March 14, 1961 H. KENMORE ET AL 2,975,120

ELECTROPLATING APPARATUS

Filed June 30, 1955

FIG. 1.

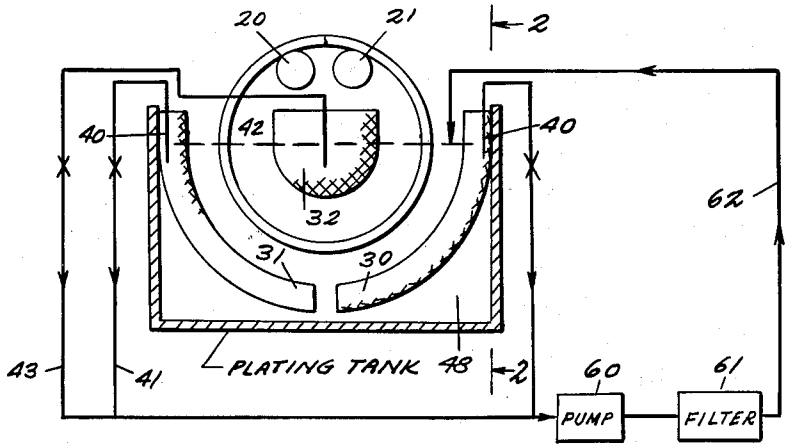
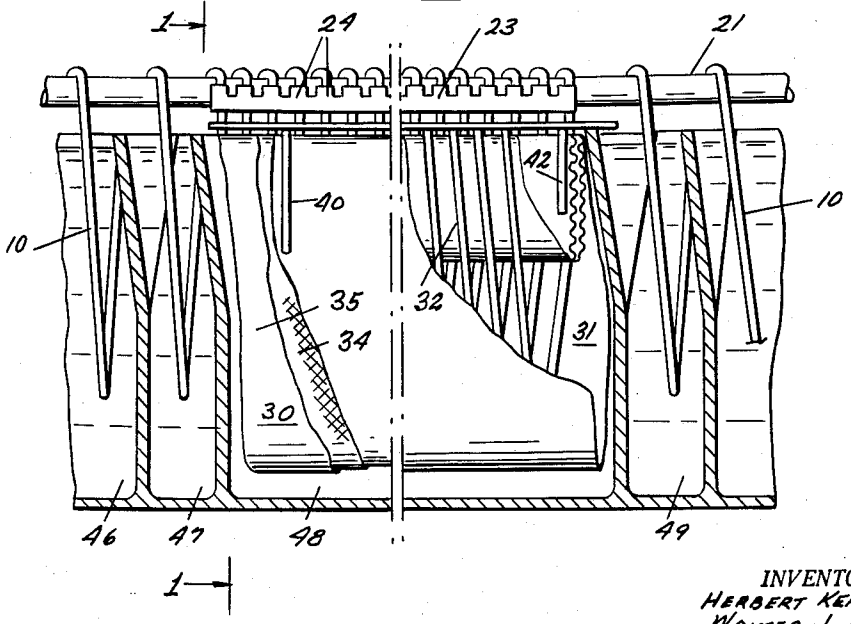


FIG. 2.



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ELECTROPLATING APPARATUS

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1 Claim. (Cl. 204—207)

This invention relates to a plating process for plating with metal cyanide baths, particularly copper cyanide baths.

In plating a metal from a cyanide bath it is of especial importance to maintain the proportion of free cyanide in the bath within certain limits. It is also important to maintain the concentration of metal ion in the electroplating bath, i.e., as much fresh metal ion must be supplied to the electroplating bath as is removed by the electroplating process. On the one hand to obtain the required anode corrosion rate free cyanide ion must be maintained next to the anode continuously and the more free cyanide in this region the better corrosion is obtained. On the other hand the amount of free cyanide that can be maintained is limited. With too much free cyanide, the efficiency of the electroplating process decreases, the current density that can be employed is more limited and the character of the deposit is less desirable. For this reason the problem of maintaining a certain uniform proportion of free cyanide is critical. When the anode is not bagged the difficulties connected with anode corrosion may be solved by assuring proper circulation of the bath. But where an especially smooth plating is required the anode must be bagged and bagging the anode creates the problem of proper anode corrosion.

Among the objects of this invention is to provide a process and apparatus for obtaining excellent anode corrosion in a cyanide electroplating system without overloading the electroplating bath with free cyanide even when the anode is bagged.

This invention is based on the discovery that the desired anode corrosion and a high proportion of metal ion in the plating bath outside of the anode compartment may be obtained by positively circulating the solution from the anode compartment or basket to the body of the electroplating bath solution. The solution may be moved by a syphoning device or by a pump means. After removal from the bath the solution is temporarily stored in a reservoir, if desired. Before being forced back into the body of the electroplating bath the solution is preferably filtered. As an alternative method a pump or similar means may be employed to force solution from the plating bath section into the anode compartments. In addition to the continuous positive circulation of the solution between the anode compartments and the plating section it has been found desirable to agitate the bath in any known manner as would be required if the anodes were not bagged.

The invention both as to its organization and its method of operation together with additional objects and advantages thereof will best be understood from the following description of specific embodiments thereof when read in connection with the accompanying drawing in which:

Fig. 1 is a cross sectional view taken on line 1—1 of Fig. 2 of a continuous type of wire plating machine fitted with the improvement of the invention.

Fig. 2 is a cross sectional view partly cut away taken along line 2—2 of Fig. 1.

In the apparatus shown, a heavy wire **10** in the form of a helix is passed through a series of baths **46, 47, 48, 49**, etc. including the electroplating bath **48**. A pair of horizontal rotating rollers **20, 21** guide the helix through the baths **46–49**. During passage through the electroplating bath **48** the wire is made the cathode by the contact means **23** having a plurality of fingers **24** adapted to elastically press against the coils of helix of the wire **10**. The anode structure comprises the two bags **30** and **31** outside the helix of wire **10** and the basket **32** inside the helix of wire **10**. Inside of the bags are pieces of the metal which is being plated. These pieces of anode metal are omitted for clarity in Fig. 2 but may take any desired form. The outside form of the anode structure may be maintained in the desired shape by supporting the bags **34** with a wire mesh structure **35** of stainless steel, for example. One continuous basket **32** for holding the inside anodes and two continuous bags holding the outside bag members **30** may be employed, as shown, or a plurality of anode structures fitted with separate bags may be employed.

Extending down into each of the separate outside bags **30** and **31** is at least one tube **40** connected to pipe line **41**. Extending into the inside anode bag **32** is the tube **42** connected to pipe line. Both of the tubes **40** and **42** are connected by means of a suitable manifold device to pump **60**. If desired tubes **40, 41** and **42, 43** may be in the form of syphon tubes feeding at their lower end to a reservoir. The liquor delivered by tubes **41, 43** is passed through a filter means **61** and then pumped back into the body of the electroplating solution by means of pipe **62**, etc. The body portion of the bath **48** is continuously agitated so that liquor introduced by pipe system **62** is uniformly distributed throughout the body of the liquor. No amount of agitation, however, produces any substantial amount of penetration of the body of the electroplating solution through the bags of the anodes except when the solution is drawn off from the inside of said bags as described, or pumped forcefully through the anode compartment. The arrows on lines **41, 43, 63** etc., show the direction of flow when the bath solution is removed from the anode bags **30, 31** and pumped to bath **48**. The direction may be reversed and the bags **30, 31** may be closed at the top, if desired. A very satisfactory way of agitating the solution is to feed compressed air to the lower portion of the bath **48**.

In the cyanide electroplating processes, the free cyanide should be maintained at a concentration of between ½ oz. per gallon and 2½ oz. per gallon. With lower amounts of free cyanide than ½ oz. per gallon, proper anode corrosion cannot be obtained; at a concentration greater than 2½ oz. per gallon, the efficiency decreases and the character of the deposit is less desirable. The following copper cyanide bath is an example of a bath which does not produce proper anode corrosion when one bags the anodes but produces very satisfactory corrosion and a very satisfactory copper electroplating when employed with the process of the invention.

Example

Wire formed into the shape of a helix is passed through an electroplating bath such as that shown in Figs. 1 and 2 at a speed of approximately 30–50 feet per minute. A copper cyanide plating bath of the following composition is employed.

	Oz. per gallon
Copper (as metal ion)	10
Potassium hydroxide	2.5
Rochelle salts	5
Free KCN or NaCN	0.5 to 2.5

The bath is maintained at a temperature of 150°–160° F. and a current density of approximately 75 amperes per square foot is employed. In a bath of this type comprising approximately 3000 gallons, the solution is removed from the anode bags and fed to the body of the bath at the rate of about 50 to 60 gallons per minute. The bath is also agitated by passing compressed air therethrough. In this way the copper concentration of the bath is maintained at the desired 10 oz. per gallon. Without the circulation system the copper ion concentration of the bath tends to become exhausted.

The same problem which occurs with other types of cyanide baths may be solved in the same way.

The features and principles underlying the invention described above in connection with specific exemplications will suggest to those skilled in the art many other modifications thereof. It is accordingly desired that the appended claim shall not be limited to any specific feature or details thereof.

We claim:

In an apparatus for electroplating metals, a bath structure, means for suspending and rotating a helically shaped wire so that at least the lower portion thereof is surrounded by said bath structure, at least one supporting means for holding soluble anode material positioned within said bath structure inside of the path of said helically shaped wire, at least one supporting structure for holding soluble anode material positioned within said bath structure on the outside of the path of said helically shaped wire, bags around said anode supporting structures, tube means having one open end thereof extending inside of the bags in the region of said anodes, means for withdrawing the plating solution from the regions of said anodes through said tubes, a filter device and means for forcing said solution as it comes from the region of said anodes through said filter and back into the bath at a region outside of the bags of the anodes.

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