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Schaer

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[54] **CUP PLATING RACK**

[75] Inventor: **Glenn R. Schaer**, Columbus, Ohio

[73] Assignee: **Dare Pafco Inc.**, Urbana, Ohio

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[52] **U.S. Cl.** ..... **204/297 W**; 204/222

[51] **Int. Cl.** **B01k 1/00**; C23b 5/70; C23b 5/48

[58] **Field of Search** ..... 204/297 W (U.S. only), 204/222, 223, 297 R

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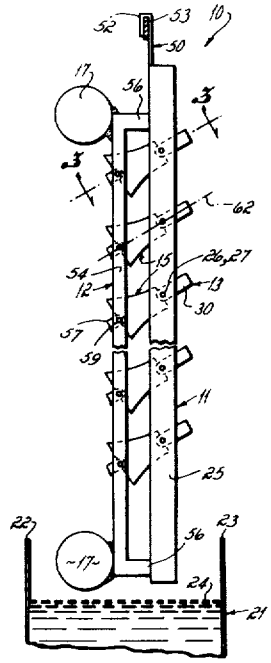
Primary Examiner—F. C. Edmundson

Attorney, Agent, or Firm—John D. Poffenberger, Esq.

[57] **ABSTRACT**

A rack for use in electroplating interior surfaces of cups or other similarly shaped recessed articles. The rack includes a multiple electrode carrying an anode support member and a multiple article or cup carrying cathode support member, the two members being longitudinally movable with respect to each other. The electrodes of the anodes are aligned with and project into the recess of each cathode supported cup or article. Upon insertion into an electroplating solution, floats attached to one of the support members cause it to move longitudinally with respect to the other so that the cups are disposed or tipped to an upwardly facing position so that gas will not collect on the interior surface. Upon removal of the rack and the attached floats from the solution, the support members move longitudinally with respect to each other to a position in which the cups are tipped downwardly to a draining position whereat each supported article will drain of plating solution.

9 Claims, 8 Drawing Figures



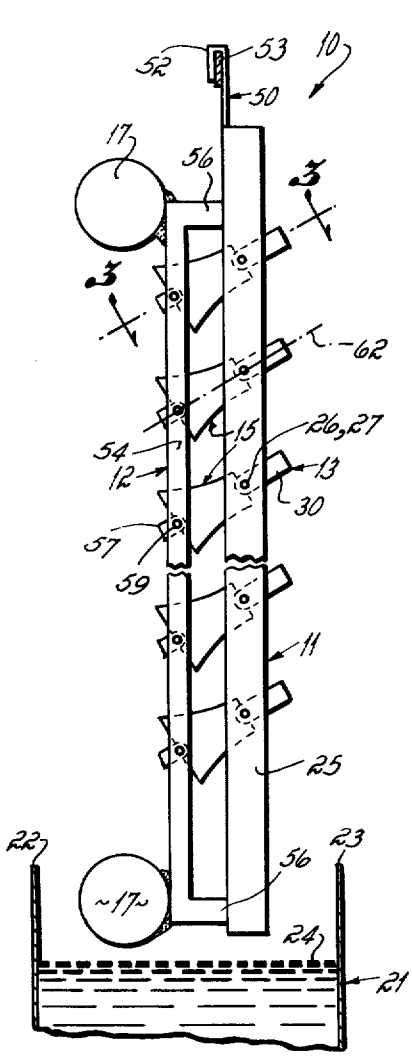


Fig. 1

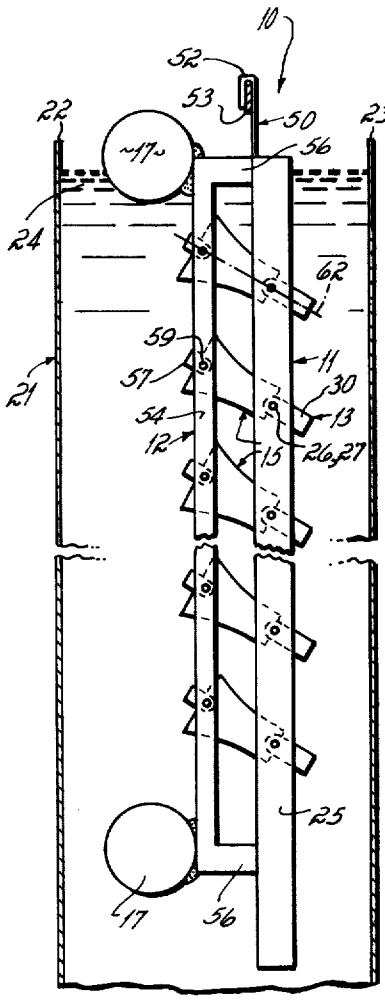


Fig. 2

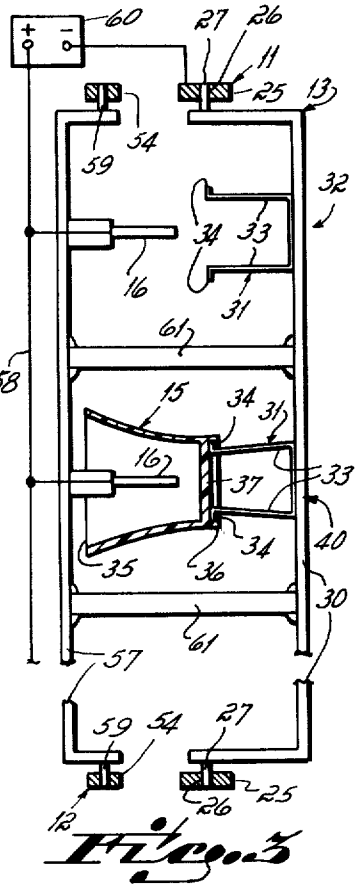


Fig. 3

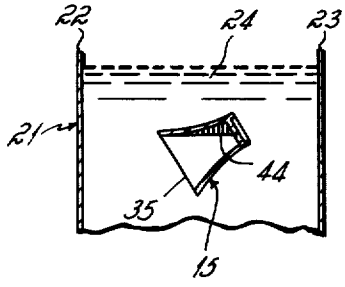


Fig. 5

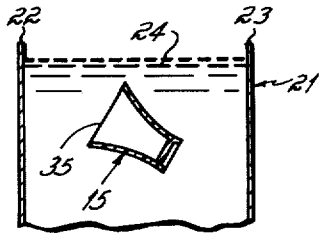


Fig. 6

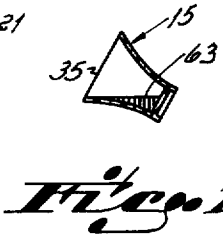


Fig. 7



Fig. 8

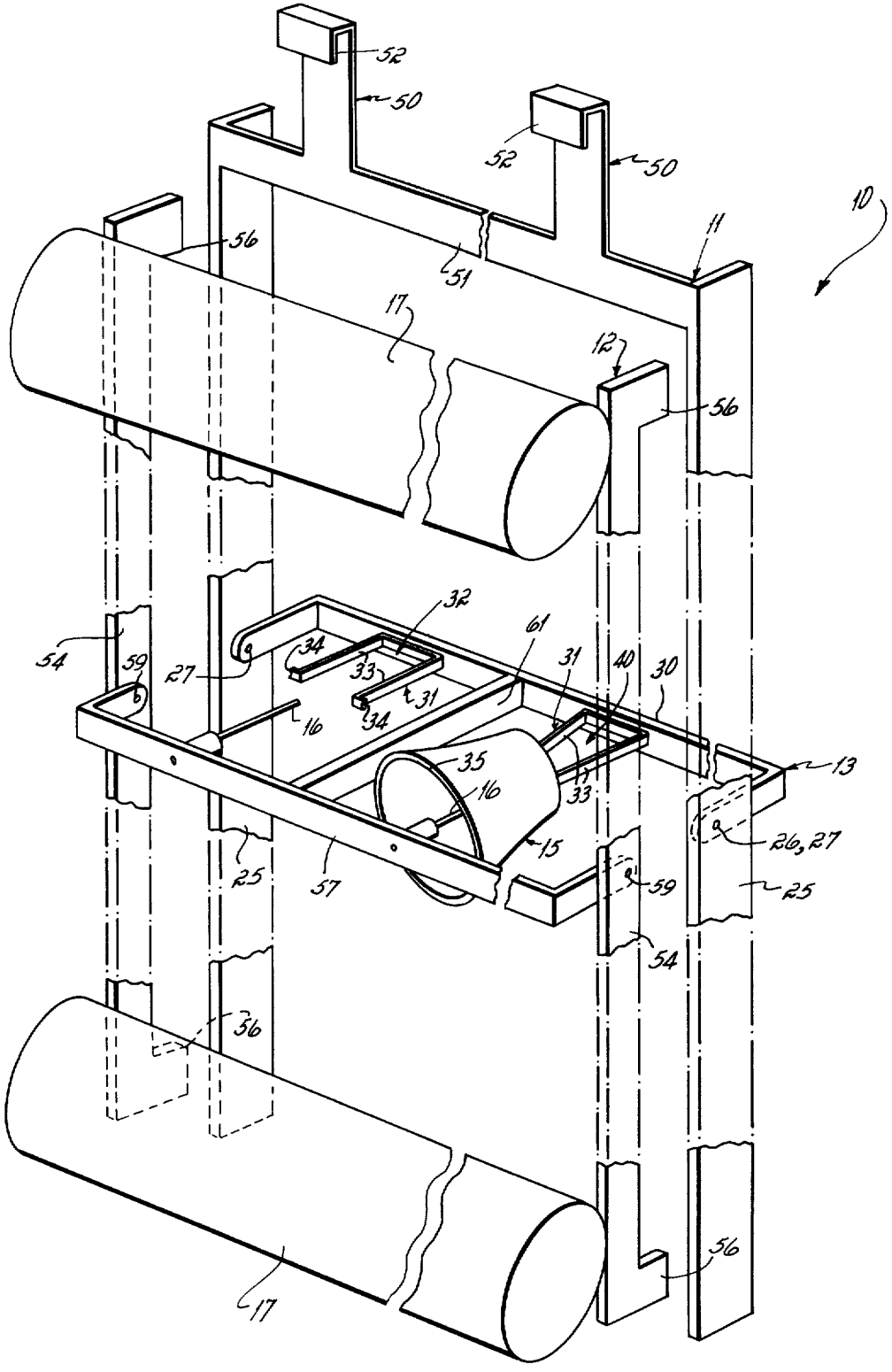

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Fig. 4

CUP PLATING RACK

BACKGROUND OF THE INVENTION

This invention relates to racks for supporting articles during electrolytic coating and especially relates to racks for supporting cups and other similar shaped recessed articles or containers to permit electroplating of interior surfaces of such recess articles.

In the field of electrolytic coating, articles that are being coated are generally suspended in a solution adjacent an electrode. A power supply is connected between the articles and the adjacent electrode so that a current will flow between each electrode and each article to cause a chemical reaction to occur at the surface of the article. This chemical reaction causes a substance such as silver, copper, nickel, or chromium to be coated onto the surface of the article. This coating is generally very thin, however, it normally is a coating of a substantially uniform thickness which, depending on the type of material being plated, may provide a coating having a very high luster.

The chemical reaction which occurs at both the anode and the cathode during the coating process frequently causes the production of a gas. Gas bubbles form on the anode or the cathode which gradually increase in size and eventually rise toward the surface of the plating solution. The formation of the bubbles within the plating solution does not drastically affect the uniformity of the coating if the article does not have any surfaces below which the bubbles can become trapped. In the case of cups, recessed articles, containers, and the like, the bubbles formed during electroplating may collect within the container or beneath an overhanging surface. As the gas collects a gas pocket is formed which prevents contact between a large portion of the interior surface of the article and the plating solution. These gas pockets then cause thickness variances of the coating on the interior surfaces of the article because the gas pockets prevent continuous contact of all interior surfaces with the solution for the whole period of time that the article is being electroplated.

Prior art racks have positioned each cup or hollow supported article with its open mouth permanently disposed upwardly permitting a uniform coating to form on the interior surfaces thereof. Because the mouth of the article is disposed upwardly though, plating solution remains inside the cup or article after removal from the solution until the cup is removed from the rack and dumped of solution. If the coating solution remains inside the container after the coating operation is complete, continued contact of the freshly deposited coating with the solution has been found to detrimentally affect the adhesion of the coating to the container.

One approach to solving this adhesion problem has been to have the operator invert the rack after removal from the solution to drain all the recessed articles supported therein. This approach, however, is time consuming and requires either more complicated equipment or more man power than is desirable.

Therefore, it is a principle objective of this invention to provide a rack for supporting recessed articles for electroplating surfaces thereof which do not permit entrapment of evolved gases and which does not require rack inversion after removal from the electroplating solution.

It is a further objective of this invention to provide a rack for supporting articles to permit coating the interior surface thereof which is automatically operative to prevent gas collection on the interior surface of the article during electroplating and also automatically operative to drain plating solution from the articles immediately as the rack is removed from the solution.

In order to achieve these objectives, a rack is provided which includes both an anode and a cathode support member. Connected to one support member is a plurality of electrodes generally in the form of rod-like bodies, each such electrode being electrically connected to one electrical terminal of a power supply. Cups or recessed articles are supported on the other support member in alignment with the electrodes so that an electrode projects into the mouth of each supported cup during electroplating. When the rack is inserted into a plating solution, the support members move automatically and longitudinally with respect to each other to a position where the cups are disposed with their open mouths facing upwardly to prevent bubble formation on the interior surface during electroplating. When the rack is removed from the solution, the support members automatically move longitudinally with respect to each other to a draining position whereat the mouth of each supported article faces downwardly permitting plating solution to drain from the article.

The above and other objects and advantages of this invention will become more readily apparent from the following detailed description of the drawings in which:

FIG. 1 is a side elevational view of a plating rack incorporating the invention of this application, the rack being illustrated as disposed at its draining position above a plating bath.

FIG. 2 is a side elevational view of the same rack when disposed at its plating position within a plating bath.

FIG. 3 is a cross-sectional view taken along the section line 3—3 of FIG. 1.

FIG. 4 is a perspective view, partially broken away of the plating rack of FIG. 1 but disposed midway between the plating position and the draining position.

FIG. 5 shows a cup in a solution with its mouth disposed downwardly in a manner which permits collection of gas within the cup during coating thereof.

FIG. 6 shows a cup in a solution disposed within a solution with its mouth disposed upwardly to thereby prevent collection of gases therein during coating operations.

FIG. 7 shows a cup located outside of a bath with its mouth facing upwardly so that solution can collect therein.

FIG. 8 shows a cup disposed above a solution with its mouth facing downwardly to thereby permit coating solution to drain from the cup.

GENERAL DESCRIPTION

The cup or recessed article plating rack **10** of the invention generally includes a main frame **11** from which all other rack elements are suspended. An auxilary frame **12** is located in parallel spaced relationship to the main frame by a plurality of support frames shown generally as **13**, each support frame **13** being pivotally connected to both the main frame **11** and the auxilary frame **12**. Each support frame **13** includes means for supporting cups or similar recessed articles **15**. Electrodes **16** are also supported on the support frame **13**, each electrode being positioned to project through the

open mouth of a supported article **15**. A pair of floatations **17** are located on the ends of the auxilary frame **12** so that when the rack is placed into a plating solution, the auxilary frame **12** will be displaced upwardly with respect to the main frame **11**. This upward displacement is operative to position the supported articles **15** with their open mouth facing upwardly so that bubbles which form during plating can escape from the article.

When the rack **10** is lifted by the main frame **11** out of the plating solution, gravity causes the auxilary frame **12** to be displaced downwardly with respect to the main frame **11**. This displacement automatically causes the supported articles **15** to be tilted downwardly so that all plating solution can drain out of the supported articles through their downwardly facing open mouths thus preventing prolonged contact of freshly plated surfaces with the plating solution.

DETAILED DESCRIPTION

Referring first to FIG. **1**, a plating rack designated generally as **10** is disposed above a container designated generally as **21**. The container **21** comprises side walls **22** and **23** and forward rear and bottom walls (not shown) which form an open topped container for holding a plating solution **24**.

The rack **10** as viewed in FIGS. **1, 2** and **4** is generally rectangular in shape and can support a plurality of containers in several parallel spaced rows. The rack includes a main frame **11** and an auxilary frame **12** which are located in parallel spaced relation to each other. The main frame **11** has two vertically arranged side bars **25**. Disposed along the longitudinal center line of each side bar **25** as shown best in FIG. **1** are a plurality of pivot holes **26** which provide a pivotal support for pivot pins **27** which pivotally interfit at one end with the holes **26** and rigidly contact at the other end to elongated support bars **30**, one such support bar **20** comprising part of a support frame **13**. This arrangement is best shown in FIG. **3**. Each side bar **25**, pivot pin **27** and support bar **30** is preferably formed of a strong, rigid electrically conductive material such as stainless steel. Each pivot hole **26** in a side bar **25** is of a size to pivotally accommodate a pivot pin **27** but, at the same time, provide a good electrical connection between the side bar **25** and the support bar **30**.

Referring again to FIG. **3**, a plurality of article supporting U-shaped spring clips **31** are rigidly secured to and in electrical contact with each support bar **30**. The clips **31** are located along the length of each support bar **30** in parallel spaced relationship. Each clip **31** is preferably formed of a spring-like material such as stainless steel strips formed with an unflexed shape substantially like that shown generally at **32**. Each U-shaped clip **31** has a pair of arms **33** having laterally and outwardly extending contact portions **34** located at their extreme ends **31**. While the clips **31** are preferably formed of a springy stainless steel material, it will be recognized by those skilled in the electroplating art that other materials might be used provided that the material selected will resist corrosion caused by the chemicals in a plating solution.

An article or container **15**, shown in section in FIG. **3**, is supported by the rack in a position to permit coating of its interior surfaces. The container **15** is shaped like a "shot glass" or a measuring cup and includes a mouth indicated generally at **35** through which fluids or the like can fill or drain from the container **15**. The container **15** also preferably includes a cylindrically shaped lip portion **36** which extends downwardly from the bottom wall **37** of the container **15**. This lip portion **36** provides a surface against which the laterally extending contact portion **34** of a clip **31** can press outwardly to thereby support a container **15**. This supporting arrangement is shown generally at **40** wherein the arm portions **33** of the clip **31** are bent inwardly towards each other and the contact portions **34** are in outward pressing engagement with the inner surface of the lip portion **36**. In this configuration, the outward pressing force of the clip **31** on the lip portion **36** is operative to support the container **15**.

Cups or recessed articles, such as the cuplike containers **15** shown in FIGS. **1–4**, are manually mounted on the plating rack. The workman who mounts the containers on the rack positions the container so that the electrode **16** projects through the container mouth into its interior. Then, by grasping the arms **33** of the spring clip **31** and flexing them inwardly, the lip portion **36** of the container **15** can be positioned so that when the clip **31** is released, the contact portion **34** of the clip **31** moves outwardly and comes into contact with the inner surface of the lip portion **36**. The spring pressure of the clip **31** directed outwardly against the lip portion **36** is sufficient to support a container **15** in the manner shown in FIG. **4**. That is, the container **15** is supported near its base by the spring clip **31** mounted on a support bar **30** and disposed so that an electrode **16** projects through the mouth and into the interior of the container.

In one application or usage of the invention of this application, the cups are made of a plastic material such as a baked polyvinyl chloride. In order to electroplate a container made of such a meterial, the surface is chemically treated to make it electrically conductive, the surface treating chemicals being included in the plating solution. Once the container is put into the plating solution, the surface becomes electrically conductive because of the chemical reation with the solution. Thereafter, the surface of the container is electrically connected to the cathode due to physical contact with the spring clip **31**, thereby causing the entire surface of the cup to be at the cathode voltage and permitting surface electroplating.

Since the container itself must have an electrically conductive surface in order to permit electroplating of chemicals thereon the container may be made of an electrically conductive material and need not be constructed of treated plastic materials of the type described above. That is, each container can be made of an electrically conductive metal material or, alternatively, it may be constructed of some other material whose surface has been treated in a manner to be electrically conductive.

One of the problems associated with coating cups or containers and especially electroplating of cups is shown schematically in connection with FIG. **5**. A cup or container **15** is shown with its mouth **35** disposed generally downwardly within a plating solution **24**. As is well-known in the art of electroplating, gases are frequently released during the chemical reaction which occurs at the cathode or at the anode during the electroplating process. When such gases form during electroplating of the interior surfaces of a cup **15** disposed as shown in FIG. **5**, the gases are trapped within the cup

itself and form a gas pocket as shown generally at **44.** As the volume of trapped gases increases within the container, plating solution is displaced and the trapped gas pocket **44** prevents interior surface contact with the plating solution. When this occurs, the interior container surface cannot be electroplated and, therefore, plating on the interior surface of a container is uneven or incomplete.

In order to overcome the problem of uneven or incomplete plating on the interior surface of containers, a cup **15** should be disposed as generally shown in FIG. **6** during the electroplating process. When the cup **15** is so disposed within the plating solution **24,** the mouth **35** of the cup **15** is disposed upwardly to thereby permit any gas bubbles which form on the interior surface of the container **15** to escape upwardly towards the surface of the plating solution **24** to thereby prevent the formation of a gas pocket within the container **15** during the electroplating process.

A further problem which arises in electroplating of containers is that the interior surface of a container is difficult if not impossible to plate with typical plating racks. In such typical electroplating racks, the container to be plated is postioned within a plating solution and electrically connected to a source of electrical current. An electrode of opposite polarity is disposed within the plating solution to thereby cause a current to flow through the solution from one electrode to another to thereby cause an electrochemical reaction to occur at the surface of the container being plated. For containers, such as cups and the like, however, this approach is ineffective at providing a uniform coating on the interior surface of the container. This problem, however, is overcome by the present rack by the electrode placement as will become more clear hereinafter.

Referring again to FIG. **4,** the plating rack **10** has a hanger **50** which extends upwardly from the uppermost portions of the assembly and is preferably electrically connected to a cross brace **51** which extends between and is rigidly connected at both ends to the two side bars **25** and is preferably constructed of a strong and rigid metal of the type used for the side bars **25.** A second cross brace (not shown) may be provided near the lowermost end of the two side bars **25** to rigidly interconnect the side bars **25** to thereby provide a rigid assembly.

The hanger **50** is preferably formed with a U-shaped hook **52** disposed at its uppermost end with the open end of the U facing downwardly to thereby permit the hanger to rest on top of the bus bar **53,** as shown in FIG. **1,** which, for the preferred embodiment is connected to the negative lead of a direct current power supply. In the preferred embodiment, two hangers **50** are provided for each plating rack **10** to thereby permit the rack to be hung from the bus bar **53.** Since the hanger **50** is rigidly connected to the side bars **25** by weldings or other rigid connection, the negative voltage from the power supply is thereby connected to any container **15** supported by a clip **31.**

Referring again to FIG. **1** and FIG. **4,** the plating rack **10** includes an auxilary frame **12** with two elongated and substantially vertically disposed end bars **54** which are themselves positioned in a parallel spaced relationship. Cross brace members (not shown) may extend between the two end bars **54** to maintain the two bars **54** in a substantially parallel spaced relationship. These cross braces are preferably located near the uppermost and lowermost ends of the auxilary frame **12.**

Disposed at the uppermost and lowermost ends of the end bars **54** are the floatation members **17** which may be attached to the cross brace members or, alternatively the floatation members **17** may be rigidly connected at opposite ends to the two end bars **54** to form the cross braces for the auxilary frame **12.** The floatation members **17** may comprise rigid cylindrical bodies having a sealed gas chamber or, they may comprise any other suitable form of floatation such as a foamed material like Styrofoam. The two floatation members **17,** must have a sufficient buoyancy to displace the auxilary frame **12** and the other elements connected thereto longitudinally or upwardly with respect to the main frame **11** when the plating rack **10** is immersed in a plating solution **24.** It will be recognized by those skilled in the art that the preferred positioning of the floatation members **17** as shown in the drawings is not mandatory and that the floatation members **17** may be located elsewhere on the auxilary frame **12.**

Also disposed at the uppermost and lowermost ends of the auxilary frame **12** are stops **56** which comprise laterally projecting earlike portions. These stops **56** are disposed between the auxilary frame **12** and the main frame **11,** and are operative to limit the longitudinal movement of the auxilary frame **12** with respect to the main frame **11.** In an alternative form, the stops **56** can be replaced by a single stop generally located centrally along either the auxilary frame **12** or the main frame **11.**

Each support frame **13** includes a support bar **57** which is pivotally connected at opposite ends to the two end bars **54.** This pivotal connection is provided by pivot pins **59** which are rigidly connected at one end to the support bar **57.** The other end of each pivot pin **59** passes through a pivot hole in the end bars **54** to thereby provide a pivotal connection between the support bar **57** and the end bars **54.**

Each support bar **57** has a plurality of electrodes **16** positioned in spaced relation along the length thereof. Each electrode **16** comprises a rod-like body preferably made of a platinized titanium material in order to resist the corrosive properties of electroplating solutions. While a platinized titanium material is preferred, it will be recognized by those skilled in the electroplating art that other materials may be used for the electrode **16** so long as the material does not react with or in any way contaminate the plating solution in which the electrode **16** must be located during the plating process.

Each electrode **16** is electrically connected by a connector wire shown schematically as **58** in FIG. **3** to a terminal of the direct current power supply **60.** As has already been indicated, the negative terminal of the power supply **60** is preferably connected to the main frame **11** and the electrodes **16** connected to the positive terminal. Consequently, when the power supply **60** is turned on and the plating rack disposed in a plating solution, a current will flow from the electrodes **16** through the plating solution to the clip supported container **15** and ultimately back to the negative terminal of the power supply **60.** This current flow will cause an electrochemical reaction to occur to thereby electroplate the container interior surface.

In an alternative form, each electode **16** may indeed be physically mounted on the support bar **57** and the wire **58** connected directly thereto. In this latter form,

however, the support bar **57** of the support frame **13** must be electrically isolated from the support bar **30** by any suitable electrical insulation.

For example, located between each support bar **57** and its aligned support bar **30** is a plurality of electrically insulative cross braces **61** forming a rigid connection between the support bars **57** and the cup support bar **30.** In one form, the cross braces **61** comprise a plastic nonconductive material rigidly connected at one end to the support bar **57** and at its other end to the support bar **30.** In an alternative arrangement, the cross brace members **61** may comprise a rigid metalic body which is electrically insulated from either the support bar **57** or the support bar **30.** In either arrangement, however, the support bar **57** and the support bar **30** must be electrically isolated so that current cannot flow through the support frame **13.**

The cross braces **61,** the support bars **30,** and the support bars **57,** all comprise the article support frame **13** which is pivotally connected to both the main frame **11** and the auxilary frame **12.** This article support frame **13,** as viewed in the drawings, pivots a supported recessed article or cup **15** and the electrodes **16** so that the electrode **16** never contacts the recessed article as the articles are tilted between their plating position shown in FIG. **2** and their draining position shown in FIG. **1.**

Referring again to FIG. **1,** since the main frame **11** and the auxilary frame **12** are connected together by a plurality of pivotally connected support frames **13,** the auxilary frame **12** can be displaced in a longitudinal direction with respect to the main frame **11.** Since the stops **56** are disposed between the main frame **11** and the auxilary frame **12,** this longitudinal movement of one frame with respect to the other frame is limited and, in the preferred embodiment, permits the axis lines **62** of aligned clips **31** and electrodes **16** to be disposed at a 30° angle to the horizontal as shown in either FIG. **1** or **2.** The actual angle of disposition for the axis lines **62** in FIG. **1** or **2** may be different than the preferred angle, however, when the rack is located in the drain position as shown in FIG. **1,** plating solution must be able to drain from containers supported on the rack and when the rack is located in the plating position shown in FIG. **2,** the mouth of the containers supported on the rack must face upwardly so no gas pockets can form within the container during the plating process.

When the plating rack **10** is supported on a bus bar **53** above the plating solution **24,** the weight of the auxilary frame **12** and the connected elements will displace the auxilary frame **12** downwardly to the position shown generally in FIG. **1.** In this container draining position, each container **15** is positioned with its mouth disposed generally in a downward direction to thereby permit any plating solution therein to drain from supported containers.

When the plating rack **10** is positioned in a plating solution as shown generally in FIG. **2,** the floatation members **17** provide an upwardly directed force on the auxilary frame **12** to diplace it upwardly with respect to the main frame **11.** The stops **56** prevent upward displacement of the auxilary frame **12** beyond a point where the axis lines **62** are arranged at a 30° angle to the horizontal. In this configuration, each supported container **15** is disposed with its mouth facing generally upwardly to permit any gas bubbles which form during the electroplating process on the interior surfaces of the container **15** to rise upwardly and not become trapped within the container itself to thereby prevent uneven or incomplete electroplating on the interior surfaces of the cup.

Referring now to FIGS. **6** and **7,** a container **15** is shown in an orientation substantially identical to the plating position for containers as shown in FIG. **2.** If a container was so disposed when withdrawn from the plating solution, a pool plating solution **63** will collect in the bottom of the container as the solution cannot drain therefrom when such a rack is lifted vertically out of the plating solution. This is undesirable because continued contact of the plating solution with a freshly plated interior surface of a container reduces the adhesion of the fresh plating and makes the plating material more likely to fall off the interior surface leaving a blemished appearance.

This problem can be solved by manually tilting the container as it is removed from the plating solution. However, the longitudinal movement of the auxilary frame with respect to the main frame and the pivoting movement of containers supported on the support frame is automatically operative to drain each container as the rack is lifted from the plating solution.

As has already been generally indicated above, the nature of the plating solution is frequently highly corrosive and, therefore, special precautions must be taken in order to prevent corrosion of the rack. This may be achieved by constructing all plating rack members of a material which is not susceptible to corrosion or dissolving in the plating solution itself. Since materials having this characteristic are generally very expensive, however, an alternative and less expensive approach is desirable. In the preferred embodiment of this invention, the exposed parts are preferably made of stainless steel or platinized titanium and the remainder of the assembly is covered with a baked plastisol material which is chemically inert in a plating solution to thereby prevent contact of the rack parts with the plating.

The foregoing description has been made with particular emphasis on a rack suitable for plating the interior surfaces of a container such as a cup, however, the rack may actually be utilized for plating the entire exterior surfaces of containers as well as the interior surfaces at the same time. Plating of the exterior surfaces of containers like the cups shown in the drawings is achieved by suspending the rack in a plating solution as shown generally in FIG. **2.** In addition to the electrodes located inside each container supported on the rack, additional electrodes are located in the plating solution at positions exterior to the containers thereby permitting current flow through the solution between these additional electrodes and the exterior surfaces of each container. Consequently, the desired chemical reaction will occur at the exterior surfaces as well as at the interior surfaces of each supported container.

While the foregoing description has been made with particular emphasis on a preferred embodiment of the invention, it will be recognized by those skilled in the art that numerous modifications may be made without departing from the spirit and scope of the invention. In particular, numerous possible hinging arrangements might be employed to permit other forms of movement of the auxilary frame with respect to the main frame. In one form, the electrodes might be located on the assembly in a fixed spatial relationship while the containers were positioned on a pivoted assembly which would

permit pivotal movement of supported containers between a plating position like that shown in FIG. 2 and a draining position like that shown in FIG. 1. In this manner, only the cup support mechanism need be pivotal in its operation, however, the electrodes must be located with respect to the cups in a position which will prevent the anodes from actually contacting the cups at either the plating or the draining position.

The plating rack may also be designed to facilitate loading and unloading. By having the auxilary frame hingedly connected to the main frame, the auxilary frame can be swung away from the main frame, leaving the clips exposed. The exposed clips can be easily manipulated to permit speedy loading and unloading of the rack. Alternatively, one frame may be easily disconnected from the other frame, thereby providing easy access to the clips for loading and unloading.

The above and other modifications may be made by those skilled in the art without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. A rack for supporting open mouthed recessed articles during electroplating of an interior surface comprising, in combination:

a first elongated substantially planar frame;

a second elongated substantially planar frame;

at least two support members pivotally connected to each said frame member;

at least one cross brace member connected at opposite ends to one support member to form a support frame which pivotally interconnects each said planar frame and permitting longitudinal movement of one frame with respect to the other frame, said cross brace member being connected to said support members in a manner so that each support member is electrically insulated from the other;

at least one stop member mounted between said frames to limit the relative longitudinal movement allowable of one frame with respect to the other frame, the two limits of relative longitudinal movement of said frames define a plating position and a draining position;

a plurality of spring clip members each shaped to fixedly support a recessed article by engagement with each article generally at the article base, each said spring clip member being formed of a flexible construction and mounted on one said support member pivotally connected to said first frame, said spring clip members being operative to support articles between said frames;

a plurality of electrodes mounted on said support members pivotally connected to said second frame, each said electrode being disposed to extend through the mouth of and into an article supported by one said spring clip member;

float means mounted on said second frame to displace said second frame upwardly with respect to said first frame when said rack is disposed in a plating solution, said relative upward movement being operative to position said frames at said plating position at which position each recessed article supported by a spring clip member is disposed with its mouth facing upwardly, the weight of said second frame being operative to displace said second frame downwardly with respect to said first frame to said draining position when the rack is removed from the plating solution whereat each supported recessed article is positioned with its mouth facing downwardly to permit draining of plating solution therefrom.

2. A rack for supporting open mouthed recessed articles during electroplating of an interior surface comprising, in combination:

a main frame;

an auxilary frame;

a plurality of support frames, each support frame being pivotally connected to both said main frame and said auxilary frame;

means on each said support frame for supporting a plurality of recessed articles;

means on said support frame for supporting a plurality of electrodes so that each of said electrodes projects through the open mouth of one of said supported recessed article into the article interior without contact therewith;

means on said auxilary frame responsive to inserting the rack into an electroplating solution to dispose supported articles with their mouth facing upwardly and responsive to withdrawal from the solution for disposing supported articles with their mouths facing downwardly.

3. The rack of claim 2 wherein said electrode supporting means and said article supporting means are rigidly connected to said support frames with each said electrode being aligned in one fixed orientation with respect to each said supported article.

4. The rack of claim 2 additionally including at least one stop member disposed between said main frame and said auxilary frame, said stop member being operative to limit longitudinal movement of said auxilary frame with respect to said main frame.

5. The rack of claim 2 wherein said last mentioned means comprises a floatation member mounted on said auxilary frame, said floatation member having sufficient buoyancy to displace said auxilary frame upwardly when the rack is inserted into an electroplating solution.

6. A rack for supporting recessed articles during electroplating of the interior surface, comprising, in combination:

a first elongated substantially planar frame;

a second elongated substantially planar frame;

at least two support frames, each said support frame being pivotally connected to each said planar frame thereby permitting longitudinal movement of one planar frame with respect to the other planar frame;

at least one stop member mounted between said planar frames to limit the relative longitudinal movement allowable of one planar frame with respect to the other planar frame, said stop member also preventing one planar frame from contacting the other planar frame, the two opposite limits of relative longitudinal movement of said planar frames define a plating position and a draining position;

a plurality of article support members mounted on said support frame to fixedly support an open mouthed recessed article each article support member being formed of a flexible construction and mounted on one of said support frames to thereby dispose each supported article between said planar frames;

a plurality of electrodes mounted on each said support frame and electrically insulated from said article support members, each said electrode being so positioned that it will not contact the interior surface of the article into which it projects as the frames move between their plating and draining positions;

float means mounted on one said planar frame to displace upwardly the frame on which said float means is mounted when the rack is disposed in a solution, said relative upward movement being operative to position said planar frames at said plating position, said upward movement also being operative to position recessed articles fixedly supported on each said article support member with its mouth facing upwardly to permit bubbles generated during electroplating to escape from each recessed article,

said planar frames being operative to move longitudinally with respect to each other upon being removed from the solution to move said planar frames to said draining position whereat each recessed article supported on each article support member is disposed with its mouth facing downwardly to permit draining of solution therefrom.

7. The rack of claim **6** wherein each said article support member provides an electrical contact between the surface of the container supported thereby and the support frame on which each said clip is mounted.

8. The rack of claim **7** additionally including:

an electrical power supply having two output terminals, each terminal having a different electrical voltage;

electrical connection means between one said terminal and each said electrode; and

electrical connection between the other said terminal and each said article support member.

9. The rack of claim **6** wherein each element of said rack excluding said article support members and said electrodes are coated with a chemically inert substance which will not chemically react with any plating solution into which the rack may be inserted.

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