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Chiz

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[54] **ANODE BASKET VIBRATOR**

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[52] **U.S. Cl.** ..... **259/1 R,** 173/170, 204/222, 204/287, 259/72

[51] **Int. Cl.** **B01f 11/00**

[58] **Field of Search** ..... 204/222, 223, 279, 286, 204/287; 259/1 R, 72, DIG. 43; 173/169, 170 X

[56] **References Cited**

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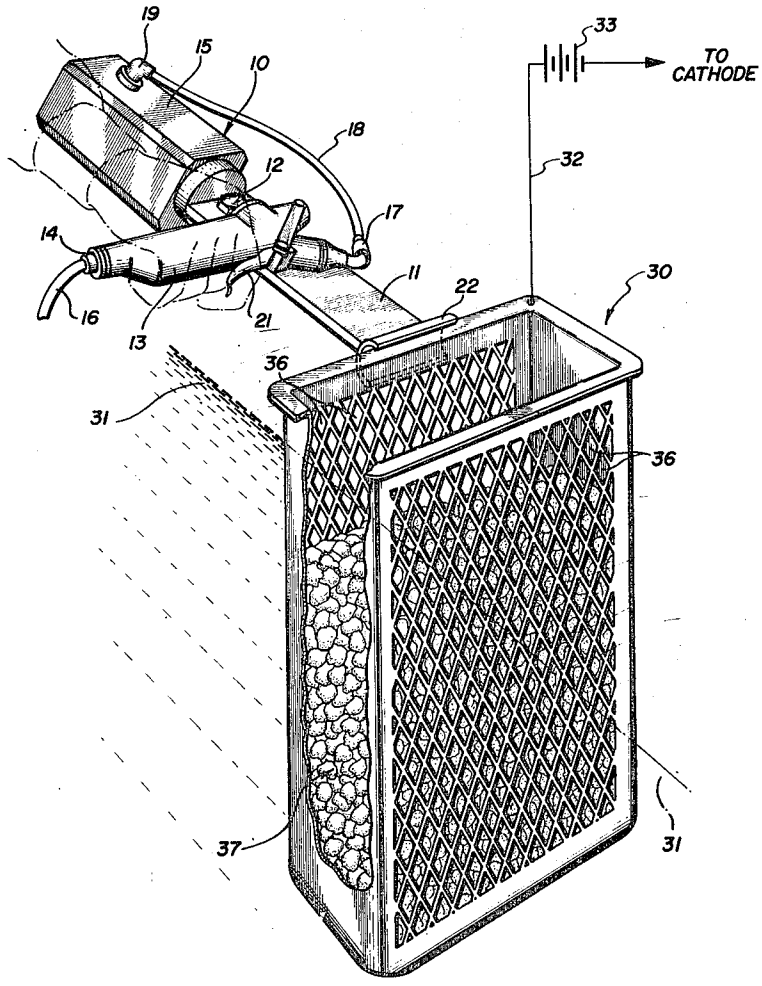
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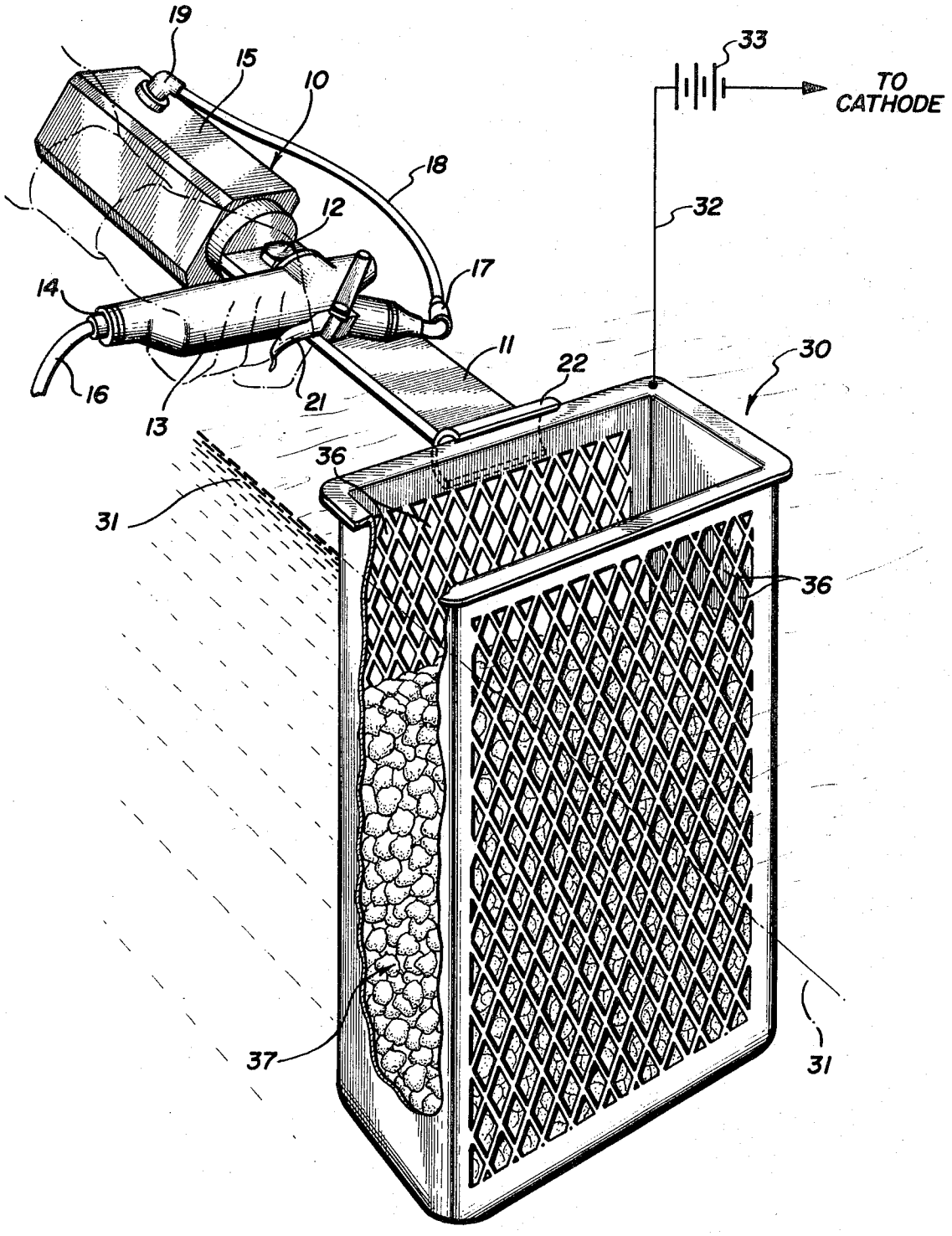
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[57] **ABSTRACT**

Vibrator assembly for compacting the particulate anode material in the anode basket of a "soluble anode" electroplating system. The assembly includes a pneumatically actuated vibrator connected by a rigid arm to contact means adapted to be placed in contact with the basket. Actuation of the vibrator causes the basket to be agitated in a manner which produces uniform settling of the anode material.

3 Claims, 1 Drawing Figure




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ANODE BASKET VIBRATOR

This application relates to apparatus for use in electroplating systems, and more particularly to vibrator apparatus useful for vibrating baskets of anode material in a "soluble anode" system of electroplating.

In electroplating, the article to be plated is immersed in a suitable electrolyte solution and an electrical current is passed through the electrolyte between the article, which is used as an electrical cathode, and a suitable anode. The passage of the current causes the article to be electroplated with a desired metal or alloy finish. Electroplating systems in general use can be divided into two categories, known as the soluble anode system and the "insoluble anode" system.

In the soluble anode system, there is used an anode having the same general composition as the metal or alloy which is to be deposited on the electroplated article. In this system, the anode material is dissolved by electrochemical action to replenish continuously the metallic content of the electrolyte which is consumed as a result of plating on the article. The anode in a soluble anode system serves the dual function of completing the electrical circuit and at the same time replenishing the metallic content of the electrolyte solution. In this type of operation, it is obvious that the anode is consumed and must be replaced periodically as necessary.

In the insoluble anode system, the anode material is different from the metal which is being electrodeposited. In this operation, the anode does not dissolve to any significant extent in the electrolyte and the metallic content of the electrolyte is maintained by periodic additions of suitable metal salts. The anode in an insoluble anode system serves only to complete the electrical circuit and is not itself consumed.

In the typical operation of a soluble anode system, with which this invention is concerned, it is common practice to employ as an anode a composite structure including a basket which is electrically conductive but chemically inert to the action of the electrolyte. The basket, containing a quantity of appropriate soluble anode material, preferably in the form of small pieces which are in electrical contact with each other and with the electrically conductive basket, is suspended in the electrolyte from an electrically conductive support bar. The electrolyte gains access to and contacts the anode material contained therein through openings provided in the basket. In the operation of the system, the soluble anode material is gradually consumed and is replaced as necessary at appropriate intervals.

A problem which is commonly encounted in the use of soluble anode systems employing an electrically conductive basket as described stems from the fact that the individual pieces of anode material gradually decrease in size during the operation of the process, leaving voids in the anode mass due to bridging of the individual anode pieces. Such bridging prevents the anode material from settling to the bottom of the basket as it is consumed, and thus prevents the formation of sufficient room for the addition of new anode material to the basket. The variable quantity of anode material in contact with the electrolyte which results from bridging of the individual anode pieces also results in poor plating uniformity. In order to overcome this problem, it is conventional practice to agitate the anode basket sufficiently to cause the anode pieces to settle to the bottom thereof, in order to permit proper refilling of the anode basket. In the past, this agitation of the basket for settling of the anode material has been done manually, typically by bouncing the basket or hitting it with a suitable object in order to cause settling of the anode material. These procedures are at best haphazard and rarely achieve the uniformly settled anode mass which is conducive to the best plating uniformity. In addition, striking the basket for settling its contents often results in physical damage to the basket.

In accordance with the invention, there is provided a pneumatically driven portable vibrator apparatus which is designed to contact the rim or other appropriate part of the basket or a bar from which the basket is suspended. The apparatus vibrates the basket and produces uniform settling of the anode material, thereby enhancing the uniformity of the electroplating results. In addition, the apparatus can be used to settle the contents of the anode basket without damage to the basket and without removing the basket from the plating tank or draining the electrolyte solution from the tank. The apparatus thus enhances both the efficiency and the quality of results achieved in the electroplating process.

The invention will be better understood from the following detailed description thereof, taken in conjunction with the accompaning drawing, which depicts the vibrator apparatus in position against the rim of an anode basket as it might be used for settling of the anode material contained therein. Alternatively, the vibrator apparatus can be placed on an anode support bar (not shown) from which the basket is suspended. When the vibrator is actuated, the induced vibration is transmitted to the basket and contents thereby causing settling of the anode material.

As shown in the drawing, the vibrator apparatus **10** of the invention comprises an elongated arm **11** suitably made of a rectangular bar of steel having sufficient thickness to insure rigidity. At one end of arm **11**, there is provided a pneumatically acutated vibrator **15** which is attached by suitable means, such as bolt **12**, to arm **11**. Vibrator **15** is of a type which produces a reciprocating motion along the longitudinal axis of arm **11** to which it is attached. Suitable devices of this type are available commercially and any of them can be used in the invention, provided that vibratory force exerted by the vibrator produces sufficient agitation of the anode basket to cause settling of the contents.

Fastened to arm **11** at a point between the ends thereof is air gun **13** which is provided with an inlet **14** for compressed gas, such as air, supplied through hose **16**. Connected to the outlet **17** of the air gun is a conduit **18** which conveys the compressed gas emitted by the gun to the inlet **19** of vibrator **15**, whereby the vibrator is acutated in conventional fashion. Air gun **13** is suitably provided with a control trigger **21** which actuates valve means (not shown) within the gun to cause the compressed gas to flow through the gun to the vibrator as described. Advantageously, the air gun has an elongated barrel which is arranged in approximately perpendicular fashion relative to arm **11**, thus providing a convenient hand-hold for the hand of a user, as shown in phantom outline.

At the end of arm **11** opposite the point of connection of vibrator **15**, there is provided appropriate means for contacting the anode support bar or a portion of the basket to be vibrated. Typical contact means which can

be used for this purpose include a split bushing or nipple **22** placed adjacent an appropriate portion of the basket, such as its rim, whereby the vibrating effect of the apparatus is transmitted to the basket.

In a typical application of the apparatus of the invention, as shown in the drawing, the vibrator **10** is used in conjunction with an electrically conductive basket **30** which is suspended by means not shown in a bath **31** of an electrolyte. The basket is electrically connected via line **32** to the positive side of a suitable power supply represented schematically by battery **33.** The negative side of the power supply is connected to the cathode, which is typically the article to be plated (not shown) and which is immersed in another section of the electrolyte bath **31.**

Basket **30** is provided with suitable openings **36** in its side walls to permit ready access of the electrolyte solution to the interior of the basket. As shown, the interior of the basket contains a supply of suitable anode material **37** in particulate form which is gradually consumed as the electroplating operation proceeds.

In order to compact the anode material in the basket before filling with fresh anode material or at other appropriate intervals, the basket is shaken down with the apparatus of the invention. To accomplish this result, the user, grasping the apparatus by the barrel of air gun **13,** places bushing **22** adjacent the rim of basket **30** and pulls trigger **21.** The stream of compressed gas which enters vibrator **15** causes a vibratory force to be applied to the edge of the basket, thus producing the desired settling of the anode contents.

It will be seen that the invention provides a simple, inexpensive, yet highly effective apparatus for achieving uniformity of plating results in an electroplating operation of the soluble anode type in which an anode basket is used. In addition, use of the invention eliminates damage to the anode baskets which has commonly occured in the past as a result of striking the basket for settling the contents.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom as modifications will be obvious to those skilled in the art.

What is claimed:

1. Portable apparatus for vibrating an electrically conductive anode basket containing a supply of particulate anode material in an electroplating process, said apparatus comprising:

an elongated rigid arm;

a pneumatic gun mounted on said arm between the ends thereof, said gun having inlet means for supplying a stream of compressed fluid to said gun, outlet means for said stream of compressed fluid and valve means for controlling the flow of said compressed fluid through said gun;

pneumatically actuated vibrator means connected to one of said ends of said arm, whereby actuation of said vibrator means produces a vibratory motion along the longitudinal axis of said arm;

conduit means leading from said outlet means of said air gun to said vibrator means for supplying a stream of compressed fluid to said vibrator means for the actuation thereof; and

contact means connected to the other said end of said arm adapted to bear against said anode basket and to impart vibrational movement to the contents thereof when said vibrator means is actuated.

2. The apparatus of claim **1** in which said air gun is contained in an elongated housing arranged generally perpendicularly to said arm, thereby affording a handhold for the user of said apparatus.

3. The apparatus of claim **2** in which said elongated housing is provided with a trigger for actuating the valve means of said gun.

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