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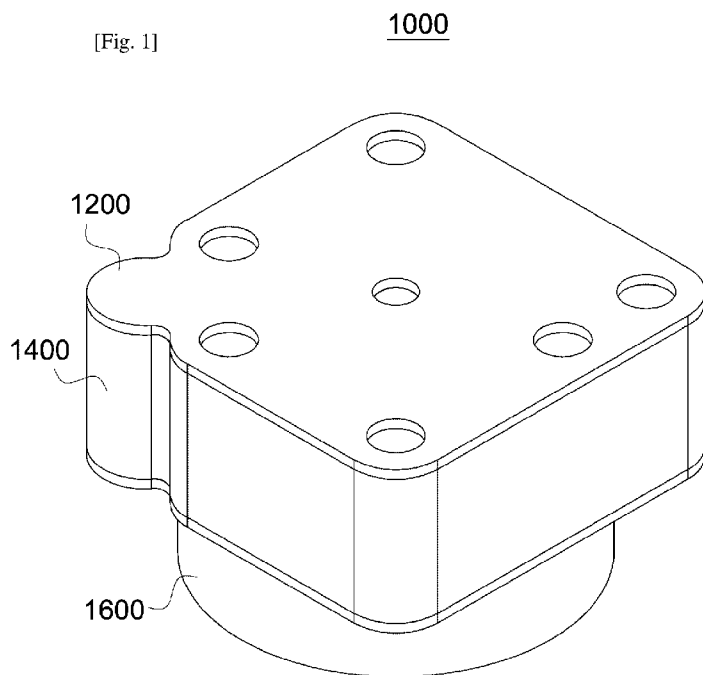
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[Continued on next page]

(54) Title: MOLECULAR DIAGNOSTIC CARTRIDGE



(57) Abstract: Provided is a molecular diagnostic cartridge. The molecular diagnostic cartridge according to one aspect of the present invention includes a first housing comprising a plurality of processing chambers continuously connected to process a sample, a washing chamber for washing and a discharging chamber connected to at least one of the plurality of processing chambers and the washing chamber, and having a discharging port through which a solution is discharged; and a second housing disposed under the first housing, and comprising a waste chamber configured to accommodate a waste solution and a target chamber configured to accommodate a target solution, and movably provided so that one of the waste chamber and the target chamber is selectively connected with the discharging port.



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Description

Title of Invention: MOLECULAR DIAGNOSTIC CARTRIDGE

Technical Field

- [1] The present invention relates to a molecular diagnostic cartridge, and more particularly, to a molecular diagnostic cartridge which is selectively connected to a fluid according to movement of a lower housing.

[2]

Background Art

- [3] Generally, a molecular diagnostic device is a device which is used to process a sample from a mixture, to measure the processed sample and thus to detect a disease, a virus or the like. The molecular diagnostic device may be generally divided into a unit which processes the sample from the mixture, and a unit which detects the disease or the virus from the sample, and a series of operations thereof may be performed in one device. Most of the molecular diagnostic devices use a cartridge which accommodates a sample or a reagent. A conventional cartridge has a cylindrical shape, a flat shape or the like so as to perform a molecular diagnostic operation, and employs a method in which only a fluid path is changed to provide various fluid routes. However, in such a method, since a means for changing the fluid path should be provided in the cartridge, it is difficult to provide the cartridge having an efficient structure and size due to restriction on a location thereof.

[4]

Disclosure of Invention

Technical Problem

- [5] The present invention is directed to providing a molecular diagnostic cartridge which is selectively connected to a fluid according to movement of a lower housing.

[6]

Solution to Problem

- [7] One aspect of the present invention provides a molecular diagnostic cartridge including a first housing including processing chambers continuously connected to process a sample, a washing chamber for washing and a discharging chamber connected to the processing chambers and the washing chamber and having a discharging port through which a solution is discharged; and a second housing disposed under the first housing, and including a waste chamber configured to accommodate a waste solution and a target chamber configured to accommodate a target solution, and movably provided so that one of the waste chamber and the target chamber is selectively connected with the discharging port.

[8]

Advantageous Effects of Invention

[9] According to the present invention, since the fluid can be selectively connected according to the movement of the lower housing, the cartridge can have a small size.

[10]

Brief Description of Drawings

[11] FIG. 1 is a perspective view of a molecular diagnostic cartridge according to an exemplary embodiment of the present invention.

[12] FIG. 2 is an exploded view of the molecular diagnostic cartridge according to the exemplary embodiment of the present invention.

[13] FIG. 3 is a plan view of a cover part according to the exemplary embodiment of the present invention.

[14] FIG. 4 is a plan view of a first housing according to the exemplary embodiment of the present invention.

[15] FIG. 5 is a plan view of a second housing according to the exemplary embodiment of the present invention.

[16] FIG. 6 is a cross-sectional view illustrating an operation of the molecular diagnostic cartridge according to the exemplary embodiment of the present invention.

[17] FIG. 7 is a cross-sectional view illustrating another operation of the molecular diagnostic cartridge according to the exemplary embodiment of the present invention.

[18] FIG. 8 is a plan view of a molecular diagnostic cartridge according to another exemplary embodiment of the present invention.

[19]

Best Mode for Carrying out the Invention

[20] One aspect of the present invention provides a molecular diagnostic cartridge including a first housing including processing chambers continuously connected to process a sample, a washing chamber for washing and a discharging chamber connected to the processing chambers and the washing chamber and having a discharging port through which a solution is discharged; and a second housing disposed under the first housing, and including a waste chamber configured to accommodate a waste solution and a target chamber configured to accommodate a target solution, and movably provided so that one of the waste chamber and the target chamber is selectively connected with the discharging port.

[21]

Mode for the Invention

[22] Objects, particular advantages and novel characteristics of the present invention will be more apparent from the following detailed description and preferred embodiments

in connection with the accompanying drawings. However, various substitutions, changes or modifications in the present invention can be realized, and hereinafter, particular embodiments will be illustrated and described in detail through the drawings.

[23] In the drawings, a thickness of a layer or an area is exaggeratedly illustrated to clearly describe the present invention. Also, it will be understood that when an element or layer is referred to as being “on” or “above” another element or layer, it can be directly on or above the other element or layer or intervening elements or layers may be present. The same components are designated in principle by the same reference numerals throughout the specification. Also, the same reference numerals refer to the same elements having the same functions within the same technical scope and spirit illustrated and described in the drawing of each embodiment.

[24] In the following description, detailed descriptions of well-known functions or constructions will be omitted since they would obscure the invention with unnecessary detail. Also, the terms “first,” “second” and the like in the description and in the claims are used for distinguishing one component from other components, and thus the components should not be limited by the terms.

[25] Hereinafter, a molecular diagnostic cartridge of the present invention will be described in detail. In consideration of only ease of writing this specification, the components used in this specification are described with the terms “module” and “part” which are intended to have no distinguishable difference in meaning or role. Thus, the “module” and “part” may also be used interchangeably and should be noted.

[26] According to one aspect of the present invention, the molecular diagnostic cartridge may include a first housing including processing a plurality of chambers continuously connected to process a sample, a washing chamber for washing and a discharging chamber connected to at least one of the plurality of processing chambers and the washing chamber and having a discharging port through which a solution is discharged; and a second housing disposed under the first housing, and including a waste chamber configured to accommodate a waste solution and a target chamber configured to accommodate a target solution, and movably provided so that one of the waste chamber and the target chamber is selectively connected with the discharging port.

[27] Also, a fluid path configured to connect the chambers of the first housing may be formed at the first housing, and the molecular diagnostic cartridge may further include a cover part provided on the first housing and included a pressure hole configured to receive a pressure to move a fluid through the fluid path.

[28] Also, a valve configured to allow movement of the fluid at a predetermined pressure or more may be provided in the fluid path.

[29] Also, a barrier configured to be broken at a predetermined pressure or more may be

provided in the fluid path.

- [30] Also, a fluid path configured to connect the chambers of the first housing may be formed at the first housing, and the molecular diagnostic cartridge further comprises a one-way valve configured to prevent a backflow of the fluid may be provided in the fluid path.
- [31] Also, the adjacent chambers of the first housing may have bottom surfaces at different heights from each other.
- [32] Also, the second housing may be configured so that one of the waste chamber and the target chamber is selectively connected with the discharging port by a rotational movement thereof.
- [33] Also, the second housing may be configured so that one of the waste chamber and the target chamber is selectively connected with the discharging port by a sliding movement thereof.
- [34] Also, the first housing may further include an elution chamber configured to accommodate a dissolving solution and connected to the discharging chamber.
- [35] Also, the plurality of processing chambers may include a first chamber configured to accommodate a first reagent, a second chamber configured to receive and process the first reagent, a third chamber configured to accommodate a mixed solution including the sample, to receive the processed first reagent and to process the mixed solution, and a fourth chamber configured to accommodate a second reagent and to process the processed mixed solution with the second reagent, and the first chamber, the second chamber, the third chamber and the fourth chamber may be connected sequentially through a fluid path, and bottom surfaces thereof are at heights that are gradually lowered sequentially.
- [36] Also, the plurality of processing chambers may further include a fifth chamber configured to accommodate a third reagent and connected to the fourth chamber, and the fifth chamber may have a higher height of a bottom surface than that of the bottom surface of the fourth chamber.
- [37] Also, at least one of the plurality of processing chambers may include a stirring member configured to facilitate the sample processing.
- [38] Also, the washing chamber may include a plurality of chambers of which of bottom surfaces are at heights that are gradually lowered in connection order.
- [39] Also, at least a part of the target chamber may be formed of a transparent material.
- [40] Also, the first housing may further include a reagent chamber configured to accommodate a reagent to be used in a reaction of the target solution, and connected to the target chamber by movement of the second housing.
- [41] The molecular diagnostic cartridge according to the present invention should be interpreted as a cartridge used in various measuring devices for detecting diseases,

viruses, or the like, as well as a cartridge which accommodates a reagent used in the molecular diagnostic cartridge.

- [42] FIG. 1 is a perspective view of a molecular diagnostic cartridge 1000 according to an exemplary embodiment of the present invention.
- [43] Referring to FIG. 1, the molecular diagnostic cartridge 1000 may include a cover part 1200, a first housing 1400 and a second housing 1600. The cover part 1200 has a pressure hole 1220 through which a pressure necessary to move a fluid through a fluid path C is received, the first housing 1400 may include processing chambers 1410, a washing chamber 1430 and a discharging chamber 1420, and the second housing 1600 may include a waste chamber 1620 and a target chamber 1640.
- [44] The cover part 1200 may be located on the first housing 1400, and may provide an upper surface of each chamber included in the first housing 1400.
- [45] The cover part 1200 may include at least one pressure hole 1220 and a sample inlet port 1240.
- [46] The pressure hole 1220 may receive the pressure necessary to move the fluid from the device in which the cartridge 1000 is installed, and the sample inlet part 1240 may be a passage through which a sample is received. The pressure hole 1220 may be connected with a pressure providing means included in the device.
- [47] The device may have a pressure generating means for generating a pressure and a pressure transmitting means for transmitting the generated pressure to the cartridge, and the pressure hole 1220 may be connected with the pressure transmitting means to receive the pressure generated from the pressure generating means. Here, the pressure may be an air pressure.
- [48] The sample inlet port 1240 is a port through which the sample is introduced, and may pass through the cover part 1200 and may be connected with the chamber into which the sample will be introduced. Here, the sample may be blood, saliva, cells or the like. A position of the sample inlet port 1240 may be changed according a position of the chamber into which the sample will be introduced.
- [49] The detailed description of the cover part 1200 will be described with reference to FIG. 3.
- [50] The first housing 1400 may include the plurality of chambers and the fluid path C which connects the plurality of chambers. Here, the plurality of chambers may be the processing chambers 1410, the washing chamber 1430 and the discharging chamber 1420.
- [51] The detailed description of the first housing 1400 will be described again with reference to FIG. 4.
- [52] The second housing 1600 may include the waste chamber 1620 which accommodates the waste solution and the target chamber 1640 which accommodates the target

solution to be measured, and may be moved to be selectively connected with a discharging port formed at the discharging chamber 1420.

[53] The detailed description of the second housing 1600 will be described again with reference to FIG. 5.

[54] FIG. 2 is an exploded view of the molecular diagnostic cartridge 1000 according to the exemplary embodiment of the present invention.

[55] Referring to FIG. 2, the molecular diagnostic cartridge 1000 may include the cover part 1200, the first housing 1400 and the second housing 1600, and the cover part 1200, the first housing 1400 and the second housing 1600 may be stacked sequentially.

[56] The cover part 1200 may be located at the uppermost portion of the molecular diagnostic cartridge 1000, may be connected with the pressure generating means, and may provide a covering function which covers upper surfaces of the chambers included in the first housing 1400.

[57] The first housing 1400 may be located under the cover 1200 to receive the pressure from the pressure hole 1220 and to receive the sample through the sample inlet port 1240.

[58] The second housing 1600 may be coupled to a lower portion of the first housing 1400. The second housing 1600 may be coupled to the first housing 1400 to be rotated or slid by an external force.

[59] FIG. 3 is a plan view of the cover part 1200 according to the exemplary embodiment of the present invention.

[60] Referring to FIG. 3, the cover part 1200 may include the pressure hole 1220 and the sample inlet port 1240.

[61] The pressure hole 1220 may be connected with the pressure transmitting means provided at the device so as to transmit the pressure to at least one of the chambers included in the first housing 1400.

[62] The pressure hole 1220 may be provided to pass through the cover part 1200 and thus, to transmit the pressure received from the pressure transmitting means to the connected chamber.

[63] As illustrated in FIG. 3, the pressure hole 1220 may be formed in a circular shape, but is not limited thereto, and may have various shapes. For example, the pressure hole 1220 may be formed in a polygonal shape such as a triangular shape and a quadrangular shape or a modified circular shape such as an elliptical shape.

[64] The pressure hole 1220 may be formed in a hole shape into which the pressure transmitting means is inserted and connected therewith, or may protrude so as to be inserted into the pressure transmitting means.

[65] When the pressure transmitting means is inserted into the pressure hole 1220 to provide the pressure, the pressure transmitting means may include a protruding portion

which is inserted into the pressure hole 1220. A diameter of the pressure hole 1220 may be provided larger than a diameter of the protruding portion of the pressure transmitting means, such that the protruding portion of the pressure transmitting means is inserted into the pressure hole 1220. Also, when the pressure hole 1220 is formed in the polygonal shape or the modified circular shape, the pressure hole 1220 may be provided to have a sufficient area to insert the protruding portion of the pressure transmitting means therein.

- [66] When the pressure hole 1220 protrudes so as to be inserted into the pressure transmitting means, a protruding portion of the pressure hole 1220 may be formed in a prismatic shape such as a triangular prism and a square pillar, or may be formed in a cylindrical shape.
- [67] The cover part 1200 may include a plurality of pressure holes 1220.
- [68] When the pressure is to be transmitted to a plurality of chambers included in the first housing 1400, the plurality of pressure holes 1220 may be provided, and each of the plurality of the pressure holes 1220 may be located above each chamber to which the pressure is to be transmitted, and may be connected thereto.
- [69] The sample inlet port 1240 is a port through which the sample is introduced into a predetermined chamber, and may be provided to pass through the cover part 1200 located at a position corresponding to the predetermined chamber. The sample inlet port 1240 may be open, when the sample is introduced, and then may be closed by a separate cap so as to prevent contamination from an outside, when the sample is not introduced.
- [70] FIG. 4 is a plan view of the first housing 1400 according to the exemplary embodiment of the present invention.
- [71] Referring to FIG. 4, the first housing 1400 may include the processing chambers 1410, the washing chamber 1430, the discharging chamber 1420, an elution chamber 1440, a reagent buffer chamber 1451 and a reagent chamber 1452. The processing chambers 1410 are chambers in which a process of processing the sample and extracting the target solution to be measured is performed, and a plurality of chambers may be provided according to a sample processing process. And the processing chambers 1410 may accommodate a reagent for processing the sample and may include a chamber for accommodating the sample.
- [72] As illustrated in FIG. 4, the processing chambers 1410 may include a first chamber 1411, a second chamber 1412, a third chamber 1413 and a fourth chamber 1414. Also, the processing chambers 1410 may further a fifth chamber 1415.
- [73] The first chamber 1411 may be connected with the second chamber 1412 through the fluid path C, and a fluid accommodated in the first chamber 1411 may be moved to the second chamber 1412 through the fluid path C by the pressure supplied from the

pressure hole 1220 to the first chamber 1411. Here, the fluid path which connects the first chamber 1411 and the second chamber 1412 may connect a lower end of a side surface of the first chamber 1411 and an upper end of a side surface of the second chamber 1412. Also, to allow the fluid to flow smoothly, a bottom surface of the second chamber 1412 may be relatively located lower than that of the first chamber 1411.

[74] The first chamber 1411 may be connected with the pressure hole 1220 to receive the pressure from the pressure hole 1220, and then may transmit the received pressure to the second chamber 1412.

[75] The second chamber 1412 may be connected with the third chamber 1413 through the fluid path C, and the fluid accommodated therein may be moved to the third chamber 1413 through the fluid path C. Here, the fluid path C which connects the second chamber 1412 and the third chamber 1413 may connect a lower end of a side surface of the second chamber 1412 and an upper end of a side surface of the third chamber 1413. Also, to allow the fluid to flow smoothly, a bottom surface of the third chamber 1413 may be relatively located lower than that of the second chamber 1412.

[76] The second chamber 1412 may receive the pressure from the first chamber 1411, and then may transmit the received pressure to the third chamber 1413.

[77] The third chamber 1413 may be the chamber for accommodating the sample, and may be connected with the sample inlet port 1240 to receive the sample.

[78] The third chamber 1413 be connected with the fourth chamber 1414 through the fluid path C, and the fluid accommodated in the third chamber 1413 may be moved to the fourth chamber 1414 through the fluid path C by the pressure received from the second chamber 1412. Here, the fluid path C which connects the third chamber 1413 and the fourth chamber 1414 may connect a lower end of a side surface of the third chamber 1413 and an upper end of a side surface of the fourth chamber 1414. Also, to allow the fluid to flow smoothly, a bottom surface of the fourth chamber 1414 may be relatively located lower than that of the third chamber 1413.

[79] The fourth chamber 1414 may be connected with the fifth chamber 1415 and the discharging chamber 1420 through the fluid path C.

[80] The fluid path which connects the fourth chamber 1414 and the fifth chamber 1415 may connect a lower end of a side surface of the fifth chamber 1415 and the upper end of the side surface of the fourth chamber 1414. Also, to allow the fluid to flow smoothly, the bottom surface of the fourth chamber 1414 may be relatively located lower than that of the fifth chamber 1415.

[81] The fluid path which connects the fourth chamber 1414 and the discharging chamber 1420 may connect a lower end of a side surface of the fourth chamber 1414 and an upper end of the side surface of the discharging chamber 1420.

- [82] The fourth chamber 1414 may include a stirring member which facilitates the sample processing.
- [83] The stirring member is provided at an inner side of the fourth chamber 1414 to receive a rotating force from the device and thus to facilitate the sample processing performed in the fourth chamber 1414. For example, an impeller shaft may be provided as the stirring member to receive the rotating force from the device and to stir the sample.
- [84] The discharging chamber 1420 may be connected with the fourth chamber 1414, the washing chamber 1430 and the elution chamber 1440 through the fluid path C.
- [85] The fluid path which connects the discharging chamber 1420 and the washing chamber 1430 may connect a lower end of a side surface of the washing chamber 1430 and an upper end of a side surface of the discharging chamber 1420.
- [86] Also, to allow the fluid to flow smoothly, a bottom surface of the discharging chamber 1420 may be relatively located lower than that of the washing chamber 1430.
- [87] The fluid path which connects the discharging chamber 1420 and the elution chamber 1440 may connect a lower end of a side surface of the elution chamber 1440 and the upper end of the side surface of the discharging chamber 1420. Also, to allow the fluid to flow smoothly, the bottom surface of the discharging chamber 1420 may be relatively located lower than that of the elution chamber 1440.
- [88] The discharging port through which the fluid is discharged may be formed at a lower portion of the discharging chamber 1420. The discharging port may be a passage through which the fluid accommodated in the discharging chamber 1420 is discharged to an outside of the first housing 1400.
- [89] The discharging chamber 1420 may include a filter which temporarily collects a target object. For example, the discharging chamber 1420 may include a membrane filter which collects DNA. The filter may be located at the lower portion of the discharging chamber 1420, and may be located at an upper portion of the discharging port to collect the target object from the fluid discharged through the discharging port.
- [90] Until now, it has been described that the first housing 140 included only one washing chamber 1430. However, as illustrated in FIG. 4, the first housing 1400 may include a plurality of washing chambers 1430.
- [91] When the plurality of washing chambers 1430 are provided, the washing chambers 1430 may be connected with each other through the fluid path C, and one of the plurality of washing chambers 1430 may be connected with the discharging chamber 1420. For example, as illustrated in FIG. 4, the first housing 1400 may include a first washing chamber 1431, a second washing chamber 1432 and a third washing chamber 1433, and the first washing chamber 1431, the second washing chamber 1432 and the third washing chamber 1433 may be connected with each other through the fluid path

C.

- [92] The first washing chamber 1431, the second washing chamber 1432 and the third washing chamber 1433 may be formed to have bottom surfaces at different heights from each other. For example, the bottom surfaces of the plurality of washing chambers 1430 may be formed to be gradually lower in order of the first washing chamber 1431, the second washing chamber 1432 and the third washing chamber 1433.
- [93] The reagent chamber 1452 may be connected with the reagent buffer chamber 1451 through the fluid path.
- [94] The fluid path which connects the reagent chamber 1452 and the reagent buffer chamber 1451 may connect a lower end of a side surface of the reagent buffer chamber 1451 and an upper end of a side surface of the reagent chamber 1452. Also, to allow the fluid to flow smoothly, a bottom surface of the reagent chamber 1452 may be relatively located lower than that of the reagent buffer chamber 1451.
- [95] The fluid path C which discharges the fluid to the outside of the first housing 1400 may be formed at a lower portion of the reagent chamber 1452 to discharge the fluid accommodated in the reagent chamber 1452 to the outside of the first housing 1400.
- [96] The fluid path C may serve to connect the chambers of the first housing 1400 or to provide a passage through which the pressure is transmitted.
- [97] A control member which controls the fluid or the pressure may be provided in the fluid path C. Here, the control member may be a one-way valve which prevents a backflow of the fluid, may be a valve which allows movement of the fluid at a predetermined pressure or more, or may be a barrier which is broken at the predetermined pressure or more. The control member may be provided at each fluid path C, and may be selectively provided in the fluid path C which is required to be controlled. Further, the control member may be provided at an end of the fluid path C to be substantially in contact with an inner surface of the chamber.
- [98] FIG. 5 is a plan view of the second housing 1600 according to the exemplary embodiment of the present invention.
- [99] Referring to FIG. 5, the second housing 1600 may include the waste chamber 1620 and the target chamber 1640.
- [100] The waste chamber 1620 may be selectively connected with the discharging port of the first housing 1400 by movement of the second housing 1600.
- [101] The target chamber 1640 may be selectively connected with the discharging port of the first housing 1400 and the fluid path C provided under the reagent chamber 1452 by the movement of the second housing 1600.
- [102] That is, one of the waste chamber 1620 and the target chamber 1640 may be connected with the discharging port of the first housing 1400 by the movement of the

second housing 1600.

[103] The waste chamber 1620 and the target chamber 1640 may be provided to be separated from each other, such that the fluid is not moved to each other, and at least a part of the target chamber 1640 may be formed of a transparent material.

[104] Hereinafter, a sample processing operation using the molecular diagnostic cartridge 1000 will be described with reference to FIG. 6.

[105] FIG. 6 is a cross-sectional view illustrating an operation of the molecular diagnostic cartridge 1000 according to the exemplary embodiment of the present invention. FIG. 6 is a cross-sectional view taken along a line A-A' of FIG. 4.

[106] Referring to FIG. 6, in the molecular diagnostic cartridge 1000, the cover part 1200 may include the pressure hole 1220 and the sample inlet port 1240, and the first housing 1400 may include the first chamber 1411, the second chamber 1412, the third chamber 1413, the fourth chamber 1414, the fifth chamber 1415, the discharging chamber 1420, the first washing chamber 1431, the second washing chamber 1432 and the third washing chamber 1433. and the second housing 1600 may include the waste chamber 1620 and the target chamber 1640.

[107] The first chamber 1411 may be a chamber which accommodates a first reagent, and may be a place in which an initial pressure is provided and movement of the fluid is started. Here, the first reagent may be a proteinase K (PK) buffer which dissolves a proteinase K (PK) reagent. The first chamber 1411 may be connected with the second chamber 1412 through the fluid path C, and the first reagent accommodated in the first chamber 1411 may be moved to the second chamber 1412 through the fluid path C by the pressure received from the pressure hole 1220 to the first chamber 1411.

[108] The first chamber 1411 is connected with the pressure hole 1220 to receive the pressure from the pressure hole 1220, and to transmit the received pressure to the second chamber 1412.

[109] The second chamber 1412 may accommodate the PK reagent which dissolves the sample, and the first reagent may be introduced therein from the first chamber. The first reagent introduced from the second chamber 1412 is mixed with the PK reagent accommodated in the second chamber 1412, and the PK reagent and the first reagent may be moved to the third chamber 1413 through the fluid path C by the pressure received from the first chamber 1411. Here, the second chamber 1412 may receive the pressure from the first chamber 1411, and may transmit the received pressure to the third chamber 1413.

[110] The third chamber 1413 may a chamber which accommodates the sample, and may be connected with the sample inlet port 1240 to receive the sample.

[111] The third chamber 1413 may receive the first reagent and the PK reagent through the second chamber 1412, and a mixed solution in which the first reagent, the PK reagent

and the sample are mixed may be generated.

- [112] The third chamber 1413 may be connected with the fourth chamber 1414 through the fluid path C, and the mixed solution may be moved to the fourth chamber 1414 through the fluid path C by the pressure received from the second chamber 1412.
- [113] The fourth chamber 1414 may be a chamber which accommodates a second reagent and into which the mixed solution of the first reagent, the PK reagent and the sample is introduced and treated by the second reagent. Here, the second reagent may be various well-known dissolving reagents which dissolve the sample. For example, the second reagent may include a buffer salt such as guanidinium salt. For example, the second reagent may include a chaotropic agent such as guanidinium thiocyanate, a chelating agent such as ethylenediaminetetraacetic acid (EDTA), and a buffer salt such as tris(hydroxymethyl)aminomethane(Tris-HCl). Also, the second reagent may include a non-ionic surfactant. For example, both of a polyethylene glycol type non-ionic surfactant and a polyhydric alcohol type non-ionic surfactant, preferably Triton X-100, Tween (an ethylene oxide adduct of a sorbitan ester), or 2-mercaptoethanol, most preferably Triton X-100 may be used as the non-ionic surfactant. The second reagent may have a non-acidic property, e.g., a neutral property or an alkaline property.
- [114] In the fourth chamber 1414, the mixed solution of the first reagent, the PK reagent and the sample may react with the second reagent, and a dissolving reaction which dissolves the sample to extract the target object from the sample mixed in the mixed solution may be performed. After the dissolving reaction, a third reagent may be introduced from the fifth chamber 1415 by the pressure received from the pressure hole 1220 into the fifth chamber 1415. Here, the target object may be DNA, RNA or nucleic acid. Also, the third reagent may be a reagent which separates the target object from the sample, and a separation reaction in which the target object is separated from the sample according to the introduction of the third reagent may be performed.
- [115] A substantial sample processing may be performed in the fourth chamber 1414, and the target object and other fluids may be provided as sample processed products.
- [116] While the dissolving reaction and the separation reaction are performed in the fourth chamber 1414, the stirring member included in the fourth chamber 1414 may be operated by the device.
- [117] The target object and the other fluids generated when the sample processing is finished through the dissolving reaction and the separation reaction in the fourth chamber 1414 may be introduced into the discharging chamber 1420.
- [118] The target object and the other fluids introduced into the discharging chamber 1420 may pass through the filter provided in the discharging chamber 1420, and then may be discharged to the outside of the first housing. At this time, the target object may not pass through the filter, and may be collected by the filter, and only the other fluids may

pass through the filter. Also, the discharging port may be connected with the waste chamber 1620 of the second housing 1600, and the discharged other fluids may be accommodated in the waste chamber 1620. The discharging port and the waste chamber 1620 may be connected with each other in advance. However, in the case in which the discharging port and the waste chamber 1620 are not connected with each other, the discharging port and the waste chamber 1620 may be connected with each other by a rotation of the second housing 1600.

- [119] After the other fluids are discharged to the waste chamber 1620 through the discharging port, a washing solution may be introduced from the washing chamber 1430 into the discharging chamber 1420.
- [120] Here, the washing solution is a solution which removes impurities mixed with the collected target object, and a component thereof is not limited, as long as the component may selectively wash and remove the impurities other than the nucleic acid. For example, the washing solution may include ethanol of 90 to 100 % strength, isopropanol or the like.
- [121] The washing solution introduced from the discharging chamber 1420 may be accommodated with the impurities in the waste chamber 1620 through the discharging port. Therefore, the waste solution including the other fluids, the impurities and the washing solution may be accommodated in the waste chamber 1620.
- [122] Hereinafter, an operation after the sample processing using the molecular diagnostic cartridge 1000 will be described with reference to FIG. 7.
- [123] FIG. 7 is a cross-sectional view illustrating another operation of the molecular diagnostic cartridge 1000 according to the exemplary embodiment of the present invention. FIG. 7 is a cross-sectional view taken along a line B-B' of FIG. 4.
- [124] Referring to FIG. 7, the first housing 1400 may include the discharging chamber 1420, the elution chamber 1440, the reagent chamber 1452 and the reagent buffer chamber 1451, and the elution chamber 1440 and the reagent buffer chamber 1451 may be connected with the pressure hole 1220. Also, the discharging port connected with the discharging chamber 1420 and the fluid path C connected with the reagent chamber 1452 may be connected with the target chamber 1640.
- [125] After a discharging of the waste solution is finished, the second housing is rotated by the device, and the discharging port and the target chamber 1640 may be connected with each other. At this time, the discharging port and the waste chamber 1620 may be separated from each other, and thus may not be connected with each other.
- [126] When the pressure is transmitted through the pressure hole 1220 connected with the elution chamber 1440, a dissolving solution accommodated in the elution chamber 1440 is introduced into the discharging chamber 1420 by the pressure.
- [127] The dissolving solution introduced into the discharging chamber 1420 may dissolve

the target object collected by the filter and may separate the target object from the filter. A target solution in which the dissolving solution and the target object separated from the filter are mixed may be accommodated into the target chamber 1640 through the discharging port.

- [128] After the target solution is accommodated into the target chamber 1640, a reagent may be introduced into the target chamber 1640. The reagent may be introduced from the reagent chamber 1452. Before the reagent is introduced into the target chamber 1640, a reagent buffer may be introduced from the reagent buffer chamber 1451 into the reagent chamber 1452, and may be mixed with the reagent. The reagent buffer may be introduced into the reagent chamber 1452 by the pressure provided to the reagent buffer chamber 1451. Also, the reagent mixed with the reagent buffer may be moved to the target chamber 1640 by the pressure obtained by transmitting the pressure provided to the reagent buffer chamber 1451 to the reagent chamber 1452.
- [129] Until now, it has been described that, after the discharging of the waste solution is finished, the second housing 1600 is rotated by the device, and the discharging port and the target chamber 1640 are connected with each other at the same time. Alternatively, the discharging port and the target chamber 1640 may be connected with each other by the rotation of the second housing 1600, and then may be connected with the fluid path C connected with the reagent chamber 1452 by another rotation of the second housing 1600.
- [130] Until now, it has been described that the waste chamber 1620 and the target chamber 1640 were selectively connected with the discharging port by the rotation of the second housing 1600. However, the waste chamber 1620 and the target chamber 1640 may be selectively connected with the discharging port by a sliding movement of the second housing 1600.
- [131] Hereinafter, the case in which the waste chamber 1620 and the target chamber 1640 are selectively connected with the discharging port by the sliding movement of the second housing 1600 according to another embodiment of the present invention will be described.
- [132] When another embodiment of the present invention is compared with the embodiment of the present invention, the sample processing and washing process is the same as each other, and there is a difference in a structure in which the waste chamber 1620 and the target chamber 1640 are selectively connected with the discharging port.
- [133] In the description of another embodiment of the present invention, repeated description will be omitted.
- [134] FIG. 8 is a plan view of the molecular diagnostic cartridge 1000 according to another exemplary embodiment of the present invention.
- [135] After the discharging of the solution is finished, the second housing 1600 may be slid

by the device, and the discharging port and the target chamber 1640 may be connected with each other. At this time, the discharging port and the waste chamber 1620 may be separated from each other and may not be connected with each other. Here, the sliding movement may mean that the second housing 1600 is moved on a plane located under the first housing 1400, and the second housing 1600 and the first housing 1400 may not be separated from each other and may be moved while parts thereof are coupled with each other.

[136] When the pressure is transmitted through the pressure hole 1220 connected with the elution chamber 1440, the dissolving solution accommodated in the elution chamber 1440 is introduced into the discharging chamber 1420 by the pressure.

[137] The dissolving solution introduced into the discharging chamber 1420 may dissolve the target object collected by the filter and then may separate the target object from the filter, and the target solution in which the dissolving solution and the target object separated from the filter are mixed may be accommodated into the target chamber 1640 through the discharging port.

[138] When the target solution is completely accommodated, the target chamber 1640 and the fluid path provided at the reagent chamber 1452 may be connected with each other by the sliding movement of the second housing 1600.

[139] After the target chamber 1640 and the fluid path provided at the reagent chamber 1452 are completely connected with each other, the reagent may be introduced into the target chamber 1640. The reagent may be from the reagent chamber 1452. Before the reagent is introduced into the target chamber 1640, the reagent buffer may be introduced from the reagent buffer chamber 1451 into the reagent chamber 1452, and may be mixed with the reagent. The reagent buffer may be introduced into the reagent chamber 1452 by the pressure provided to the reagent buffer chamber 1451. Also, the reagent mixed with the reagent buffer may be moved to the target chamber 1640 by the pressure obtained by transmitting the pressure provided to the reagent buffer chamber 1451 to the reagent chamber 1452.

[140] It will be apparent to those skilled in the art that various modifications can be made to the above-described exemplary embodiments of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention covers all such modifications provided they come within the scope of the appended claims and their equivalents.

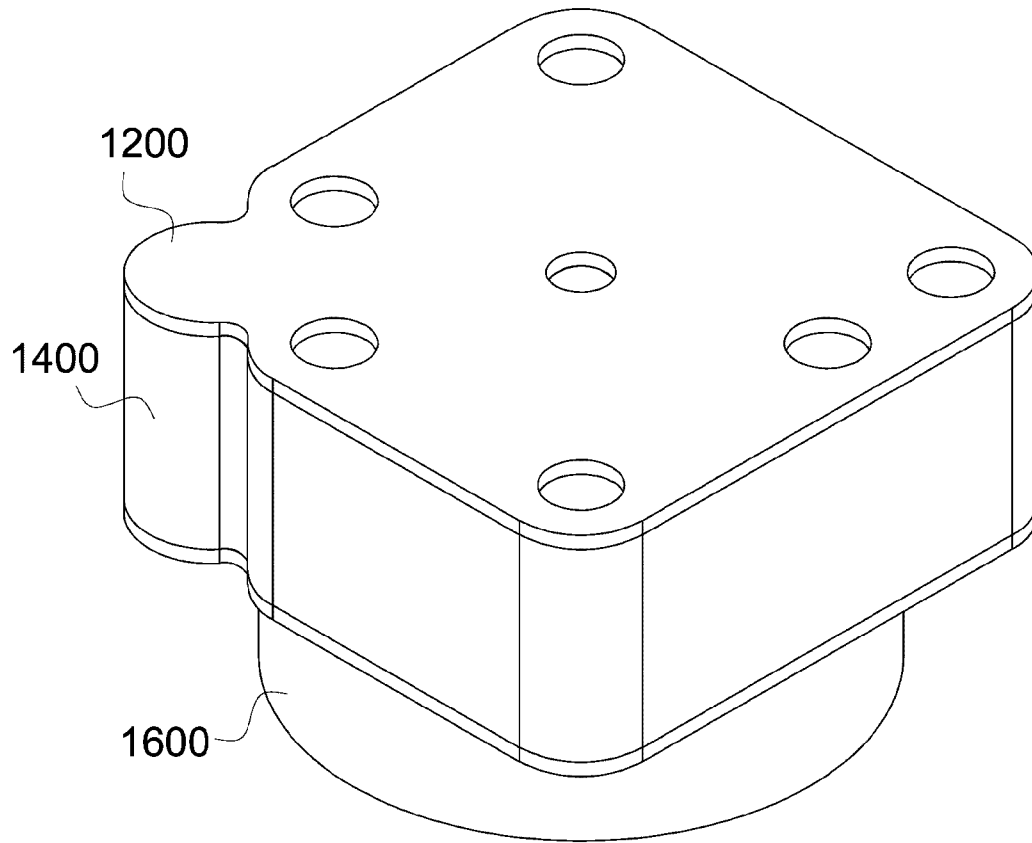
Claims

- [Claim 1] A molecular diagnostic cartridge comprising:
a first housing comprising a plurality of processing chambers continuously connected to process a sample, a washing chamber for washing and a discharging chamber connected to at least one of the plurality of processing chambers and the washing chamber, and having a discharging port through which a solution is discharged; and
a second housing disposed under the first housing, and comprising a waste chamber configured to accommodate a waste solution and a target chamber configured to accommodate a target solution, and movably provided so that one of the waste chamber and the target chamber is selectively connected with the discharging port.
- [Claim 2] The molecular diagnostic cartridge of claim 1, wherein a fluid path configured to connect a plurality of chambers of the first housing is formed in the first housing, and
the molecular diagnostic cartridge further comprises a cover part provided on the first housing and included a pressure hole configured to receive a pressure to move a fluid through the fluid path.
- [Claim 3] The molecular diagnostic cartridge of claim 2, wherein a valve configured to allow movement of the fluid at a predetermined pressure or more is provided in the fluid path.
- [Claim 4] The molecular diagnostic cartridge of claim 2, wherein a barrier configured to be broken at a predetermined pressure or more is provided in the fluid path.
- [Claim 5] The molecular diagnostic cartridge of claim 1, wherein a fluid path configured to connect the chambers of the first housing is formed in the first housing, and
wherein the molecular diagnostic cartridge further comprises a one-way valve configured to prevent a backflow of the fluid being provided in the fluid path.
- [Claim 6] The molecular diagnostic cartridge of claim 1, wherein the adjacent chambers of the first housing have bottom surfaces at different heights from each other.
- [Claim 7] The molecular diagnostic cartridge of claim 1, wherein the second housing is configured so that one of the waste chamber and the target chamber is selectively connected with the discharging port by a rotational movement thereof.

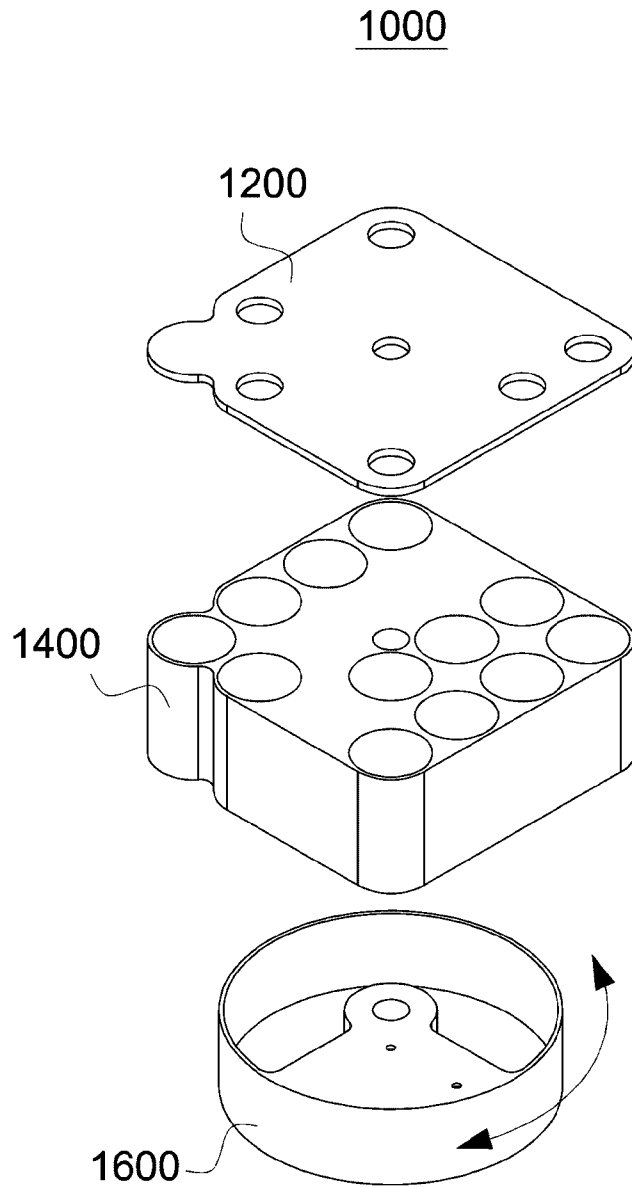
- [Claim 8] The molecular diagnostic cartridge of claim 1, wherein the second housing is configured so that one of the waste chamber and the target chamber is selectively connected with the discharging port by a sliding movement thereof.
- [Claim 9] The molecular diagnostic cartridge of claim 1, wherein the first housing further comprises an elution chamber configured to accommodate a dissolving solution and connected to the discharging chamber.
- [Claim 10] The molecular diagnostic cartridge of claim 1, wherein the plurality of processing chambers comprises a first chamber configured to accommodate a first reagent, a second chamber configured to receive and process the first reagent, a third chamber configured to accommodate a mixed solution including the sample, to receive the processed first reagent and to process the mixed solution, and a fourth chamber configured to accommodate a second reagent and to process the processed mixed solution with the second reagent, and the first chamber, the second chamber, the third chamber and the fourth chamber are connected sequentially through a fluid path, and bottom surfaces thereof are at heights that are gradually lowered sequentially.
- [Claim 11] The molecular diagnostic cartridge of claim 10, wherein the plurality of processing chambers further comprises a fifth chamber configured to accommodate a third reagent and connected to the fourth chamber, and wherein the fifth chamber has a bottom surface at a higher height than the bottom surface of the fourth chamber.
- [Claim 12] The molecular diagnostic cartridge of claim 1, wherein at least one of the plurality of processing chambers comprises a stirring member configured to facilitate the sample processing.
- [Claim 13] The molecular diagnostic cartridge of claim 1, wherein the washing chamber comprises a plurality of chambers of which bottom surfaces are at heights that are gradually lowered in connection order.
- [Claim 14] The molecular diagnostic cartridge of claim 1, wherein at least a part of the target chamber is formed of a transparent material.
- [Claim 15] The molecular diagnostic cartridge of claim 1, wherein the first housing further comprises a reagent chamber configured to accommodate a reagent using a reaction of the target solution, and connected to the target chamber by movement of the second housing.

[Fig. 1]

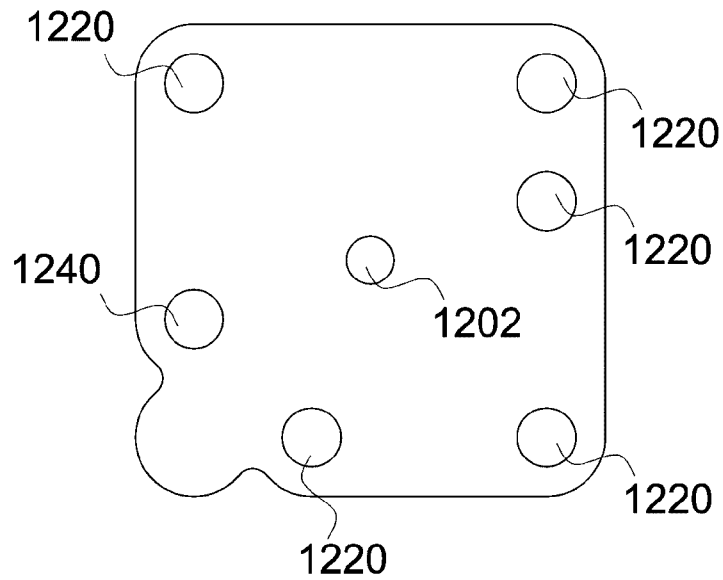
1000



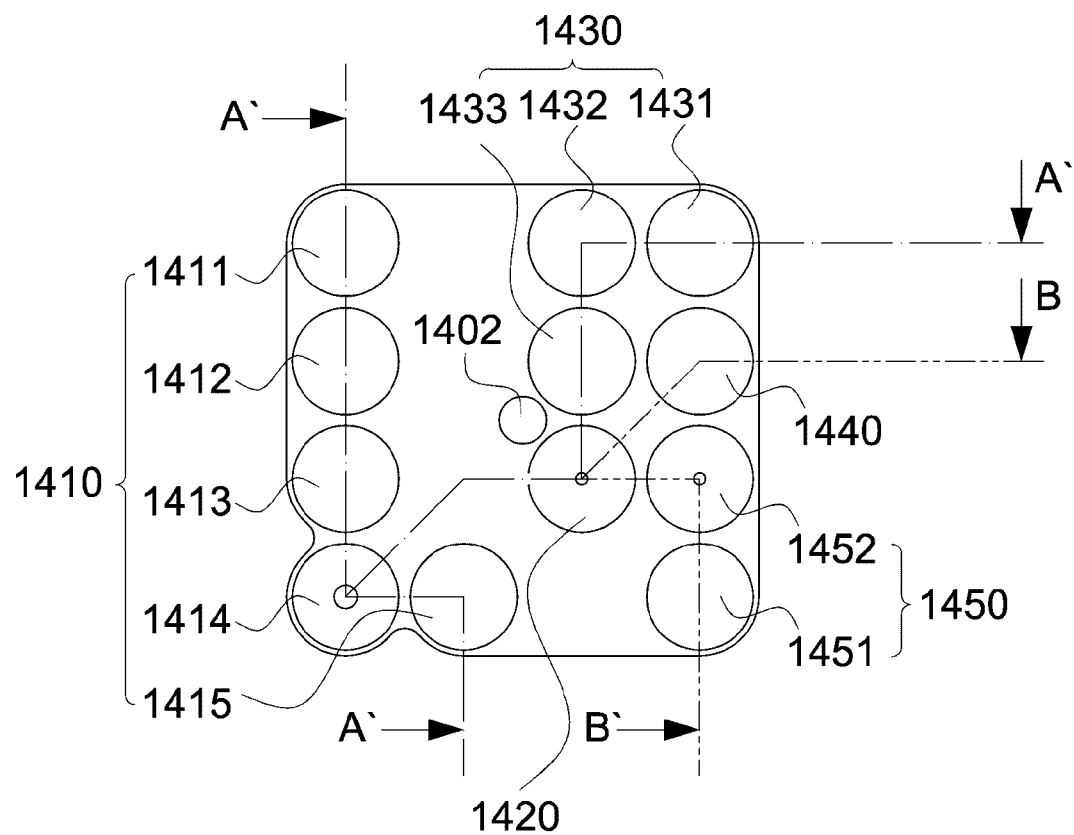
[Fig. 2]



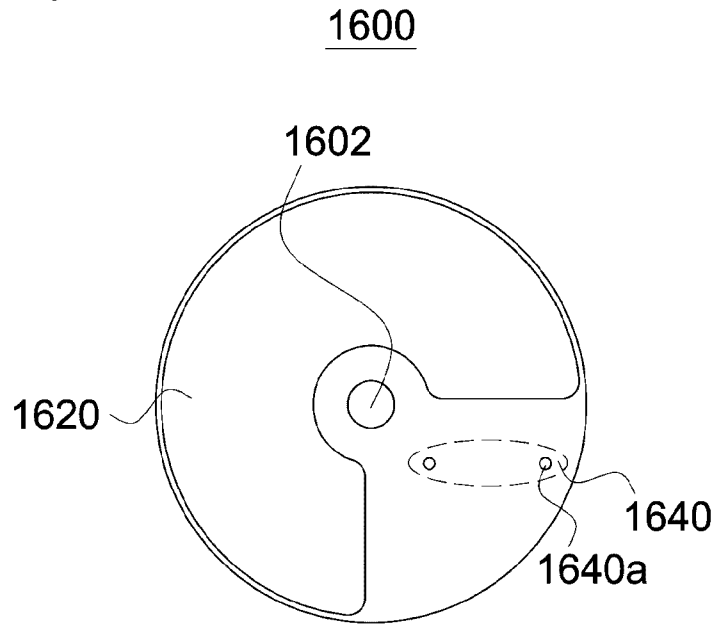
[Fig. 3]

1200

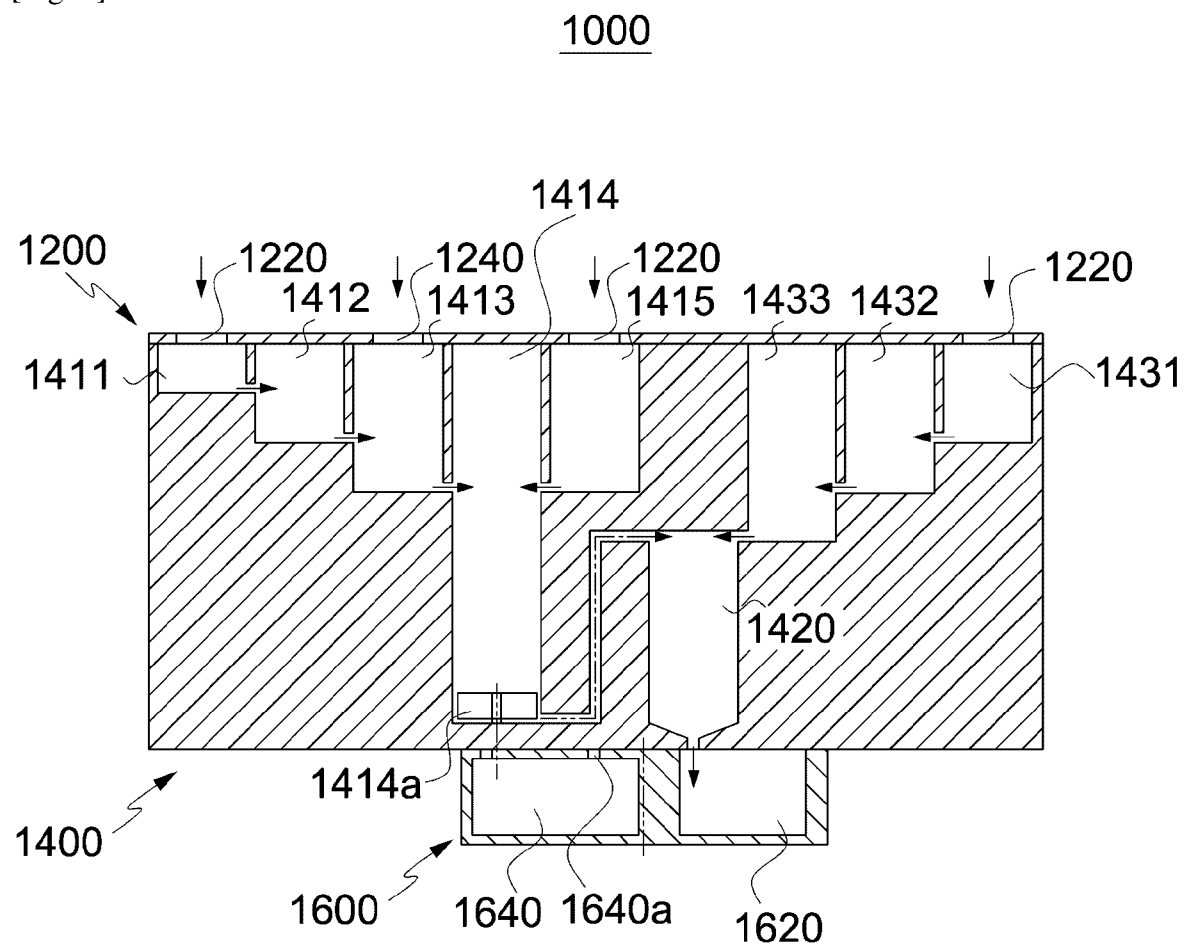
[Fig. 4]

1400

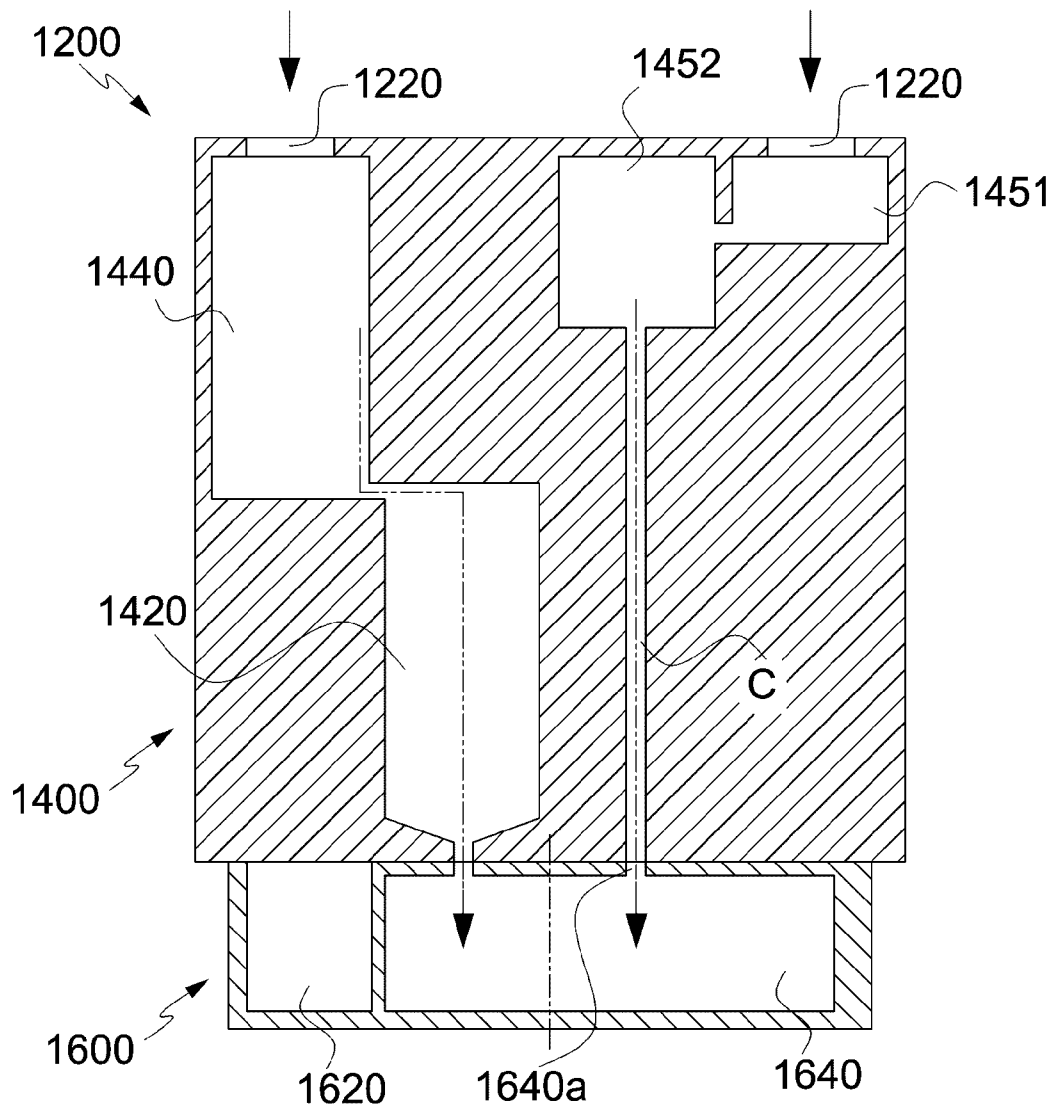
[Fig. 5]



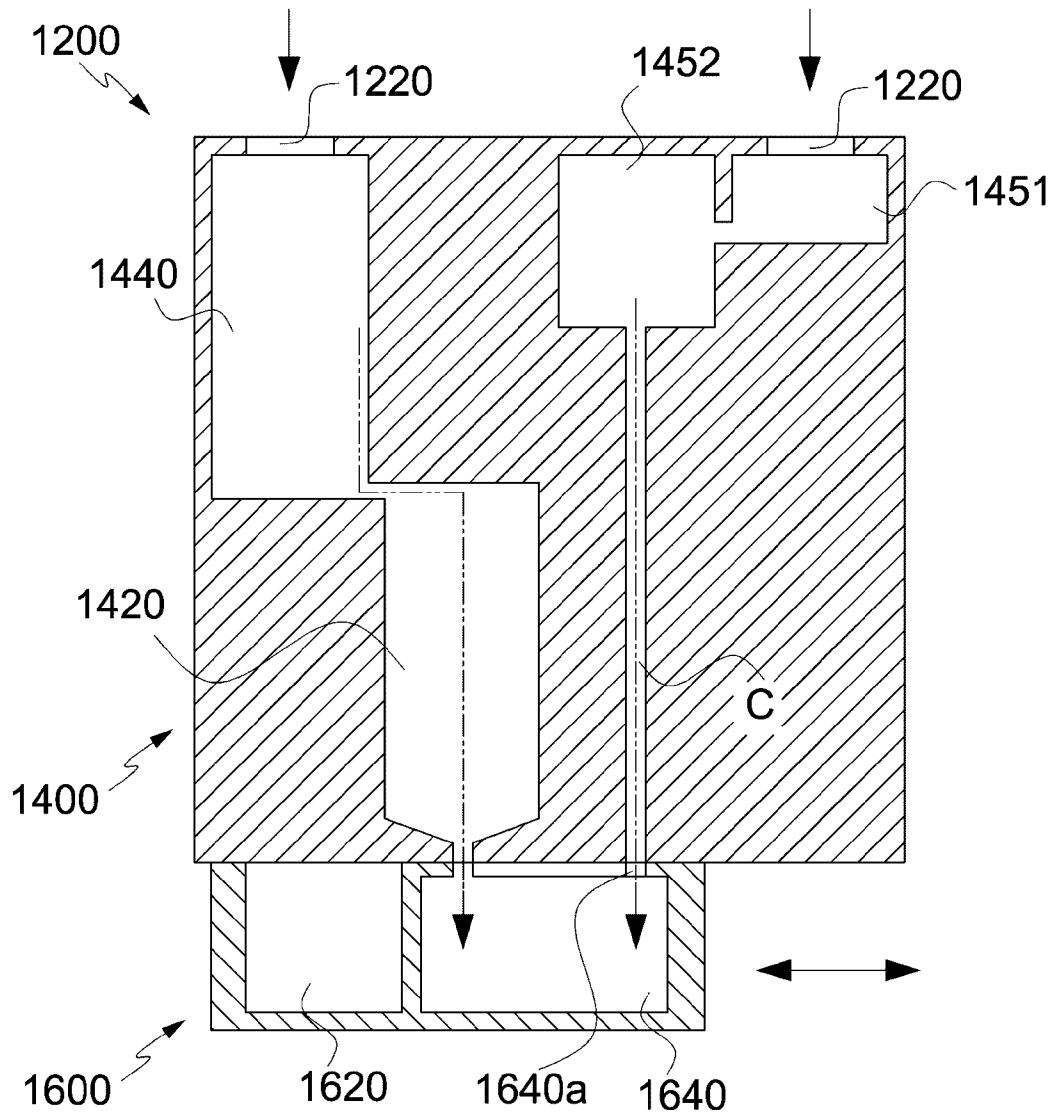
[Fig. 6]



[Fig. 7]

1000

[Fig. 8]

1000

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2015/000693**A. CLASSIFICATION OF SUBJECT MATTER****B01L 3/00(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B01L 3/00; G01N 15/06; G01N 31/20; G01N 33/00; C07H 21/00; C12Q 1/70; G01N 21/75; C12M 1/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: cartridge, housing, processing chamber, washing chamber, discharging chamber, discharging port, target chamber, waste chamber, lower housing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 8894946 B2 (INTEGENX INC.) 25 November 2014 See abstract; claims 1-7, 17, 21, 22, 27; and figures 1-10.	1-15
A	US 6729196 B2 (MOLER, CHRISTOPHER L. et al.) 4 May 2004 See abstract; column 16, lines 21-65; claims 32, 36; and figures 6B, 7.	1-15
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A	US 2011-0275058 A1 (ZHOU, PENG et al.) 10 November 2011 See abstract; paragraph [0119]; and figure 13A.	1-15
A	US 2012-0329142 A1 (BATTRELL, C. FREDERICK et al.) 27 December 2012 See abstract; paragraphs [0258]-[0260]; claim 15; and figures 15-16E.	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

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Information on patent family members

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INTERNATIONAL SEARCH REPORT

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