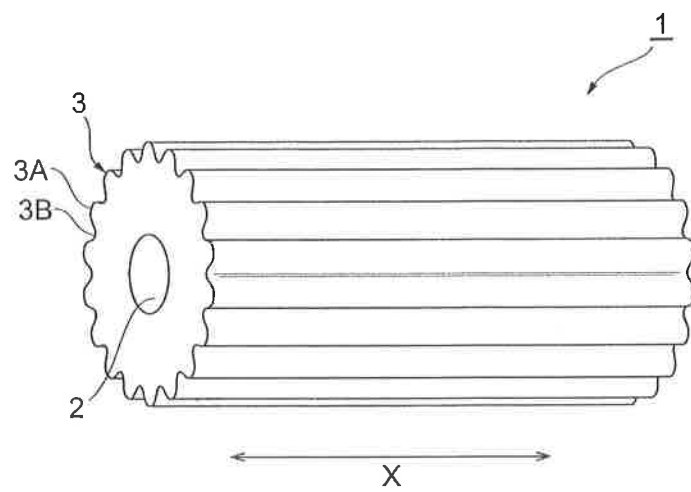
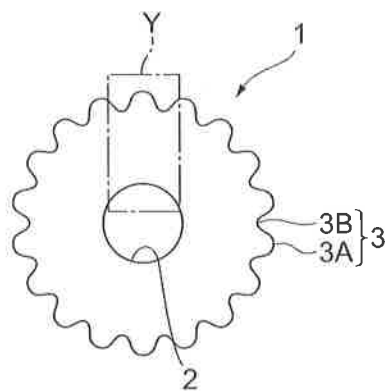
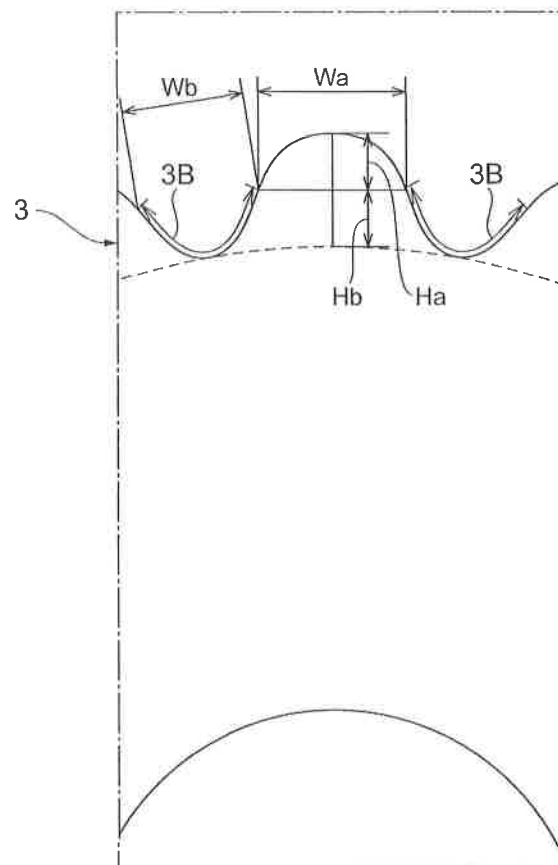


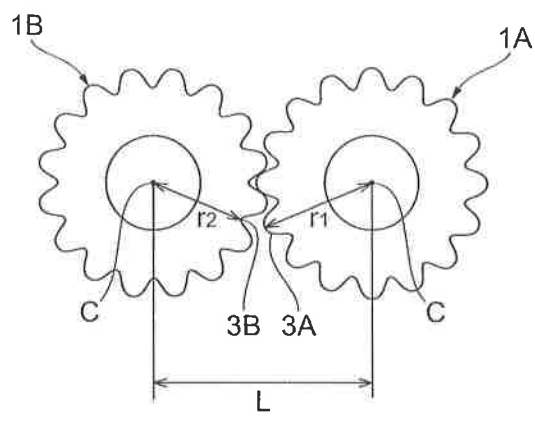
**Fig.1**

**Fig.2**

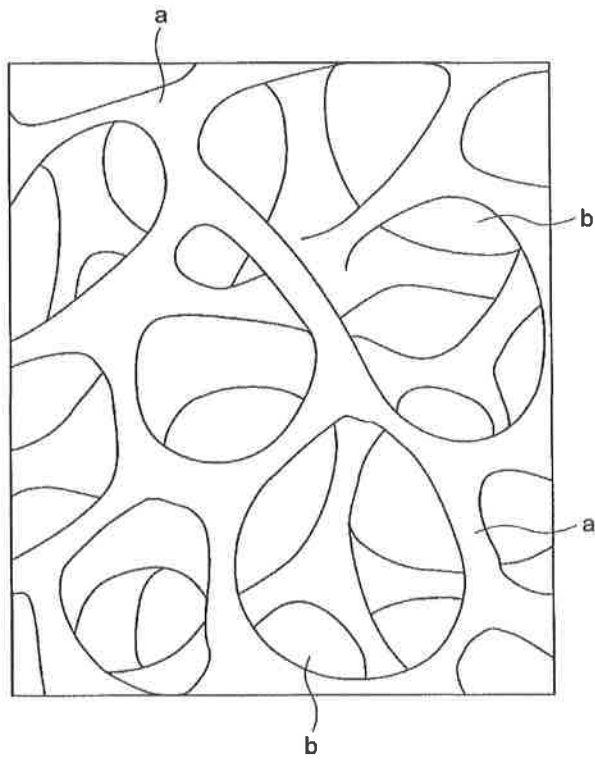


**Fig.3**

**Fig.4**



**Fig.5**



**Fig.6**

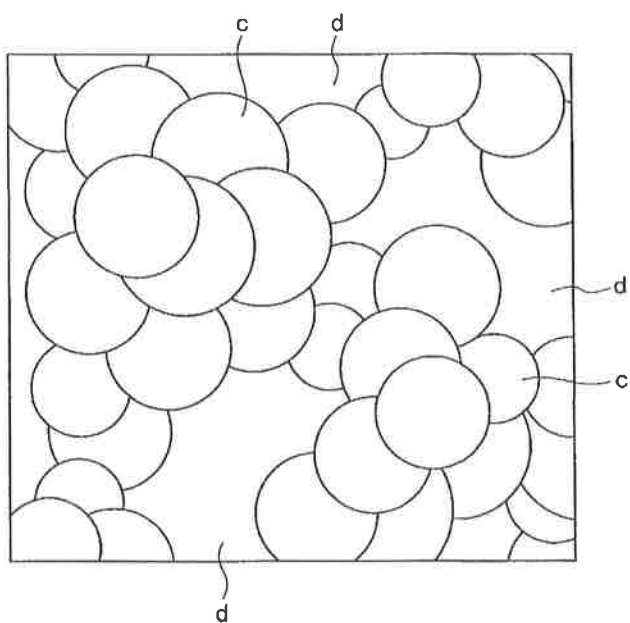
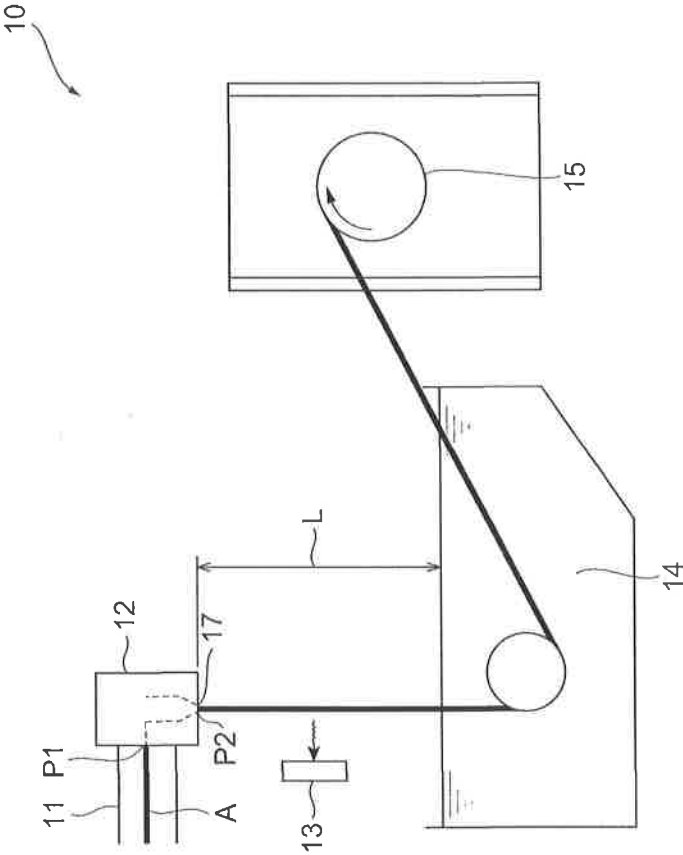
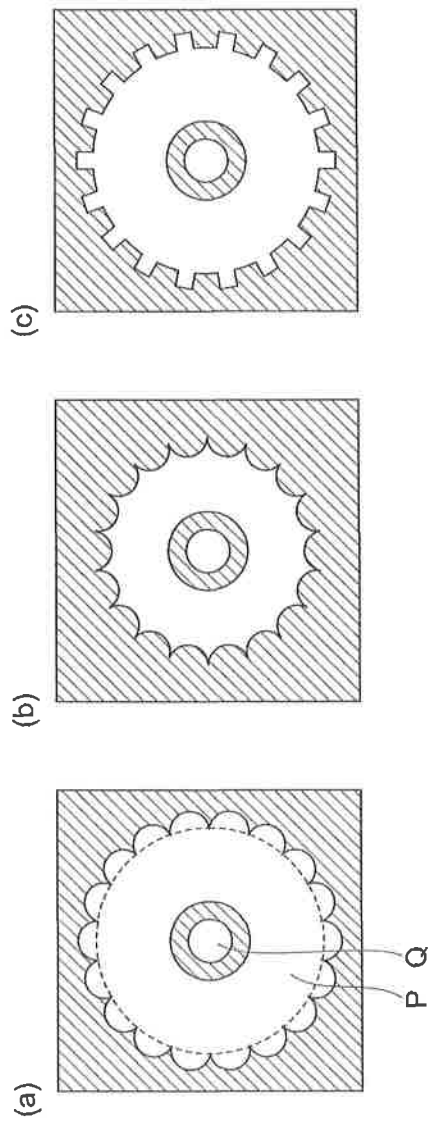


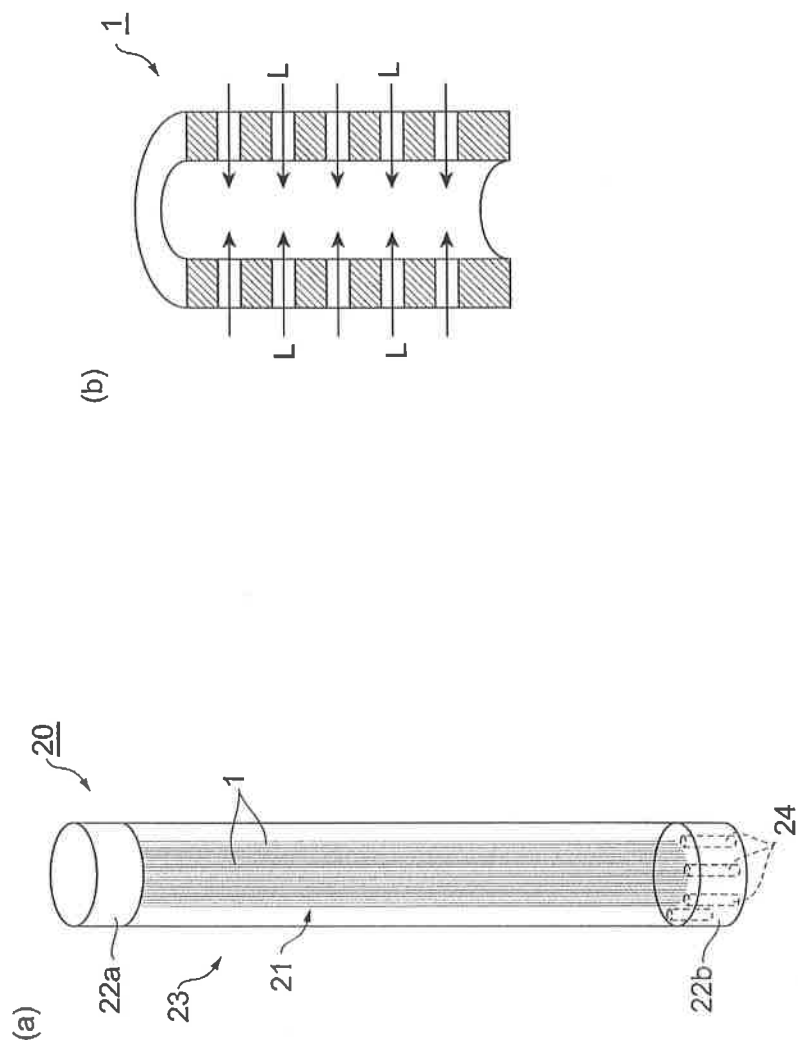
Fig.7

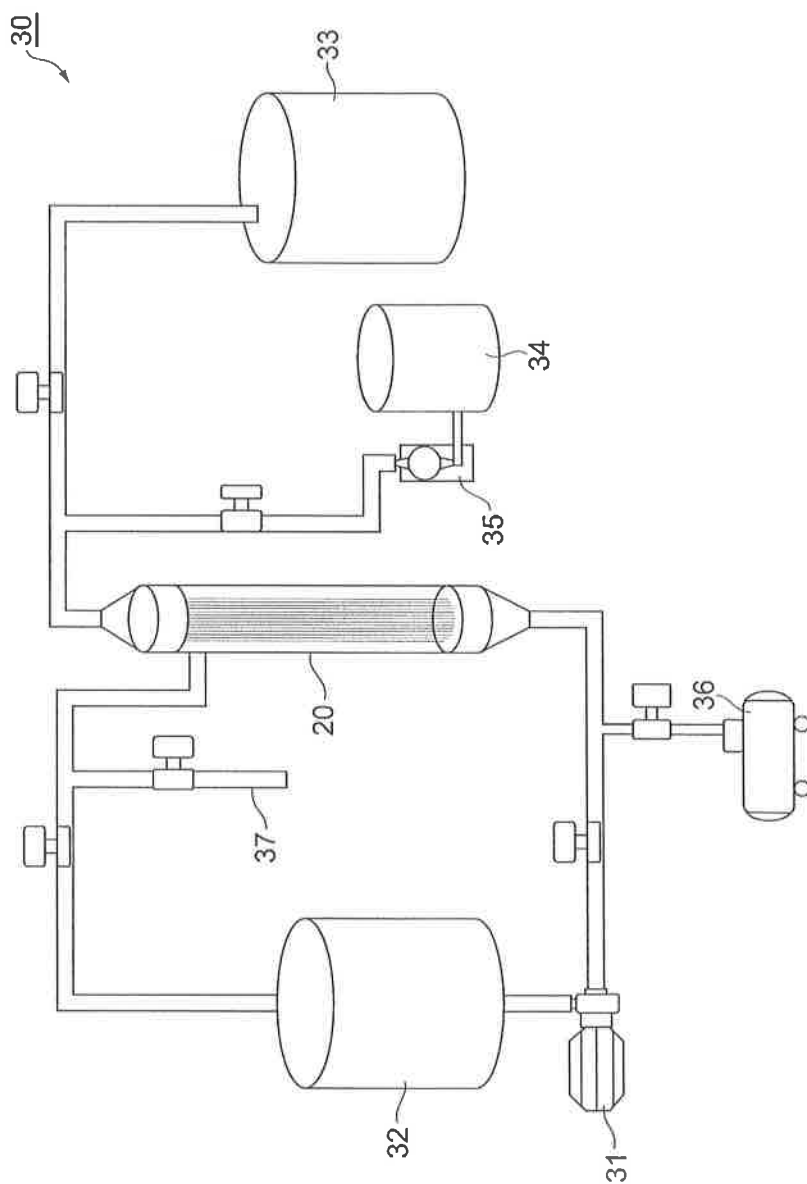


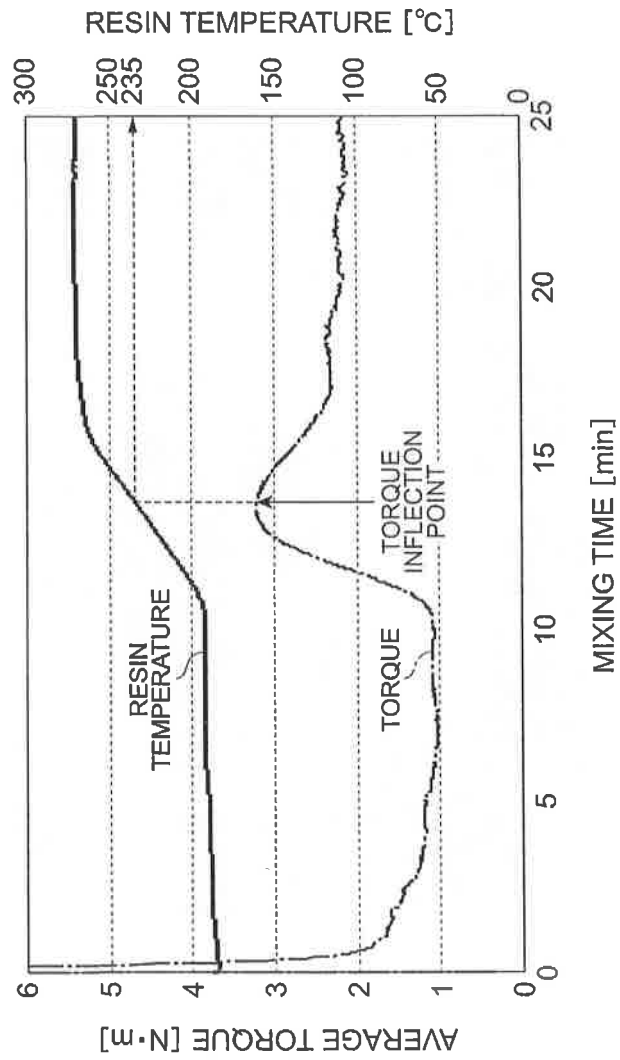
**Fig.8**



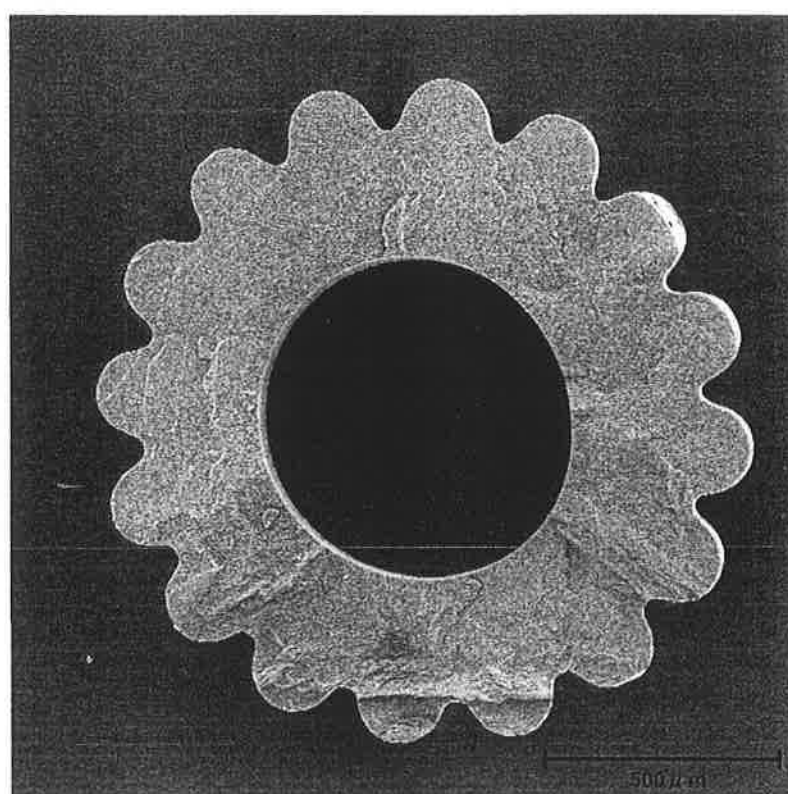
**Fig.9**



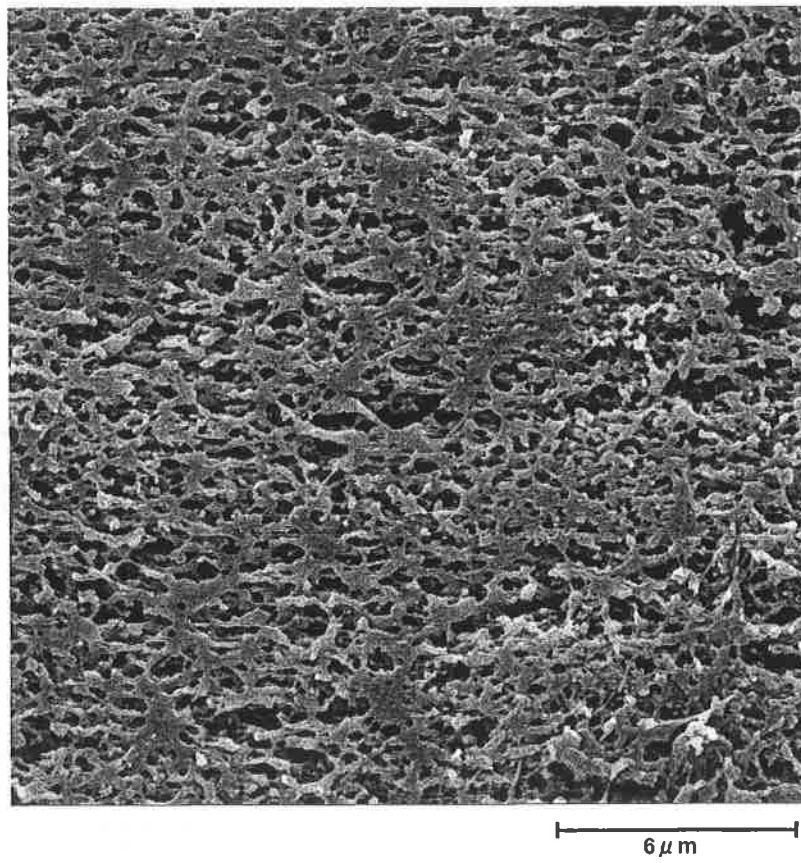
**Fig.10**

**Fig.11**

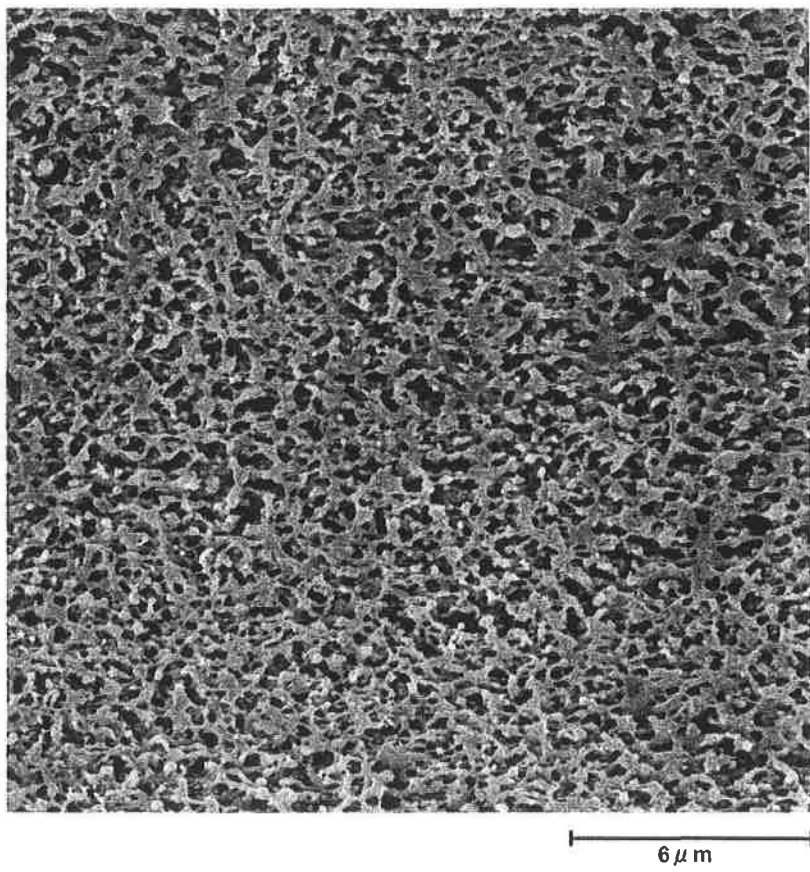
**Fig.12**



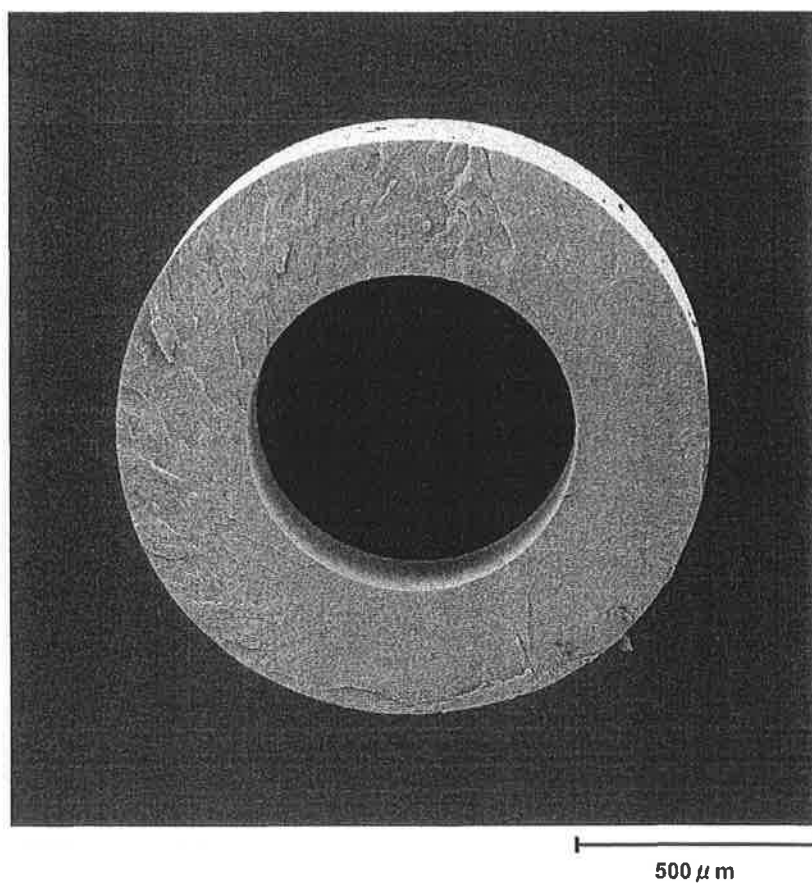
***Fig.13***



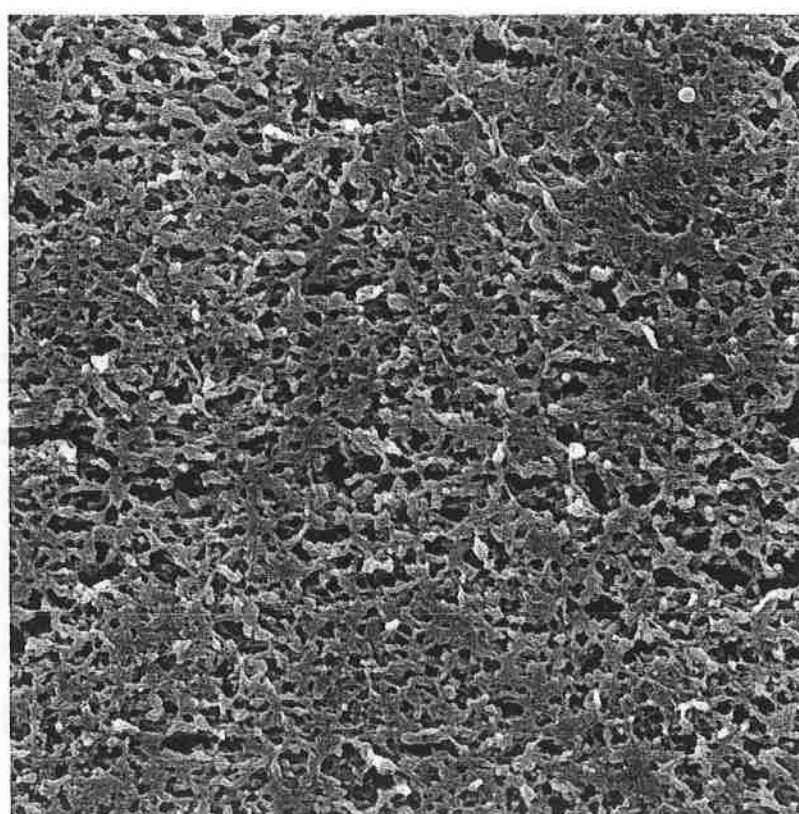
***Fig.14***



**Fig.15**

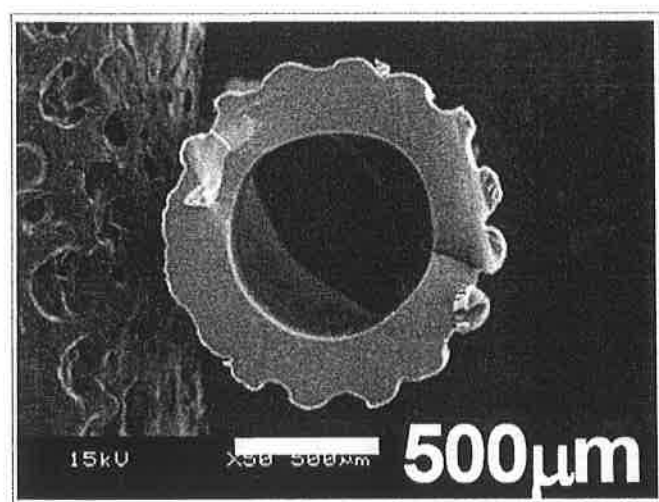


**Fig.16**



6 μm

**Fig.17**



**Fig.18**

|                                |                                                                         |     | Ex. 1 | Ex. 2   | Ex. 3 | Ex. 4 | Ex. 5   | Ex. 6 | Ex. 7 | Ex. 8 |
|--------------------------------|-------------------------------------------------------------------------|-----|-------|---------|-------|-------|---------|-------|-------|-------|
| Composition ratio              | Thermoplastic resin                                                     | R-1 | 34.0  | 34.0    | 34.0  | 34.0  | 34.0    | 34.0  | 34.0  | 34.0  |
|                                |                                                                         | R-2 | —     | —       | —     | —     | —       | —     | —     | —     |
|                                |                                                                         | R-3 | —     | —       | —     | —     | —       | —     | —     | —     |
|                                |                                                                         | R-4 | —     | —       | —     | —     | —       | —     | —     | —     |
|                                | Organic liquid                                                          | L-1 | 33.8  | 33.8    | 33.8  | 33.8  | 33.8    | 33.8  | 33.8  | 33.8  |
|                                |                                                                         | L-2 | 6.8   | 6.8     | 6.8   | 6.8   | 6.8     | 6.8   | 6.8   | 6.8   |
|                                |                                                                         | L-3 | —     | —       | —     | —     | —       | —     | —     | —     |
|                                |                                                                         | L-4 | —     | —       | —     | —     | —       | —     | —     | —     |
|                                | Inorganic fine powder                                                   | P-1 | 25.4  | 25.4    | 25.4  | 25.4  | 25.4    | 25.4  | 25.4  | 25.4  |
|                                | Hydrophilic additive                                                    | P-2 | —     | —       | —     | —     | —       | —     | —     | —     |
| Outlet size                    | Height of asperity [ $\mu\text{m}$ ]                                    |     | 200   | 200     | 200   | 200   | 200     | 200   | 200   | 200   |
|                                | Width of asperity [ $\mu\text{m}$ ]                                     |     | 400   | 400     | 400   | 400   | 400     | 400   | 400   | 400   |
|                                | Number of asperities (number)                                           |     | 16    | 16      | 16    | 16    | 16      | 16    | 16    | 16    |
|                                | Outer diameter of depressed part [mm]                                   |     | 1.72  | 1.72    | 1.72  | 1.72  | 1.72    | 1.72  | 1.72  | 1.72  |
|                                | Inner diameter [mm]                                                     |     | 0.92  | 0.92    | 0.92  | 0.92  | 0.92    | 0.92  | 0.92  | 0.92  |
|                                | Cross-sectional area of outlet [ $\text{mm}^2$ ]                        |     | 2.66  | 2.66    | 2.66  | 2.66  | 2.66    | 2.66  | 2.66  | 2.66  |
|                                | Peripheral length of outlet [mm]                                        |     | 12.9  | 12.9    | 12.9  | 12.9  | 12.9    | 12.9  | 12.9  | 12.9  |
|                                | Equivalent radius [mm]                                                  |     | 0.41  | 0.41    | 0.41  | 0.41  | 0.41    | 0.41  | 0.41  | 0.41  |
| Condition for forming membrane | Airflow time [sec]                                                      |     | 0.60  | 0.60    | 0.60  | 0.60  | 0.60    | 0.60  | 0.60  | 0.60  |
|                                | Discharge amount of fusion kneaded product [ $\text{mm}^3/\text{sec}$ ] |     | 521   | 42      | 71    | 147   | 240     | 325   | 789   | 1042  |
|                                | Linear speed $V_s$ on discharge [ $\text{mm}/\text{sec}$ ]              |     | 196   | 16      | 26    | 55    | 90      | 122   | 296   | 391   |
|                                | Take-up speed $V_t$ [m/min]                                             |     | 30    | 3       | 5     | 10    | 15      | 20    | 45    | 60    |
|                                | Outlet SR [1/sec]                                                       |     | 376   | 30      | 51    | 106   | 173     | 235   | 570   | 752   |
|                                | Shear rate [1/sec]                                                      |     | 4119  | 266     | 453   | 987   | 1749    | 2408  | 6296  | 8239  |
|                                | Melt viscosity [ $\text{Pa}\cdot\text{sec}$ ]                           |     | 54    | 122     | 104   | 82    | 69      | 63    | 47    | 43    |
|                                | Pressure at the tip of nozzle [kPa]                                     |     | 494   | 90      | 130   | 214   | 294     | 362   | 659   | 803   |
|                                | Draft ratio                                                             |     | 2.6   | 3.2     | 3.1   | 3.0   | 2.8     | 2.7   | 2.5   | 2.6   |
|                                | Cooling air direction to the discharging direction                      |     | 90°   | 90°     | 90°   | 90°   | 90°     | 90°   | 90°   | 90°   |
|                                | $T_e$ [°C]                                                              |     | 250   | 250     | 250   | 250   | 250     | 250   | 250   | 250   |
|                                | $T_s$ [°C]                                                              |     | 245   | 245     | 245   | 245   | 245     | 245   | 245   | 245   |
|                                | $T_p$ [°C]                                                              |     | 235   | 235     | 235   | 235   | 235     | 235   | 235   | 235   |
|                                | Fiber diameter variation                                                | —   | None  | None    | None  | None  | None    | None  | None  | None  |
|                                | Defect                                                                  | —   | None  | None    | None  | None  | None    | None  | None  | None  |
|                                | Coil                                                                    | —   | None  | Present | None  | None  | Present | None  | None  | None  |

**Fig.19**

[illegible]

**Fig.20**

|                                |                                                                         |     | Ex. 19 | Ex. 20 | Ex. 21      |             | Ex. 22 | Ex. 23 | Ex. 24 | Ex. 25 | Ex. 26 | Ex. 27 |
|--------------------------------|-------------------------------------------------------------------------|-----|--------|--------|-------------|-------------|--------|--------|--------|--------|--------|--------|
|                                |                                                                         |     |        |        | Outer layer | Inner layer |        |        |        |        |        |        |
| Composition ratio              | Thermoplastic resin                                                     | R-1 |        | —      | 34.0        | 36.0        | 34.0   | 34.0   | 34.0   | 34.0   | 34.0   | 34.0   |
|                                |                                                                         | R-2 | 20     | —      | —           | —           | —      | —      | —      | —      | —      | —      |
|                                |                                                                         | R-3 | —      | —      | —           | —           | —      | —      | —      | —      | —      | —      |
|                                |                                                                         | R-4 | —      | —      | —           | —           | —      | —      | —      | —      | —      | —      |
|                                | Organic liquid                                                          | L-1 | 56     | —      | 33.8        | 34.8        | 33.8   | 33.8   | 33.8   | 33.8   | 33.8   | 33.8   |
|                                |                                                                         | L-2 | —      | —      | 6.8         | 5.0         | 6.8    | 6.8    | 6.8    | 6.8    | 6.8    | 6.8    |
|                                |                                                                         | L-3 | —      | —      | —           | —           | —      | —      | —      | —      | —      | —      |
|                                |                                                                         | L-4 | —      | —      | —           | —           | —      | —      | —      | —      | —      | —      |
|                                | Inorganic fine powder                                                   | P-1 | 24     | —      | 25.4        | 24.2        | 25.4   | 25.4   | 25.4   | 25.4   | 25.4   | 25.4   |
|                                | Hydrophilic additive                                                    | P-2 | —      | —      | —           | —           | —      | —      | —      | —      | —      | —      |
| Outlet size                    | Height of asperity [ $\mu\text{m}$ ]                                    |     | 200    | —      | 200         |             | 270    | 100    | 50     | 50     | 100    | 300    |
|                                | Width of asperity [ $\mu\text{m}$ ]                                     |     | 400    | —      | 400         |             | 540    | 200    | 100    | 400    | 400    | 400    |
|                                | Number of asperities [number]                                           |     | 16     | —      | 16          |             | 12     | 32     | 64     | 16     | 16     | 16     |
|                                | Outer diameter of depressed part [mm]                                   |     | 1.72   | —      | 1.72        |             | 1.72   | 1.72   | 1.72   | 1.72   | 1.72   | 1.72   |
|                                | Inner diameter [mm]                                                     |     | 0.92   | —      | 0.92        |             | 0.92   | 0.92   | 0.92   | 0.92   | 0.92   | 0.92   |
|                                | Cross-sectional area of outlet [ $\text{mm}^2$ ]                        |     | 2.66   | —      | 2.66        |             | 3.03   | 2.16   | 1.91   | 1.91   | 2.16   | 3.17   |
|                                | Peripheral length of outlet [mm]                                        |     | 12.9   | —      | 12.9        |             | 14.4   | 12.9   | 12.9   | 9.4    | 9.8    | 15.6   |
|                                | Equivalent radius [mm]                                                  |     | 0.41   | —      | 0.41        |             | 0.42   | 0.33   | 0.30   | 0.40   | 0.44   | 0.41   |
| Condition for forming membrane | Airflow time [sec]                                                      |     | 0.60   | —      | 0.90        |             | 0.60   | 0.60   | 0.60   | 0.60   | 0.60   | 0.60   |
|                                | Discharge amount of fusion kneaded product [ $\text{mm}^3/\text{sec}$ ] |     | 356    | —      | 528         |             | 564    | 474    | 449    | 442    | 468    | 579    |
|                                | Linear speed $V_s$ on discharge [ $\text{mm}/\text{sec}$ ]              |     | 134    | —      | 204         |             | 186    | 219    | 235    | 232    | 216    | 183    |
|                                | Take-up speed $V_t$ [m/min]                                             |     | 20     | —      | 30          |             | 30     | 30     | 30     | 30     | 30     | 30     |
|                                | Outlet SR [1/sec]                                                       |     | 262    | —      | 392         |             | 315    | 522    | 636    | 626    | 515    | 295    |
|                                | Shear rate [1/sec]                                                      |     | 2888   | —      | 4350        |             | 3973   | 7864   | 11590  | 4356   | 3278   | 4452   |
|                                | Melt viscosity [ $\text{Pa}\cdot\text{sec}$ ]                           |     | 92     | —      | 53          | 28          | 54     | 44     | 39     | 53     | 57     | 52     |
|                                | Pressure at the tip of nozzle [kPa]                                     |     | 582    | —      | 319         |             | 455    | 693    | 848    | 595    | 505    | 463    |
|                                | Draft ratio                                                             |     | 2.5    | —      | 2.5         |             | 2.7    | 2.3    | 2.1    | 2.2    | 2.3    | 2.7    |
|                                | Cooling air direction to the discharging direction                      |     | 90°    | —      | 90°         |             | 90°    | 90°    | 90°    | 90°    | 90°    | 90°    |
|                                | $T_0$ [°C]                                                              |     | 245    | —      | 250         | 265         | 250    | 250    | 250    | 250    | 250    | 250    |
|                                | $T_5$ [°C]                                                              |     | 240    | —      | 260         | 260         | 245    | 245    | 245    | 245    | 245    | 245    |
|                                | $T_p$ [°C]                                                              |     | 228    | —      | 235         | 260         | 235    | 235    | 235    | 235    | 235    | 235    |
| Fiber diameter variation       | —                                                                       |     | None   | —      | None        |             | None   | None   | None   | None   | None   | None   |
| Defect                         | —                                                                       |     | None   | —      | None        |             | None   | None   | None   | None   | None   | None   |
| Coil                           | —                                                                       |     | None   | —      | None        |             | None   | None   | None   | None   | None   | None   |

**Fig.21**

21/25

[illegible]

Fig.22

|                                                                                      | Ex. 1 | Ex. 2 | Ex. 3 | Ex. 4 | Ex. 5 | Ex. 6 | Ex. 7 | Ex. 8 | Ex. 9 |
|--------------------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Outer diameter of projected part<br>(mm)                                             | 1.39  | 1.25  | 1.26  | 1.30  | 1.36  | 1.35  | 1.40  | 1.38  | 1.39  |
| Outer diameter of depressed part<br>(mm)                                             | 1.22  | 1.23  | 1.22  | 1.22  | 1.23  | 1.21  | 1.22  | 1.21  | 1.22  |
| Inner diameter<br>(mm)                                                               | 0.67  | 0.67  | 0.68  | 0.66  | 0.67  | 0.68  | 0.68  | 0.66  | 0.67  |
| Height of asperity<br>( $\mu$ m)                                                     | 86    | 12    | 21    | 42    | 67    | 71    | 88    | 86    | 87    |
| Width of asperity<br>( $\mu$ m)                                                      | 129   | 18    | 32    | 63    | 101   | 107   | 132   | 129   | 131   |
| Number of asperities<br>(number)                                                     | 16    | 16    | 16    | 16    | 16    | 16    | 16    | 16    | 16    |
| Asperity proportion<br>on the periphery<br>(%)                                       | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   |
| Proportion of depressed part<br>(%)                                                  | 50    | 50    | 50    | 50    | 50    | 50    | 50    | 50    | 50    |
| Distance of closest approach<br>(mm)                                                 | 1.38  | 1.24  | 1.25  | 1.30  | 1.35  | 1.35  | 1.38  | 1.39  | 1.38  |
| Distance of closest approach/<br>( $r1+r2$ )<br>(—)                                  | 1.05  | 1.00  | 1.01  | 1.03  | 1.04  | 1.05  | 1.06  | 1.07  | 1.06  |
| Ellipticity<br>(—)                                                                   | 1.03  | 1.05  | 1.01  | 1.03  | 1.02  | 1.08  | 1.06  | 1.09  | 1.15  |
| Deionized water permeability<br>(L/m <sup>2</sup> /hr)                               | 5000  | 5000  | 5000  | 5000  | 5000  | 5000  | 5000  | 5000  | 5000  |
| Pore ratio of projected part<br>on outer surface<br>(%)                              | 30.1  | 30.2  | 29.8  | 30.3  | 30.2  | 30.0  | 30.2  | 30.1  | 30.2  |
| Pore ratio of depressed part<br>on outer surface<br>(%)                              | 35.9  | 33.2  | 33.5  | 34.5  | 35.0  | 35.5  | 36.0  | 36.1  | 35.9  |
| Ratio of depressed part/<br>projected part pore ratio<br>on the outer surface<br>(—) | 1.19  | 1.10  | 1.12  | 1.14  | 1.16  | 1.18  | 1.19  | 1.20  | 1.19  |
| Strength at break<br>(MPa)                                                           | 7.2   | 7.2   | 7.4   | 7.2   | 7.3   | 7.2   | 7.4   | 7.3   | 7.3   |
| Elongation at break<br>(%)                                                           | 180   | 180   | 180   | 180   | 180   | 180   | 150   | 120   | 95    |
| Latex rejection<br>(%)                                                               | >99   | >99   | >99   | >99   | >99   | >99   | >99   | >99   | >99   |
| Compressive strength<br>(MPa)                                                        | 0.85  | 0.90  | 0.85  | 0.90  | 0.85  | 0.85  | 0.85  | 0.85  | 0.85  |
| Maximum pore size<br>( $\mu$ m)                                                      | 0.42  | 0.41  | 0.44  | 0.41  | 0.41  | 0.42  | 0.41  | 0.40  | 0.40  |
| Average pore size<br>( $\mu$ m)                                                      | 0.28  | 0.27  | 0.28  | 0.28  | 0.26  | 0.28  | 0.28  | 0.27  | 0.27  |
| Maximum pore size/<br>average pore size<br>(—)                                       | 1.50  | 1.52  | 1.57  | 1.46  | 1.58  | 1.50  | 1.46  | 1.48  | 1.48  |
| Water permeation amount<br>of actual liquid in (22)<br>(m/day)                       | 2.9   | 2.1   | 2.3   | 2.7   | 2.9   | 2.9   | 2.9   | 2.9   | 2.9   |

Fig.23

|                                                                                      | Ex. 10 | Ex. 11 | Ex. 12 | Ex. 13 | Ex. 14 | Ex. 15 | Ex. 16 | Ex. 17 | Ex. 18 |
|--------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Outer diameter of projected part<br>(mm)                                             | 1.40   | 1.39   | 1.39   | 1.39   | 1.39   | 1.39   | 1.39   | 1.39   | 1.40   |
| Outer diameter of depressed part<br>(mm)                                             | 1.23   | 1.22   | 1.22   | 1.22   | 1.22   | 1.22   | 1.22   | 1.22   | 1.24   |
| Inner diameter<br>(mm)                                                               | 0.66   | 0.67   | 0.67   | 0.67   | 0.67   | 0.67   | 0.68   | 0.69   | 0.66   |
| Height of asperity<br>( $\mu\text{m}$ )                                              | 84     | 86     | 86     | 86     | 86     | 87     | 83     | 86     | 91     |
| Width of asperity<br>( $\mu\text{m}$ )                                               | 126    | 129    | 129    | 129    | 129    | 131    | 125    | 129    | 137    |
| Number of asperities<br>(number)                                                     | 16     | 16     | 16     | 16     | 16     | 16     | 16     | 16     | 16     |
| Asperity proportion<br>on the periphery<br>(%)                                       | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    |
| Proportion of depressed part<br>(%)                                                  | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     |
| Distance of closest approach<br>(mm)                                                 | 1.38   | 1.39   | 1.39   | 1.40   | 1.39   | 1.40   | 1.38   | 1.38   | 1.40   |
| Distance of closest approach/<br>( $r_1+r_2$ )<br>(-)                                | 1.05   | 1.06   | 1.06   | 1.07   | 1.06   | 1.07   | 1.06   | 1.06   | 1.06   |
| Ellipticity<br>(-)                                                                   | 1.06   | 1.03   | 1.03   | 1.03   | 1.03   | 1.07   | 1.18   | 1.18   | 1.02   |
| Deionized water permeability<br>( $\text{L}/\text{m}^2/\text{hr}$ )                  | 4900   | 5000   | 5000   | 5000   | 5000   | 5000   | 8900   | 9200   | 2500   |
| Pore ratio of projected part<br>on outer surface<br>(%)                              | 30.2   | 30.0   | 29.9   | 30.1   | 30.3   | 30.4   | 30.5   | 30.3   | 25.0   |
| Pore ratio of depressed part<br>on outer surface<br>(%)                              | 33.1   | 34.5   | 35.7   | 35.8   | 36.1   | 32.7   | 32.5   | 31.9   | 29.5   |
| Ratio of depressed part/<br>projected part pore ratio<br>on the outer surface<br>(-) | 1.10   | 1.15   | 1.19   | 1.19   | 1.19   | 1.08   | 1.07   | 1.05   | 1.18   |
| Strength at break<br>(MPa)                                                           | 7.4    | 7.4    | 7.4    | 7.4    | 7.4    | 7.4    | 8.2    | 8.1    | 8.5    |
| Elongation at break<br>(%)                                                           | 180    | 180    | 180    | 180    | 180    | 130    | 110    | 100    | 200    |
| Latex rejection<br>(%)                                                               | >99    | >99    | >99    | >99    | >99    | >99    | 77     | 79     | >99    |
| Compressive strength<br>(MPa)                                                        | 0.90   | 0.90   | 0.90   | 0.90   | 0.90   | 0.90   | 0.75   | 0.75   | 0.80   |
| Maximum pore size<br>( $\mu\text{m}$ )                                               | 0.57   | 0.50   | 0.47   | 0.44   | 0.43   | 0.44   | 0.63   | 0.65   | 0.30   |
| Average pore size<br>( $\mu\text{m}$ )                                               | 0.28   | 0.28   | 0.28   | 0.28   | 0.28   | 0.27   | 0.35   | 0.36   | 0.18   |
| Maximum pore size/<br>average pore size<br>(-)                                       | 2.04   | 1.79   | 1.68   | 1.57   | 1.54   | 1.63   | 1.80   | 1.81   | 1.67   |
| Water permeation amount<br>of actual liquid in (22)<br>(m/day)                       | 2.4    | 2.6    | 2.9    | 2.9    | 2.9    | 2.8    | 2.6    | 2.4    | 2.4    |
| Water permeation amount<br>of actual liquid in (23)<br>(m/day)                       | -      | -      | -      | -      | -      | 0.70   | 0.68   | 0.62   | 0.59   |
| Fretting resistance<br>(%)                                                           | 85     | 90     | 95     | 95     | 95     | 95     | 95     | 95     | 95     |

Fig.24

|                                                                               | Ex. 19                    | Ex. 20 | Ex. 21      | Ex. 22      | Ex. 23 | Ex. 24 | Ex. 25 | Ex. 26 | Ex. 27 |
|-------------------------------------------------------------------------------|---------------------------|--------|-------------|-------------|--------|--------|--------|--------|--------|
|                                                                               |                           |        | Outer layer | Inner layer |        |        |        |        |        |
| Outer diameter of projected part                                              | (mm)                      | 1.34   | 1.33        | 1.40        | 1.48   | 1.27   | 1.27   | 1.31   | 1.52   |
| Outer diameter of depressed part                                              | (mm)                      | 1.18   | 1.15        | 1.22        | 1.22   | 1.22   | 1.22   | 1.22   | 1.22   |
| Inner diameter                                                                | (mm)                      | 0.68   | 0.66        | 0.67        | 0.67   | 0.67   | 0.67   | 0.67   | 0.67   |
| Height of asperity                                                            | ( $\mu\text{m}$ )         | 95     | 92          | 89          | 118    | 24     | 21     | 42     | 134    |
| Width of asperity                                                             | ( $\mu\text{m}$ )         | 143    | 138         | 126         | 177    | 68     | 36     | 128    | 128    |
| Number of asperities                                                          | (number)                  | 16     | 16          | 16          | 12     | 32     | 64     | 16     | 16     |
| Asperity proportion on the periphery                                          | (%)                       | 100    | 100         | 100         | 100    | 100    | 100    | 100    | 100    |
| Proportion of depressed part                                                  | (%)                       | 50     | 50          | 50          | 50     | 50     | 50     | 50     | 50     |
| Distance of closest approach                                                  | (mm)                      | 1.32   | 1.32        | 1.39        | 1.45   | 1.31   | 1.26   | 1.30   | 1.47   |
| Distance of closest approach/<br>( $r_1+r_2$ )                                | (-)                       | 1.05   | 1.06        | 1.06        | 1.07   | 1.03   | 1.02   | 1.03   | 1.07   |
| Ellipticity                                                                   | (-)                       | 1.01   | 1.01        | 1.02        | 1.01   | 1.01   | 1.01   | 1.01   | 1.01   |
| Deionized water permeability<br>( $\text{L}/\text{m}^2/\text{hr}$ )           |                           | 5800   | 7800        | 8000        | 5000   | 5000   | 5000   | 5000   | 5000   |
| Pore ratio of projected part<br>on outer surface                              | (%)                       | 30.4   | 40.4        | 30.6        | 30.2   | 30.2   | 30.2   | 30.2   | 30.2   |
| Pore ratio of depressed part<br>on outer surface                              | (%)                       | 36.1   | 46.5        | 36.3        | 35.5   | 33.2   | 32.9   | 34.1   | 36.2   |
| Ratio of depressed part/<br>projected part pore ratio<br>on the outer surface | (-)                       | 1.19   | 1.15        | 1.19        | 1.18   | 1.20   | 1.09   | 1.13   | 1.20   |
| Strength at break                                                             | (MPa)                     | 4.5    | 7.6         | 7.6         | 7.2    | 7.2    | 7.2    | 7.2    | 7.2    |
| Elongation at break                                                           | (%)                       | 500    | 100         | 180         | 180    | 180    | 180    | 180    | 180    |
| Latex rejection                                                               | (%)                       | >99    | >99         | >99         | >99    | >99    | >99    | >99    | >99    |
| Compressive strength                                                          | (MPa)                     | 0.60   | 0.65        | 0.90        | 0.90   | 0.90   | 0.90   | 0.90   | 0.90   |
| Maximum pore size                                                             | ( $\mu\text{m}$ )         | 0.44   | 0.56        | 0.44        | 0.42   | 0.42   | 0.42   | 0.42   | 0.42   |
| Average pore size                                                             | ( $\mu\text{m}$ )         | 0.30   | 0.35        | 0.27        | 0.28   | 0.28   | 0.28   | 0.28   | 0.28   |
| Maximum pore size/<br>average pore size                                       | (-)                       | 1.47   | 1.60        | 1.60        | 1.50   | 1.50   | 1.50   | 1.50   | 1.50   |
| Water permeation amount<br>of actual liquid in (22)                           | ( $\text{m}/\text{day}$ ) | 2.7    | 3.8         | 3.5         | 2.6    | 2.9    | 2.7    | 2.9    | 2.7    |
| Water permeation amount<br>of actual liquid in (23)                           | ( $\text{m}/\text{day}$ ) | 0.74   | 0.96        | 0.80        | 0.65   | 0.73   | 0.66   | 0.73   | 0.66   |
| Fretting resistance                                                           | (%)                       | 90     | 95          | 95          | 95     | 95     | 75     | 90     | 95     |

Fig.25

|                                                                               |                                     | Ex. 28 | Ex. 29 | Ex. 30 | Ex. 31 | Comp.<br>Ex. 1 | Comp.<br>Ex. 2 | Comp.<br>Ex. 3 | Comp.<br>Ex. 4 | Comp.<br>Ex. 5 |
|-------------------------------------------------------------------------------|-------------------------------------|--------|--------|--------|--------|----------------|----------------|----------------|----------------|----------------|
| Outer diameter of projected part                                              | (mm)                                | 1.62   | 1.41   | 1.41   | 1.60   | 1.31           | —              | —              | 1.30           | 1.64           |
| Outer diameter of depressed part                                              | (mm)                                | 1.22   | 1.22   | 1.22   | 1.40   | 1.23           | 1.16           | 1.22           | 1.25           | 1.58           |
| Inner diameter                                                                | (mm)                                | 0.67   | 0.67   | 0.67   | 0.90   | 0.67           | 0.69           | 0.88           | 0.70           | 0.70           |
| Height of asperity                                                            | ( $\mu\text{m}$ )                   | 178    | 86     | 86     | 91     | 28-52          | —              | —              | 0-45           | 0-50           |
| Width of asperity                                                             | ( $\mu\text{m}$ )                   | 128    | 129    | 129    | 137    | 50-78          | —              | —              | 0-88           | 0-100          |
| Number of asperities                                                          | (number)                            | 16     | 16     | 16     | 20     | 12             | —              | —              | 10             | 14             |
| Asperity proportion<br>on the periphery                                       | (%)                                 | 100    | 100    | 100    | 100    | 40             | —              | —              | 55             | 80             |
| Proportion of depressed part                                                  | (%)                                 | 50     | 50     | 50     | 50     | 10             | —              | —              | 10             | 10             |
| Distance of closest approach                                                  | (mm)                                | 1.57   | 1.37   | 1.36   | 1.57   | 1.25           | 1.16           | 1.22           | 1.20           | 1.48           |
| Distance of closest approach/<br>( $r_1 + r_2$ )                              | (—)                                 | 1.11   | 1.04   | 1.03   | 1.05   | 0.98           | 1.00           | 1.00           | 0.93           | 0.92           |
| Ellipticity                                                                   | (—)                                 | 1.01   | 1.03   | 1.03   | 1.06   | 1.27           | 1.31           | 1.06           | 1.18           | 1.18           |
| Deionized water permeability                                                  | ( $\text{l}/\text{m}^2/\text{hr}$ ) | 5000   | 3000   | 3500   | 5800   | 6200           | 1060           | 4500           | 3000           | 3000           |
| Pore ratio of projected part<br>on outer surface                              | (%)                                 | 30.2   | 19.2   | 24.2   | 30.2   | 15.3           | 7.4            | 30.1           | 30.3           | 30.3           |
| Pore ratio of depressed part<br>on outer surface                              | (%)                                 | 36.2   | 35.8   | 35.9   | 36.1   | 15.2           | 7.4            | 30.2           | 30.1           | 30.1           |
| Ratio of depressed part/<br>projected part pore ratio<br>on the outer surface | (—)                                 | 1.20   | 1.86   | 1.48   | 1.20   | 0.99           | 1.00           | 1.00           | 0.99           | 0.99           |
| Strength at break                                                             | (MPa)                               | 7.2    | 3.3    | 5.4    | 6.3    | 5.2            | 5.5            | 5.2            | 6.0            | 7.2            |
| Elongation at break                                                           | (%)                                 | 180    | 110    | 450    | 190    | 80             | 90             | 180            | 100            | 170            |
| Latex rejection                                                               | (%)                                 | >99    | >99    | >99    | >99    | >99            | >99            | >99            | >99            | >99            |
| Compressive strength                                                          | (MPa)                               | 0.90   | 0.40   | 0.55   | 0.52   | 0.60           | 0.60           | 0.85           | 0.75           | 0.75           |
| Maximum pore size                                                             | ( $\mu\text{m}$ )                   | 0.42   | 0.35   | 0.35   | 0.38   | 0.65           | 0.68           | 0.41           | <0.1           | <0.1           |
| Average pore size                                                             | ( $\mu\text{m}$ )                   | 0.28   | 0.20   | 0.22   | 0.25   | 0.24           | 0.32           | 0.27           | <0.1           | <0.1           |
| Maximum pore size/<br>average pore size                                       | (—)                                 | 1.50   | 1.75   | 1.59   | 1.52   | 2.71           | 2.13           | 1.52           | —              | —              |
| Water permeation amount<br>of actual liquid in (22)                           | ( $\text{m}/\text{day}$ )           | 2.9    | 2.2    | 2.4    | 3.1    | 1.6            | —              | 1.8            | 2.0            | 1.6            |
| Water permeation amount<br>of actual liquid in (23)                           | ( $\text{m}/\text{day}$ )           | 0.73   | 0.55   | 0.60   | 0.75   | 0.50           | —              | 0.40           | —              | —              |
| Fretting resistance                                                           | (%)                                 | 95     | 70     | 70     | 95     | 40             | —              | 40             | 30             | 40             |
| Retention of height of projected part                                         | (%)                                 | >99    | 80     | 80     | >99    | 95             | —              | —              | 90             | 80             |
| Drying resistance                                                             | (%)                                 | >95    | >95    | >95    | >95    | 45             | 40             | 40             | 45             | —              |