BOTTLE CLAMPING DEVICE, ULTRASONIC DISSOLUTION EQUIPMENT, AND ULTRASONIC DISSOLUTION SYSTEM

CROSS-REFERENCE TO THE RELATED APPLICATIONS

[0001] The present invention claims priority to Chinese Patent Application No. 202420268905.6, filed with the Chinese Patent Office on February 2, 2024, and entitled "BOTTLE CLAMPING DEVICE, ULTRASONIC DISSOLUTION EQUIPMENT, AND ULTRASONIC DISSOLUTION SYSTEM", the entirety of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates to the technical field of laboratory instruments, and in particular, to a bottle clamping device, ultrasonic dissolution equipment, and an ultrasonic dissolution system.

BACKGROUND

[0003] In pharmaceutical synthesis experiments, some poorly soluble solids or poorly miscible solvents exist, which affect the normal progress of reactions. To achieve mixing of poorly soluble solids or poorly miscible solvents, a reaction bottle containing the poorly soluble solid or poorly miscible solvent can be placed in a water tank of an ultrasonic dissolution device to achieve dissolution of the poorly soluble solid or poorly miscible solvent.

[0004] However, under the action of water in the water tank, the reaction bottle is prone to toppling over, and manual holding of the reaction bottle cannot satisfy the requirement of long-time operation of the ultrasonic dissolution device. To satisfy the requirement of long-time operation of the ultrasonic dissolution device, a fixing device capable of fixing the reaction bottle can be provided on the ultrasonic dissolution device. The fixing device generally includes a fixing plate, the fixing plate is provided with placement holes, and the reaction bottle is clamped in the placement holes to achieve fixing of the reaction bottle. However, the fixing effect of the placement holes on the reaction bottle is poor, and the reaction bottle still has a relatively large risk of toppling over.

SUMMARY

[0005] In view of the above, the present invention provides a bottle clamping device to solve the problem that the clamping device has a poor fixing effect on the reaction bottle, and the reaction bottle still has a risk of toppling over.

[0006] A first aspect of the present invention provides a bottle clamping device, wherein the bottle clamping device is configured to fix a member to be clamped, the bottle clamping device comprises a bracket, a fixing plate, and a clamping assembly, the fixing plate is fixed on the bracket, and the fixing plate is provided with a predetermined number of guide holes; and

[0007] at least one of the predetermined number of guide holes is correspondingly provided with the clamping assembly, wherein the clamping assembly surrounds to form a clamping space, the clamping space is in communication with an interior of the guide hole corresponding to the clamping assembly, at least a portion of the member to be clamped is able to extend through the guide hole into the clamping space, and the clamping assembly is able to apply a force toward an interior of the clamping space on the member to be clamped.

[0008] Optionally, the clamping assembly comprises a plurality of elastic pieces, the plurality of elastic pieces are fixed on the fixing plate, the plurality of elastic pieces are spaced apart and surround an edge of the guide hole corresponding to the clamping assembly, and the plurality of elastic pieces surround to form the clamping space.

[0009] Optionally, the plurality of elastic pieces are all disposed on a same side of the fixing plate; or the plurality of elastic pieces are disposed on two opposite sides of the fixing plate.

[0010] Optionally, the elastic piece comprises an abutting portion and an extension portion connected to each other, the abutting portion is connected to the fixing plate, and a portion of the extension portion extends toward an interior of the guide hole.

[0011] Optionally, the elastic piece comprises an abutting portion and an extension portion connected to each other, the abutting portion is connected to the fixing plate, an upper portion of the extension portion protrudes toward an exterior of the guide hole, and a middle portion of the extension portion protrudes toward an interior of the guide hole.

[0012] Optionally, the clamping assembly comprises a rubber ring fixed on the fixing plate, an inner wall of the rubber ring surrounding to form the clamping space.

[0013] Optionally, the bottle clamping device further comprises a mounting plate and a flexible plate, the flexible plate is fixed on the mounting plate, and the mounting plate is disposed on the fixing plate; and

[0014] the mounting plate is provided with a mounting hole, the flexible plate is provided with a limiting hole, the mounting hole is in communication with the limiting hole, and the member to be clamped can penetrate through the limiting hole and the mounting hole, wherein the flexible plate is configured to be in an interference fit with the member to be clamped.

[0015] Optionally, the bottle clamping device further comprises a supporting plate, a first supporting rod, and a second supporting rod, the supporting plate is fixed to the bracket through the first supporting rod, and the fixing plate is fixed to the supporting plate through the second supporting rod.

[0016] Optionally, the predetermined number of guide holes are divided into two groups, each of the guide holes in a first group is correspondingly provided with the clamping assembly; and

[0017] the supporting plate is provided with clamping holes, a position of the clamping holes corresponds to a position of the guide holes in a second group, and the member to be clamped can pass through the clamping holes and the guide holes in the second group.

[0018] Optionally, the bracket comprises a bearing plate and at least two mounting members, the at least two mounting members are each connected to the bearing plate, and the fixing plate is fixed to the bearing plate.

[0019] Optionally, the mounting member comprises a connecting plate and an overlapping plate, two sides of the connecting plate are respectively connected to the bearing plate and the overlapping plate, and the overlapping plate protrudes from the connecting plate in a direction away from the fixing plate.

[0020] A second aspect of the present invention provides a bottle clamping device, wherein the bottle clamping device is configured to fix a member to be clamped, the bottle clamping device comprises a bracket, a fixing plate, and a plurality of elastic pieces, the fixing plate is connected to the bracket, the plurality of elastic pieces are each connected to the fixing plate, and the plurality of elastic pieces surround to form a clamping space, wherein the clamping space is configured to receive the member to be clamped inserted therein, and the plurality of elastic pieces are configured to abut against the member to be clamped.

[0021] A third aspect of the present invention provides an ultrasonic dissolution equipment, the ultrasonic dissolution equipment comprising a water tank and the above bottle clamping device, wherein the bottle clamping device is fixed to the water tank, and at least a portion of the bottle clamping device is located in the water tank.

[0022] Optionally, the water tank comprises a tank body and a cover, the tank body has an opening, and the cover is disposed on the opening; and

[0023] the cover is provided with a mounting opening, the bottle clamping device is fixed to the cover, and a portion of the bottle clamping device extends into an interior of the water tank through the mounting opening.

[0024] A fourth aspect of the present invention provides an ultrasonic dissolution system, the ultrasonic dissolution system comprising the above ultrasonic dissolution equipment.

[0025] When the bottle clamping device of the present invention is in use, the bottle clamping device can be fixed on a water tank of an ultrasonic dissolution device through the bracket, the member to be clamped can extend through a fixing hole into a mounting space, the fixing hole performs preliminary fixing on the member to be clamped, and the clamping assembly can apply a force toward an interior of the clamping space on the member to be clamped, to further fix the member to be clamped. In this way, the member to be clamped is fixed through the guide hole and the clamping assembly, which improves stability of fixing the member to be clamped and reduces a risk of the member to be clamped toppling over.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] In order to explain technical solutions of embodiments of the present invention more clearly, drawings to be used in the embodiments will be briefly described below. It should be understood that the following drawings merely show some embodiments of the present invention, and therefore should not be construed as limiting the scope. For those of ordinary skill in the art, other related drawings can also be obtained based on these drawings without creative efforts.

[0027] FIG. 1 shows a perspective structural schematic diagram of a bottle clamping device according to an embodiment of the present invention;

[0028] FIG. 2 shows a planar structural schematic diagram of the bottle clamping device according to an embodiment of the present invention;

[0029] FIG. 3 shows a structural schematic diagram of a fixing plate;

[0030] FIG. 4 shows a relative position diagram of a mounting plate and a flexible plate;

[0031] FIG. 5 shows a structural schematic diagram of an ultrasonic dissolution equipment;

[0032] FIG. 6 shows a structural schematic diagram of a tank body; and

[0033] FIG. 7 shows a structural schematic diagram of a cover.

[0034] Reference numerals: 1-bracket; 11-bearing plate; 12-mounting member; 121-connecting plate; 122-overlapping plate; 2-fixing plate; 21-guide hole; 3-clamping assembly; 31-elastic piece; 41-supporting plate; 411-clamping hole; 42-mounting plate; 421-mounting hole; 422-first through hole; 43-flexible plate; 431-limiting hole; 432-second through hole; 51-first supporting

rod; 52-second supporting rod; 53-third supporting rod; 6-member to be clamped; 71-tank body; 711-water injection tank; 72-cover; 721-mounting opening.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0035] The following detailed description is provided to help a reader obtain a comprehensive understanding of the methods, devices, and/or systems described herein. However, after understanding the present invention, various changes, modifications, and equivalents of the methods, devices, and/or systems described herein will be apparent. For example, the sequence of operations described herein is merely exemplary, and is not limited to the sequences set forth herein, but may be changed as will be apparent after understanding the present invention, except for operations that must occur in a particular order. In addition, descriptions of features known in the art may be omitted for clarity and conciseness.

[0036] The features described herein can be implemented in different forms and should not be construed as limited to the examples described herein. Rather, the examples described herein are provided merely to illustrate some of the many possible ways of implementing the methods, devices, and/or systems described herein that will be apparent after understanding the present invention.

[0037] Throughout the specification, when an element (such as a layer, region, or substrate) is described as being "on", "connected to", "bonded to", "above", or "covering" another element, it can be directly "on", "connected to", "bonded to", "above", or "covering" the other element, or one or more other intervening elements may be present. In contrast, when an element is described as being "directly on", "directly connected to", "directly bonded to", "directly above", or "directly covering" another element, no other intervening elements may be present.

[0038] As used herein, the term "and/or" includes any one and any combination of two or more of the listed associated items.

[0039] Although terms such as "first", "second", and "third" may be used herein to describe various members, components, regions, layers, or portions, these members, components, regions, layers, or portions are not limited by these terms. Rather, these terms are only used to distinguish one member, component, region, layer, or portion from another member, component, region, layer, or portion. Thus, a first member, component, region, layer, or portion referred to in the examples described herein can also be referred to as a second member, component, region, layer, or portion without departing from the teachings of the examples.

[0040] Spatial relationship terms such as "above", "upper", "below", and "lower" may be used herein for ease of description to describe the relationship of one element to another element as illustrated in the drawings. Such spatial relationship terms are intended to encompass different orientations of the device in use or operation in addition to the orientations depicted in the drawings. For example, if the device in the drawings is turned over, an element described as being "above" or "upper" relative to another element will then be "below" or "lower" relative to the other element. Thus, the term "above" encompasses both "above" and "below" orientations depending on a spatial orientation of the device. The device can also be positioned in other ways (for example, rotated by 90 degrees or at other orientations), and the spatial relationship terms used herein will be interpreted accordingly.

[0041] The terminology used herein is for the purpose of describing various examples and is not intended to limit the present invention. Unless the context clearly indicates otherwise, singular forms are also intended to include plural forms. The terms "include", "comprise", and "have" enumerate the presence of stated features, quantities, operations, members, elements, and/or combinations thereof, but do not exclude the presence or addition of one or more other features, quantities, operations, members, elements, and/or combinations thereof.

[0042] Variations in shapes shown in the drawings may occur due to manufacturing techniques and/or tolerances. Therefore, the examples described herein are not limited to specific shapes shown in the drawings, but include changes in shape that occur during manufacturing.

[0043] The features of the examples described herein can be combined in various ways that will be apparent after understanding the present invention. In addition, although the examples described herein have various configurations, other configurations are possible as will be apparent after understanding the present invention.

[0044] The present invention provides a bottle clamping device, and the bottle clamping device is configured to fix a member 6 to be clamped. As shown in FIG. 1, FIG. 2, and FIG. 3, the bottle clamping device comprises a bracket 1, a fixing plate 2, and a clamping assembly 3, the fixing plate 2 is fixed on the bracket 1, and the fixing plate 2 is provided with a predetermined number of guide holes 21. At least one of the predetermined number of guide holes 21 is correspondingly provided with the clamping assembly 3, the clamping assembly 3 surrounds to form a clamping space, the clamping space is in communication with an interior of the guide hole 21 corresponding to the clamping assembly 3, at least a portion of the member 6 to be clamped can extend through the guide hole 21 into the clamping space, and the clamping assembly 3 can apply a force toward an interior of the clamping space on the member 6 to be

clamped, to clamp the member 6 to be clamped. When the bottle clamping device of the present invention is in use, the bottle clamping device can be fixed on a water tank of an ultrasonic dissolution device through the bracket 1, the member 6 to be clamped can extend through the guide hole 21 into a mounting space, to perform preliminary fixing on the member 6 to be clamped by means of the guide hole 21, and then the clamping assembly 3 is used to apply a force toward an interior of the clamping space on the member 6 to be clamped, to further fix the member 6 to be clamped. In this way, the member 6 to be clamped is fixed through the guide hole 21 and the clamping assembly 3, which improves stability of fixing the member 6 to be clamped and reduces a risk of the member 6 to be clamped toppling over.

[0045] Optionally, the number of guide holes 21 is selected according to requirements. For example, the predetermined number can be 1, 2, 4, 8, or more.

[0046] The present invention does not limit a specific structure and specification of the member 6 to be clamped used, and those of ordinary skill in the art can select a suitable structure and specification of the member 6 to be clamped based on the technical solutions of the present invention through non-creative labor, and technical solutions formed thereby all fall within the protection scope of the present invention.

[0047] Optionally, as shown in FIG. 3, the clamping assembly 3 comprises a plurality of elastic pieces 31, the plurality of elastic pieces 31 are fixedly connected to the fixing plate 2, the plurality of elastic pieces 31 are spaced apart and surround an edge of the guide hole 21 corresponding to the clamping assembly 3, and the plurality of elastic pieces 31 surround to form the clamping space. When the member 6 to be clamped is not inserted into the clamping space, edges of the plurality of elastic pieces 31 extend toward an interior of the guide hole 21 relative to an edge of the guide hole 21. When the member 6 to be clamped is inserted into the clamping space through the guide hole 21, the elastic pieces 31 deform, and the plurality of elastic pieces 31 clamp the member 6 to be clamped and apply force on the member 6 to be clamped, to ensure stability of fixing the member 6 to be clamped.

[0048] Optionally, the plurality of elastic pieces 31 can all be disposed on a same side of the fixing plate 2, or can be respectively disposed on two opposite sides of the fixing plate 2. In a case where the plurality of elastic pieces 31 are all disposed on a lower side of the fixing plate 2, the plurality of elastic pieces 31 are configured to clamp a portion of the member 6 to be clamped located on the lower side of the fixing plate 2. Taking one of the elastic pieces 31 as an example, the elastic piece 31 comprises an abutting portion and an extension portion connected to each other, the abutting portion abuts against a lower surface of the fixing plate 2, and a

portion of the extension portion extends toward an interior of the guide hole 21. In a case where the plurality of elastic pieces 31 are all disposed on an upper side of the fixing plate 2, the plurality of elastic pieces 31 clamp a portion of the member 6 to be clamped located on the upper side of the fixing plate 2. Taking one of the elastic pieces 31 as an example, the elastic piece 31 comprises an abutting portion and an extension portion connected to each other, the abutting portion abuts against a lower surface or an upper surface of the fixing plate 2, an upper portion of the extension portion protrudes toward an exterior of the guide hole 21, a middle portion of the extension portion protrudes toward an interior of the guide hole 21, and a lower portion of the extension portion protrudes toward an exterior of the guide hole 21 or protrudes toward an interior of the guide hole 21. In a case where some of the plurality of elastic pieces 31 are disposed on the upper side of the fixing plate 2 and other elastic pieces 31 are disposed on the lower side of the fixing plate 2, the elastic pieces 31 disposed on the upper side of the fixing plate 2 clamp a portion of the member 6 to be clamped located on the upper side of the fixing plate 2, and the elastic pieces 31 disposed on the lower side of the fixing plate 2 clamp a portion of the member 6 to be clamped located on the lower side of the fixing plate 2. The elastic pieces 31 on the upper side of the fixing plate 2 can adopt a form of the elastic pieces 31 in the above arrangement where the plurality of elastic pieces 31 are all disposed on the upper side of the fixing plate 2, and the elastic pieces 31 on the lower side of the fixing plate 2 can adopt a form of the elastic pieces 31 in the above arrangement where the plurality of elastic pieces 31 are all disposed on the lower side of the fixing plate 2.

[0049] Optionally, the number of elastic pieces 31 included in the clamping assembly 3 corresponding to each guide hole 21 can be two, three, four, or more; and a spacing between adjacent elastic pieces 31 is selected merely according to requirements. Optionally, the plurality of elastic pieces 31 can be disposed at equal intervals, to ensure stability of fixing the member 6 to be clamped. Of course, the plurality of elastic pieces 31 can also be disposed at unequal intervals.

[0050] Optionally, the form of the clamping assembly 3 is not limited thereto. For example, the clamping assembly 3 can also be a rubber ring fixed on the fixing plate 2, an inner wall of the rubber ring surrounds to form the clamping space, and when the member 6 to be clamped extends into the clamping space surrounded by the inner wall of the rubber ring, the inner wall of the rubber ring is in an interference fit with the member 6 to be clamped, and the rubber ring can apply force on the member 6 to be clamped, to ensure stability of fixing the member 6 to be clamped.

[0051] In an embodiment of the present invention, the guide holes 21 can be round holes, and the predetermined number of guide holes 21 are divided into two groups, in which each of the guide holes 21 in a first group is correspondingly provided with the clamping assembly 3. A diameter of each of the guide holes 21 in the first group is smaller than a diameter of each of the guide holes 21 in a second group, which enables the guide holes 21 in the second group to be configured to fix a member 6 to be clamped having a larger capacity. A member 6 to be clamped disposed in the guide holes 21 of the second group has a larger weight, and the guide holes 21 of the second group can all be not provided with the clamping assembly 3.

[0052] Optionally, the shape of the guide holes 21 is not limited thereto, and the shape of the guide holes 21 can be adjusted according to the shape of the member 6 to be clamped. The guide holes 21 can be oblong holes, square holes, etc. In this case, the guide holes 21 in the first group and the guide holes 21 in the second group merely need to satisfy that an area of a geometric figure surrounded by an edge of each of the guide holes 21 in the first group is larger than an area of a geometric figure surrounded by an edge of each of the guide holes 21 in the second group, so that the bottle clamping device can simultaneously clamp two members to be clamped having different capacities.

[0053] Optionally, the number of guide holes 21 in the first group is 12, the 12 guide holes 21 are arranged in 3 columns, and four elastic pieces 31 are disposed at equal intervals corresponding to each guide hole 21.

[0054] In an embodiment of the present invention, as shown in FIG. 2, the bracket 1 comprises a bearing plate 11 and at least two mounting members 12, the at least two mounting members 12 are each fixed to the bearing plate 11, the fixing plate 2 is fixed on the bearing plate 11, and the mounting members 12 can be connected to a water tank of an ultrasonic dissolution device, so that the fixing plate 2 and the clamping assembly 3 can extend into the water tank of the ultrasonic dissolution device, to facilitate ultrasonic dissolution.

[0055] Optionally, the at least two mounting members 12 are divided into two groups, the two groups of mounting members 12 are respectively fixed on two opposite sides of the bearing plate 11, the fixing plate 2 is fixed on the bearing plate 11, and the fixing plate 2 is located between the two groups of mounting members 12. In this way, during use of the bottle clamping device, the two groups of mounting members 12 can be overlapped on two sides of the water tank of the ultrasonic dissolution device, to ensure stability of fixing the bottle clamping device and the water tank of the ultrasonic dissolution device.

[0056] Optionally, the number of mounting members 12 can be two, three, four, or more.

[0057] Optionally, the mounting member 12 comprises a connecting plate 121 and an overlapping plate 122, two sides of the connecting plate 121 are respectively connected to the bearing plate 11 and the overlapping plate 122, the connecting plate 121 is perpendicular to the bearing plate 11 or at a certain inclination angle, and the overlapping plate 122 protrudes from the connecting plate 121 in a direction away from the fixing plate 2. During use of the bottle clamping device, two overlapping plates 122 can be overlapped on the ultrasonic dissolution device, thereby fixing the bottle clamping device on the water tank of the ultrasonic dissolution device.

[0058] In addition, the form of the mounting member 12 is not limited thereto. For example, the mounting member 12 can be a plate-shaped member extending downward relative to the bearing plate 11, and in this case, the mounting member 12 can be directly fixedly connected to a bottom of the water tank, thereby achieving fixing of the bottle clamping device and the water tank. As another example, the mounting member 12 can extend toward a side wall of the water tank, a carrier plate corresponding to the mounting member is disposed on the side wall of the water tank, and the mounting member 12 is overlapped on the carrier plate, which can also achieve fixing of the bottle clamping device and the water tank.

[0059] In an embodiment of the present invention, as shown in FIG. 1 and FIG. 2, the bottle clamping device further comprises a supporting plate 41, a first supporting rod 51, and a second supporting rod 52, four corners of the supporting plate 41 are respectively fixed on the bearing plate 11 through four first supporting rods 51, four corners of the fixing plate 2 are respectively fixed on four corners of the supporting plate 41 through four second supporting rods 52, and when the member 6 to be clamped extends through the guide hole 21 into the clamping space, a bottom of the member 6 to be clamped can abut against the supporting plate 41, so that the supporting plate 41 supports the member 6 to be clamped.

[0060] Optionally, as shown in FIG. 1 and FIG. 3, the supporting plate 41 is provided with clamping holes 411, and positions of the guide holes 21 in the second group correspond to the clamping holes 411. The member 6 to be clamped can extend into the clamping hole 411 and the guide holes 21 in the second group, and a bottom of the member 6 to be clamped can abut against the bearing plate 11, thereby achieving fixing of the member 6 to be clamped. In this way, fixation and clamping of a member to be clamped having a larger capacity can be achieved through cooperation of the guide holes 21 in the second group and the clamping holes 411.

[0061] Optionally, the number of clamping holes 411 is the same as the number of guide holes 21 in the second group, and the clamping holes 411 and the guide holes 21 in the second group

correspond one-to-one. The number of clamping holes 411 can be selected according to requirements, and the number of clamping holes 411 can be 1, 2, 4, 6, 8, or more. Optionally, the number of clamping holes 411 is 8, and the 8 clamping holes 411 are arranged in 2 columns.

[0062] Optionally, a bottom of the member 6 to be clamped can abut against the supporting plate 41 or the bearing plate 11. When the member 6 to be clamped has a larger length, the bearing plate 11 can also be provided with a through hole, so that a portion of the member 6 to be clamped can extend below the bearing plate through the through hole, and in this case, the bottom of the member 6 to be clamped does not abut against any plate.

[0063] In addition, as shown in FIG. 2 and FIG. 4, the bottle clamping device further comprises a mounting plate 42 and a flexible plate 43, four corners of the mounting plate 42 are respectively fixed on the fixing plate 2 through four third supporting rods 53, and the mounting plate 42 is provided with a plurality of first through holes 422. The flexible plate 43 is provided with a plurality of second through holes 432, the plurality of first through holes 422 and the plurality of second through holes 432 correspond one-to-one, and the first through hole 422 and the corresponding second through hole 432 are penetrated by the same screw, thereby achieving fixing of the mounting plate 42 and the flexible plate 43.

[0064] Optionally, the flexible plate 43 can be a silicone plate or a rubber plate.

[0065] Optionally, as shown in FIG. 4, the mounting plate 42 is provided with a mounting hole 421, the flexible plate 43 is provided with a limiting hole 431, the mounting hole 421 is in communication with the limiting hole 431. Shapes of the limiting hole 431 and the mounting hole 421 can each be selected according to the shape of the member 6 to be clamped, an edge of the limiting hole 431 can extend toward an interior of the mounting hole 421 relative to an edge of the mounting hole 421, and a portion of the member 6 to be clamped is inserted into the mounting hole 421 and the limiting hole 431, so that the flexible plate 43 is in an interference fit with the member 6 to be clamped, to further improve stability of fixing the member 6 to be clamped.

[0066] Optionally, the mounting holes 421 and the limiting holes 431 correspond one-to-one, and the limiting holes 431 can also be divided into two groups, and the two groups of limiting holes 431 respectively correspond to the two groups of guide holes 21, to satisfy the clamping requirements for two members to be clamped 6 having different capacities.

[0067] In addition, after ultrasonic dissolution is completed, when the member 6 to be clamped is removed, the flexible plate 43 can wipe an outer wall of the member 6 to be clamped, to reduce water stains carried out by the member 6 to be clamped.

[0068] The bottle clamping device of the present invention achieves limiting of the member 6 to be clamped through the fixing plate 2, the supporting plate 41, the flexible plate 43, the mounting plate 42, and the clamping assembly 3, and ensures stability of fixing the member 6 to be clamped. The bottle clamping device can achieve limiting of a plurality of reaction bottles, and can achieve batch processing.

[0069] The present invention further provides an ultrasonic dissolution equipment, the ultrasonic dissolution equipment comprising a water tank and a bottle clamping device, wherein the bottle clamping device is fixed to the water tank, at least a portion of the bottle clamping device is located in the water tank, and during ultrasonic dissolution, the bottle clamping device can fix a reaction bottle, to avoid the reaction bottle from toppling over.

[0070] Optionally, as shown in FIG. 5, FIG. 6, and FIG. 7, the water tank comprises a tank body 71 and a cover 72, the tank body 71 has a water injection tank 711 and an opening in communication with the water injection tank 711, an ultrasonic generator is fixed in an interior of the tank body 71, and the cover 72 is disposed on the opening. The cover 72 is provided with a mounting opening 721, and an overlapping plate 122 of the bottle clamping device abuts against the cover 72, thereby achieving fixing of the bottle clamping device. A portion of the bottle clamping device extends into an interior of the water tank through the mounting opening 721, to facilitate ultrasonic dissolution.

[0071] The present invention further provides an ultrasonic dissolution system, the ultrasonic dissolution system comprising an ultrasonic dissolution equipment. For example, a grabbing device can be provided to cooperate with the ultrasonic dissolution equipment for use (not shown in the drawings), the grabbing device is disposed on one side of the ultrasonic dissolution equipment, and the grabbing device can grab the member 6 to be clamped, to place the member 6 to be clamped into the bottle clamping device or remove the member 6 to be clamped from the bottle clamping device.

[0072] Taking the member 6 to be clamped as a reaction bottle as an example, when the ultrasonic dissolution system of the present invention is used to simultaneously perform ultrasonic dissolution on poorly soluble solids or poorly miscible solvents in reaction bottles having a smaller capacity and reaction bottles having a larger capacity, the bottle clamping device is fixed on the cover 72. When installing a reaction bottle having a smaller capacity, a robotic arm drives a gripper assembly to clamp the reaction bottle having a smaller capacity and moves above a corresponding limiting hole 431, and then the robotic arm drives the gripper assembly to move downward. The reaction bottle having a smaller capacity sequentially passes

through the corresponding limiting hole 431, the mounting hole 421, the guide hole 21 in the first group, and the clamping space surrounded by the clamping assembly 3, until a bottom of the reaction bottle having a smaller capacity abuts against the supporting plate 41. At this time, the elastic pieces 31 of the clamping assembly 3 and the flexible plate 43 can each clamp the reaction bottle having a smaller capacity, and ultrasonic waves can perform ultrasonic dissolution on the poorly soluble solid or poorly miscible solvent in the reaction bottle having a smaller capacity. When installing a reaction bottle having a larger capacity, the robotic arm drives the gripper assembly to clamp the reaction bottle having a larger capacity and moves above a corresponding limiting hole 431, and then the robotic arm drives the gripper assembly to move downward. The reaction bottle having a larger capacity sequentially passes through the corresponding limiting hole 431, the mounting hole 421, the guide hole 21 in the first group, and the clamping hole 411, until a bottom of the reaction bottle having a larger capacity abuts against the bearing plate 11, thereby completing fixing of the member 6 to be clamped. The ultrasonic waves can perform ultrasonic dissolution on the poorly soluble solid or poorly miscible solvent in the reaction bottle having a larger capacity.

[0073] In order to ensure consistency of downward movement positions when the gripper assembly grips the reaction bottle having a smaller capacity and the reaction bottle having a larger capacity and places them in the bottle clamping device, after the reaction bottle having a smaller capacity and the reaction bottle having a larger capacity are placed in the bottle clamping device, a lower surface of a bottle cap of the reaction bottle having a smaller capacity and a lower surface of a bottle cap of the reaction bottle having a larger capacity are coplanar. After the ultrasonic dissolution is completed, the robotic arm drives the gripper assembly to move directly above the reaction bottle having a smaller capacity or the reaction bottle having a larger capacity, and the gripper assembly moves downward to grip the reaction bottle having a smaller capacity or the reaction bottle having a larger capacity and then moves upward. During the upward movement, when the reaction bottle having a smaller capacity or the reaction bottle having a larger capacity passes through the flexible plate 43, the flexible plate 43 cleans water stains on a surface of the reaction bottle having a smaller capacity or the reaction bottle having a larger capacity.

[0074] Finally, it should be noted that: the above embodiments are merely used to explain the technical solutions of the present invention, and not to limit them; although the present invention has been described in detail with reference to the foregoing embodiments, those of ordinary skill in the art should understand that: they can still modify the technical solutions described in the

foregoing embodiments, or perform equivalent replacements to some or all of the technical features thereof; and these modifications or replacements do not cause the essence of the corresponding technical solutions to depart from the scope of the technical solutions of the embodiments of the present invention.

INDUSTRIAL APPLICABILITY

[0075] When the bottle clamping device of the present invention is in use, the bottle clamping device can be fixed on a water tank of an ultrasonic dissolution device through a bracket. A member to be clamped can extend through a fixing hole into a mounting space, the fixing hole performs preliminary fixing on the member to be clamped, and the clamping assembly can apply a force toward an interior of the clamping space on the member to be clamped, to further fix the member to be clamped. The member to be clamped can be fixed through the guide hole and the clamping assembly to improve stability of fixing the member to be clamped and reduce a risk of the member to be clamped toppling over.

CLAIMS

1. A bottle clamping device, wherein the bottle clamping device is configured to fix a member to be clamped, characterized in that the bottle clamping device comprises a bracket, a fixing plate, and a clamping assembly, the fixing plate is fixed on the bracket, the fixing plate is provided with a predetermined number of guide holes; and

the predetermined number of guide holes comprise at least one guide hole correspondingly provided with the clamping assembly, the clamping assembly surrounds to form a clamping space, the clamping space is in communication with an interior of the guide hole corresponding to the clamping assembly, at least a portion of the member to be clamped is able to extend through the guide hole into the clamping space, and the clamping assembly is able to apply a force toward an interior of the clamping space on the member to be clamped.

2. The bottle clamping device according to claim 1, wherein the clamping assembly comprises a plurality of elastic pieces, the plurality of elastic pieces are fixed on the fixing plate, the plurality of elastic pieces are spaced apart and surround an edge of the guide hole corresponding to the clamping assembly, and the plurality of elastic pieces surround to form the clamping space.

3. The bottle clamping device according to claim 2, wherein the plurality of elastic pieces are all disposed on a same side of the fixing plate; or the plurality of elastic pieces are disposed on two opposite sides of the fixing plate.

4. The bottle clamping device according to claim 2, wherein the elastic piece comprises an abutting portion and an extension portion connected to each other, the abutting portion is connected to the fixing plate, and a portion of the extension portion extends toward the interior of the guide hole.

5. The bottle clamping device according to claim 2, wherein the elastic piece comprises an abutting portion and an extension portion connected to each other, the abutting portion is connected to the fixing plate, an upper portion of the extension portion protrudes toward an exterior of the guide hole, and a middle portion of the extension portion protrudes toward the interior of the guide hole.

6. The bottle clamping device according to claim 1, wherein the clamping assembly comprises a rubber ring fixed on the fixing plate, an inner wall of the rubber ring surrounding to form the clamping space.

7. The bottle clamping device according to claim 1, wherein the bottle clamping device further comprises a mounting plate and a flexible plate, the flexible plate is fixed on the mounting plate, and the mounting plate is disposed on the fixing plate; and

the mounting plate is provided with a mounting hole, the flexible plate is provided with a limiting hole, the mounting hole is in communication with the limiting hole, and the member to be clamped can penetrate through the limiting hole and the mounting hole, wherein the flexible plate is configured to be in an interference fit with the member to be clamped.

8. The bottle clamping device according to claim 1, wherein the bottle clamping device further comprises a supporting plate, a first supporting rod, and a second supporting rod, the supporting plate is fixed to the bracket through the first supporting rod, and the fixing plate is fixed to the supporting plate through the second supporting rod.

9. The bottle clamping device according to claim 8, wherein the predetermined number of guide holes are divided into two groups, each of the guide holes in a first group is correspondingly provided with the clamping assembly; and

the supporting plate is provided with a clamping hole, a position of the clamping hole corresponds to a position of the guide hole in a second group, and the member to be clamped can pass through the clamping hole and the guide hole in the second group.

10. The bottle clamping device according to claim 9, wherein a diameter of each of the guide holes in the first group is smaller than a diameter of each of the guide holes in the second group.

11. The bottle clamping device according to any one of claims 1-10, wherein the bracket comprises a bearing plate and at least two mounting members, the at least two mounting members are each connected to the bearing plate, and the fixing plate is fixed on the bearing plate.

12. The bottle clamping device according to claim 11, wherein the mounting member comprises a connecting plate and an overlapping plate, two sides of the connecting plate are respectively connected to the bearing plate and the overlapping plate, and the overlapping plate protrudes from the connecting plate in a direction away from the fixing plate.

13. A bottle clamping device, wherein the bottle clamping device is configured to fix a member to be clamped, characterized in that the bottle clamping device comprises a bracket, a fixing plate, and a plurality of elastic pieces, the fixing plate is connected to the bracket, the plurality of elastic pieces are each connected to the fixing plate, and the plurality of elastic pieces surround to form a clamping space, wherein the clamping space is configured to receive the member to be clamped inserted therein, and the plurality of elastic pieces is configured to abut against the member to be clamped.

14. An ultrasonic dissolution equipment, characterized in that the ultrasonic dissolution equipment comprises a water tank and the bottle clamping device according to any one of claims 1-13, the bottle clamping device is fixed to the water tank, and at least a portion of the bottle clamping device is located in the water tank.

15. The ultrasonic dissolution equipment according to claim 14, wherein the water tank comprises a tank body and a cover, the tank body has an opening, and the cover is disposed on the opening; and

the cover is provided with a mounting opening, the bottle clamping device is fixed to the cover, and a portion of the bottle clamping device extends into an interior of the water tank through the mounting opening.

16. An ultrasonic dissolution system, characterized in that the ultrasonic dissolution system comprises the ultrasonic dissolution equipment according to claim 14 or 15.