pluggage.

The above and other features and advantage of the invention will become more apparent from the detailed description of the invention which follows considered in conjunction with the accompanying drawings which together form a part of the specification.

Description of the Drawings

Figure 1 is a perspective view of a cathode assembly made in accordance with the instant invention.

Figure 2 is a cross sectional view of a cathode assembly made accordance with the instant invention showing polymeric cathode layer on both faces of the supporting structure.

Figure 3 is a cross sectional view of a typical electrolytic cell utilizing the cathode assemblies of the instant invention.

Best Embodiment of the Invention

Referring to the drawings, Figure 1 and 2 show perspective and edge views respectively of a cathode assembly 10. The cathode assembly 10 includes an openly fluid permeable supporting structure 12 and a polymeric cathode layer 14 attached to the structure and in good electrical contact with it.

The supporting structure 12 can be of any electrically conductive, relatively rigid material. Electrically conductive metal mesh, a perforated plate, an interwoven wire grid or a grid formed from an electrically conductive plates such as Caprez (T.M.) polypropylene available from Alloy Polymers or conductive polyvinyl chloride may be

utilized. Other suitable or conventional materials may be utilized that readily conduct electrical current through their structure while permitting ready fluid passage.

The supporting structure 12 performs a dual function. Electrical current is distributed via the structure to the polymeric cathode layer 14, and the structure functions to position and support the cathode layer 14 within an electrolytic cell and maintain it in a desirable spaced relationship with anodes utilized in the electrolytic cell.

The cathode layer 14 is formed from an openly porous conductive polymer composition. Three polymeric forms have been found attractive, foams, fiber weaves and non-woven mats. The polymer utilized should be resistant to corrosive and solvating attack by whatever metal ion laden solution is to be electrolytically relieved of its metal ion content using the cathode assembly of the instant invention.

One preferred form of the conductive polymer composition is a foam. Polyurethanes and polyesters have been found to provide effective cathode layers, although other conductive foams may be satisfactory. The foam should be openly porous, that is, relatively freely passing fluid through its thickness. The openly porous foam should accommodate over the surface of the cathode assembly a liquid flow through the foam at least equal to the volume rate of solution from which metal ion recovery is desired.

Another preferred form of the invention is an openly porous woven or non-woven of polymeric, which mat passes a liquid flow through the cathode assembly at least equal to the volume rate of solution from which metal ion recovery is desired. Particularly polyester fiber weaves have been found desirable, though other electrically conductive polymeric fibers may be utilized.

The polymeric fiber mat foam cathode layer 14 is made conductive by incorporation of carbon into same. Carbon can be included by incorporation into the polymeric matrix of the foam or mat during its formation or by impregnating the foam or mat subsequent to formation. Techniques for carbon inclusion or impregnation are well known.

Resistivity of the polymeric cathode layer should never be greater than about 10,000 ohms per centimeter, and usually below 5,000 ohms centimeter with preferred materials having an average resistivity of 3,000 ohms centimeter or less.

The cathode layer 14 can vary in thickness over a considerable range. Typically a foam of 0.013 to 2.5 cm (0.05" to 1.0" thick is utilized and preferably between 0.16 to 1.3 cm (1/16" to 1/2"). Thicker foam cathode layers tend to spread anode and cathode within a cell to an extent that considerable voltage inefficiency in operation a metal ion recovery cell can be introduced. Thinner cathode layers quickly become loaded with recovered metal, requiring undesirably frequent removal and replacement.

Porosity of the foam or mat can vary between about 1.6 to 16 pores/cm². Preferred are materials of about 4 to 6.5 pores/cm².

The polymeric cathode layer 14 is affixed to the supporting structure 12 in any suitable or conventional manner which secures electrical communication between them. Conductive adhesives such as two part epoxys available from Crest Products Corp. or a conductive latex available from Chomerics Corps., staples 16 or U bolts are able to hold the structure 12 and polymeric cathode layer 14 in intimate electrical contact. It is important that electrical current be transferred between the supporting structure 12 and the attached cathode layer 14 over substantial portions thereof.

When the conductive reticulated supporting structure utilized polymeric, it is sometimes desirable to apply an electrically conductive metal foil (not shown) along an upper edge thereof whereby electrical current can be transferred thereto along the full length of the cathode assembly from a source of electrical current. Otherwise electrical current can be transferred to the cathode assembly 10 at one or more locations along supporting structure. In the preferred embodiment one or more flange portions 18 of the supporting structure is oriented upwardly from the cathode assembly and can be used both for mounting of the cathode assembly 10 in an electrolytic cell and for conducting electrical current to the cathode assembly. The flange portions 18 can be fabricated in any suitable or conventional manner such as by forming the flange from the supporting structure and bending the portions, or by attachment of separately formed flange portions 18.

Referring to Fig. 3, an electrolytic cell 24 is depicted including a plurality of cathode assemblies 10 and a plurality of anodes 26 arranged in spaced relationship spanning the width of the cell 24. The cathode assemblies 10 generally separate the cell 24 into compartments 28. The cell includes a fluid inlet 30 and outlet 32.

Solution containing metal ions to be recovered enters the cell via the fluid inlet and exits via the outlet. The solution passes through each cathode assembly in traversing the cell, and metal ions are thereby brought into intimate contact with the cathode assemblies for recovery, largely within the porous polymeric members thereof.

Where a cathode assembly becomes laden with recovered metal ions, impeding flow of the solution therethrough, the solution level in compartments behind the solution flow will tend to rise as shown at 38 in Fig. 3. In the preferred embodiment, the polymeric cathode layer 14 does not cover the supporting structure to full height, allowing a rising solution level to overflow the cathode layer 14 by passing through holes in zone 40 of the supporting structure. Detection of cathode assemblies requiring changeout is thereby facilitated.

Anodes, and surfaces of cathode layers 14 within the electrolytic cell are desirably

separated by between 0.635 and 1.3 cm. Closer spacing is feasible but formation of dendrites upon cathodes closely spaced to anodes can lead to short circuiting. Greater spacing is workable, but can cause unacceptable power inefficiencies. Generally anode cathode spacing in excess of about 13 cm or less than about 0.16 cm are not desirable.

The polymeric cathode layer 14 may be applied to one or both surfaces of the conductive supporting structure 12, as shown in Fig. 2. Selection of one or both surfaces of the structure 12 for coating is in part dependent upon factors such as concentration of metal ions in the solution being treated, flow rate of the solution through the cell, thickness of the cathode layer 14 being applied, and placement of anodes. Each application is therefore somewhat unique and should be approached individually.

The following examples are offered to further illustrate the invention.

Example I

An open-topped electrolytic cell measuring 15 × 20 × 20 cm approximately (6" × 8" × 8") fabricated from Lucite® (product of duPont), was provided with a fluid inlet and outlet. Two approximately 15 cm by 15 cm by 1 cm thickness of conductive urethane foam squares were each placed in a 15 cm by 15 cm three sided channel frame. The channels were compressed to retain the foam. A strip of aluminum foil was compressed into the foam along the unchanneled edge. The effective open foam area was thereby about 13 × 13 cm.

The foam squares were installed in the Lucite cell, the encasing channels adjacent to the walls and bottom of the cell. Three expanded metal mesh anodes measuring approximately 13 cm by 13 cm and coated with a mixture of tantalum, titanium, and iridium oxides were arranged alternating with the foam squares in the cell. A spacing of approximately 1.3 cm was established between each face of each foam square and the adjacent anode. A current feeder was connected to the aluminum foil strip attached to each square whereby the square was made cathodic by connection to a current source.

15 liters of a 250 parts per million CuSO₄ solution in sulfuric acid was circulated repeatedly through the cell, passing through each of the foam cathodes. pH of the solution was about 1.5. A current of 0.5 A/m² of exposed area of each foam face was passed between the anodes and the cathodes. The solution circulated at 13.2 × 10⁻³ [m³/min m²] of foam cathode area per face.

Circulation was continued for approximately one hour during which copper concentration in the circulating solution declined to 73 parts per million. Voltage between anodes and cathodes during this period declined from about 3.8 volts to about 2.4 volts.

Example II

A cathode was fabricated by attaching two 15

by 15 by 0.65 cm conductive foam squares to both faces of a 15 cm by 20 cm piece of aluminum structural mesh having substantial open area. Attachment was made using staples. A 5 cm wide strip of the aluminum mesh remaining exposed.

The finished cathode was installed in the cell between and spaced apart by 13 cm from each of 2 mesh anodes of the type utilized in Example I. The anodes and exposed aluminum portion of the cathode were duly connected to an electrical current source. A reservoir of 15 liters of a 210 parts per million CuSO₄ solution at a pH of about 1.75 was circulated through the cell at a flow rate of 26.4 [m³/min m²] of foam cathode area per face.

After approximately one hour, copper content in the circulating solution had been reduced to 100 parts per million. Voltage between anode and cathode declined from an initial 2.5 volts to a final 2.3 volts.

Example III

A cathode assembly was fabricated by placing an 45 cm wide sheet of expanded aluminum foil mesh between two 45 × 38 × 0.3 cm thick cathodes formed of carbon impregnated polyurethane foam. The three-component cathode assembly was secured by bonding the foam to the aluminum with a conductive epoxy resin adhesive. The cathode assembly was placed in an open electrolytic cell between two metallic anodes with a spacing between anodes and the foam surfaces of approximately 1.3 cm.

A wastewater stream containing approximately 150 parts per million CuCO₄ was passed through the electrolytic cell with no recycle for approximately 200 hours at a flow rate of 8.8 × 10⁻³ [m³/min m²] of exposed cathode area per face. A direct current of 0.3 amps square meter of exposed cathode area per face was applied to the cell at a constant voltage of 2.3 volts. At the conclusion of the experiment, 300 grams of metallic copper had been removed from the CuSO₄ solution.

While a preferred embodiment of the invention has been shown and described in detail, it should be apparent that various modifications can be made thereto without departing from the scope of the claims following.

Claims

1. A cathode assembly (10) for electrodeposition of metals from solutions comprising an electrically conductive supporting structure (12) having open areas therein and an outwardly extending electrical current connection portion (18), wherein the metal deposition surface in said assembly (10) is provided by an openly porous, carbon impregnated polymeric cathode layer (14) attached to at least one face of the supporting structure (12), the cathode layer being in electrical contact with the supporting structure and covering at least a portion of its surface including open areas therein.

2. The assembly of claim 1, wherein said layer

(14) is an openly porous foam or openly porous fiber mat.

3. The assembly of claim 1 or 2, wherein the polymer in said layer (14) is polyurethane or polyester.

4. The assembly of claim 1, wherein said polymeric layer is an electrically conductive, carbon impregnated polyurethane foam.

5. The assembly of claim 1, wherein the supporting structure (12) has an open area of between 10% and 95%, and the layer (14) has a thickness between about 0.13 and 2.5 cm.

6. The assembly of claim 1 or 2, wherein said layer (14) is an electrically conductive, carbon impregnated, polyester fiber mat.

7. A method for making a cathode assembly (10) comprising selecting an electrically conductive, relatively rigid supporting base structure (12) having open areas therein and an outwardly extending connecting portion (18) by which electrical current can be transferred between said supporting structure (12) and a source of electrical potential and attaching to at least one face of said supporting base structure (12) an openly porous, electrically conductive, carbon impregnated polymeric cathode layer (14) covering at least a portion of said supporting base structure (12), said layer (14) being in electrical contact with said supporting structure (12).

8. The method of claim 7, wherein said layer (14) is a foam or a fibrous mat.

9. The method of claim 7 or 8, wherein the polymer in said layer (14) is polyester or polyurethane.

10. The method of claim 7, wherein the layer (14) is attached by means of an electrically conductive epoxy cement, an electrically conductive latex, staples, or combinations thereof.

11. An electrolytic cell (24) for electrodeposition of metals from solutions having a series of reticulated cathode assemblies (10) and alternating parallel anodes (26) arranged in line in the cell (24) and in electrical current communication with a source of electrical potential, wherein the cathodes (10) comprise openly porous, carbon impregnated polymeric cathode layers (14) attached to and in electrical contact with at least one face of the electrically conducting, reticulated supporting base structure (12) of each cathode and covering at least a portion of its surface, including the open areas therein.

12. The electrolytic cell of claim 11, wherein said layers (14) are carbon impregnated foams or carbon impregnated fibrous mats.

13. The electrolytic cell of claim 11 or 12, wherein said layers (14) are polyester or polyurethane.

14. The electrolytic cell of claim 11 or 12, wherein said layers (14) have between about 1.6 to 16 pores/cm².

15. The electrolytic cell of claim 11, wherein said layers (14) have a thickness between 0.13 to 2.5 cm and the supporting base structures (12) have open areas between about 10% and 95%.

Patentansprüche

1. Kathodenanordnung (10) für die elektrolytische Abscheidung von Metallen aus Lösungen, welche eine elektrisch leitende Trägerstruktur (12) mit darin befindlichen offenen Bereichen und ein sich nach außen erstreckendes Teil (18) als elektrischen Stromanschluß umfaßt, bei der die Metallabscheidungsfläche der Anordnung (10) von einer mit Kohlenstoff imprägnierten polymeren Kathodenschicht (14) mit offenen Poren gebildet wird, die an mindestens einer Seite der Trägerstruktur (12) befestigt ist, wobei sich die Kathodenschicht in elektrischem Kontakt mit der Trägerstruktur befindet und mindestens einen Teil von deren Oberfläche einschließlich der darin befindlichen offenen Bereiche bedeckt.

2. Anordnung nach Anspruch 1, bei der die Schicht (14) ein Schaum mit offenen Poren oder eine Fasermatte mit offenen Poren ist.

3. Anordnung nach Anspruch 1 oder 2, bei der das Polymer in der Schicht (14) ein Polyurethan oder ein Polyester ist.

4. Anordnung nach Anspruch 1, bei der die polymere Schicht ein elektrisch leitender, mit Kohlenstoff imprägnierter Polyurethanschaum ist.

5. Anordnung nach Anspruch 1, bei der die Trägerstruktur (12) einen offenen Bereich zwischen 10% und 95% aufweist und die Schicht (14) eine Dicke zwischen etwa 0,13 und 2,5 cm hat.

6. Anordnung nach Anspruch 1 oder 2, bei der die Schicht (14) eine elektrisch leitende, mit Kohlenstoff imprägnierte Polyesterfasermatte ist.

7. Verfahren zur Herstellung einer Kathodenanordnung (10), dadurch gekennzeichnet, daß man eine elektrisch leitende, relativ starre Trägerbasisstruktur (12) mit darin befindlichen offenen Bereichen und einem sich nach außen erstreckenden Anschlußteil (18), durch welches ein elektrischer Strom zwischen der Trägerstruktur (12) und einer elektrischen Spannungsquelle übertragen werden kann, auswählt und an mindestens einer Seite der Trägerbasisstruktur (12) eine elektrisch leitende, mit Kohlenstoff imprägnierte polymere Kathodenschicht (14) mit offenen Poren befestigt, die mindestens einen Teil der Trägerbasisstruktur (12) bedeckt, wobei sich die Schicht (14) in elektrischem Kontakt mit der Trägerstruktur (12) befindet.

8. Verfahren nach Anspruch 7, bei dem die Schicht (14) ein Schaum oder eine Fasermatte ist.

9. Verfahren nach Anspruch 7 oder 8, bei dem das Polymer in der Schicht (14) ein Polyester oder ein Polyurethan ist.

10. Verfahren nach Anspruch 7, bei dem die Schicht (14) mittels eines elektrisch leitenden Epoxylebers, eines elektrisch leitenden Latex, Haftklammern oder Kombinationen derselben befestigt ist.

11. Elektrolysezelle (24) für die elektrolytische Abscheidung von Metallen aus Lösungen, die eine Serie metzartiger Kathodenanordnungen (10) und damit im Wechsel parallel Anoden (26)

aufweist, die in der Zelle (24) in Reihe angeordnet sind und in elektrischer Verbindung mit einer elektrischen Spannungsquelle stehen, bei der die Kathoden (10) mit Kohlenstoff imprägnierte polymere Kathodenschichten (14) mit offenen Poren umfassen, die an mindestens einer Seite der elektrisch leitenden, netzartigen Trägerbasisstruktur (12) jeder Kathode befestigt sind, mit dieser in elektrischem Kontakt stehen und mindestens eine Teil von deren Oberfläche, einschließlich der darin befindlichen offenen Bereiche, bedecken.

12. Elektrolysezelle nach Anspruch 11, bei der die Schichten (14) mit Kohlenstoff imprägnierte Schaüme oder mit Kohlenstoff imprägnierte Fasermatten sind.

13. Elektrolysezelle nach Anspruch 11 oder 12, bei der die Schichten (14) ein Polyester oder ein Polyurethan sind.

14. Elektrolysezelle nach Anspruch 11 oder 12, bei der die Schichten (14) zwischen etwa 1,6 und 16 Poren/cm² aufweisen.

15. Elektrolysezelle nach Anspruch 1, bei der die Schichten (14) eine Dicke zwischen 0,13 und 2,5 cm haben und die Trägerbasisstruktur (12) offene Bereiche zwischen etwa 10% und 95% hat.

Revendications

1. Cathode montée (10) destinée à l'électro-déposition de métaux à partir de solutions et comprenant une structure (12) formant support conducteur de l'électricité, laquelle présente des régions ouvertes ménagées dans celle-ci et une partie (18) s'étendant vers l'extérieure et destinée à la connexion électrique, caractérisée en ce que la surface de la cathode montée (10) destinée à la déposition de métaux est procurée par une couche formant cathode (14), nettement poreuse, en polymère imprégné de carbone, laquelle couche est fixée à au moins une face de la structure formant support (12), la couche formant cathode étant en contact électrique avec la structure formant support et recouvrant au moins une partie de sa surface, y compris des régions ouvertes dans celle-ci.

2. Cathode montée selon la revendication 1, caractérisée en ce que la couche (14) est une mousse nettement poreuse ou un produit tissé ou non tissé, nettement poreux, en fibres.

3. Cathode montée selon la revendication 1 ou 2, caractérisée en ce que le polymère constitutif de la couche (14) est du polyuréthane ou du polyester.

4. Cathode montée selon la revendication 1, caractérisée en ce que la couche en polymère est une mousse de polyuréthane imprégnée de carbone et conductrice de l'électricité.

5. Cathode montée selon la revendication 1, caractérisée en ce que la structure formant support (12) présente une aire ouverte comprise entre 10 et 95 % et la couche (14) présente une épaisseur comprise entre environ 0,13 et 2,5 cm.

6. Cathode montée selon la revendication 1 ou 2, caractérisée en ce que la couche (14) est un

produit tissé ou non tissé, en fibres polyester, imprégné de carbone et conducteur de l'électricité.

7. Procédé pour la confection d'une cathode montée (10), caractérisé en ce qu'il consiste à choisir une structure formant support (12) relativement rigide et conductrice de l'électricité, laquelle présente des régions ouvertes ménagées dans celle-ci et une partie (18) s'étendant vers l'extérieur et destinée à des fins de connexion grâce à laquelle du courant électrique peut être amené à passer entre la structure formant support (12) et une source de potentiel électrique, et à fixer à au moins une face de la structure formant support (12) une couche nettement poreuse formant cathode (14) en polymère imprégné de carbone et conducteur de l'électricité qui recouvre au moins une partie de la structure formant support (12), la couche (14) étant en contact électrique avec la structure formant support (12).

8. Procédé selon la revendication 7, caractérisé en ce que la couche (14) est une mousse ou un produit fibreux tissé ou non tissé.

9. Procédé selon la revendication 7 ou 8, caractérisé en ce que le polymère de la couche (14) est du polyester ou du polyuréthane.

10. Procédé selon la revendication 7, caractérisé en ce que la couche (14) est assujettie au moyen d'un adhésif à base de résine époxy conducteur de l'électricité, d'un latex conducteur de l'électricité, d'agrafes ou de combinaisons de ceux-ci.

11. Cellule électrolytique (24) destinée à l'électro-déposition de métaux à partir de solutions et comprenant une série de cathodes montées réticulées (10) et, alternant avec celle-ci, des anodes parallèles (26) disposées de manière alignée dans la cellule (24) et connectées électriquement à une source de potentiel électrique, caractérisée en ce que les cathodes montées (10) comprennent des couches formant cathodes nettement poreuses (14) en polymère imprégné de carbone qui sont fixées et en contact électrique avec au moins une face de la structure formant support (12) réticulée et conductrice de l'électricité de chaque cathode et recouvrent au moins une partie de sa surface, y compris les régions ouvertes dans cette structure.

12. Cellule électrolytique selon la revendication 11, caractérisée en ce que les couches (14) sont formées de mousses imprégnées de carbone ou de produits fibreux, tissés ou non tissés, imprégnés de carbone.

13. Cellule électrolytique selon la revendication 11 ou 12, caractérisée en ce que les couches (14) sont en polyester ou polyuréthane.

14. Cellule électrolytique selon la revendication 11 ou 12, caractérisée en ce que les couches (14) présentent environ 1,6 à 16 pores/cm².

15. Cellule électrolytique selon la revendication 11, caractérisée en ce que les couches (14) présentent une épaisseur comprise entre 0,13 et 2,5 cm et les structures formant support (12) présentent des régions ouvertes dans une proportion d'environ 10 à 95 %.

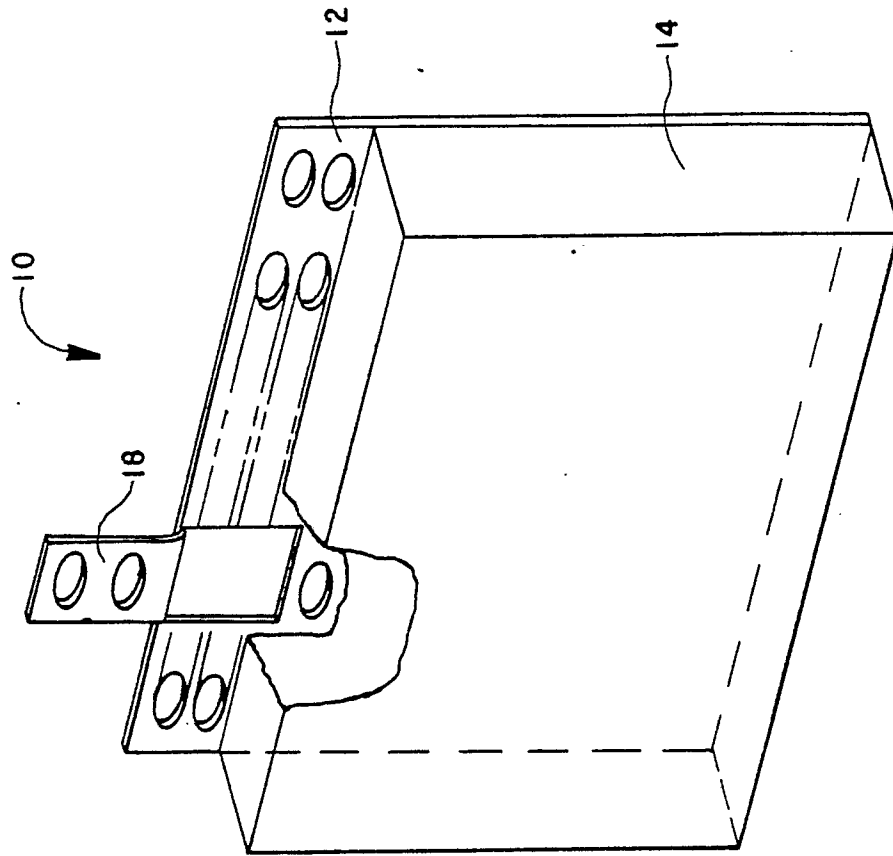


FIG. 1

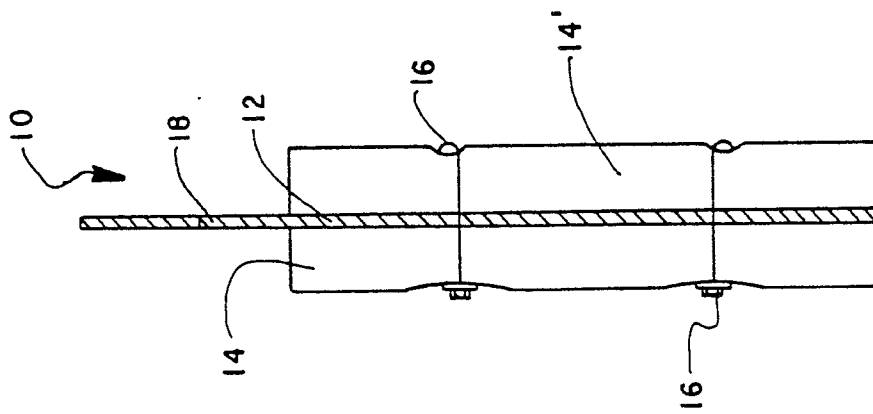


FIG. 2

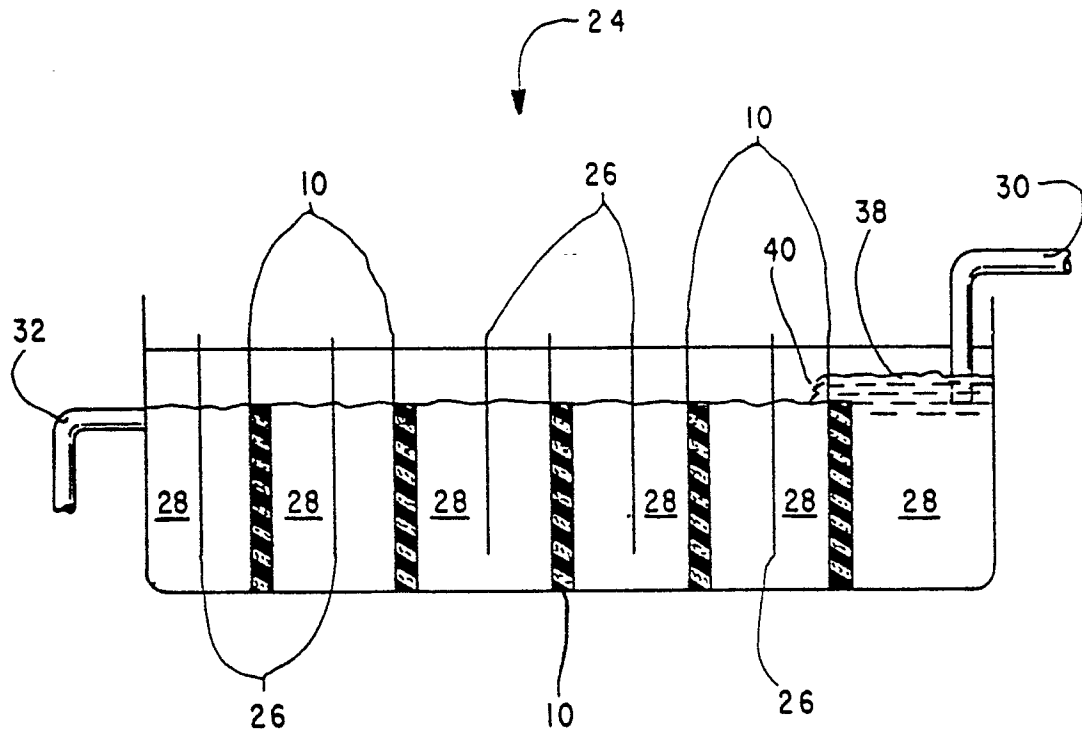


FIG. 3