[0062]

FIGS. 13A and 13B are views (photographs) showing an example of the resin ring 204 that has failed to be press-fitted and fixed and has been deformed on the membrane storage portion 104. FIG. 13C is a table summarizing examples of outer diameter dimensions and success/failure of press-fitting and fixing of the resin ring 204. A press-fitting failure as shown in FIG. 13A was observed when the inner diameter R of the membrane storage portion 104 at the fixation position of the purification membrane 201 was about 6.5 mm and the outer diameter a of the resin ring 204 was equal to or greater than 6.9 mm, that is, (a - R) was equal to or greater than at least 400 μm. In regard to this relationship, the same results were obtained in a case where the inner diameter b and the thickness (height) c of the resin ring 204 were changed and in a case of the membrane storage portion 104 (FIG. 9) including a pedestal portion instead of the porous holding member 205 as well. At the same time, an event in which press-fitting and fixing failed within a range satisfying $a - R \geq 400$ μm was observed at least in a case of 1 mm $\leq R \leq 7$ mm. The main reason for the failure of the press-fitting and fixing is considered to be because rigidity of the substrate 102 is large as compared with the spin column method, and the strain when the resin ring 204 is press-fitted cannot be absorbed by both the resin ring 204 and the substrate 102.

[0063]

In the case of the spin column method, the container storing the purification membrane 201 is thin and has low rigidity, and it is thus not necessary to consider any dimensional range like that for the flow path device 101 according to the present disclosure. As described above, the flow path device 101 of the present disclosure can be stably manufactured at a practical level by designing the inner diameter R of the membrane storage portion 104 and the resin ring 204 to satisfy, for example, $0 \leq a - R < 400$ μm. This dimensional range can be selected depending on physical properties such as materials, rigidity, and bending moment of the substrate 102 and the resin ring 204, and is preferably set in an appropriate manner.

[0064]

(iii) Another problem in the case of using the flow path device 101 based on the spin column configuration including the porous holding member 205 is that the eluent 403 is

responsiveness. Furthermore, since the liquid feeding power source 3003 can be freely operated in the atmosphere open state, an operation of starting liquid feeding after the outputs of the liquid feeding power source 3003 and the pressure control mechanism 3004 are stabilized and an operation of returning a plunger of a syringe to a predetermined position in a case where a syringe pump is used as the liquid feeding power source 3003 can be performed with the piping tube 307 connected to the reagent holding portion 303. It is also possible to operate such that the timing at which the pressure is applied to the first connection port 3001 is controlled by an operation of the multi-way valve mechanism 3006 with the liquid feeding power source 3003 constantly driven. The configuration of FIG. 14B can be used in a case where it is desired to minimize the number of times the liquid feeding power source 3003 and the pressure control mechanism 3004 are switched, such as a case where the liquid feeding power source 3003 with large power consumption immediately after current application is used. Note that the multi-way valve mechanism 3006 can also achieve an equivalent function by combining a plurality of on-off valve mechanisms 3005 as shown in FIG. 15.

[0071]

The liquid feeding power source 3003, the pressure control mechanism 3004, and the multi-way valve mechanism 3006 may be connected to the second connection port 3002. In this case, an equivalent operation can be achieved by performing pressurization and depressurization operations opposite to those in the case where they are connected to the first connection port 3001. It is also possible to use pairs of liquid feeding power sources 3003, pressure control mechanisms 3004, and multi-way valve mechanisms 3006 and to connect each of them to both the first connection port 3001 and the second connection port 3002. It is thus possible to establish access from both the connection ports to the flow path device 101 via the reagent holding portion 303 and to select a liquid feeding route that minimizes influences of a liquid feeding pressure loss due to an increase in piping length. Similarly, a multi-way valve mechanism 3006 having a function of a three-way valve that can switch a pair of liquid feeding power source 3003 and the pressure control mechanism 3004 to the first connection port 3001, the second connection port 3002, or the atmosphere opening flow path 3007 can be used as a set of the liquid feeding power source 3003 and the pressure control mechanism 3004. In this

continuous conveying method of reducing the liquid feeding pressure by continuously conveying the two solutions satisfying specific conditions without air sandwiched therebetween in the technology of the present disclosure. It has been found by experiments that since the main component of the sample solution 401 is water and the main component of the cleaning liquid 402 is ethanol, the liquid feeding pressure reducing effect can be easily obtained by applying the continuous conveying method. In addition, it is known from experiments that it is preferable that "the evaporation rate of the second liquid (cleaning liquid 402) is higher than that of the first liquid (sample solution 401), and the surface tension of the second liquid is lower than that of the first liquid". When the nucleic acid purification treatment shown in FIGS. 30A and 30B was actually performed, it was confirmed that the maximum liquid feeding pressure was about 40 kPa and high purification efficiency was able to be achieved even by the flow path device 101 of the present disclosure. As described above, it is possible to enable low-pressure liquid feeding by the continuous conveying method and to realize high-performance nucleic acid purification with a small-sized and low-cost mechanism while achieving high-yield and high-robust nucleic acid purification by the purification membrane fixing method using the resin ring 204 according to the present disclosure.

[0118]

(7) Summary

(i) The flow path device 101 of the present embodiment includes the purification membrane 201 that is formed on the substrate 102 and is able to collect a nucleic acid, the membrane storage portion 104 that is a space formed on the substrate 102, is connected to the first flow path 105 and the second flow path 106 formed on the substrate, and houses the purification membrane 201, and the annular resin ring 204 that is press-fitted to the membrane storage portion 104. Also, the membrane storage portion 104 includes a pedestal surface 109 formed between the upper surface and the lower surface of the substrate 102 such that the purification membrane 201 can be installed thereon, and is divided into a cylindrical membrane storage portion upper portion 110 and the membrane storage portion lower portion 111 with a smaller diameter than that of the membrane storage portion upper portion 110 with the pedestal surface 109 sandwiched as a boundary. The first flow path 105 and the second flow path 106