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(11)

EP 1 531 195 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.05.2005 Bulletin 2005/20

(51) Int Cl.7: **C25D 17/08**

(21) Application number: **03025977.4**

(22) Date of filing: **13.11.2003**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**
Designated Extension States:
AL LT LV MK

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(54) **Work holder frame particularly for electroplating machines**

(57) A work holder frame particularly for electroplating machines, particularly adapted for electroplating systems of the types that comprise tanks for containing the electrolytic bath on the upper rim of which couplings for bus bars are arranged. The frame comprises a plurality of motorized work holder rods that are arranged

parallel to each other and in succession and are rotatably coupled and electrically connected to a supporting structure that is designed to be arranged during use within the electrolytic bath as a cathode and is provided with brackets for coupling and electrical connection to the bus bar.

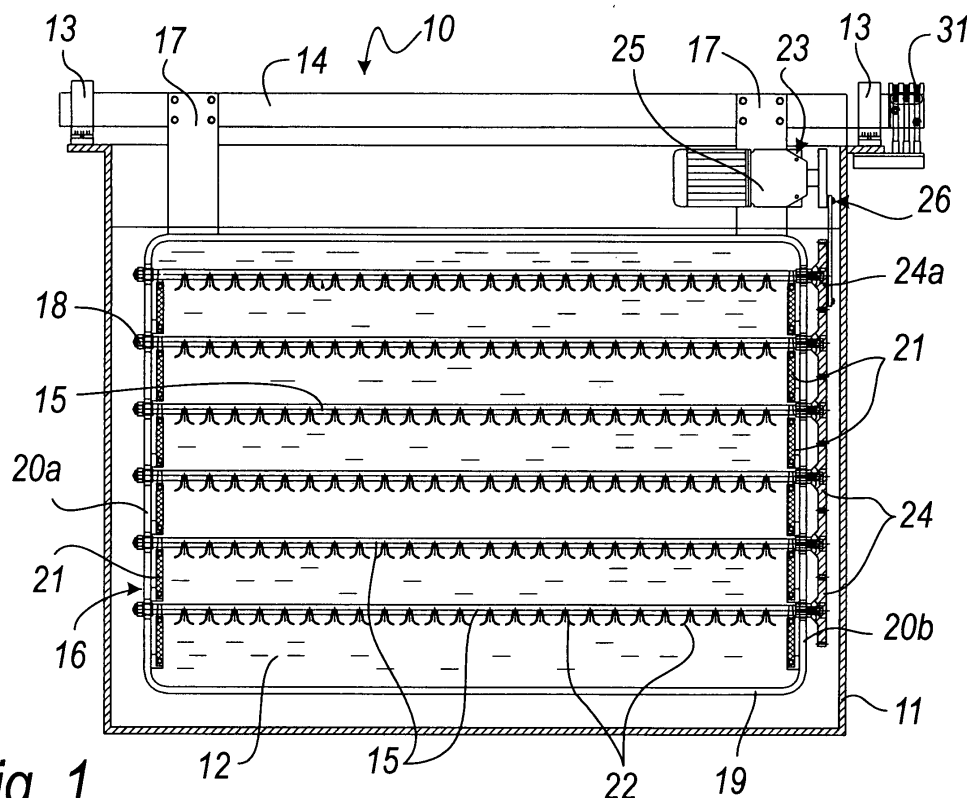


Fig. 1

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Description

[0001] The present invention relates to a work holder frame particularly for electroplating machines.

[0002] As is known, the electroplating process allows, by electrolysis, to coat with a thin protective and/or decorative metallic layer parts of various shapes and kinds, also made of metallic material or treated plastic material.

[0003] Electroplating machines comprise large tanks that contain anodes in an electrolytic bath in which the parts to be treated are immersed while arranged on frames supported by a supporting bar known as bus bar.

[0004] In practice, the parts to be treated are immersed in the electrolytic bath as cathodes.

[0005] The metallic ions, due to a difference in potential applied between the cathode and the anode, flow from said anode toward said cathode and are deposited on the surface of the parts.

[0006] The importance of the work holder frame, which has to support said parts, connect to the bus bar and allow its electrical connection to a current rectifier, is evident.

[0007] Despite the now well-established use of devices of this type, these devices are not free from drawbacks.

[0008] Normally, the relative position of the parts is affected by certain limitations that are due mainly to the fact that the surfaces to be subjected to the electroplating treatment should not hide each other, since the lines of flux of the ion current generated in the electrolytic bath would not be distributed uniformly.

[0009] This causes a generally limited loading capacity due to the space occupation and relative distance between the various parts.

[0010] Another problem that is very frequent, especially with reference to concave parts such as faucets or parts formed by molding, is the forming of air pockets within which the electrolyte cannot penetrate, consequently failing to provide final plating in the area affected by the air pocket.

[0011] An attempt is usually made to contrast this phenomenon by taking care with the arrangement of the parts upon assembly or by making the entire frame oscillate through 10-15 sexagesimal degrees.

[0012] Moreover, since the relative position of the parts (cathodes) with respect to the anodes is fixed, at the end of the treatment there is an unevenness of the deposited thickness that is not always acceptable.

[0013] The aim of the present invention is to solve or reduce substantially the above-noted problems of known types of electroplating machine.

[0014] Within this aim, an object of the present invention is to provide a work holder frame whose structure is such that it increases the loading capacity of the electroplating machine.

[0015] Another object is to provide a work holder frame whose structure is such that a uniformly distributed surface layer is deposited on the parts.

[0016] Another object is to provide a work holder frame structure that prevents the forming of air pockets.

[0017] Another object is to provide a work holder frame that has a simple structure.

[0018] This aim and these and other objects that will become better apparent hereinafter, are achieved by a work holder frame particularly for electroplating machines of the types that comprise tanks for containing the electrolytic bath on the upper rim of which couplings for bus bars are arranged, characterized in that it comprises a plurality of motorized work holder rods that are arranged parallel to each other and in succession and are rotatably coupled and electrically connected to a supporting structure that is designed to be arranged during use within said electrolytic bath as a cathode and is provided with brackets for coupling and electrical connection to said bus bar.

[0019] Further characteristics and advantages of the present invention will become better apparent from the description of a preferred but not exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a view of a work holder frame having the structure according to the invention, arranged within a tank that contains the electrolytic bath;

Figures 2 and 3 are two side views of the frame of Figure 1;

Figures 4 and 5 are respectively a front view and a side view of a work holder frame having the structure according to the invention in a further embodiment, arranged within a tank that contains the electrolytic bath.

[0020] With reference to the figures, a work holder frame particularly for electroplating machines having the structure according to the invention is generally designated by the reference numeral 10 in a first embodiment.

[0021] The work holder frame 10 is particularly suitable for electroplating machines of the types that comprise tanks 11 for containing an electrolytic bath 12 on the upper rim of which couplings 13 for bus bars 14 are arranged.

[0022] The frame 10 comprises a plurality of motorized work holder rods 15, which are arranged parallel to each other in succession and are rotatably coupled and electrically connected to a supporting structure 16, described in greater detail hereinafter, that is designed to be arranged during use within the electrolytic bath 12 as a cathode and is provided with brackets 17 for coupling and electrical connection to the bus bar 14.

[0023] The rods 15 are detachably rotatably coupled at their ends to sliding blocks 18 that can slide and be fixed in a chosen position on the supporting structure 16.

[0024] The supporting structure 16 is constituted by a substantially quadrangular outer frame 19, in which the vertically arranged portions 20a and 20b provide sliding guides along which it is possible to arrange adjustably

the sliding blocks 18.

[0025] Each rod 15 is connected electrically to the supporting structure 16 by means of pairs of flexible cables 21 arranged at its ends.

[0026] The electrical connection between the rods 15 and the support 16, however, can also be provided by means of bearings for the rotation of the rods 15 on the corresponding sliding blocks 18.

[0027] Advantageously, the flexible cables 21, the supporting structure 16 and the rods 15 are sheathed with insulating material except for the regions of mutual contact, for electrical connection, so as to allow the parts supported by said rods 15, by means of grip means 22, for example clamps, to act as a cathode, accordingly allowing electroplating.

[0028] The rods 15 are kinematically connected, by way of a corresponding kinematic chain, described in greater detail hereinafter, to a source of oscillating rotary motion 23, which is also described in greater detail hereinafter.

[0029] The kinematic chain is constituted in this case by a gear system that comprises a plurality of gears 24 that are keyed to one end of said rods 15 on the same side of said supporting structure 16.

[0030] The oscillating rotary motion source 23 is constituted, in this case, by a gearmotor 25 that is fixed to one of said brackets 17, is arranged eccentrically with respect to said gears 24, and is connected to the upper gear 24a by means of a rod-and-crank mechanism 26.

[0031] Since the gearmotor 25 is fixed to a bracket 17, it is necessary to arrange laterally to the tank 11 a three-phase movable contact 31 to supply it with alternating current.

[0032] In practice, the work holder frame 10 allows to rotate the parts mounted on said frame 10 synchronously, transferring with a single actuation the oscillating motion to the rods 15.

[0033] The work holder rods 15 can be disassembled and optionally reassembled, after replacing the corresponding gear 24, even with a different center distance if it is necessary to plate parts whose dimensions differ considerably.

[0034] It is possible to fit more than one frame 10 for each bus bar 14.

[0035] Advantageously, the rods 15 can be connected kinematically to a circular rotary motion source.

[0036] The circular rotary motion source is constituted by a gearmotor, which is fixed to one of said brackets 17 and is kinematically connected to an upper gear 24a.

[0037] In this case, therefore, the rods 15 have a constant direction of rotation.

[0038] Figures 4 and 5 illustrate a second embodiment of the work holder frame, which in this case is designated by the reference numeral 110.

[0039] The frame 110 is fully similar to the first embodiment described above, except for the position of the oscillating rotary motion source 123.

[0040] In this case, the oscillating motion source 123

is constituted by a gearmotor 125 that is fixed laterally and externally to a tank 111 and is kinematically connected, when the frame 110 is arranged within the tank 111, to an upper gear 124a by way of a corresponding transmission, described in greater detail hereinafter, which comprises a rod-and-crank mechanism 126 that is arranged eccentrically with respect to the axis of the gear system constituted by the gears 124.

[0041] The transmission comprises a second ring gear 128 that meshes, when the frame 110 is arranged within the tank 111, with a corresponding first ring gear 127 that is supported in a cantilevered fashion by the gearmotor 125.

[0042] The second ring gear 128 is rigidly coupled to the end of a shaft 129 that is rotatably coupled to one of the brackets 117 and has a third ring gear 130 that is keyed thereto and is connected by means of the rod-and-crank mechanism 126 to the upper gear 124a.

[0043] The rod-and-crank mechanism 126 is arranged eccentrically with respect to the axis of the gear system constituted by the gears 124, so as to impart an oscillating motion to them and accordingly to the rods 115.

[0044] Advantageously, the rods 115 can be connected kinematically to a circular rotary motion source.

[0045] The circular rotary motion source can be constituted by a gearmotor that is fixed laterally and externally to the tank 111 and is kinematically connected, when the frame 110 is arranged within the tank 111, to an upper gear 124a by means of a corresponding transmission.

[0046] In practice it has been found that the present invention has achieved the intended aim and objects.

[0047] The work holder frame 10 effectively helps to minimize the differences in plating thickness on the various surfaces of a same part.

[0048] Moreover, it allows to load the parts in a mutually closer arrangement, and by orientating alternately the part to the right and to the left by a substantial angle, or by making it rotate always in the same direction, it effectively contrasts the forming of air pockets even if different parts are mounted together.

[0049] The present invention is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0050] The technical details may be replaced with other technically equivalent elements.

[0051] The materials, so long as they are compatible with the contingent use, as well as the dimensions, may be any according to requirements.

[0052] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A work holder frame particularly for electroplating machines of the types that comprise tanks (11) for containing the electrolytic bath (12) on the upper rim of which couplings (13) for bus bars (14) are arranged, **characterized in that** it comprises a plurality of motorized work holder rods (15) that are arranged parallel to each other and in succession and are rotatably coupled and electrically connected to a supporting structure (16) that is designed to be arranged during use within said electrolytic bath (12) as a cathode and is provided with brackets (17) for coupling and electrical connection to said bus bar (14).
2. The frame according to claim 1, **characterized in that** said rods (15) can be arranged at adjustable heights on said supporting structure (16).
3. The frame according to one or more of the preceding claims, **characterized in that** said rods (15) are rotatably coupled, at their ends, to sliding blocks (18) that can slide and be fixed in a chosen position on said supporting structure (16).
4. The frame according to one or more of the preceding claims, **characterized in that** said rods (15) are detachably coupled to said sliding blocks (18).
5. The frame according to one or more of the preceding claims, **characterized in that** said supporting structure (16) is constituted by a substantially quadrangular frame (19), in which the vertically arranged portions (20a, 20b) provide sliding guides for said sliding blocks (18).
6. The frame according to one or more of the preceding claims, **characterized in that** each rod (15) is connected electrically to said supporting structure (16) by means of pairs of flexible cables (21) that are arranged at their ends.
7. The frame according to claim 6, **characterized in that** said flexible cables (21) are sheathed with insulating material except for the regions of contact with said supporting structure (16) and said rods (15).
8. The frame according to one or more of claims 1 to 5, **characterized in that** each rod (15) is connected electrically to said supporting structure (16) by means of corresponding rotation bearings that are arranged at said sliding blocks (18).
9. The frame according to one or more of the preceding claims, **characterized in that** said rods (15) are provided with a plurality of grip means (22) for the parts to be electroplated.
10. The frame according to one or more of the preceding claims, **characterized in that** said supporting structure (16) is sheathed with insulating material except for the regions of electrical contact.
11. The frame according to one or more of the preceding claims, **characterized in that** said rods (15) are sheathed with insulating material except for the regions of electrical contact.
12. The frame according to one or more of the preceding claims, **characterized in that** said rods (15) are kinematically connected to a source of rotary motion by means of a corresponding kinematic chain.
13. The frame according to claim 12, **characterized in that** said kinematic chain is constituted by a gear system that comprises a plurality of gears (24) that are keyed to one end of said rods (15) on the same side of said supporting structure (16).
14. The frame according to one or more of the preceding claims, **characterized in that** said rods (15) are kinematically connected to a source of oscillating rotary motion (23).
15. The frame according to one or more of the preceding claims, **characterized in that** said oscillating motion source (23) is constituted by a gearmotor (25) that is fixed to one of said brackets (17), is arranged eccentrically with respect to said gears (24) and is connected to an upper gear (24a) by means of a rod-and-crank mechanism (26).
16. The frame according to one or more of claims 1 to 14, **characterized in that** said oscillating motion source (123) is constituted by a gearmotor (125) that is fixed laterally externally to the tank (111) and is kinematically connected, when said frame (110) is arranged within said tank (111), to an upper gear (124a) by means of a corresponding transmission that comprises a rod-and-crank mechanism (126) that is arranged eccentrically with respect to the axis of the gear system constituted by said gears (124).
17. The frame according to claim 16, **characterized in that** said transmission comprises a second ring gear (128) that meshes, when said frame (110) is arranged within said tank (111), with a corresponding first ring gear (127) that is supported in a cantilevered fashion by said gearmotor (125), said second ring gear (128) being rigidly coupled to the end of a shaft (129) that is rotatably coupled to one of said brackets (117), said shaft (129) having a third ring gear (130) that is keyed thereto and is connect-

ed by way of said rod-and-crank mechanism (126) to the upper gear (124a), said rod-and-crank mechanism (126) being arranged eccentrically with respect to the axis of the gear system constituted by said gears (124).

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18. The frame according to one or more of claims 1 to 13, **characterized in that** said rods (15) are kinematically connected to a source of circular rotary motion.

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19. The frame according to claim 18, **characterized in that** said circular rotary motion source is constituted by a gearmotor that is fixed to one of said brackets (17) and is kinematically connected to an upper gear (24a).

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20. The frame according to claim 18, **characterized in that** said circular rotary motion source is constituted by a gearmotor that is fixed laterally, externally to the tank (111), and is kinematically connected, when said frame (110) is arranged within said tank (111), to an upper gear (124a) by means of a corresponding transmission.

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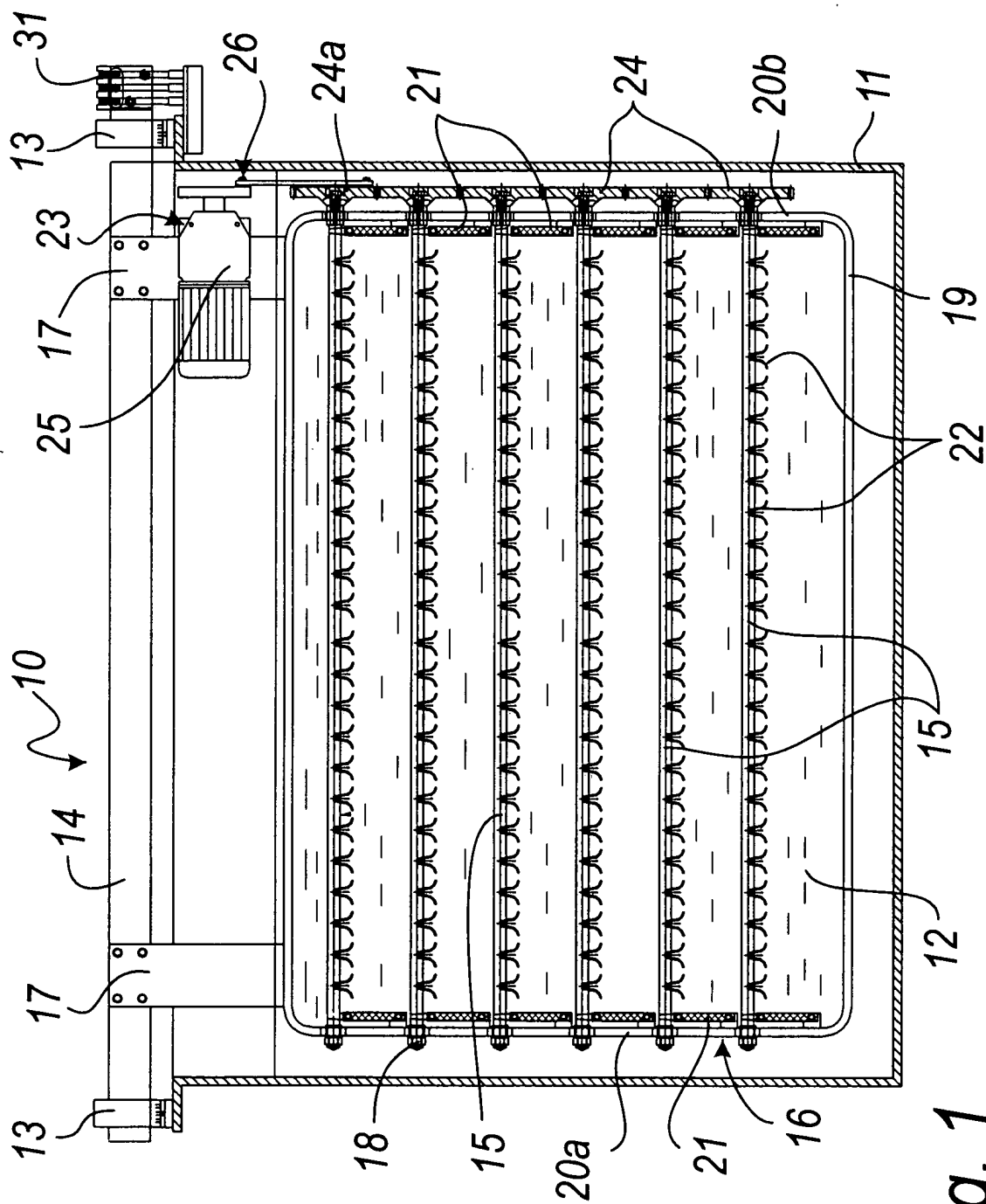


Fig. 1

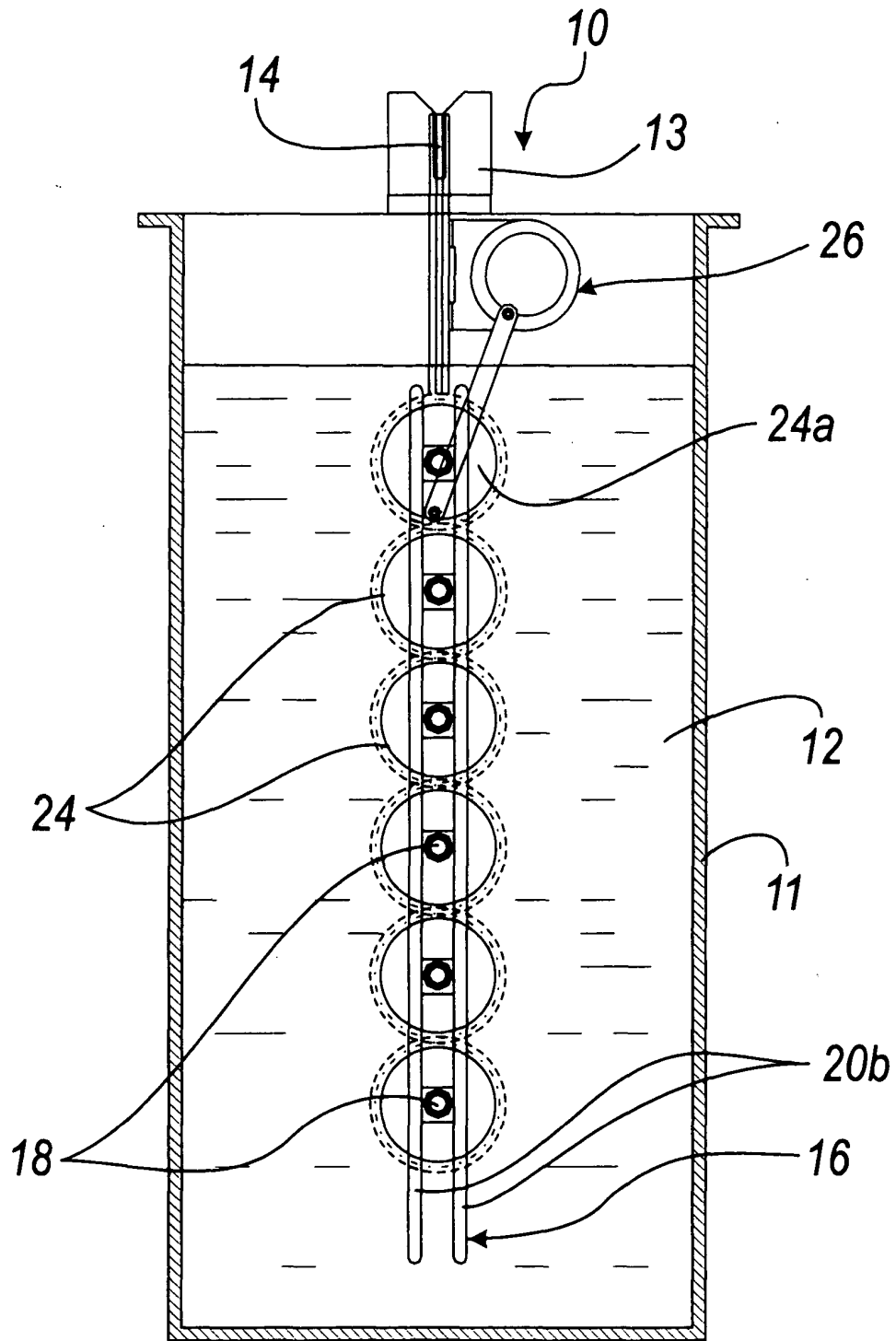


Fig. 2

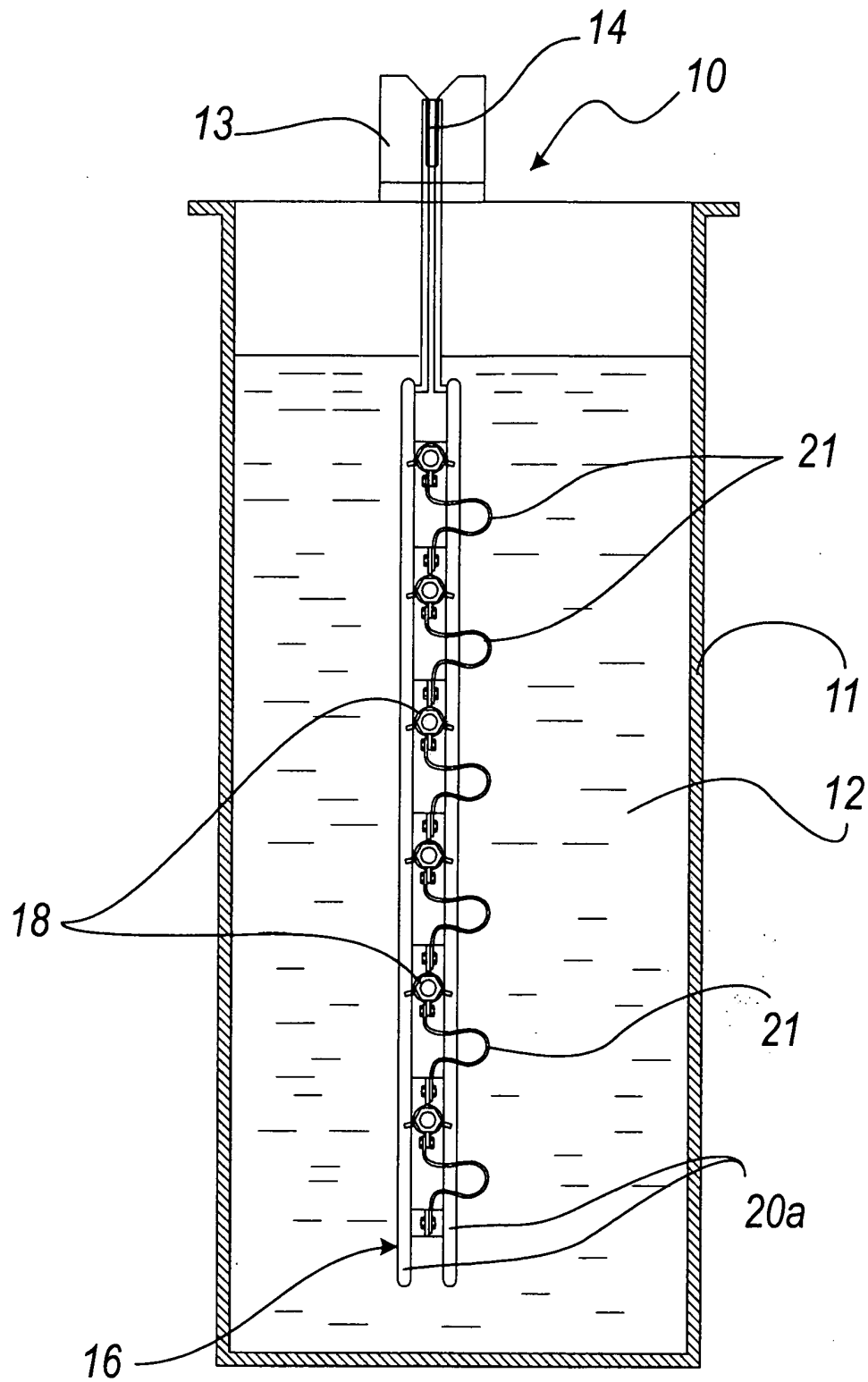


Fig. 3

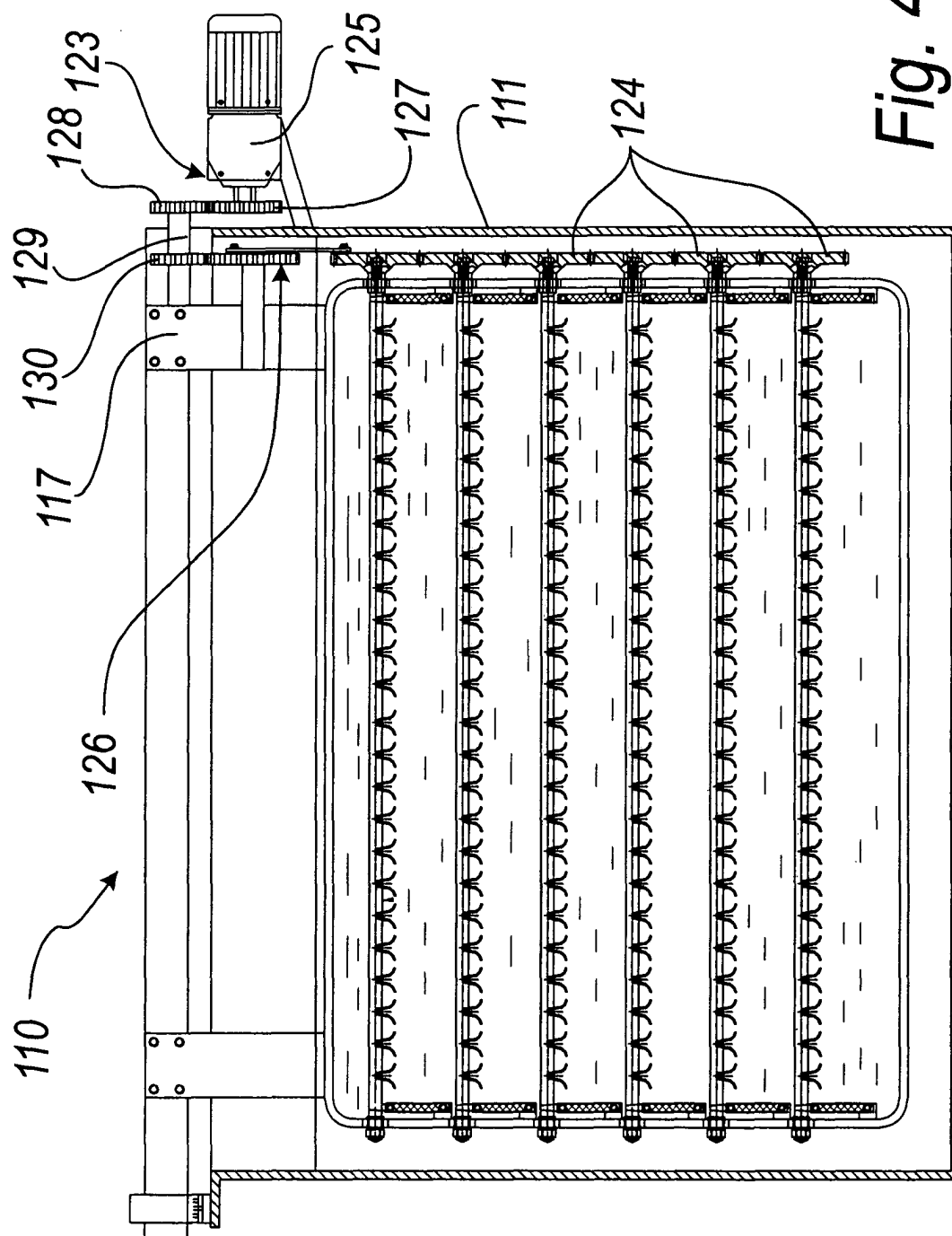


Fig. 4

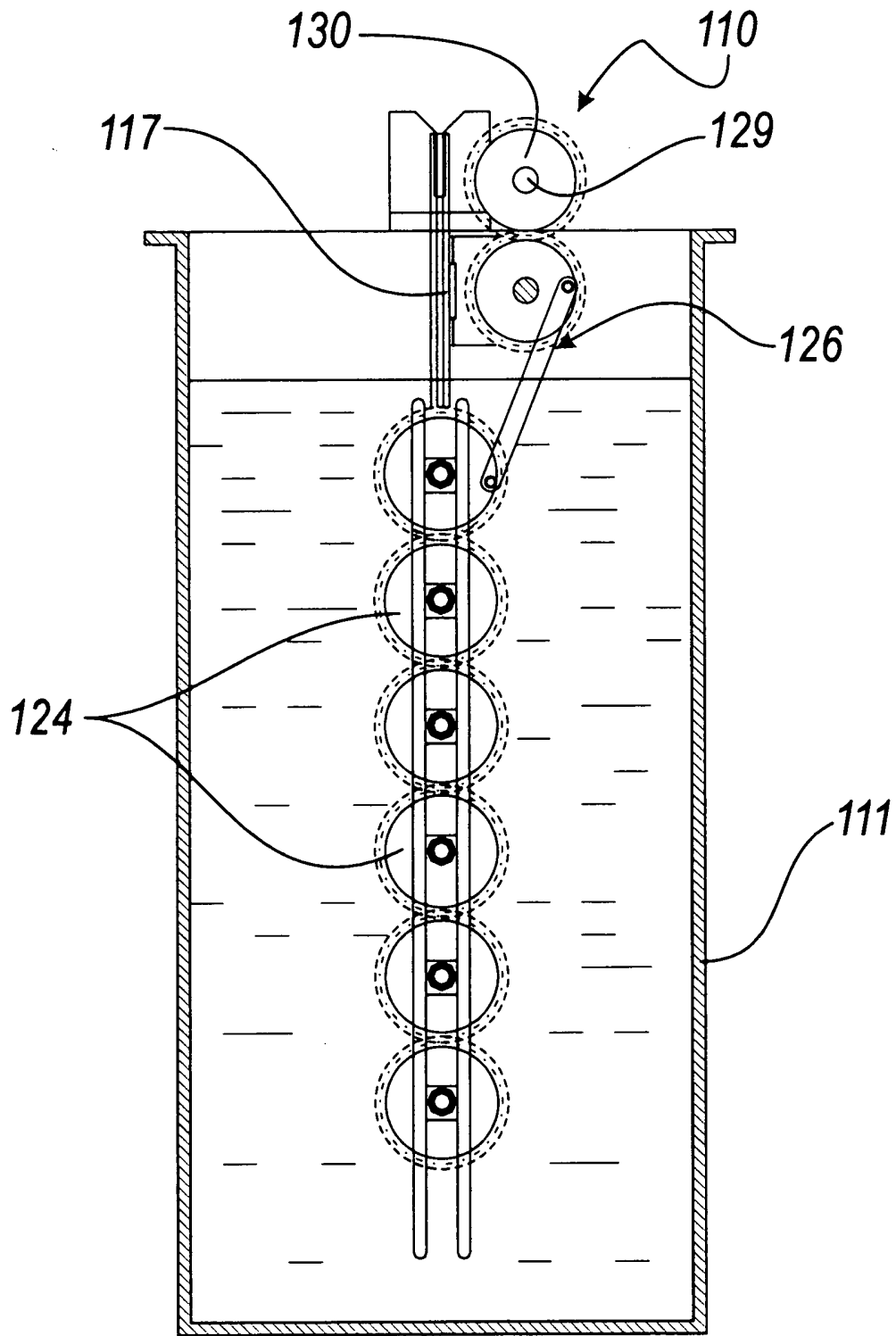


Fig. 5



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Application Number
EP 03 02 5977

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 September 2004	Examiner Zech, N
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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