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(54) **SERIAL PLATING SYSTEM**

(71) Applicant: **Tomohiro NODA**, Kanumashi (JP)

(72) Inventor: **Tomohiro NODA**, Kanumashi (JP)

(73) Assignee: **ALMEX PE INC.**, Kanuma-shi (JP)

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(57) **ABSTRACT**

A serial plating system includes a plating tank that receives a plating solution, a plurality of workpieces that are serially transferred along a transfer path being simultaneously plated in the plating tank, a common cathode that is electrically connected to the plurality of workpieces via a plurality of transfer jigs that respectively hold the plurality of workpieces, a plurality of split anodes that are disposed in the plating tank so as to face the transfer path, and a plurality of power supplies that are respectively connected to a corresponding split anode among the plurality of split anodes and the common cathode, and independently control current supplied to the corresponding split anode among the plurality of split anodes.

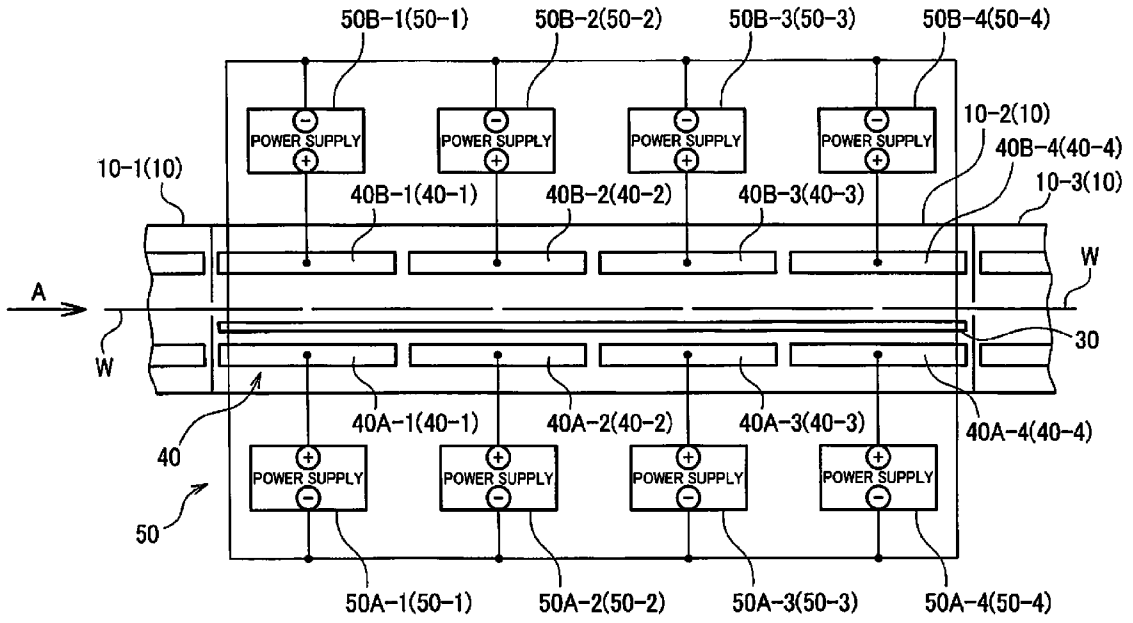
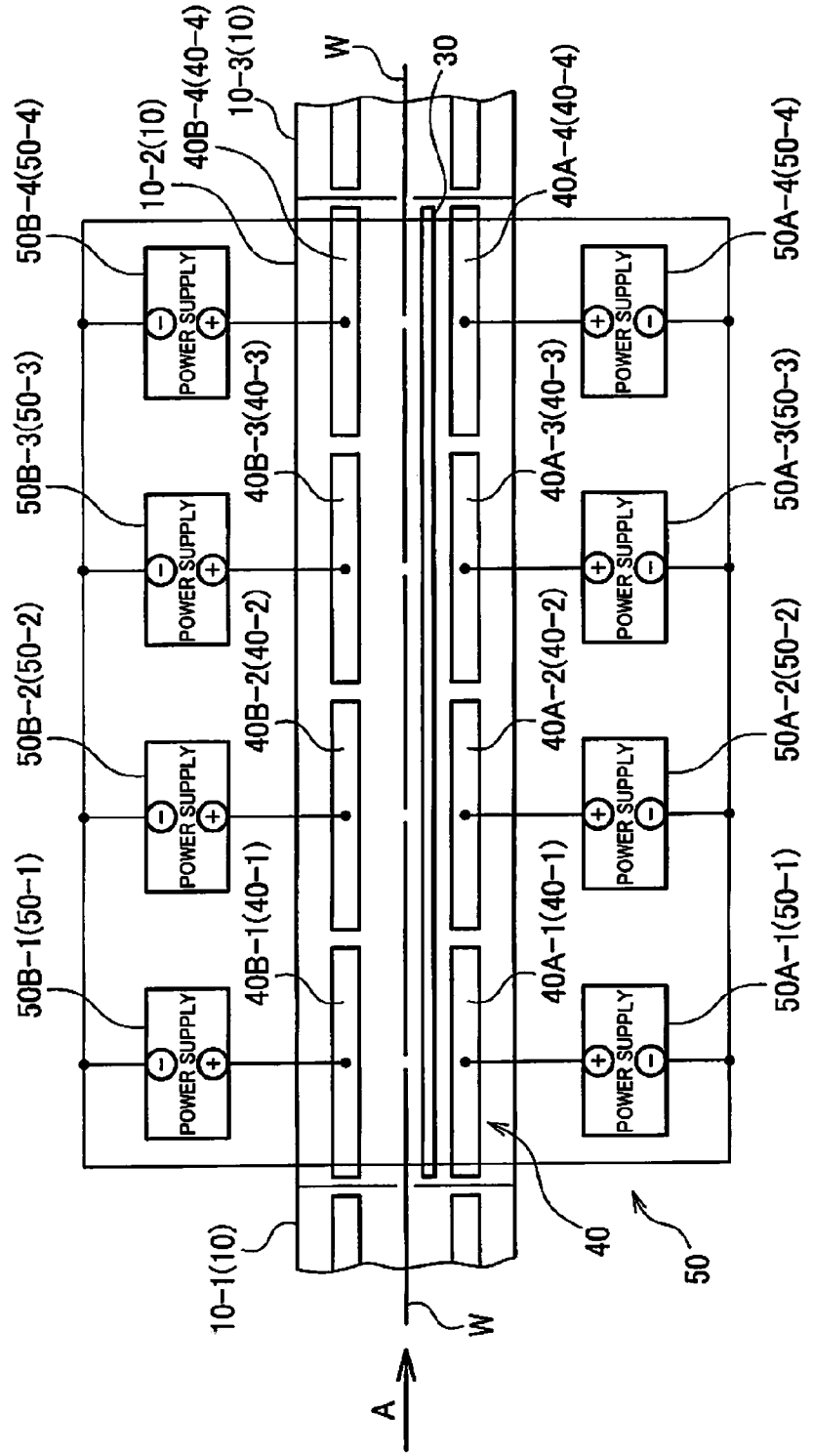


FIG. 1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50B-3(50-3)
50B-2(50-2)
50B-1(50-1)
10-2(10)
40B-4(40-4)
10-3(10)
W
30
40A-4(40-4)
50A-4(50-4)
40B-3(40-3)
40A-3(40-3)
50A-3(50-3)
40B-2(40-2)
40A-2(40-2)
50A-2(50-2)
40B-1(40-1)
40A-1(40-1)
50A-1(50-1)
POWER SUPPLY
10-1(10)
W
A
40
50

FIG. 2

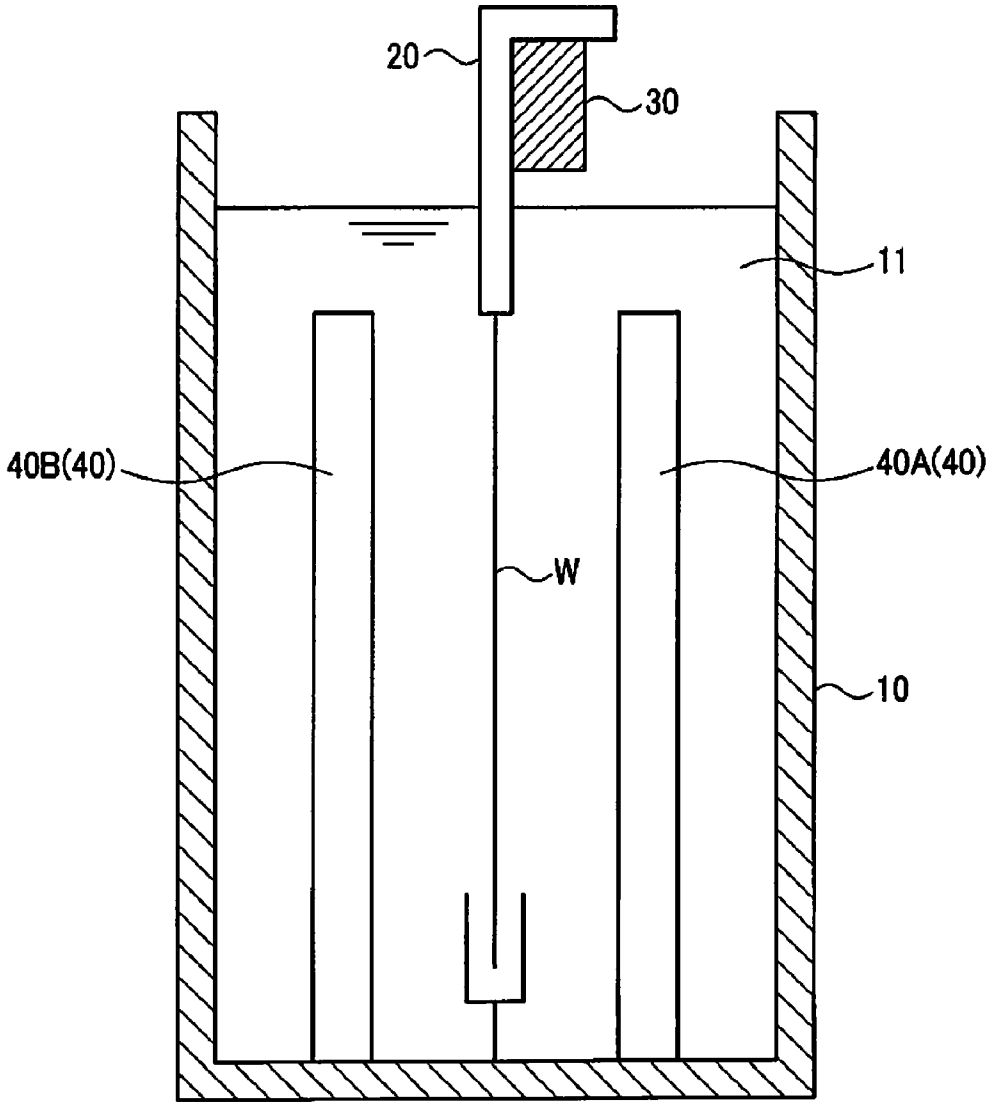


FIG. 3A

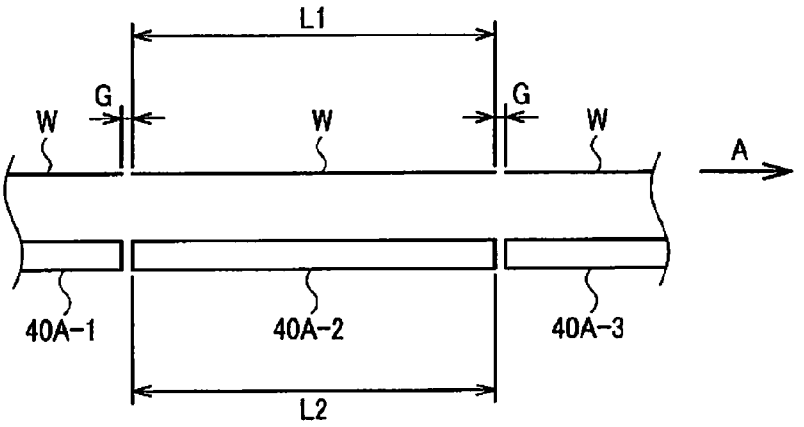


FIG. 3B

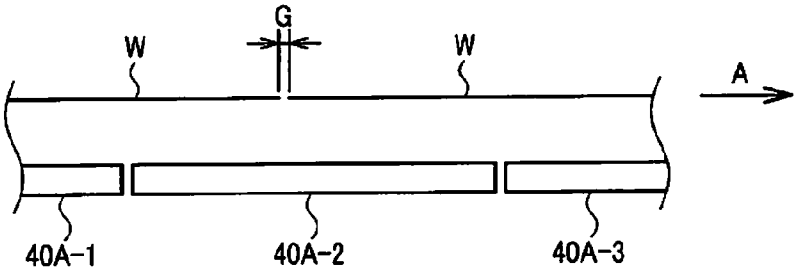
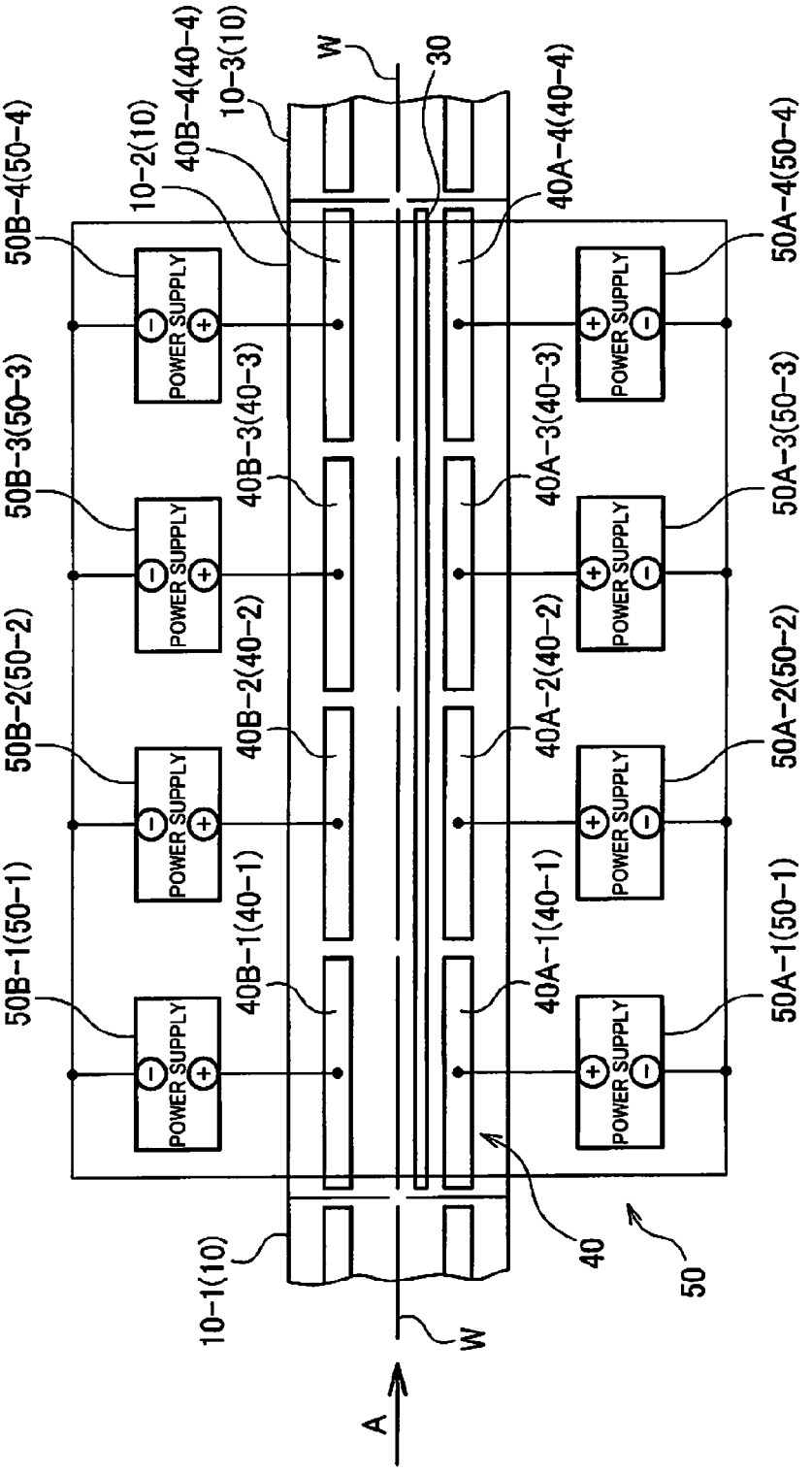


FIG. 4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50B-3(50-3)
50B-2(50-2)
50B-1(50-1)
10-2(10)
40B-4(40-4)
10-3(10)
W
30
40A-4(40-4)
40B-3(40-3)
40A-3(40-3)
40B-2(40-2)
40A-2(40-2)
40B-1(40-1)
40A-1(40-1)
POWER SUPPLY
50A-4(50-4)
50A-3(50-3)
50A-2(50-2)
50A-1(50-1)
10-1(10)
W
40
50
A

FIG. 5A

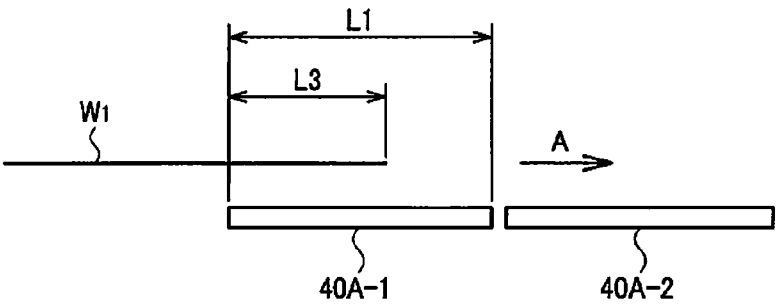


FIG. 5B

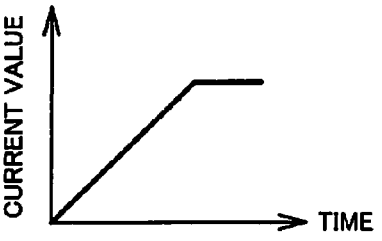


FIG. 6A

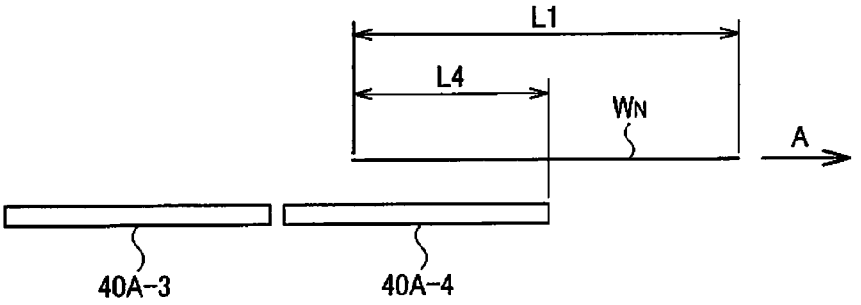


FIG. 6B

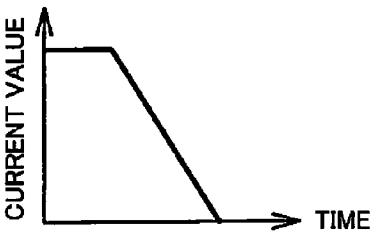


FIG. 7A

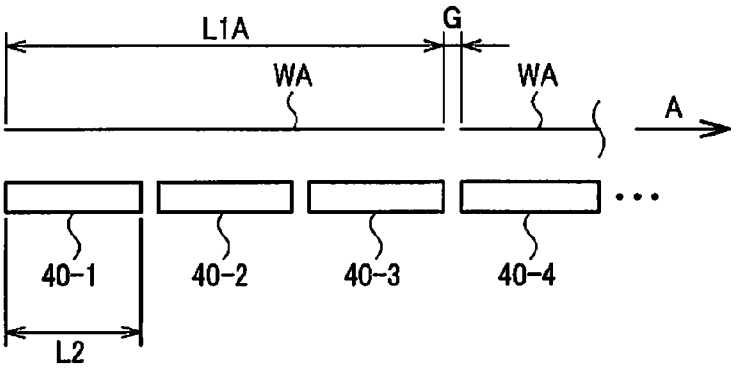


FIG. 7B

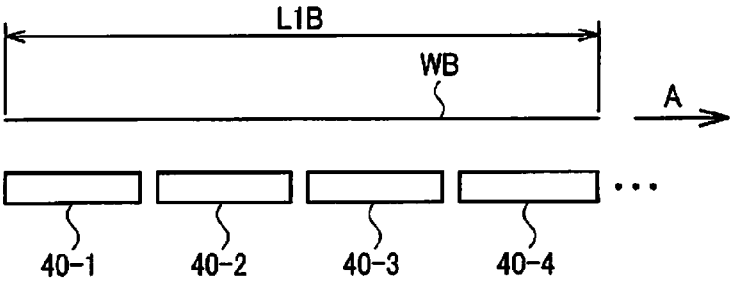


FIG. 7C

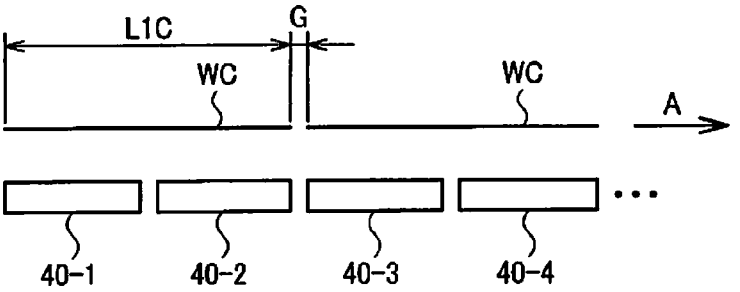


FIG. 8 RELATED ART

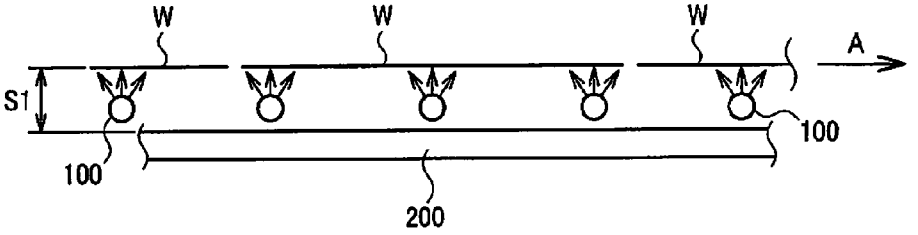


FIG. 9

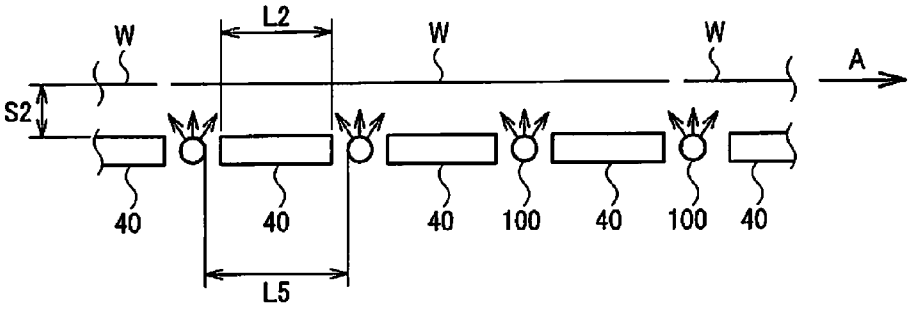
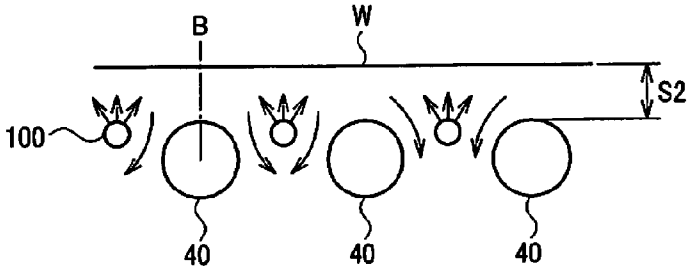


FIG. 10



SERIAL PLATING SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from Japanese Patent Application No. 2011-214301, filed on Sep. 29, 2011, the entirety of which is incorporated herein by reference.

BACKGROUND

[0002] The present invention relates to a serial plating system that supplies current to workpieces that are serially transferred in a plating tank to plate the workpieces.

[0003] JP-A-2009-132999 applied for by the assignee of the present application discloses a current control method that utilizes a common anode and split cathode rails. In the method disclosed in JP-A-2009-132999, five power supply units supply current to up to five workpieces that are serially transferred in a plating tank via five corresponding split cathode rails (cathode relay members) so that the current density (A/dm2) is constant (see FIG. 1 of JP-A-2009-132999). Each power supply unit performs constant-current control at a preset current value in a completely immersed state in which the entire workpiece faces the common anode. The most upstream-side power supply unit gradually increases the amount of current based on the electrolysis area in which the workpiece in a partially immersed state that is being transferred to the plating tank faces the common anode. The most downstream-side power supply unit gradually decreases the amount of current based on the electrolysis area in which the workpiece in a partially immersed state that is being transferred from the plating tank faces the common anode.

[0004] This makes it possible to implement serial plating at a current value set corresponding to each workpiece, and form a uniform and high-quality coating on each workpiece at a thickness corresponding to the preset current density.

[0005] According to the method disclosed in JP-A-2009-132999, however, since it is necessary to dispose the split cathode rails in parallel to the plating tank, the width of the serial plating system necessarily increases. This requires a larger installation area.

[0006] According to the method disclosed in JP-A-2009-132999, since it is necessary to gradually increase or decrease the current value each time the workpiece transferred in lot units is set to a partially immersed state, the control process becomes complex.

[0007] When the number of workpieces that are simultaneously set to a completely immersed state in the plating tank is referred to as N, the number of workpieces that are positioned in the plating tank when a partially immersed state occurs on the upstream side and the downstream side is (N+1). Therefore, it is necessary to provide (N+1) split cathode rails and (N+1) power supply units.

SUMMARY

[0008] Several aspects of the invention may provide a serial plating system that forms a coating on each workpiece at a thickness corresponding to the preset current value without using a plurality of split cathode rails.

[0009] Several aspects of the invention may provide a serial plating system that makes it possible to reduce the number of power supplies.

[0010] Several aspects of the invention may provide a serial plating system that gradually increases or decreases the current value corresponding to only the first workpiece and the final workpiece of one lot instead of gradually increasing or decreasing the current value corresponding to each workpiece transferred in lot units.

[0011] Several aspects of the invention may provide a serial plating system that makes it unnecessary to exchange the anode, and gradually increase or decrease the current value even if the size of the workpiece has been changed.

[0012] (1) According to one aspect of the invention, there is provided a serial plating system comprising:

[0013] a plating tank that receives a plating solution, a plurality of workpieces that are serially transferred along a transfer path being simultaneously plated in the plating tank;

[0014] a common cathode that is electrically connected to the plurality of workpieces via a plurality of transfer jigs that respectively hold the plurality of workpieces;

[0015] a plurality of split anodes that are disposed in the plating tank so as to face the transfer path; and

[0016] a plurality of power supplies that are respectively connected to a corresponding split anode among the plurality of split anodes and the common cathode, and independently control current supplied to the corresponding split anode among the plurality of split anodes.

[0017] According to one aspect of the invention, since the anode is split into the split anodes, differing from the related-art method, it is unnecessary to provide split cathode rails connected to the workpiece, and it suffices to connect the workpiece to the common cathode via the transfer jig. This makes it possible to reduce the width of the serial plating system. Since the plurality of workpieces connected to the common cathode are serially transferred so that a small gap is formed between the adjacent workpieces, the total electrolysis area of the workpiece(s) that faces one split anode when the split anode faces one workpiece is almost equal to that when the split anode faces two workpieces. Therefore, it suffices to control the split anode at a constant current during serial transfer.

[0018] (2) In the serial plating system,

[0019] each of the plurality of split anodes may include a first electrode that faces a first side of each of the plurality of workpieces, and may include a second electrode that faces a second side of each of the plurality of workpieces.

[0020] This makes it possible to plate each side of the workpiece.

[0021] (3) In the serial plating system,

[0022] each of the plurality of power supplies may include a first power supply that supplies current to the first electrode, and a second power supply that supplies current to the second electrode, the first power supply and the second power supply may independently control the current value.

[0023] This makes it possible to set a different current value corresponding to each side of the workpiece when each side of the workpiece has a different plating target area.

[0024] (4) In the serial plating system,

[0025] a relationship "L**1**=L**2**" may be substantially satisfied, L**1** being a length of each of the plurality of workpieces along a transfer direction, and L**2** being a length of each of the plurality of split anodes along the transfer direction.

[0026] According to this configuration, it suffices to provide N split anodes and N power supplies even when the number of workpieces that are simultaneously set to a completely immersed state in the plating tank is N, and the number of workpieces that are positioned in the plating tank when a partially immersed state occurs on the upstream side and the

downstream side is (N+1). Specifically, the number of expensive power supplies can be reduced as compared with the method disclosed in JP-A-2009-132999 that requires (N+1) power supplies. Specifically, the number of power supplies can be minimized by substantially satisfying the relationship "L1=L2".

[0027] (5) In the serial plating system,

[0028] the plurality of workpieces may be supplied to the plating tank in lot units, the plurality of power supplies may respectively gradually increase the current value of the corresponding split anode among the plurality of split anodes when a first workpiece of one lot faces the corresponding split anode based on an electrolysis area in which the first workpiece faces the corresponding split anode, and the plurality of power supplies may respectively gradually decrease the current value of the corresponding split anode among the plurality of split anodes when a final workpiece of one lot faces the corresponding split anode based on an electrolysis area in which the final workpiece faces the corresponding split anode.

[0029] Specifically, it suffices to gradually increase or decrease the current value corresponding to only the first workpiece and the final workpiece of one lot instead of gradually increasing or decreasing the current value corresponding to each workpiece transferred in lot units.

[0030] (6) In the serial plating system,

[0031] a relationship "L2<L1/n" may be satisfied, L1 being a length of each of the plurality of workpieces along a transfer direction, L2 being a length of each of the plurality of split anodes along the transfer direction, and n being an integer equal to or larger than 2.

[0032] According to this configuration, since it is unnecessary to utilize a split anode having a different length corresponding to the size of the workpiece, it is unnecessary to exchange the split anode corresponding to the size of the workpiece.

[0033] (7) In the serial plating system,

[0034] the plurality of workpieces may be supplied to the plating tank in lot units, and

[0035] each of the plurality of power supplies may control the corresponding split anode among the plurality of split anodes at a constant current from a first workpiece to a final workpiece of each lot.

[0036] Since the electrolysis area corresponding to each anode decreases when the length L1 of the workpiece and the length L2 of the anode satisfy the relationship "L2<L1/n", it is unnecessary to gradually increase or decrease the current value even when the first or final workpiece of one lot unit passes by the split anode.

[0037] (8) In the serial plating system,

[0038] a plurality of nozzles that discharge the plating solution to the plurality of workpieces may be provided in the plating tank along a transfer direction at positions opposite to each of the plurality of workpieces, and

[0039] at least one split anode among the plurality of split anodes may be respectively disposed between two adjacent nozzles among the plurality of nozzles.

[0040] When the length L1 of the workpiece and the length L2 of the split anode satisfy the relationship "L2<L1/n", the length L2 of the split anode can be set to be less than the distance between two adjacent nozzles. Therefore, at least one split anode among the plurality of split anodes can be disposed between two adjacent nozzles. This makes it possible to reduce the distance between the split anode and the workpiece, and reduce the electrical resistance of the plating solution that is present between the split anode and the workpiece, so that the density of current supplied from the split anode to the workpiece can be increased to implement high-speed plating.

[0041] (9) In the serial plating system,

[0042] each of the plurality of split anodes may have a circular horizontal cross-sectional shape.

[0043] If the split anode is rectangular when viewed from above (in a plan view), since the distance between the plating target surface of the workpiece and the split anode is constant, the plating solution discharged from the nozzle is concentrated (trapped) in a narrow range corresponding to the constant distance. When the split anode has a circular horizontal cross-sectional shape, the distance between the plating target surface of the workpiece and the split anode increases as the distance from the centerline of the split anode increases, so that the plating solution can escape from the space between the workpiece and the split anode.

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] FIG. **1** is a schematic plan view illustrating a serial plating system according to a first embodiment of the invention.

[0045] FIG. **2** is a schematic cross-sectional view illustrating a serial plating system.

[0046] FIGS. **3**A and **3**B are views illustrating that the electrolysis area when the split anode faces one workpiece is substantially equal to that when the split anode faces two workpieces.

[0047] FIG. **4** is a view illustrating a transfer state in which one workpiece faces one split anode.

[0048] FIGS. **5**A and **5**B are views illustrating a control process that gradually increases the current value when the first workpiece of one lot is carried in.

[0049] FIGS. **6**A and **6**B are views illustrating a control process that gradually decreases the current value when the final workpiece of one lot is carried out.

[0050] FIGS. **7**A to **7**C are views illustrating a second embodiment of the invention.

[0051] FIG. **8** is a view illustrating related-art method in which a nozzle is provided between a workpiece and an anode.

[0052] FIG. **9** is a view illustrating a third embodiment of the invention.

[0053] FIG. **10** is a view illustrating an example in which a split anode has a circular horizontal cross-sectional shape.

DESCRIPTION OF EXEMPLARY EMBODIMENT(S)

[0054] Exemplary embodiments of the invention are described in detail below. Note that the following embodiments do not in any way limit the scope of the invention defined by the claims laid out herein. Note also that all of the elements described in connection with the following embodiments should not necessarily be taken as essential elements of the invention.

1. First Embodiment

[0055] As illustrated in FIG. **1**, a serial plating system according to a first embodiment of the invention includes at

least one plating tank **10**. A plurality of plating tanks **10-1** to **10-3** may preferably be connected along a workpiece transfer direction A.

[0056] As illustrated in FIG. **2**, the plating tank **10** receives a plating solution **11**, and a plurality of workpieces W that are serially transferred along the transfer direction A (see FIG. **1**) are simultaneously plated in the plating tank **10**.

[0057] As illustrated in FIG. **2**, a common cathode **30** that is electrically connected to each workpiece W via a transfer jig **20** that holds the workpiece W is provided over the plating tank **10**. Note that the common cathode **30** may be disposed at a position offset from the position over the plating tank **10**.

[0058] A plurality of split anodes **40** (**40-1** to **40-4**) are disposed in the plating tank **10** so as to face the transfer path of the workpiece W. Each split anode **40** (**40-1** to **40-4**) may include a first electrode **40**A (**40**A-**1** to **40**A-**4**) that is disposed on one side of the transfer path, and may include a second electrode **40**B (**40**B-**1** to **40**B-**4**) that is disposed on the other side of the transfer path. When plating only one side of the workpiece W, the split anodes **40** (**40-1** to **40-4**) may be disposed only on one side of the transfer path.

[0059] A plurality of power supplies **50** (**50-1** to **50-4**) are provided, the plurality of power supplies **50** (**50-1** to **50-4**) being respectively connected to the corresponding split anode among the split anodes **40** (**40-1** to **40-4**) and the common cathode **30**, and independently controlling current supplied to the corresponding split anode among the split anodes **40** (**40-1** to **40-4**). A power supply that is connected to the first electrode **40**A (**40**A-**1** to **40**A-**4**) is referred to as a first power supply **50**A (**50**A-**1** to **50**A-**4**), and a power supply that is connected to the second electrode **40**B (**40**B-**1** to **40**B-**4**) is referred to as a second power supply **50**B (**50**B-**1** to **50**B-**4**). The first power supply **50**A (**50**A-**1** to **50**A-**4**) and the second power supply **50**B (**50**B-**1** to **50**B-**4**) independently control the current value.

[0060] According to the first embodiment, since each anode is split into split anodes, differing from the related-art method, it is unnecessary to provide split cathode rails that are connected to the workpiece W. The workpiece W is connected to the common cathode **30** via the transfer jig **20**. This makes it possible to reduce the width of the serial plating system.

[0061] As illustrated in FIGS. **3**A and **3**B, a plurality of workpieces W that are connected to the common cathode **30** are serially transferred so that a small gap G is formed between adjacent workpieces W among the plurality of workpieces W. If the gap G formed between the adjacent workpieces W is large, electric field concentration occurs at each edge of the workpiece W in the transfer direction A, so that a dog-bone phenomenon occurs (i.e., the plating thickness increases at each edge of the workpiece W). The gap G is set so that electric field concentration does not occur.

[0062] In this case, the total electrolysis area of the workpiece(s) W that faces the split anode **40**A-**2** when the split anode **40**A-**2** faces one workpiece (see FIG. **3**A) is almost equal to that when the split anode **40**A-**2** faces two workpieces (see FIG. **3**B). Therefore, the split anodes **40** can be subjected to constant-current control at a preset current value (A/dm2) when a plurality of workpieces W are serially transferred in a state in which the gap G is formed between adjacent workpieces W. More specifically, a plurality of workpieces W that are transferred in the plating tank **10** can be regarded as a single workpiece, and the electrolysis area substantially does not change even if the workpiece W moves relative to each split anode **40**.

[0063] According to the method disclosed in JP-A-2009-132999, since it is necessary to gradually increase or decrease the current value each time the workpiece W transferred in lot units is set to a partially immersed state, the control process becomes complex. According to the method disclosed in JP-A-2009-132999, the workpiece W that is simultaneously positioned in two plating tanks **10** comes in contact with the split cathode rails of the two plating tanks **10**. Therefore, it is necessary to gradually decrease the current value in the plating tank **10** from which the workpiece W is being transferred, and gradually increase the current value in the plating tank **10** to which the workpiece W is being transferred. According to the first embodiment, since the workpiece W that is simultaneously positioned in two plating tanks **10** is connected to the common cathode, it is unnecessary to perform such a complex control process.

[0064] As illustrated in FIG. **3**A, when the length of each workpiece W along the transfer direction A is referred to as L**1**, and the length of each split anode **40** along the transfer direction A is referred to as L**2**, the relationship "L**1**=L**2**" may be substantially satisfied.

[0065] The number of workpieces that are simultaneously set to a completely immersed state in the plating tank **10** is referred to as N (N=4 in FIG. **4**). As illustrated in FIG. **1**, the number of workpieces that are positioned in the plating tank **10** when a partially immersed state occurs on the upstream side and the downstream side is (N+1) (N+1=5 in FIG. **1**). Therefore, it suffices to provide N split anodes **40** (**40**A or **40**B) (provided in the plating tank **10**) and N power supplies **50** (**50**A or **50**B) (N=4 in FIGS. **1** and **4**). Accordingly, the number of expensive power supplies **50** can be reduced as compared with the method disclosed in JP-A-2009-132999 that requires (N+1) power supplies. Specifically, the number of power supplies **50** can be minimized by substantially satisfying the relationship "L**1**=L**2**".

[0066] In the first embodiment, a plurality of workpieces W**1** to WN are supplied to the plating tank **10** in lot units. As illustrated in FIG. **5**A, when the first workpiece W**1** of one lot faces each of the split anodes **40**A-**1** to **40**A-**4**, another plating target workpiece is not present on the downstream side of the workpiece W**1**. Note that a dummy workpiece that prevents electric field concentration at the edge of the workpiece may be provided on the upstream side of the workpiece W**1** so that the gap G is formed between the dummy workpiece and the workpiece W**1**. In this case, the power supplies **50**A-**1** to **50**A-**4** respectively gradually increase the current value of the corresponding split anode among the split anodes **40**A-**1** to **40**A-**4** based on the electrolysis area (L**3** (see FIG. **5**A)× workpiece height) in which the first workpiece W**1** faces the split anode **40**A (see FIG. **5**B). This makes it possible to set the current density of the workpiece W**1** to be constant.

[0067] Likewise, when the final workpiece WN of one lot faces each of the split anodes **40**A-**1** to **40**A-**4**, another plating target workpiece is not present on the upstream side of the workpiece WN (see FIG. **6**A). Note that a dummy workpiece that prevents electric field concentration at the edge of the workpiece may be provided on the downstream side of the workpiece WN so that the gap G is formed between the dummy workpiece and the workpiece WN. In this case, the power supplies **50**A-**1** to **50**A-**4** respectively gradually decrease the current value of the corresponding split anode among the split anodes **40**A-**1** to **40**A-**4** based on the electrolysis area (L**4** (see FIG. **6**A)×workpiece height) in which the final workpiece WN faces the split anode **40**A (see FIG.

6B). This makes it possible to set the current density of the workpiece WN to be constant.

[0068] This means that it suffices to gradually increase or decrease the current value corresponding to the first workpiece W1 and the final workpiece WN of one lot (i.e., it is unnecessary to gradually increase or decrease the current value corresponding to each workpiece transferred in lot units (see JP-A-2009-132999)).

2. Second Embodiment

[0069] In a second embodiment of the invention, the relationship "L2<L1/n" is satisfied, L1 being the length of each workpiece W along the transfer direction A, L2 being the length of each split anode **40** along the transfer direction A, and n being an integer equal to or larger than 2.

[0070] FIGS. 7A to 7C illustrate a state in which a workpiece WA having a length L1A, a workpiece WB having a length L1B, or a workpiece WC having a length L1C is transferred in the plating tank **10** in which the split anodes **40-1**, **40-2**, **40-3**, and **40-4** having the length L2 are disposed. The relationship "L2<L1A/3" (n=3) is satisfied in FIG. 7A, the relationship "L2<L1B/4" (n=4) is satisfied in FIG. 7B, and the relationship "L2<L1C/2" (n=2) is satisfied in FIG. 7C.

[0071] Since it is unnecessary to utilize a split anode **40** having a different length corresponding to the size of each workpiece, it is unnecessary to exchange the split anode **40** corresponding to the size of each workpiece.

[0072] In the second embodiment, a plurality of workpieces W are supplied to the plating tank **10** in lot units, and each power supply **50** can control the corresponding split anode **40** at a constant current from the first workpiece to the final workpiece of each lot.

[0073] When the length L1(L1A, L1B, or L1C) of each workpiece and the length L2 of the anode **40** satisfy the relationship "L2<L1/n", the electrolysis area decreases in proportion to n. Therefore, even when the first workpiece W or the final workpiece W of one lot passes by the split anode **40** (see FIG. 5A or 6A), it is unnecessary to gradually increase or decrease the current value (see FIG. 5B or 6B) if the area in which the split anode **40** does not face the workpiece W is negligibly small. Note that the length L1A of the workpiece WA, the length L1B of the workpiece WB, and the length L1C of the workpiece WC need not necessarily correspond to an integral multiple of one cycle of the split anodes that are arranged cyclically, but may be an arbitrary length.

3. Third Embodiment

[0074] A nozzle that discharges the plating solution to the workpiece may be provided between the workpiece and the electrode (anode). Such a nozzle is disclosed in JP-A-2000-178784 (FIGS. **1** and **3**), JP-A-2006-214006 (FIG. **1**), or JP-A-58-6998 (FIG. **4**), for example.

[0075] According to the related-art method (see FIG. **8**), a space having a dimension (width) equal to or more than the diameter of a nozzle **100** is required between a workpiece W and an anode **200**. JP-A-58-6998 discloses that the distance S1 between the workpiece W and the anode **200** is 100 mm or more.

[0076] In a third embodiment of the invention (see FIG. **9**), a plurality of nozzles **100** that discharge the plating solution to the workpiece W may be provided along the transfer direction A at positions opposite to one workpiece W, and at least one split anode **40** among the plurality of split anodes **40** may be disposed between two adjacent nozzles among the plurality of nozzles **100** so that at least part of one split anode **40** may be positioned between two adjacent nozzles **100**.

[0077] When the length L1 of the workpiece W and the length L2 of the split anode **40** satisfy the relationship "L2<L1/n", the length L2 of the split anode **40** can be set to a value less than the distance L5 between two adjacent nozzles **100**. Therefore, at least one split anode **40** among the plurality of split anodes **40** can be disposed between two adjacent nozzles **100** among the plurality of nozzles **100**. This makes it possible to reduce the distance S2 between the split anode **40** and the workpiece W, and reduce the electrical resistance of the plating solution that is present between the split anode **40** and the workpiece W, so that the density of current supplied from the split anode **40** to the workpiece W can be increased to implement high-speed plating.

[0078] Each split anode **40** may have a circular horizontal cross-sectional shape (outline) as shown in FIG. **10**. If the split anode has a rectangular shape when viewed from above (in a plan view), the distance between the plating target surface of the workpiece and the split anode **40** is constant. Therefore, the plating solution **11** discharged from the nozzle **100** is trapped in a narrow range. When the split anode **40** has a circular horizontal cross-sectional shape, the distance between the plating target surface of the workpiece W and the split anode **40** increases as the distance from a centerline B of the split anode **40** increases, so that the plating solution **11** can escape from the space between the workpiece W and the split anode **40**.

[0079] When the plating solution **11** can escape from the space between the workpiece W and the split anode **40**, the workpiece **1** always comes in contact with fresh plating solution. If the flow of the plating solution between the workpiece W and the nozzle **100** (anode **40**) is insufficient, the plating solution may not enter a negative-pressure area that occurs around a high-speed nozzle flow. In particular, a flexible workpiece W may be drawn toward the nozzle **100**. Therefore, it is important to ensure that the plating solution discharged from the nozzle **100** can escape from the space between the workpiece W and the split anode **40** in order to prevent a phenomenon in which the workpiece W is drawn toward the negative-pressure area.

[0080] Although only some embodiments of the invention have been described in detail above, those skilled in the art would readily appreciate that many modifications are possible in the embodiments without materially departing from the novel teachings and advantages of the invention. Accordingly, such modifications are intended to be included within the scope of the invention. Any term cited with a different term having a broader meaning or the same meaning at least once in the specification and the drawings can be replaced by the different term in any place in the specification and the drawings

[0081] Although the invention has been described using specific terms, devices, and/or methods, such description is for illustrative purposes of the preferred embodiment(s) only. Changes may be made to the preferred embodiment(s) by those of ordinary skill in the art without departing from the scope of the present invention. In addition, it should be understood that aspects of the preferred embodiment(s) generally may be interchanged in whole or in part.

What is claimed is:

1. A serial plating system comprising:

a plating tank that receives a plating solution, a plurality of workpieces that are serially transferred along a transfer path being simultaneously plated in the plating tank;

a common cathode that is electrically connected to the plurality of workpieces via a plurality of transfer jigs that respectively hold the plurality of workpieces;

a plurality of split anodes that are disposed in the plating tank so as to face the transfer path; and

a plurality of power supplies that are respectively connected to a corresponding split anode among the plurality of split anodes and the common cathode, and that respectively independently control current supplied to the corresponding split anode among the plurality of split anodes.

2. The serial plating system as defined in claim **1**,

each of the plurality of split anodes including a first electrode that faces a first side of each of the plurality of workpieces, and including a second electrode that faces a second side of each of the plurality of workpieces.

3. The serial plating system as defined in claim **2**,

each of the plurality of power supplies including a first power supply that supplies current to the first electrode, and including a second power supply that supplies current to the second electrode, the first power supply and the second power supply independently controlling the current value.

4. The serial plating system as defined in claim **1**,

a relationship "L**1**=L**2**" being substantially satisfied, L**1** being a length of each of the plurality of workpieces along a transfer direction, and L**2** being a length of each of the plurality of split anodes along the transfer direction.

5. The serial plating system as defined in claim **1**,

the plurality of workpieces being supplied to the plating tank in lot units, the plurality of power supplies respectively gradually increasing the current value of the corresponding split anode among the plurality of split anodes when a first workpiece of one lot faces the corresponding split anode based on an electrolysis area in which the first workpiece faces the corresponding split anode, and the plurality of power supplies respectively gradually decreasing the current value of the corresponding split anode among the plurality of split anodes when a final workpiece of one lot faces the corresponding split anode based on an electrolysis area in which the final workpiece faces the corresponding split anode.

6. The serial plating system as defined in claim **1**,

a relationship "L**2**<L**1**/n" being satisfied, L**1** being a length of each of the plurality of workpieces along a transfer direction, L**2** being a length of each of the plurality of split anodes along the transfer direction, and n being an integer equal to or larger than 2.

7. The serial plating system as defined in claim **6**,

the plurality of workpieces being supplied to the plating tank in lot units, and

each of the plurality of power supplies controlling the corresponding split anode among the plurality of split anodes at a constant current from a first workpiece to a final workpiece of each lot.

8. The serial plating system as defined in claim **6**,

a plurality of nozzles that discharge the plating solution to the plurality of workpieces being provided in the plating tank along a transfer direction at positions opposite to each of the plurality of workpieces, and

at least one split anode among the plurality of split anodes being respectively disposed between two adjacent nozzles among the plurality of nozzles.

9. The serial plating system as defined in claim **8**,

each of the plurality of split anodes having a circular horizontal cross-sectional shape.

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