US 20020005349A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2002/0005349 A1**

Katz (43) **Pub. Date: Jan. 17, 2002**

(54) **ELECTRODE DEVICE PARTICULARLY FOR A TINNING BATH AND THE LIKE**

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(21) Appl. No.: **09/822,751**

(22) Filed: **Mar. 30, 2001**

(30) **Foreign Application Priority Data**

Mar. 31, 2000 (DE)..... 200 05 957.2

Publication Classification

(51) **Int. Cl.**[7] **C25D 1/00**

(52) **U.S. Cl.** **204/194**

(57) **ABSTRACT**

Electrode device for electrochemical baths, particularly for electrolytic tinning contrivances, comprising a container **(10)** having at least one liquid-permeable wall **(14)** and comprised of a material which remains unaffected by the electrochemical fluid, whereby said container **(10)** is provided for the accommodating of a material substance necessary for the electrochemical process.

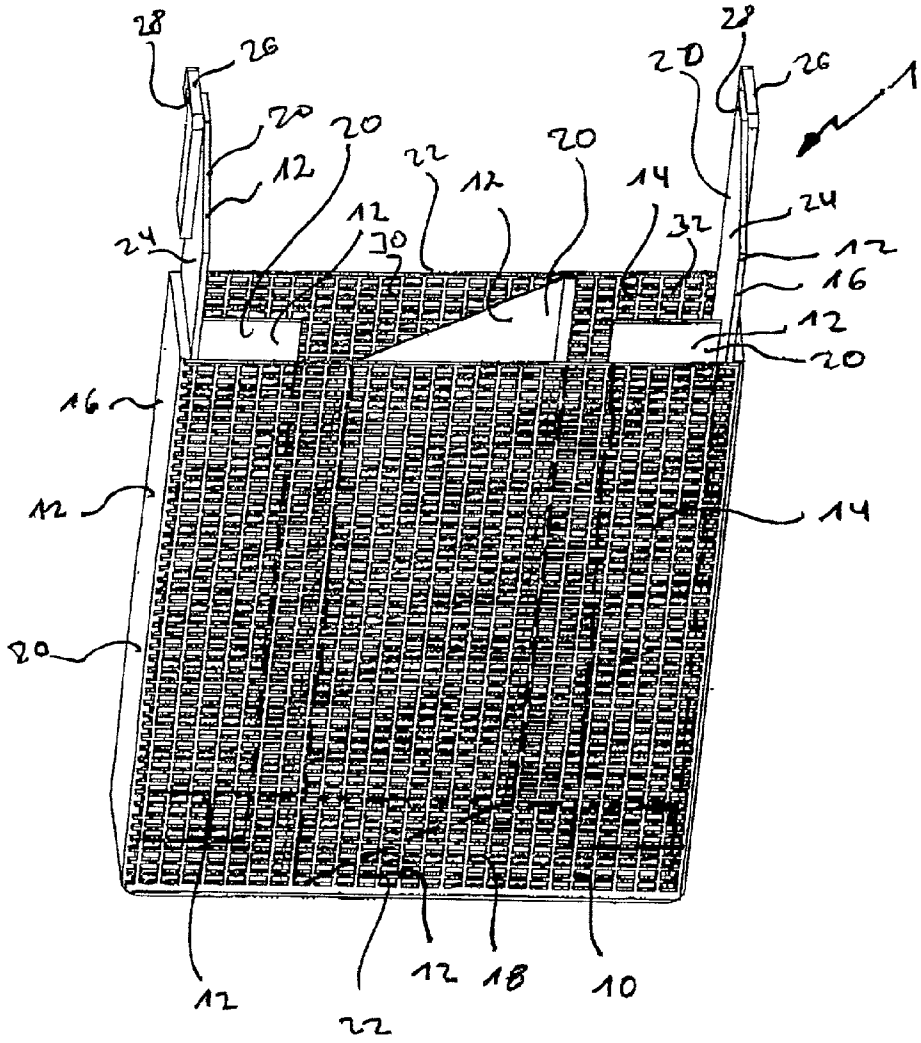

Fig 1

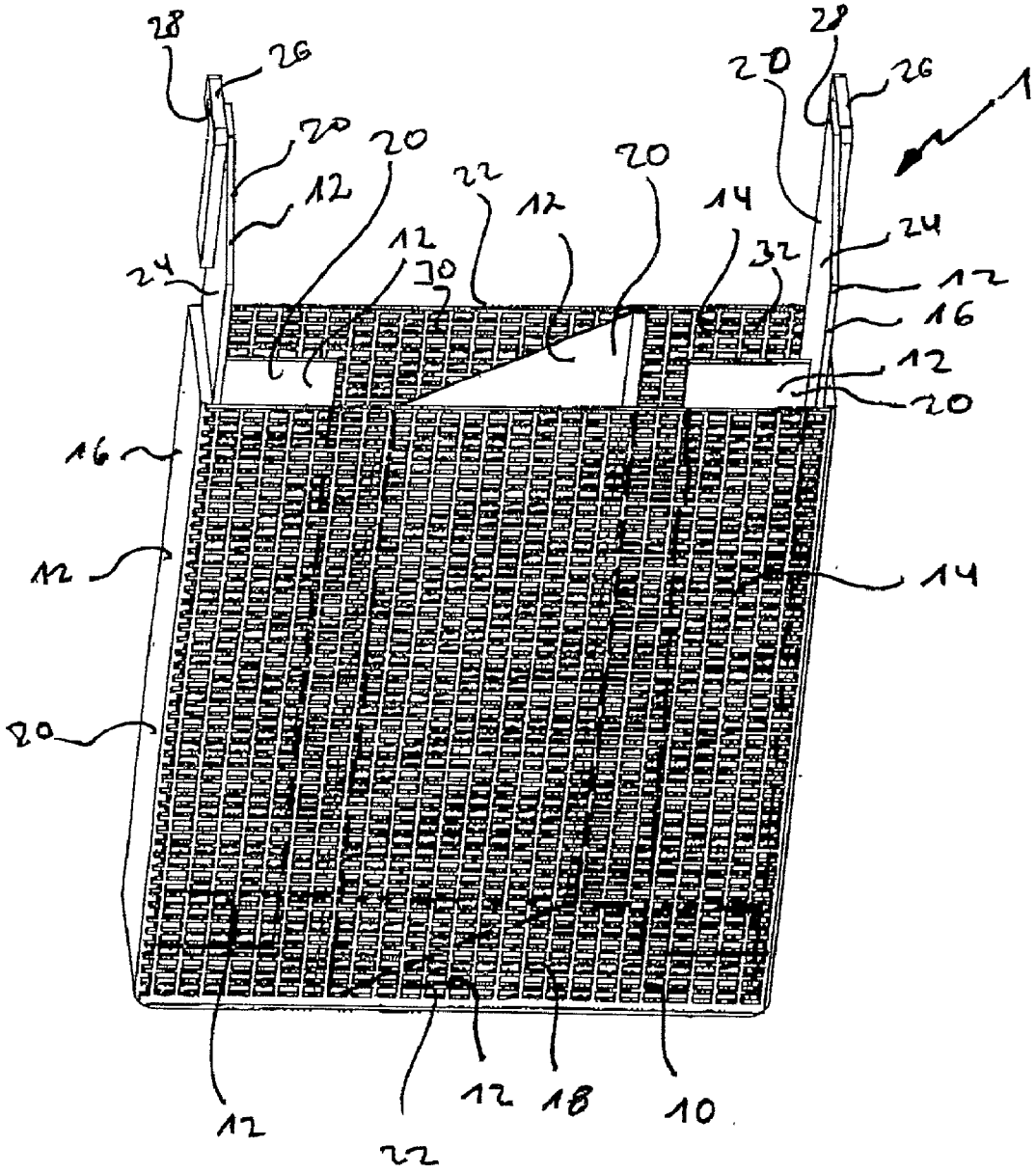
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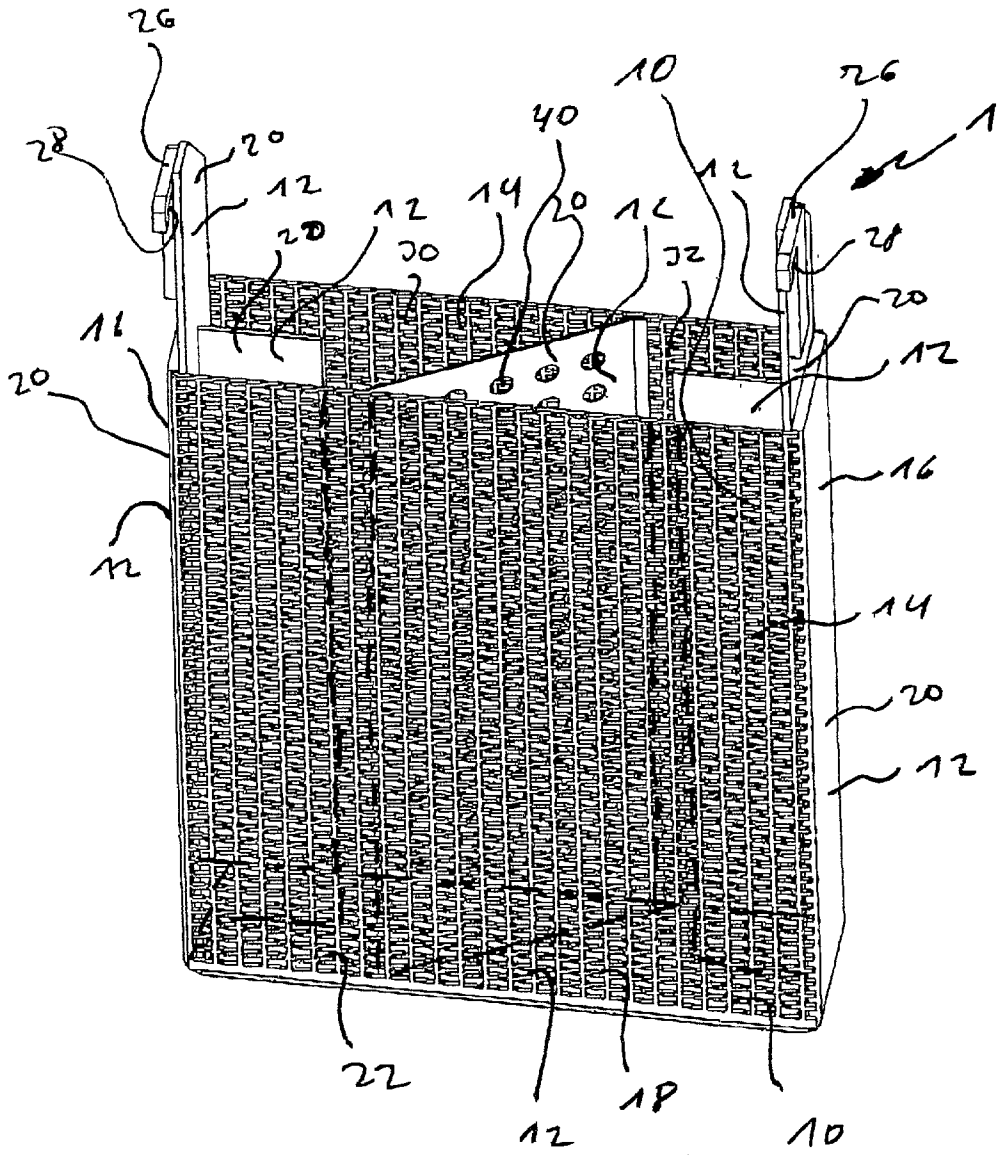
Fig. 2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ELECTRODE DEVICE PARTICULARLY FOR A TINNING BATH AND THE LIKE

[0001] The present invention relates to an electrode device for a tinning bath and the like.

[0002] The invention will be described in the following using the example of a tinning bath for copper wires and copper strands. However, it must be pointed out that this exemplary description is not to be regarded as restrictive to the application of the invention and that, on the contrary, the invention may also be applied in other areas of electrochemical and especially electrolytic treatment of materials and workpieces.

[0003] In tinning contrivances, tin is electrochemically transferred from anode to workpiece; e.g., the wire which is to be tin-coated.

[0004] Tin plates suspended into the electrolytic bath are commonly used as anodes. As the material transfer progresses over time, the anode plates shrink and have to be replaced by new ones. What remains of the anode plates is melted down in recovery and production of new anode plates.

[0005] This procedure is complicated and has the disadvantage, especially when only one anode plate is used, that the electrolytic process has to be interrupted when changing the anode.

[0006] Therefore, it has been proposed that instead of plates, baskets made of metal—namely titanium—be suspended into the electrolytic bath and that these baskets be filled with individual tin beads, so-called pellets. This process also has several disadvantages.

[0007] Thus, it is the task of the present invention to provide an electrode device for an electrochemical procedure which avoids the disadvantages of the known anode devices and enables an inexpensive realization of the electrochemical procedure.

[0008] In accordance with the invention, this task is solved by means of the object of claim **1** or **2**.

[0009] The task is additionally solved by an electrochemical bath in accordance with claim **20**.

[0010] Preferred embodiments of the invention comprise the subject matter of the subclaims.

[0011] The present invention particularly provides for an electrode device for electrochemical baths, especially electrolytic tinning contrivances, which comprise a container, the walls of which are made at least partly of an electrically non-conductive material. The electrode device further comprises a metal body which is in electrically conductive contact with an electrochemically effective substance, respectively the metal body is configured in such a way that the electrochemically effective substance accommodated in the container may be brought into contact with it.

[0012] The container can be designed in different configurations and in particular has a container bottom, likewise designated as a wall, as well as lateral side walls. The container is open to the top. The outer contour of the lateral walls may also be of varying configurations, such as rectangular, square, round, etc.

[0013] The container has at least one liquid-permeable wall. This wall is preferably configured as a grating or the like.

[0014] In the sense of the present invention, the term "wall" is to be principally understood as that of a restrictive element within the container with respect to a certain direction or to various different directions or as the vicinity of such a limiting element.

[0015] The container walls are made of a material which remains unaffected by specific electrochemical fluids, meaning in particular those electrochemical fluids as commonly used in galvanizing or tinning systems.

[0016] The container is provided for use during an electrochemical process, especially during galvanization or tin-coating, etc., for the accommodating of the substance necessary for the electrochemical process.

[0017] This substance is particularly a material which can give off or absorb ions. Preferably, the substance is an anode material. The substance can be of various forms and preferably consists of a plurality of pellets of round, conical or pill-shaped configuration.

[0018] It is particularly preferred that this substance is tin, whereby other materials are also preferred.

[0019] The substance or anode material is particularly formed in such a way that it disintegrates as the galvanization or tinning process progresses, and that the ions released are transported through the electrochemical fluid to the body to be galvanized or tinned, producing a surface layer thereupon.

[0020] According to the present invention, the metal body can be of various configurations.

[0021] Preferably, the metal body comprises a section which extends in planar or rod-like form.

[0022] It is particularly preferred that the container walls are formed at least partially by the metal body.

[0023] The metal body is supported against the container walls or at least a part thereof is arranged within said container without coming into actual contact with the container itself.

[0024] The metal body is formed as a single integral element or comprises several contacting segments such that either they are affixed to one another or not affixed. The securing means between different elements of the metal body provided as required can be configured in such a way that these elements are releasable or non-releasable.

[0025] It is particularly preferred to provide said metal body with at least one first section as well as at least one second section. Said first section or sections especially serve for accommodating the material substance. Said first section preferably comprises slab-shaped or plate-shaped or flat or otherwise configured elements which can accommodate said substance. Said first section or sections is/are preferably aligned horizontally. In accordance with the present invention, curved or otherwise shaped first sections are likewise preferred. At least one first section is formed as a sieve.

[0026] At least one part of said second sections is preferably formed such that same extends toward the depth of the container. This is particularly to be understood as that the

second sections' upper end is situated farther from the container bottom than its lower end.

[0027] It is particularly preferred for at least a part of said first sections to extend laterally away from said second section and be in electrically conductive connection with said second section.

[0028] The second section is preferably connected with one or more electrically conductive contact terminals which are made of or contain copper or the like. Said contact terminals enable the generating of an electrically conductive connection between a conduction arrangement situated external the container and the second section(s), allowing an electrical current to flow between the conduction arrangement and the second section and, if applicable, the first section as well. Said conduction arrangement is preferably configured such that it has copper bars or similar members in which the second section is hung, and particularly in such a manner that the contact terminals come into contact with said copper bars or similar members.

[0029] The second section is provided with through openings as required.

[0030] The second section is preferably rod-shaped or plate-shaped or of other configuration.

[0031] In accordance with a preferred embodiment of the present invention, the second section is arranged within the container such that it divides the container or a part thereof into different chambers. This subdivision into chambers is particularly designed in such a way that a plate-shaped second section extends between two facing walls of the container or between two facing corners of the container, particularly arranged diagonally to one another.

[0032] The second section is preferably arranged diagonally within the container, meaning relative the container transverse.

[0033] It is especially preferred for the first sections and the second sections to be arranged essentially at the container's center, meaning relative the plane of the container bottom or relative the volume of the container.

[0034] Preferably, the first and/or the second section are arranged within the container and with respect to each other such that their form, configuration and arrangement support an electrolyte flow in the direction of the electron flow as issues during the galvanization or tinning process.

[0035] Preferably, the metal body and particularly the second section are formed like a cowl which extends to the walls of the container, and particularly the container wall's inward facing side.

[0036] The electrically non-conductive material of the container walls is particularly that of plastic such as polypropylene (PP) or polyethylene (PE) or the like.

[0037] The inventive task is further solved by an electrode device in accordance with claim **2**, which provides for a container having at least one metallic liquid-permeable wall and consisting of a material which remains electrochemically unaffected.

[0038] The electrode device further comprises a metal body which is particularly configured and arranged such as previously described, but which differs from the metallic wall of the container and which is not in electrically conductive contact with same. Further, the electrode device has an electrical contact terminal, which is in electrically conductive connection with the metal body and which can generate an electrically conductive connection to a conduction arrangement external the container. The contact terminal is arranged and configured in such a way that during the electrochemical process, thus specifically during the actual galvanization or tin-coating, the electrical potential of the container's metallic walls is less than the electrical potential of the material substance which is in at least partial electrically conductive connection with the metal body.

[0039] Preferably, the metal body extends into the container such that it is supported by the container bottom surface or that it is suspended in the container with or without coming into contact with the container walls. Suspension arrangements for the metal body may be particularly provided on the container walls or on the outside of the container. Configuring the metal body as an insert which can be inserted into the container, provided it is removable, is especially preferred.

[0040] The metal body is at least partly releasable from or firmly connected to the container or may be removed completely from the container.

[0041] Preferably, the metal body has at least one component which is supported at different points on the walls of the container.

[0042] The container bottom is preferably a first section of said metal body.

[0043] Preferably, at least one first section is disposed with through openings which enable the electrochemical fluid to flow through said openings to the substance accommodated at or on the first section.

[0044] Preferably, the first sections as well as the material substance are formed in such a way that said first sections and, if applicable, said second sections are essentially wholly enveloped by said material substance, especially meaning covered, such that the surface of said first sections are not immersed and remain essentially free of electrolyte wash. In accordance with a preferred embodiment of the invention, the metal body is configured such that during the galvanization process, the current flow from the metal body is fundamentally directed centrally outward.

[0045] It is especially preferred for the metallic walls of the container and/or the metal body to be at least partly made of titanium.

[0046] The contact terminal is preferably configured such that a copper element is enveloped within a titanium layer, which is interrupted at the area of contact with the conduction arrangement.

[0047] At least one support means is preferably provided for bearing the container. Said support means particularly enables the hanging of the container in a conduction arrangement, etc., such as metal runners. Said support means are configured as hooks or other similar members and particularly preferably comprise the electrically conductive contact terminal(s).

[0048] At least one container wall segment or at least one first section is preferably disposed with reinforcing means

such as a webbing or the like. Preferably, said first sections are arranged such within the container that the substance which it accommodates comes into at least partial contact with the walls of the container.

[0049] The container preferably has at least one receiving means such as hooks or eyelets, etc., which can be employed for the transporting of the container. A transporting device like a crane with a crane hook or other such similar apparatus can then interlock with said receiving means.

[0050] Preferably, the support means and/or the receiving means are arranged below the container's upper wall edge, so that it is easy to refill substrate material into the container during the galvanization process. Preferably, the inventive device is utilized for the galvanizing of items of continuous lengths.

[0051] The task of the present invention is further solved by an electrochemical bath according to claim **20**.

[0052] The electrochemical bath comprises a reservoir with electrolyte into which the electrode device according to the present invention, respectively the inventive container having at least one liquid-permeable wall can be at least partially inserted or introduced.

[0053] Said container is in particular mounted or suspended by way of a support means.

[0054] Preferred and exemplary embodiments of the present invention as given are not to be considered as restrictions to the invention.

[0055] In the following, the invention will be described in greater detail with reference to exemplary embodiments, which are not to be considered as restricting of the present invention, and which therein show:

[0056] **FIG. 1 a** first exemplary embodiment of the invention in schematic, partly sectional view; and

[0057] **FIG. 2 a** second exemplary embodiment of the invention in schematic, partly sectional view.

[0058] **FIG. 1** shows an electrode device **1** according to the present invention having a container **10** and a metal body **12**.

[0059] Said container comprises walls, respectively wall segments **14, 16, 18**.

[0060] Said walls or wall segments **14** are arranged essentially parallel and facing one another.

[0061] Wall segments **16** are likewise arranged essentially parallel and facing one another.

[0062] Wall **18**, which is the bottom of container **10**, is a first section **22**.

[0063] Walls **16, 18** are each made of metal, particularly titanium, and configured to be fundamentally impermeable to liquids.

[0064] Walls **14** are liquid-permeable, as resulting from the fact that said walls **14** are configured as gratings. Walls **14** are made of plastic such as polypropylene or polyethylene.

[0065] Metal body **12** comprises different sections, specifically second sections **20** as well as first sections **22**.

[0066] Second sections **20** are each of plate-shaped configuration. Two of these plate-shaped second sections **20** together respectively form one lateral wall **16** of the container. Two further second, respectively plate-shaped sections **20** project at an angle into the container interior, configured here as 90°, from said lateral walls **16** formed by said second sections **20** and specifically in such a manner that they are distanced from grid-like electrically non-conducting walls **14**. A further second section **20** which is substantially of plate-shaped configuration is arranged at an inclined angle to walls **14** of container **10** and connects facing walls **14** to one another.

[0067] Plates **24** extend over the upper edge **22** of the container from the second sections **20** forming the container's lateral walls **16**; said plates also being second sections **20** of the metal body.

[0068] Container bottom **18**, which is also termed a "wall" and which is metallic, is a second section of said metal body and is in electrically conductive contact with said second sections **20**, which constitute the lateral walls **16** of container **10**, with said second sections **20** which extend from lateral walls **16** into the container interior, as well as with second section **20** arranged diagonally between non-conductive walls **14** of container **10**.

[0069] The container may be filled with pellets, such as tin pellets or the like, and specifically in such a way that said pellets are accommodated at the container bottom **18** and particularly come into contact with second section **20** which forms lateral walls **16**, second sections **20** which extend into the container from lateral walls **16**, as well as second section **20** arranged diagonally between lateral non-conducting walls **14**.

[0070] Support means **26** are arranged at the upper ends of second sections **20** projecting over the upper edge **22** of the container which enable hanging the container in a conduction arrangement such as copper bands or the like. Said support means are made of titanium and have electrically conductive contact terminals **28** at which the titanium coating is interrupted so that the copper can come into direct contact with said conduction arrangement.

[0071] The second section arranged diagonally between walls **14** is a continuous plate and realizes the dividing of container **10** into different chambers **30, 32**.

[0072] **FIG. 2** shows a second exemplary embodiment of the invention which essentially corresponds to a rotated view of the embodiment represented in **FIG. 1**.

[0073] The embodiment according to **FIG. 2** differs from the embodiment in accordance with **FIG. 1** essentially in that through openings **40** are provided in second section **20** as arranged diagonally between walls **14** of container **10**, said openings enabling electrolyte, respectively fluid to flow between chamber **30** and chamber **32** within container **10**.

1. Electrode device for electrochemical baths, particularly for electrolytic tinning contrivances, comprising a container **(10)** having at least one liquid-permeable wall **(14)** and comprised of a material which remains unaffected by the electrochemical fluid, whereby said container **(10)** is provided for the accommodating of a material substance necessary for the electrochemical process, characterized in that said walls **(14)** of said container **(10)** are of an at least partly

electrically nonconductive material, and at least one metal body is provided which is in electrically conductive contact with the electrochemically effective material substance.

2. Electrode device for electrochemical baths, particularly for electrolytic tinning contrivances, comprising a container **(10)** having at least one metallic liquid-permeable wall and comprised of a material which remains unaffected by the electrochemical fluid, whereby said container **(10)** is provided for the accommodating of a material substance necessary for the electrochemical process, characterized in that at least one metal body is provided which is different from the metallic liquid-permeable wall, which does not come into contact with said wall, and which is in electrically conductive contact with the electrochemically effective material substance, and at least one electrically conductive contact terminal is provided, which is in electrically conductive contact with said metal body and which is arranged and configured such that the electrical potential of said metallic liquid-permeable wall during an electrochemical process is less than the electrical potential of at least a portion of said material substance.

3. Electrode device according to one of the preceding claims, characterized in that said metal body **(12)** extends into or in said container **(10)** and, when applicable, is in contact with said container **(10)**.

4. Electrode device according to one of the preceding claims, characterized in that said walls **(14; 16; 18)** of said container **(10)** are formed at least partially by said metal body **(12)** of same.

5. Electrode device according to one of the preceding claims, characterized in that said metal body **(12)** comprises at least one first section **(22)** which accommodates material substance.

6. Electrode device according to one of the preceding claims, characterized in that said metal body **(12)** comprises at least one second section **(20)** which extends essentially toward the depth of said container and from which at least one first section **(22)** for accommodating said material substance branches off laterally.

7. Electrode device according to one of the preceding claims, characterized in that at least one first section **(22)** is disposed with through openings which enable the fluid present in said container **(10)** to flow from the bottom of said first section **(22)** through said first section **(22)** to the substance accommodated at the top of said first section **(22)**.

8. Electrode device according to one of the preceding claims, characterized in that said metal body **(12)** is at least at parts, and particularly in the region of said first sections **(22)**, essentially completely enveloped by said material substance.

9. Electrode device according to one of the preceding claims, characterized in that said metal body **(12)** is at least partly an insert which, provided it is removable, can be inserted into the container **(10)**.

10. Electrode device according to one of the preceding claims, characterized in that at least one first section **(22)** is releasably secured to a second section **(20)**.

11. Electrode device according to one of the preceding claims, characterized in that said container **(10)** is divided into different chambers **(30; 32)** by said metal body **(12)**.

12. Electrode device according to one of the preceding claims, characterized in that said first section **(22)** and/or said second section **(20)** is/are arranged essentially at the center of said container.

13. Electrode device according to one of the preceding claims, characterized in that said metal body **(12)** is disposed with at least one structural member arranged essentially diagonally in said container **(10)**.

14. Electrode device according to one of the preceding claims, characterized in that said metal body **(12)** and/or said metallic walls **(14; 16; 18)** is/are at least partly made of titanium.

15. Electrode device according to one of the preceding claims, characterized in that at least one support means **(26)** is provided for supporting said container **(10)**.

16. Electrode device in accordance with claim 15, characterized in that at least one electrically conductive contact terminal **(28)** is disposed in the region of said support means **(26)** in electrically conductive contact with said metal body **(12)**.

17. Electrode device according to one of the preceding claims, characterized in that at least one segment of said walls **(14; 16; 18)** of said container **(10)** or at least one first section **(22)** of said container **(10)** comprises reinforcing means such as webbing, etc.

18. Electrode device according to one of the preceding claims, characterized in that at least one receiving means is arranged on said container **(10)** into which a transporting device such as a crane having a crane hook or other such similar apparatus can interlock for the transporting of said container **(10)**.

19. Electrode device in accordance with claim 15, characterized in that said support and/or receiving means is/are arranged below the upper edges of said walls of said container **(10)**.

20. Electrochemical bath having a reservoir containing an electrolyte, into which said container **(10)** of said electrode device is introduced, in particular suspended, in accordance with one of the preceding claims.

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