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(54) WASTEWATER TREATMENT EQUIPMENT

(76) Inventors: **Chihpin Huang**, Hsinchu (TW); **Walter Den**, Hsinchu (TW)

Correspondence Address:
JIANQ CHYUN INTELLECTUAL PROPERTY OFFICE
7 FLOOR-1, NO. 100
ROOSEVELT ROAD, SECTION 2
TAIPEI 100 (TW)

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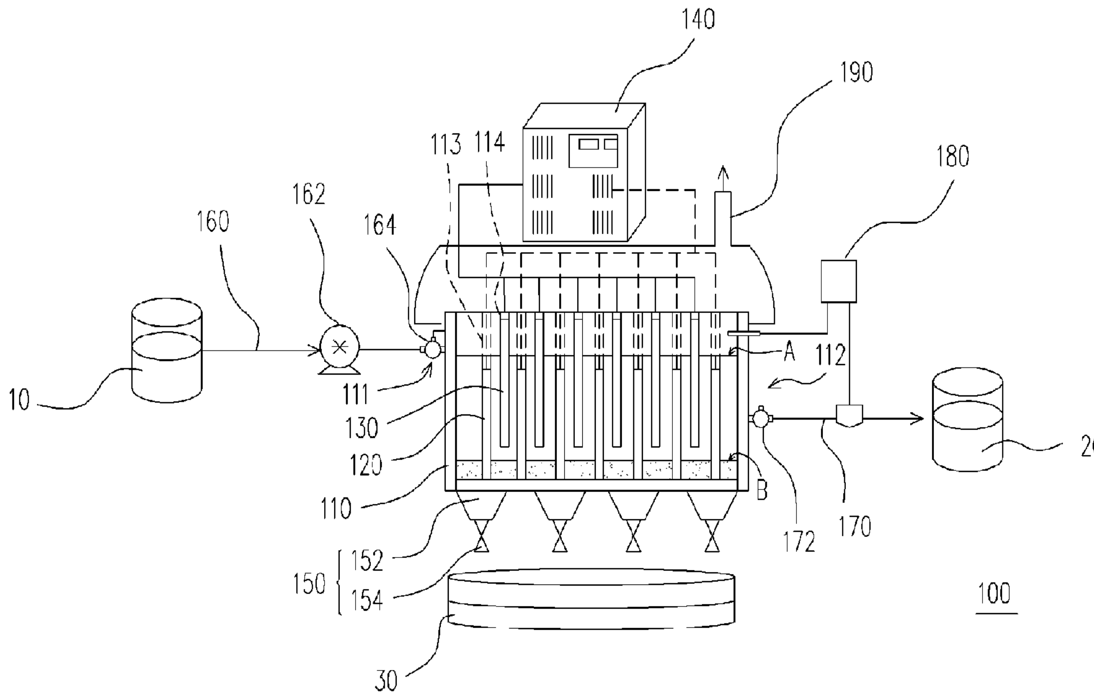
(57) **ABSTRACT**

A wastewater treatment equipment comprising a reaction tank, a plurality of anodic plates, a plurality of cathodic plates, a power supply and a collection device is provided. The reaction tank comprises an inlet and an outlet. The anodic plates and the cathodic plates are placed in a staggered order in the reaction tank. The power supply is electrically connected to the anodic plates and the cathodic plates. The collection device is disposed at the bottom of the reaction tank so the colloidal particles deposited at he bottom of the reaction tank can be removed.



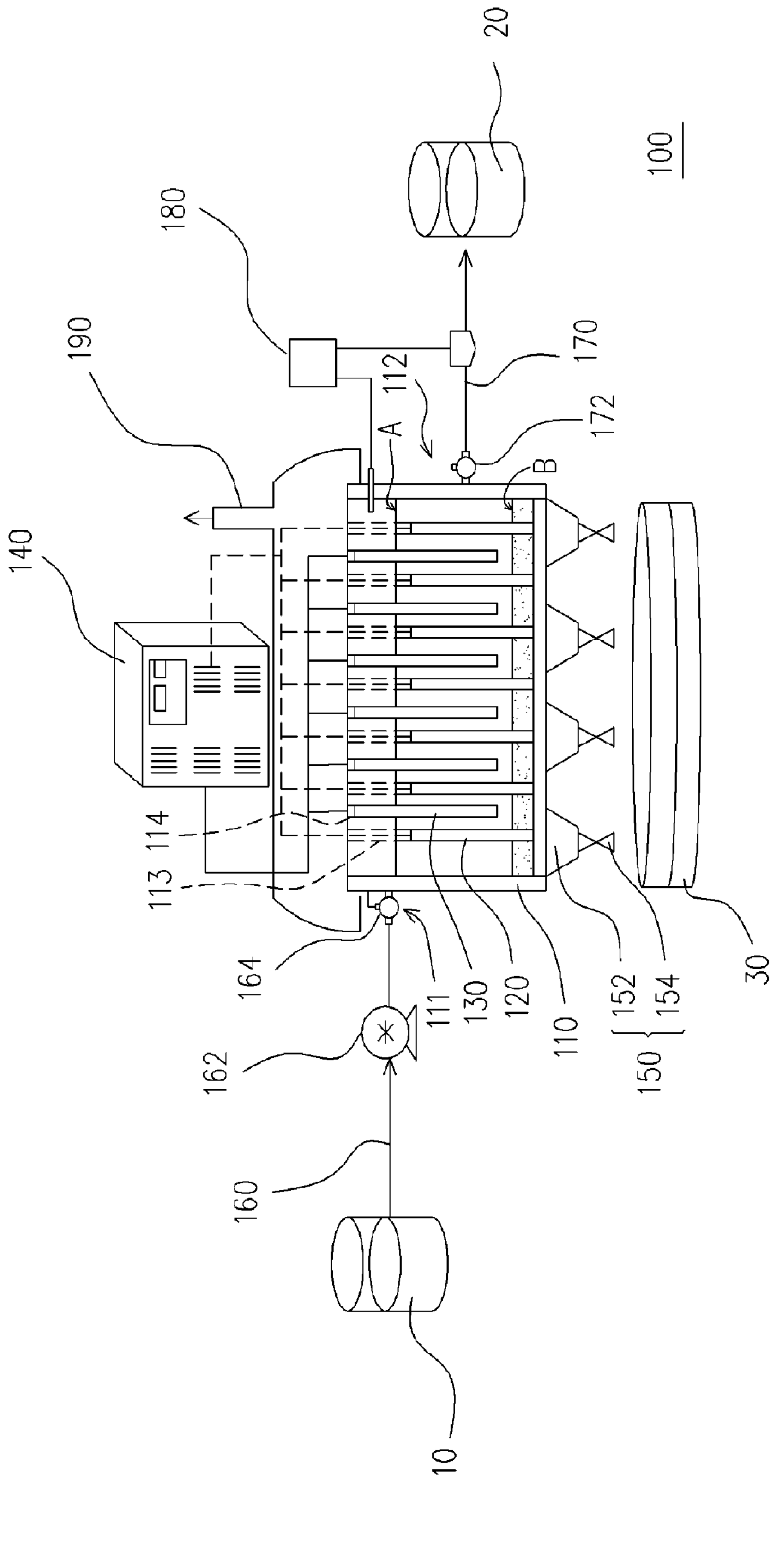

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FIG. 1A

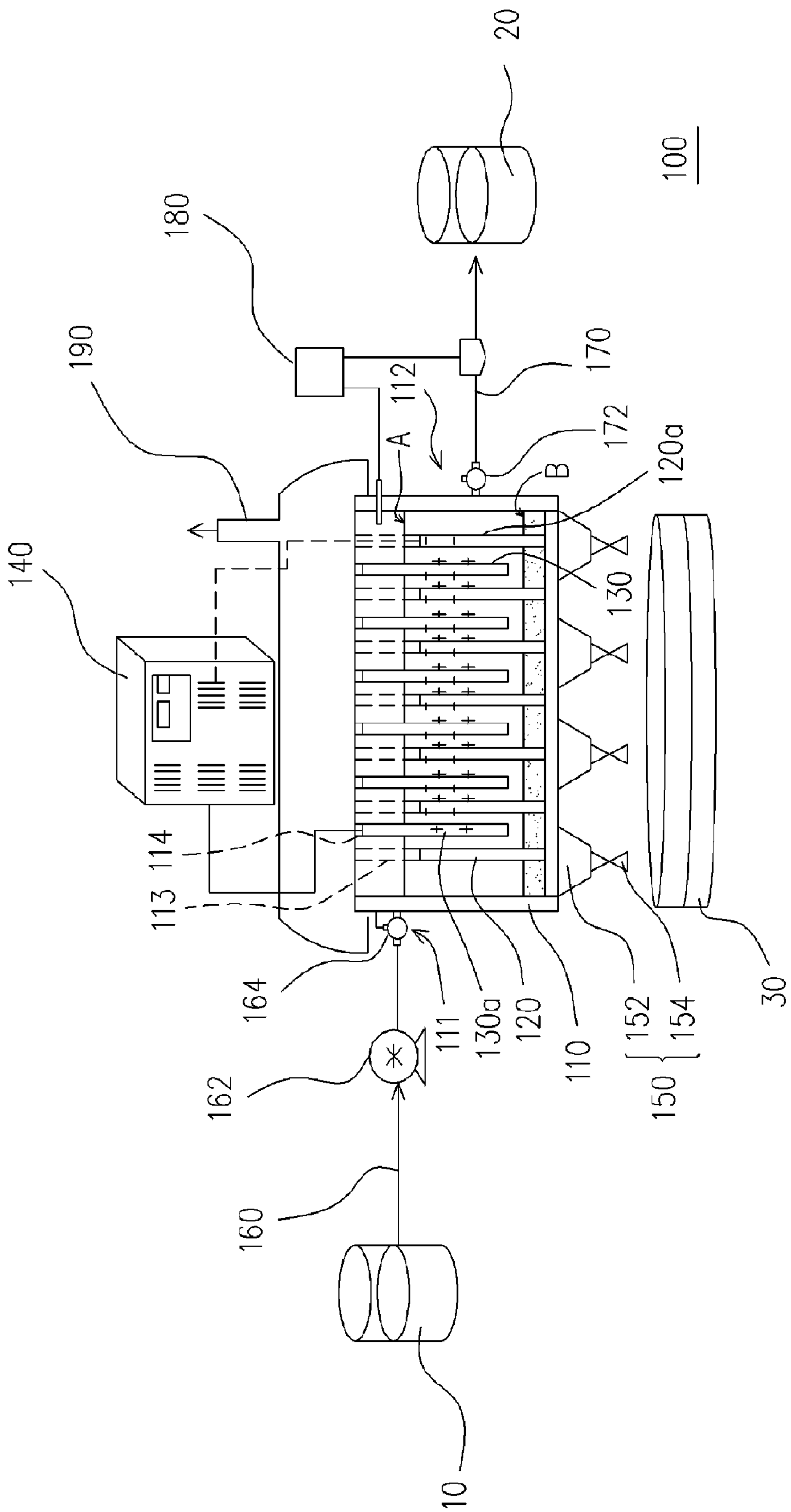
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FIG. 1B

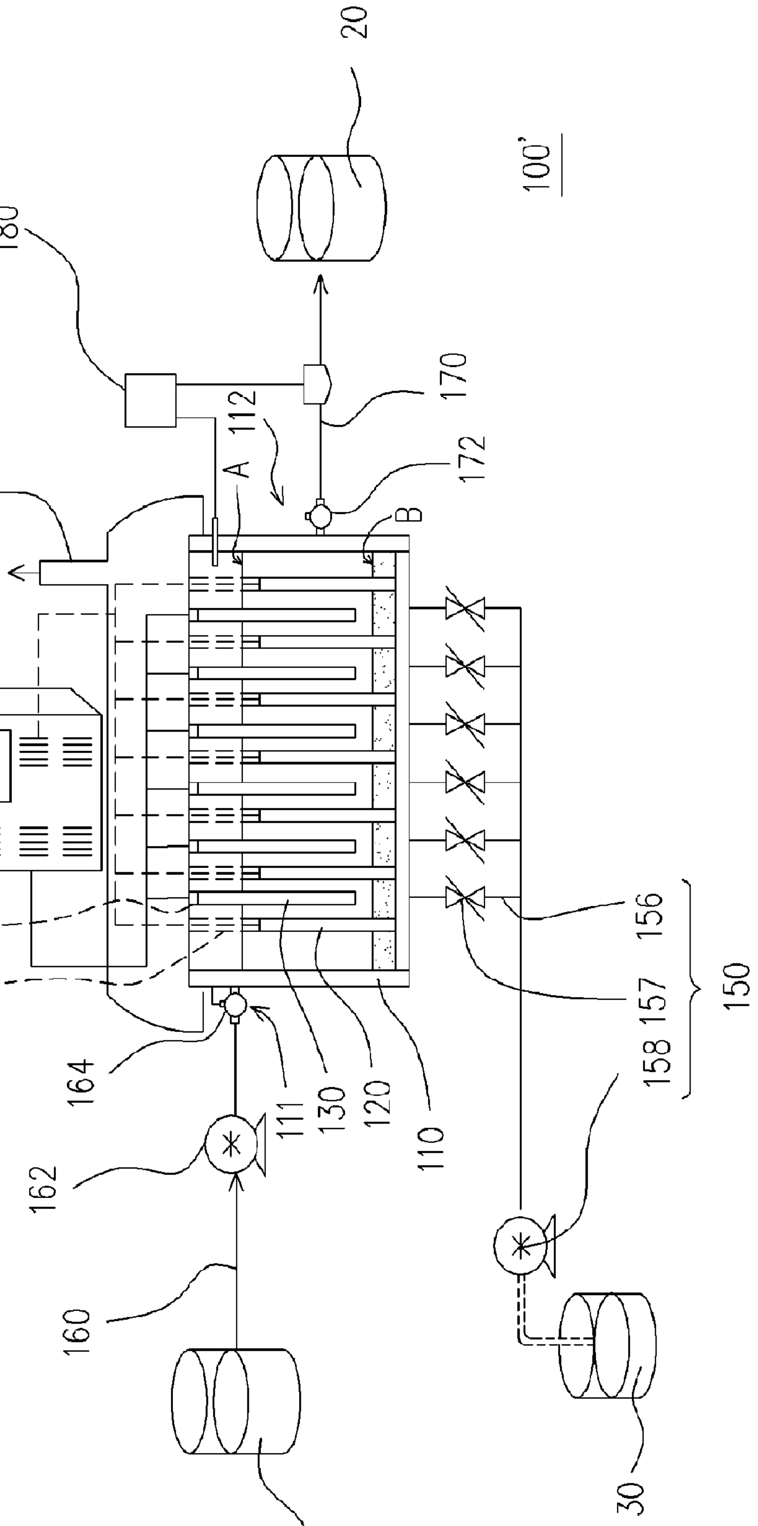
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FIG. 2A

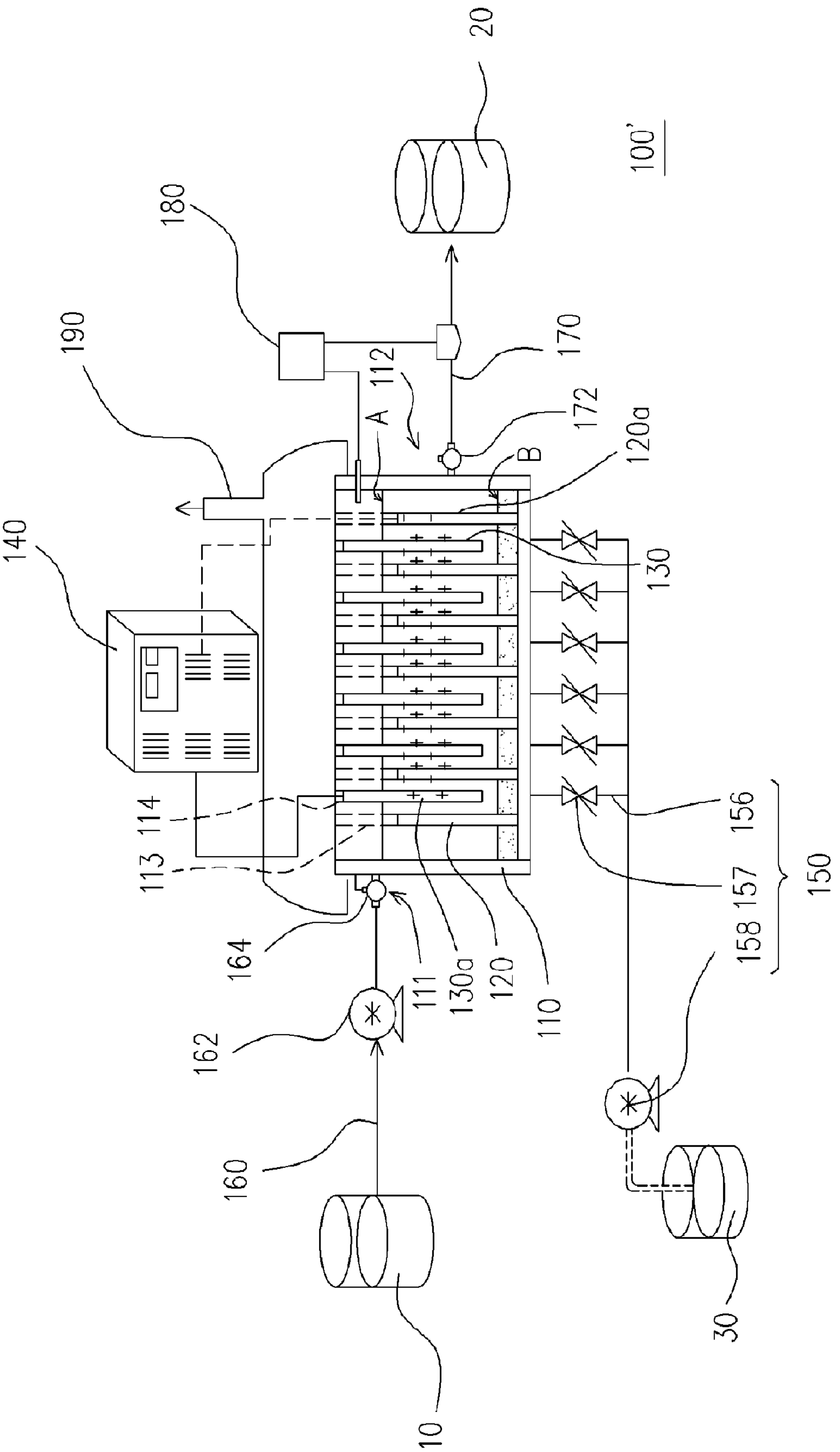
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FIG. 2B

WASTEWATER TREATMENT EQUIPMENT

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority benefit of Taiwan application serial no. 93117445, filed on Jun. 17, 2004.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a wastewater treatment equipment. More particularly, the present invention relates to wastewater treatment equipment for collecting particles with high surface charge in the wastewater.

[0004] 2. Description of the Related Art

[0005] Recently, as the IC industry advances, the manufacturing direction of wafer has developed toward higher density, larger integration and more excellent performance. In order to increase the density and the number of conductive wire layers of the IC, a global planarization process is necessary after the lithographic and thin film deposition processes. Conventionally, the global planarization process is performed by the chemical mechanical polishing (CMP) technology. However, the CMP process consumes large amount of ultrapure water, and therefore wastewater carrying the slurry from the CMP process is produced. In general, the polishing wastewater contains a plurality of nano-grade colloidal particles having the property of high surface charge and stable suspension, which further complicates the wastewater treatment. In addition, although the diluted polishing wastewater can meet the discharge standard of the total suspended solid of the effluent, the fine polishing particles of the wastewater such as silicon, aluminum, tungsten may precipitate in the wastewater treatment plant and as a result, the performance of the wastewater treatment plant is weakened. Moreover, the biological processing unit of the wastewater treatment plant may become completely inactive.

[0006] The conventional treatment methods of the polishing wastewater in the optoelectronic and semiconductor industry include chemical coagulation and membrane filtration. The chemical coagulation method is the conventional technology for removing suspended and colloidal particles in the wastewater. The removal mechanism of chemical coagulation is performed by using inorganic salt coagulating agent to agglomerate fine particles into large particles, and then the particles will precipitate by the gravity thereof. The drawback of the chemical coagulation method is that the properties of the polishing wastewater, such as the components, the turbidity or the conductivity, are not stable. Therefore, the exact amount of the agents in the chemical coagulation process is hard to determine, thus the effect of the coagulation deposition is not obvious. Also, among other disadvantages, the oxidants of the CMP wastewater needs to be removed before the chemical coagulation method is performed, the space required for the method need to be large, the flexibility of the method is almost non-existent, and the sludge volume produced in the method is large.

[0007] Alternatively, the membrane filtration method has been broadly applied for removing micro-colloidal particles, microbes, natural organic compounds or other inorganic ion contaminants. The removal mechanism of the membrane filtration method is performed by using external pressure to filter out large molecule contaminations from the water molecule by the membrane. The drawback of the method is that although the micro particles can be effectively separated from the water, they can easily clog up the pores of the membrane. As a result, the lifetime of the membrane is shortened since the reverse cleaning of the membrane is difficult. In addition, in the method, the size of the separated particles is highly dependent on the membrane pores and should be carefully monitored. Moreover, the method is less ideal for processing polishing wastewater having a large amount of micro particles or high concentration micro particles.

[0008] In solution, the conventional technology introduces a method using the electrochemical reactions comprising the electrophoresis effect due to electric field and the coagulation effect induced by sacrificial electrodes to separate the particles with high surface charge in the wastewater. The electrochemical reactions include electro-coagulation process and electro-decantation process. The electro-coagulation process is performed by using electric field to aggregate particles by the electrical attractions thereof, wherein the anodic plate releases metal ions after anodic oxidation reaction, thus the aggregated particles may be removed by the coagulation mechanism. Alternatively, in the electro-decantation process, the charged particles move to the electrode with opposite charge due to the electrophoresis effect by using electric field to aggregate high concentration particles near the electrode plate. After the aggregated concentration reaches a certain level, the particles may settle on the bottom of the electrolysis tank along the electrode plate.

[0009] Hereinafter, the Taiwan Patent Publication No. 144872, entitled "Continuous Operation Electrolysis Device Of Processing Industry Wastewater By Using Electrochemical Method" will be briefly described. The electrolysis device includes an electrolysis tank having a plurality of staggered positive and negative charged electrode plates. A water inlet and a water outlet are disposed in both sides of the electrolysis tank, wherein the liquid enters the electrolysis tank from the water inlet, passes through every electrode plate, and then flows out through the water outlet. A plurality of scraping components are disposed between every two adjacent electrode plates, wherein each scraping component is driven by a portion of the repetition driving mechanism in the electrolysis tank to move repeatedly on each electrode plate to scrape on the surface of the electrode plate. It should be noted that, since the electrode plate described above is in a round shape, and the fluid passes through a round hole in the center of the electrode plate, the opportunity of the fluid flowing through the electrode plate is reduced. In addition, the edge of the electrode plate and the inner wall of the electrolysis tank are sealed, and thus the electrode plate is hard to dissemble. Moreover, although the scraping components and the repetition driving mechanism in the electrolysis tank may successfully scrape off the sludge, the complex design of mechanism will increase the cost of the whole equipment.

[0010] Hereinafter, the U.S. Pat. No. 6,582,592, entitled "Apparatus For Removing Dissolved Metals Form Wastewater By Electro-Coagulation" will be briefly described. In the device of the pattern, a plurality of electrode plates are disposed in an electro-coagulation process tank to form a flow channel in the reaction tank. The electrode plates are connected to the power supply, whereby electrical currents are provided to form an electric field between the electrode plates, in order to ionize the electrode surface to react with the wastewater. In addition, a cyclone filter is disposed in the outlet terminal outside the reaction tank to separate the colloidal particles by centrifugal force. It should be noted that, the colloidal particles are carried out from the reaction tank by the wastewater, then the colloidal particles are separated by cyclone filter. In other words, there is no device in the reaction tank that can directly separate the colloidal particles. In addition, the complex design of the machine inside the cyclone filter will also increase the cost of the equipment.

SUMMARY OF THE INVENTION

[0011] Therefore, the present invention is directed to providing a wastewater treatment equipment using electrochemical reactions comprising electro-coagulation process and electro-decantation process. In addition, a collection device at the bottom of the reaction tank is also provided to collect the colloidal particles with high surface charge in the wastewater so the treated wastewater can meet the effluent standard.

[0012] In accordance with one embodiment of the present invention, an equipment for treating wastewater is provided. The wastewater treatment equipment comprises, for example but not limited to, a reaction tank, a plurality of anodic plates, a plurality of cathodic plates, a power supply and a collection device. The reaction tank comprises an inlet and an outlet. The anodic plates and the cathodic plates are placed in stagger in the reaction tank. The power supply is electrically connected to the anodic plates and the cathodic plates, and provides an electrical current to each of the anodic plates. In addition, the electrical currents of all anodic plates may have equal amplitudes. It should be noted that, in another embodiment of the present invention, the power supply may also be electrically connected to an outermost anodic plate of the anodic plates and an outermost cathodic plate of the cathodic plates, and provides an electrical current to the outermost anodic plate. Therefore, every two surfaces of each of the anodic plates and the cathodic plates except for the outermost anodic plate and the outermost cathodic plate will accumulate equal but opposite charges. The collection device is disposed at the bottom of the reaction tank for collecting the colloidal particles in the wastewater.

[0013] In one embodiment of the present invention, the collection device comprises, for example but not limited to, a plurality of cones and a plurality of switch valves, wherein the top of the cones is connected to the reaction tank, and switch valves are disposed at the bottom of the corresponding cones. In another embodiment of the present invention, the collection device comprises, for example but not limited to, a plurality of collection pipelines, a plurality of switch valves and a pump. The collection pipelines are connected to the reaction tank, the switch valves are disposed in the corresponding collection pipelines, and the pump is connected to the collection pipelines.

[0014] In one embodiment of the present invention, two opposite sidewalls of the reaction tank comprise a plurality of first plugs and a plurality of second plugs for installing the anodic plates and the cathodic plates respectively. The plugs also allow for the anodic and the cathodic plates to exchange with each other. In addition, the first plugs are extended to the bottom edge of the reaction tank, and the second plugs are not extended to the bottom edge of the reaction tank. Therefore, when the anodic and the cathodic plates are installed in the first plugs and the second plugs respectively, an upward and downward flow is generated between the anodic and the cathodic plates due to flow channel to increase the opportunity of the particles contacting the electrode plates.

[0015] In one embodiment of the present invention, the position of the inlet is higher than that of the outlet. In addition, the reaction tank has an operational water level, wherein the height of the operational water level is maintained between the inlet and outlet to keep the equipment in a stable condition. Moreover, the reaction tank has a deposition height, which is kept higher than the outlet to avoid draining out the deposited colloidal particles at the bottom layer produced during the electro-coagulation process or the concentrated solution at the bottom layer produced during the electrolysis in the reaction tank.

[0016] In one embodiment of the present invention, when the wastewater treatment equipment is provided to perform the electrochemical reactions of both electro-coagulation process and electro-decantation process, the anodic plates comprise, for example but not limited to, iron plates or aluminum plates, and the cathodic plates comprise, for example but not limited to, stainless steel plates. In another embodiment of the present invention, when the wastewater treatment equipment is only provided to perform the electrochemical reaction of electro-decantation process, the anodic plates and the cathodic plates comprise, for example but not limited to, stainless steel plates.

[0017] In one embodiment of the present invention, the ratio of width to height of the reaction tank is within the range of about 1.0 to about 2.0. The distance between every anodic plate and every cathodic plate is within the range of about 2 cm to about 15 cm. The current density of the power supply is within the range of about 1.0 mA/cm2 to about 500 mA/cm2.

[0018] In one embodiment of the present invention, the wastewater treatment equipment further comprises an inlet pipeline, wherein one terminal of the inlet pipeline is connected to the inlet of the reaction tank, and the other terminal of the inlet pipeline is connected to the wastewater collection tank. In addition, a pump is disposed in the inlet pipeline to pump the wastewater into the reaction tank for continuous treatment of the wastewater. Also, a switch valve is disposed in the inlet pipeline and between the pump and the reaction tank. Moreover, the pump is electrically connected to an automatic controller, which is applied to detect the water level, the pressure or the pH value of the reaction tank to control the suction speed.

[0019] In one embodiment of the present invention, the wastewater treatment equipment further comprises an outlet pipeline, wherein one terminal of the outlet pipeline is connected to the outlet of the reaction tank, and the other terminal of the outlet pipeline is connected to the outlet collection tank. In addition, a switch valve is also disposed in the outlet pipeline. Moreover, a suction device is disposed at the top of the reaction tank to draw out the hydrogen and oxygen gases produced between the electrode plates during the electrolysis of the water molecule in the wastewater.

[0020] Accordingly, the present invention provides an equipment using electrochemical reactions of electro-coagulation process and electro-decantation process to separate colloidal particles with high surface charge from the wastewater. In addition, the collection device at the bottom of the reaction tank is provided to collect the colloids or particles deposited at the bottom. Therefore, the treated wastewater can meet the effluent standard.

[0021] One or part or all of these and other features and advantages of the present invention will become readily apparent to those skilled in this art from the following description wherein there is shown and described an embodiment of this invention, simply by way of illustration of one of the modes best suited to carry out the invention. As it will be realized, the invention is capable of different embodiments, and its several details are capable of modifications in various, obvious aspects all without departing from the invention. Accordingly, the drawings and descriptions will be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

[0023] **FIGS. 1A and 1B** are schematic drawings of a wastewater treatment equipment according to embodiments of the present invention.

[0024] **FIGS. 2A and 2B** are schematic drawings of a wastewater treatment equipment according to another embodiments of the present invention.

DESCRIPTION OF EMBODIMENTS

[0025] **FIGS. 1A and 1B** are schematic drawings of a wastewater treatment equipment according to embodiments of the present invention. Referring to **FIG. 1A**, a wastewater treatment equipment **100** for treating wastewater having the property of nano-grade particles with high surface charge and stable suspension is provided. The wastewater treatment equipment **100** comprises, for example but not limited to, a reaction tank **110**, a plurality of anodic plates **120**, a plurality of cathodic plates **130**, a power supply **140** and a collection device **150**. It is noted that, the embodiment illustrated in **FIG. 1B** is similar **FIG. 1B**, wherein the differences between **FIG. 1B** and **FIG. 1A** will be described hereinafter.

[0026] The reaction tank **110** comprises an inlet **111** and an outlet **112**, wherein the terminal of the inlet **111** is connected to one terminal of the inlet pipeline **160**, and the other terminal of the inlet pipeline **160** is connected to the wastewater collection tank **10**. In addition, a pump **162** is disposed in the inlet pipeline **160** to pump the wastewater in the wastewater collection tank **10** to the reaction tank **110** for continuous treatment of the wastewater. Moreover, a switch valve **164** is disposed in the inlet pipeline **160** between the pump **162** and the reaction tank **110** to control the entrance of the wastewater to the reaction tank **110**. Furthermore, the outlet **112** of the reaction tank **110** is connected to the terminal of an outlet pipeline **170**, and the other terminal of the outlet pipeline **170** is connected to the outlet collection tank **20**. In addition, a switch valve **172** may also be disposed in the outlet pipeline **170** to control the exit of the wastewater from the reaction tank **110**.

[0027] The anodic plates **120** and the cathodic plates **130** are disposed in the reaction tank **110**. The anodic plates **120** can be iron plates or aluminum plates. The cathodic plates **130** can be stainless steel plates. In addition, the anodic plates **120** and the cathodic plates **130** are placed in a staggered order. In one embodiment of the present embodiment, a plurality of first plugs **113** and a plurality of second plugs **114** are disposed on two opposite sidewalls of the reaction tank **110** respectively to install the anodic plates **120** and cathodic plates **130**. The design of plugs **113** and **114** enables exchangeability of the anodic and cathodic plates **120** and **130** during installation.

[0028] In addition, it should be noted that the first plugs **113** are extended to the bottom edge of the reaction tank **110**, and the second plugs **114** are not extended to the bottom edge of the reaction tank **110**. Therefore, after the anodic and cathodic plates **120** and **130** are installed in the first plugs **113** and the second plugs **114** respectively, an upward and downward flow between the anodic and cathodic plates **120** and **130** is generated by the flow channel thereof. As a result, the flow path of the wastewater is enlarged, and thus the opportunity of the particles contacting the electrode plates is increased. Moreover, the ratio of width to height of the reaction tank **110** ranges between about 1.0 to about 2.0. The length of the reaction tank **110** is dependent on the number of the anodic and cathodic plates **120** and **130**.

[0029] Referring to **FIG. 1A**, in one embodiment of the present invention, the power supply **140** is electrically connected to the anodic plates **120** and the cathodic plates **130** to provide an electrical current to each anodic plate **120**, therefore, each cathodic plate **130** will have corresponding electrical current in opposite direction. In addition, for example, the electrical currents of all the anodic plates **120** may have equal amplitudes. Therefore, a dual polarized electric field is formed between the anodic plates **120** and the cathodic plates **130**. In addition, the power supply **140** provides a current density in a range of, for example but not limited to, about 1.0 mA/cm2 to about 500 mA/cm2. The distance between every anodic plate **120** and every cathodic plate **130** is in a range of, for example but not limited to, about 2 cm to about 15 cm.

[0030] Referring to **FIG. 1B**, in another embodiment of the present invention, the power supply **140** may also be electrically connected to an outermost anodic plate **120*a*** of the anodic plates **120** and an outermost cathodic plate **130*a*** of the cathodic plates **130** to provide an electrical current to the anodic plate **120*a***, therefore, the cathodic plate **130*a*** will have corresponding electrical current in opposite direction. In addition, every two surfaces of each of the anodic plates **120** and the cathodic plates **130** except for the outermost anodic plate **120*a*** and the outermost cathodic plate **130*a*** will accumulate equal but opposite charges. Therefore, a polarized electric field is formed between the anodic plates **120** and the cathodic plates **130**.

[0031] The collection device **150** is disposed at the bottom of the reaction tank **110** to collect the colloidal particles in the wastewater. In the present embodiment, the collection device **150** comprises, for example but not limited to, a plurality of cones **152** and a plurality of switch valves **154**. The top of the cones **152** is connected to the reaction tank **110**, and the switch valves **154** are disposed at the bottom of the corresponding cones **152**.

[0032] As shown in **FIG. 1A**, when the wastewater flows through the electric field, particles with high surface charge in the wastewater may be directed by the electric field and attracted to the electrode plates having opposite charges. The moving of the charged particles to the electrode plates is called an electrophoresis effect. Therefore, charged particles are aggregated near the electrode plates with a high concentration. When the concentration is high enough, the particles will deposit at the bottom of the reaction tank **110** along the electrode plates and will be collected by the collection device **150**. Meanwhile, the anodic plates **120** (e.g., an iron plate or an aluminum plate) may release metal ion (e.g., iron ion or aluminum ion) due to anodic oxidation reaction. Therefore, metal oxides are produced in the wastewater, and the aggregated particles will deposit in the bottom of the reaction tank **110** due to coagulation mechanism, and will be collected by the collection device **150**. In other words, in the present embodiment, when the wastewater of the reaction tank **110** flows through the electric field, the electro-coagulation process and the electro-decantation process perform simultaneously for the colloidal particles to deposit in the bottom of the reaction tank **110**.

[0033] It should be noted that, in the present embodiment, the cones **152** of the collection device **150** facilitates the collection of the colloidal particles produced during the electro-coagulation process or the particles concentrated during the electro-decantation process. Thereafter, to remove the deposited sludge, first of all, the switch valve **164** of the inlet and the switch valve **172** of the outlet should be turn off. Then, the switch valve **154** is turned on to receive the sludge from the reaction tank **110** and forward the sludge to collection tank **30**. In addition, in the process of electro-coagulation, the anodic and cathodic electrodes may be connected reversibly to the power supply **140** to remove the accumulated particles on the anodic plate **120**. Therefore, the treated wastewater from the outlet **112** of the reaction tank **110** may meet the effluent standard.

[0034] Accordingly, in order to facilitate the flow of the wastewater in the reaction tank **110**, the position of the inlet **111** may be disposed higher than that of the outlet **112**. In addition, the wastewater flows into the reaction tank **110** in an operational water level A, which may be maintained between the height of inlet **111** and outlet **112** to keep the equipment in a stable condition. Moreover, the deposited sludge at the bottom of the reaction tank has a deposition height B, which may be maintained higher than the outlet **112**. Therefore, when the treated wastewater exits the reaction tank, the deposited colloidal particles at the bottom layer produced during the electro-coagulation process or the concentrated solution at the bottom layer produced during the electrolysis process will not flow out with the treated wastewater.

[0035] Furthermore, in order to control the suction speed of the pump **170** in the inlet pipeline **160**, an automatic controller **180** may be connected to the pump **170**. The automatic controller **180** has a sensor component to detect the water level, the pressure or the pH value of the reaction tank **110**. When a change of the water level, pressure or pH value of the reaction tank **110** is detected by the sensor component of the automatic controller **180**, the suction speed of the pump **170** can be adjusted by the automatic controller **180** to keep the equipment in a stable condition. In one embodiment of the present invention, the automatic controller **180** may also be electrically connected to the switch valve **154**. Therefore, the whole equipment may be automatically controlled at the switch of the switch valve **154**.

[0036] In addition, when the wastewater flows through the electric field, the water molecule in the wastewater may generate hydrogen and oxygen gases in the anodic plates **120** and the cathodic plates **130** respectively. In addition, for the safety issue of the gases, an enclosure and a suction device **190** may be disposed on top of the reaction tank **110** to draw out the gases.

[0037] **FIGS. 2A and 2B** are schematic drawings of a wastewater treatment equipment according to another embodiments of the present invention. It is noted that, the embodiment of **FIG. 2A/2B** is similar **FIG. 1A/1B**, and the difference there-between will be described hereinafter. As shown in **FIG. 2A**, the wastewater treatment equipment **100'** has a structure similar to that described in the above embodiment except that the collection device **150** is replaced by a plurality of collection pipelines **156**, a plurality of switch valves **157** and the pump **158**. The collection pipelines **156** are connected to the reaction tank **110**, the switch valves **157** are disposed in the corresponding collection pipelines **156**, and the pump **158** is connected to the collection pipelines **156**. When the deposited sludge is removed, the switch valves **157** and the pump **158** are turned on to pump the sludge from the reaction tank **110** directly to the sludge collection tank **30** via the collection pipelines **156**.

[0038] Accordingly, the present invention utilizes electrochemical reactions of electro-coagulation process and electro-decantation process to separate colloidal particles with high surface charge from the wastewater. In addition, the collection device at the bottom of the reaction tank is provided to collect the colloids or particles deposited at the bottom of the reaction tank. Therefore, the treated wastewater can meet the effluent standard. In the present invention, the wastewater treatment equipment performs electrochemical reactions of electro-coagulation process and electro-decantation process for treating wastewater. However, in another embodiment of the present invention, the wastewater treatment equipment is not limited to performing the electrochemical reactions of electro-coagulation process and electro-decantation process at the same time. The present invention can be used to only perform the electrochemical reaction of electro-decantation process. In other words, when the electrochemical reaction of the wastewater treatment equipment only comprises the electro-decantation process, the anodic plates and the cathodic plates can be stainless steel plates.

[0039] Accordingly, the wastewater treatment equipment in the present invention has at least the following advantages. First, the electrochemical reactions of the present invention comprising the electro-coagulation process and the electro-decantation process can separate the nano-grade colloidal particles from the wastewater. Next, in the present invention, the collection device is disposed at the bottom of the reaction tank to remove the deposited sludge at the bottom directly. The structure of the collection device is simple and can therefore reduce the cost of the equipment.

[0040] Moreover, in the present invention, the anodic and cathodic electrodes of the power supply may be reversed to facilitate the removal of the sludge accumulated on the anodic plates. Therefore, a complex mechanism of the scraped device can be spared. Furthermore, in the present invention, an upward and downward flow between the anodic and cathodic plates are generated due to the flow channel thereof. Therefore, the flow path of the wastewater is enlarged, and thus the opportunity for the particles contacting the electrode plates is increased.

[0041] In addition, the plugs on the sidewall of the reaction tank in the present invention enables the exchangeability when installing the anodic and cathodic plates. Also, the wastewater treatment equipment of the present invention is suitable for treating wastewater with high charge particles produced during the semiconductor, electronic, optoelectronic, wafer machining and surface polishing manufacturing process and is thus highly applicable.

[0042] The foregoing description of the preferred embodiment of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form or to exemplary embodiments disclosed. Accordingly, the foregoing description should be regarded as illustrative rather than restrictive. Obviously, many modifications and variations will be apparent to practitioners skilled in this art. The embodiments are chosen and described in order to best explain the principles of the invention and its best mode practical application, thereby to enable persons skilled in the art to understand the invention for various embodiments and with various modifications as are suited to the particular use or implementation contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents in which all terms are meant in their broadest reasonable sense unless otherwise indicated. It should be appreciated that variations may be made in the embodiments described by persons skilled in the art without departing from the scope of the present invention as defined by the following claims. Moreover, no element and component in the present disclosure is intended to be dedicated to the public regardless of whether the element or component is explicitly recited in the following claims.

What is claimed is:

1. An equipment for treating wastewater, comprising:

a reaction tank comprising an inlet and an outlet;

a plurality of anodic plates disposed in the reaction tank;

a plurality of cathodic plates disposed in the reaction tank, wherein the anodic plates and the cathodic plates are disposed in a staggered order;

a power supply electrically connected in parallel with the anodic plates and the cathodic plates for providing an electrical current to each of the anodic plates in which the electrical currents have equal amplitudes, or electrically connected to an outermost anodic plate of the anodic plates and an outermost cathodic plate of the cathodic plates for providing an electrical current to the outermost anodic plate so that two surfaces of each of the anodic plates and the cathodic plates except for the outermost anodic plate and the outermost cathodic plate accumulate equal but opposite charges; and

a collection device disposed at a bottom of the reaction tank to collect colloidal particles in the wastewater.

2. The equipment of claim 1, wherein the collection device comprises:

a plurality of cones, wherein a top of the cone is connected to the reaction tank; and

a plurality of switch valves, wherein each of the switch valves is disposed at a bottom of each of the cone.

3. The equipment of claim 1, wherein the collection device comprises:

a plurality of collection pipelines connected to the reaction tank;

a plurality of switch valves, wherein each of the switch valve is disposed in each of the collection pipelines; and

a pump connected to the collection pipelines.

4. The equipment of claim 1, wherein a plurality of first plugs and a plurality of second plugs are disposed on two opposite sidewalls of the reaction tank for installing the anodic plates and the cathodic plates respectively, and the first plugs are extended to a bottom edge of the reaction tank, and the second plugs are not extended to the bottom edge of the reaction tank.

5. The equipment of claim 1, wherein a ratio of width to height of the reaction tank is in a range of about 1.0 to about 2.0.

6. The equipment of claim 1, wherein a position of the inlet is higher than a position of the outlet.

7. The equipment of claim 1, wherein the reaction tank comprises an operational water level, wherein a height of the operational water level is maintained between the inlet and the outlet.

8. The equipment of claim 1, wherein the reaction tank comprises a deposition height, wherein the deposition height is higher than a height of the outlet.

9. The equipment of claim 1, wherein the anodic plates comprise iron plates or aluminum plates, and the cathodic plates comprise stainless steel plates.

10. The equipment of claim 1, wherein the anodic plates and the cathodic plates comprise stainless steel plates.

11. The equipment of claim 1, wherein a distance between each of the anodic plates and each of the cathodic plates is in a range of about 0.5 cm to about 15 cm.

12. The equipment of claim 1, wherein a current density provided by the power supply is in a range of about 1.0 mA/cm2 to about 500 mA/cm2.

13. The equipment of claim 1, further comprising an inlet pipeline, wherein a terminal of the inlet pipeline is connected to the inlet of the reaction tank.

14. The equipment of claim 13, further comprising a pump connected to the inlet pipeline to pump the wastewater into the reaction tank.

15. The equipment of claim 14, further comprising a switch valve connected to the inlet pipeline and between the pump and the reaction tank.

16. The equipment of claim 14, further comprising an automatic controller electrically connected to the pump for detecting a water level, a pressure or a pH value of the reaction tank to control a suction speed.

17. The equipment of claim 1, further comprising an outlet pipeline, wherein the terminal of the outlet pipeline is connected to the outlet of the reaction tank.

18. The equipment of claim 17, further comprising a switch valve disposed on the outlet pipeline.

19. The equipment of claim 1, further comprising a suction device disposed on top of the reaction tank.

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