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(54) **OILING NOZZLE**

(57) Provided is an oiling nozzle including: a feed-in section; a feed-out section; and a middle section located between the feed-in section and the feed-out section and configured to be in contact with a fabric. In the oiling nozzle, the middle section includes: an oil discharge hole located at a position on the feed-in section side; and a plurality of groove-shaped oil reservoirs located at a po-

sition on the feed-out section side of the oil discharge hole and perpendicular to a path of the fabric. In addition, in a cross-section taken along a path of the fabric, a first oil reservoir that is closest one of all the plurality of oil reservoirs to the oil discharge hole has the largest cross-sectional area.

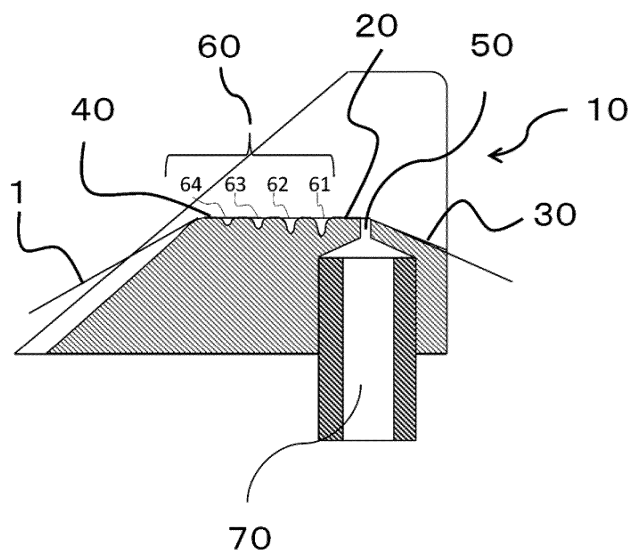


FIG. 2

Description

Technical Field

5 **[0001]** The disclosure relates to an oiling nozzle.

Background Art

10 **[0002]** For the purpose of guiding fabric in textile machines, fabric guides of various shapes are installed and used in the textile machines. Such fabric guides include what is known as: a roller guide, an oiling nozzle, a rod guide, and a traverse guide, etc. The above-mentioned oiling nozzle is expected to cause less damage, such as scratches and fraying, than otherwise to a fabric guided at a high speed by supplying the optimal amount of oil to the fabric and by attaching the oil more uniformly to the fabric. For example, Patent Literature 1 discloses an oil-supplying guide including: oil discharge hole formed in a fabric-contact surface; and an oil reservoir adjoining the oil discharge hole.

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Citation List

Patent Literature

20 **[0003]** Patent Literature 1: Japanese Unexamined Patent Application Publication No. H7 (1995)-252716

Summary of Invention

25 **[0004]** An oiling nozzle of the disclosure includes: a feed-in section; a feed-out section; and a middle section located between the feed-in section and the feed-out section. In addition, the middle section is configured to be in contact with a fabric. In addition, the middle section includes: an oil discharge hole located at a position on the feed-in section side; a plurality of groove-shaped oil reservoirs located at a position on the feed-out section side of the oil discharge hole. In addition, the plurality of groove-shaped oil reservoirs are perpendicular to a path of the fabric. In addition, in a cross-section taken along the path of the fabric, a first oil reservoir, which is the closest oil reservoir to the oil discharge hole among the plurality of oil reservoirs, has a cross-sectional area that is largest of all.

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Brief Description of Drawings

[0005]

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FIG. 1 is a perspective view schematically illustrating an exemplar oiling nozzle of the disclosure.

FIG. 2 is a cross-sectional view taken along a fabric path provided in the oiling nozzle illustrated in FIG. 1.

FIG. 3 is an enlarged view illustrating the oil reservoir and a vicinity thereof illustrated in the cross-sectional view of FIG. 2.

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Description of Embodiment

45 **[0006]** In recent years, to achieve an improved production efficiency, an extremely fast fabric-feeding speed ranging from 3000 to 10000 m/min has been adopted. Hence, for the purpose of suppressing the damage to the fabric, it is necessary to uniformly supply oil to the fabric. In addition, for the purpose of reducing burden on the environment, it is also necessary to reduce the amount of oil to be used.

[0007] The oiling nozzle of the disclosure is operable to supply oil uniformly to the fabric, and thus to suppress damage to the fabric and to reduce the amount of oil to be used. The oiling nozzle of the disclosure will be described in detail below with reference to the drawings.

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[0008] As illustrated in FIG. 1 and FIG. 2, an oiling nozzle 10 of the disclosure includes: a feed-in section 30, a feed-out section 40, and a middle section 20 located between the feed-in section 30 and the feed-out section 40, and configured to be in contact with a fabric 1. In addition, the middle section 20 includes: an oil discharge hole 50 located at a position on the feed-in section 30 side; and a plurality of groove-shaped oil reservoirs 60 located at a position on the feed-out section 40 side of the oil discharge hole 50. The plurality of groove-shaped oil reservoirs 60 are perpendicular to a path of the fabric 1.

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[0009] Note that the position on the feed-in section 30 side in the middle section 20 refers to a position, located in the middle section 20, that is closer to the feed-in section 30 than to the feed-out section 40. This means a position on the right-hand side in FIG. 2. On the other hand, the position on the feed-out section 40 side in the middle section 20 refers

to a position, located in the middle section 20, that is closer to the feed-out section 40 than to the feed-in section 30. This means a position on the left-hand side in FIG. 2.

[0010] Next, the guiding of the fabric 1 by the oiling nozzle 10 of the disclosure will be described below. The fabric 1 is fed from the right-hand side in FIG. 2, enters through the feed-in section 30, slides through the middle section 20, and advances towards the feed-out section 40. In the meanwhile, oil is discharged through the oil discharge hole 50 in communication with an oil supply path 70, and is supplied to the fabric 1. In addition, a part of the oil supplied to the fabric 1 moves along with the fabric 1 that advances towards the feed-out section 40. The part of the oil is gathered in the plurality of oil reservoirs 60. The oil gathered in the plurality of oil reservoirs 60 serves as a source of oil to be supplied to the fabric 1 that advances from the feed-in section 30 to the feed-out section 40. In addition, the oil reservoirs 60 serve as places to store the excess supplied oil.

[0011] Note that FIG. 2 illustrates an exemplar case where four oil reservoirs 60 are provided, but the number of oil reservoirs 60 have only to be more than one. Needless to say, two, three, five, or more oil reservoirs 60 may be provided.

[0012] In addition, when cross-sections of the plurality of oil reservoirs 60 in the oiling nozzle 10 of the disclosure are taken along the path of the fabric 1, the first oil reservoir 61--the closest one of the plurality of oil reservoirs to the oil discharge hole 50--has the largest cross-sectional area S_1 of all the corresponding cross-sectional areas. With this configuration, the oiling nozzle 10 of the disclosure can quickly optimize the amount of oil needed for the fabric 1.

[0013] Specifically, with the above-described configuration, if too much oil is discharged through the oil discharge hole 50, the excess oil will be stored in the first oil reservoir 61. In contrast, if too little oil is discharged through the discharge hole 50, the oil stored in the first oil reservoir 61 will be supplied. Hence, according to the oiling nozzle 10 of the disclosure, the amount of oil needed for the fabric 1 is substantially optimized at the point where the fabric 1 has just passed by the first oil reservoir 61. Thus, the damage to the fabric 1 can be suppressed. In addition, as the amount of oil that flows out through the feed-out section 20 is reduced, the amount of oil to be used can be reduced.

[0014] The cross-sectional area mentioned above of each of the plurality of oil reservoirs 60 may be measured by defining as the measurement-target surface, the cross section taken along the path of the fabric 1. Then, a photo may be taken by use of an optical microscope with a magnification rate of 10 to 100, and then the cross-sectional area may be calculated by use of an image analysis software program. An exemplar image analysis software program that may be used for the above-described purpose is "Eizou-kun" (registered trademark), an image analysis software program manufactured by Asahi Kasei Engineering Corporation.

[0015] The cross-sectional areas of the plurality of oil reservoirs 60 in the oiling nozzle 10 of the disclosure may have a relationship of $S_1 \geq S_2 \geq \dots \geq S_n$ (provided that $S_1 \neq S_n$), where $S_1, S_2, \dots, S_n$ denote the cross-sectional areas of the plurality of reservoirs 60 in an order from the one closest to the oil discharge hole 50 to the one remotest from the oil discharge hole 50. Note that in the example illustrated in FIG. 2, the plurality of oil reservoirs 60 are a first oil reservoir 61, a second oil reservoir 62, a third oil reservoir 63, and a fourth oil reservoir 64. The first oil reservoir 61 has a cross-sectional area S_1 , the second oil reservoir 62 has a cross-sectional area S_2 , the third oil reservoir 63 has a cross-sectional area S_3 , and the fourth oil reservoir 64 has a cross-sectional area S_4 . In this example, as the number of the oil reservoirs 60 is 4, the number $n = 4$.

[0016] If the cross-sectional areas of the oil reservoirs 60 have a relationship of $S_1 \geq S_2 \geq S_3 \geq S_4$ (provided that $S_1 \neq S_4$), or if the structure has the cross-sectional areas gradually decreasing from the oil discharge hole 50 side towards the feed-out section 40 side, the optimization of the amount of oil needed for the fabric 1 can be achieved more rapidly. Consequently, damage to the fabric 1 can be suppressed and the amount of oil to be used can be reduced.

[0017] Note that some of the exemplar cases where the cross-sectional areas have the relationship of $S_1 \geq S_2 \geq S_3 \geq S_4$ (provided that $S_1 \neq S_4$) are: $S_1 = S_2 = S_3 > S_4$, $S_1 > S_2 = S_3 = S_4$, $S_1 = S_2 > S_3 = S_4$, $S_1 > S_2 > S_3 > S_4$, etc.

[0018] The cross-sectional area S_1 of the first oil reservoir 61 may be from 1.2 times to 2.0 times as large as the cross-sectional area S_4 of the fourth oil reservoir 64. With this configuration, damage to the fabric 1 can be further suppressed.

[0019] In addition, as illustrated in FIG. 3, the first oil reservoir 61 may have a greater radius of curvature A_1 of the corner on the feed-in section 30 side than the radius of curvature B_1 of the corner on the feed-out section 40 side ($A_1 > B_1$).

[0020] With this configuration, the oil discharged through the oil discharge hole 50 is let into the oil reservoir 61 more easily. Hence, while it is easy to supply oil to the fabric 1, it is more difficult for the oil having entered the oil reservoir 61 to exit from the oil reservoir 61. Hence, as the oil can be supplied favorably, damage to the fabric 1 can be further suppressed.

[0021] If in any of the other of the plurality of oil reservoirs 60, the radius of curvature of the corner on the feed-in section 30 side is greater than the radius of curvature of the corner on the feed-out section 40 side, damage to the fabric 1 is further suppressed.

[0022] In addition, the radius of curvature A_1 of the corner on the feed-in section side of the first oil reservoir 61 may be the greatest of all the radii of curvature of the corners on the feed-in section 30 side of the plurality of oil reservoirs 60. With this configuration, the oil discharged from the oil discharge hole 50 is more easily let into the first oil reservoir 61, the closest one to the oil discharge hole 50. Hence, as a sufficient amount of oil can be supplied, damage to the fabric 1 can be further suppressed.

[0023] The radii of curvature of corners on the feed-in section 30 side in the plurality of oil reservoirs 60 may have a relationship of $A1 \geq A2 \geq \dots \geq An$ (provided that $A1 \neq An$), where $A1, A2, \dots, An$ denote the radii of curvature of a corner on the feed-in section side in the plurality of oil reservoir 60 in an order from the closest one to the oil discharge hole 50 to the one remotest from the oil discharge hole 50. With this configuration, entry of too much oil into the remotest oil reservoir from the oil discharge hole 50 is suppressed, and the amount of oil that flows out can be reduced. Hence, as the amount of oil to be used can be reduced, and the oil can be supplied favorably, damage to the fabric 1 can be further suppressed.

[0024] In addition, the radius of curvature $B1$ of the corner on the feed-out section 40 side of the first oil reservoir 61 may be the greatest of all the radii of curvature of corners on the feed-out section 40 side of the plurality of oil reservoirs 60. With this configuration, when the oil discharged through the oil discharge hole 50 is supplied, the oil can be smoothly transferred from the first oil reservoir 61 to the next second oil reservoir 62. Hence, as a sufficient amount of oil can be supplied, damage to the fabric 1 can be further suppressed.

[0025] The radii of curvature of corners on the feed-out section 40 side in the plurality of oil reservoirs 60 may have a relationship of $B1 \geq B2 \geq \dots \geq Bn$ (provided that $B1 \neq Bn$), where $B1, B2, \dots, Bn$ denote the radii of curvature of corners on the feed-out section 40 side in the plurality of oil reservoirs 60 in an order from the closest one to the oil discharge hole 50 to the one remotest from the oil discharge hole 50. With this configuration, leakage of oil out of the remotest oil reservoir from the oil discharge hole 50 is suppressed, and the amount of oil that flows out can be reduced. Hence, as the amount of oil to be used can be reduced, and the oil can be supplied favorably, damage to the fabric 1 can be further suppressed.

[0026] The radius of curvature of the corner on the feed-in section 30 side of each of the plurality of oil reservoirs 60 and the radius of curvature of the corner on the feed-out section 40 side thereof may be measured in a similar manner to the measurement of the cross-sectional area of each of the oil reservoirs 60. Specifically, the cross-section taken along the path of the fabric 1 is defined as the measurement-target surface. Then, a photo of the cross-section may be taken by use of an optical microscope with a magnification rate of 10 to 100, and then the cross-sectional area may be calculated from this photo.

[0027] In addition, the material used for the oiling nozzle 10 of the disclosure is not limited to a specific material. In a case where the oiling nozzle 10 of the disclosure is made from a ceramic, the oiling nozzle 10 generates less frictional heat than an oiling nozzle made from a metal or a resin. Some examples of the ceramics are: alumina ceramics, zirconia ceramics, titania ceramics, silicon carbide ceramics, silicon nitride ceramics, and composite materials of some/all of these mentioned above.

[0028] In particular, amongst the ceramics, alumina ceramics are inexpensive materials. Hence, by making the oiling nozzle 10 of the disclosure from an alumina ceramic, the cost of the oiling nozzle 10 can be reduced. The alumina ceramic refers to a ceramic containing the alumina content of at least 80% by mass of 100% by mass of all the components in the ceramic.

[0029] The material of the oiling nozzle 10 can be identified in the following way. Firstly, the oiling nozzle 10 is measured by use of an X-ray diffractometer (XRD), and from the value of the diffraction angle 2θ , the identification is performed by use of JCPDS cards. Then, by use of an X-ray fluorescence spectrometer (XRF), a quantitative analysis of the components is performed. If, for example, the above-described identification confirms the presence of alumina, and the measurement by the XRF indicates an AL content that can be converted into an alumina (Al_2O_3) content of at least 80% by mass, the oiling nozzle 10 is determined as one that is made from an alumina ceramic.

[0030] Next, an exemplar method of manufacturing the oiling nozzle of the disclosure will be described below. Note that the following description is based on an exemplar case where the oiling nozzle is made of a ceramic.

[0031] Firstly, a mixture of raw material is prepared by mixing the powder of the main raw material (alumina, zirconia, titania, silicon carbide, silicon nitride, or a compound thereof) and a sintering additive at a predetermined ratio. Then, the mixture of raw material and a solvent are put in a ball mill together with balls to grind the mixture of raw material until a predetermined particle size is reached. Thus, a slurry is obtained.

[0032] Then, a binder is added to the slurry thus obtained, and after that the resultant mixture is subjected to a spray drying process by use of a spray dryer. A granular material is thus obtained. Then, the granular material is cast into a mechanical press machine and a certain pressure is applied to obtain a compact powder with a shape of the oiling nozzle.

[0033] The compact powder thus obtained is subjected further to a machining process, etc. Thus a compact powder with a shape of the oiling nozzle including oil reservoirs having different cross-sectional areas from each other is obtained.

[0034] Alternatively, a compact powder may be obtained by: adding a binder after the spray drying of the above-mentioned slurry by use of a spray dryer; then kneading the resultant mixture in a kneader to obtain a pellet; and then performing an injection molding process by use of the resultant pellet. In this case, a suitable mold may be used to give the resultant compact powder the oiling-nozzle shape with oil reservoirs having cross-sectional areas that are different from each other. In addition, the radius of curvature of the corner on the feed-in section side of each oil reservoir and the radius of curvature of the corner on the feed-out section side thereof may be set as desired by performing a machining process, by use of molds of different shapes, or other like method.

[0035] Then, the obtained compact powder with the oiling nozzle shape is fired to obtain the oiling nozzle of the disclosure. If, for example, the oiling nozzle is mainly made from alumina powder, the firing is performed in air atmosphere by keeping the highest temperature ranging from 1450°C to 1750°C for a period ranging from 1 hour to 8 hours.

Example 1

[0036] Firstly, alumina powder of 99.0% by mass as the main raw material, calcia powder of 0.5% by mass as a sintering additive, and silica powder of 0.5% by mass as another sintering additive were weighed and mixed together to obtain a mixture of raw material. Then, the mixture of raw material and a solvent were put in a ball mill together with balls to grind the mixture of raw material until a predetermined particle size was reached. Thus, a slurry was obtained.

[0037] Then, a pellet was obtained by spray drying the slurry by use of a spray dryer, then adding a binder, and after that, kneading the resultant mixture. Then, a compact powder with the shape of the oiling nozzle was obtained by performing an injection molding process by use of the pellet obtained in the above-described way and by use of a mold that can give the resultant compact powder the oiling-nozzle shape with oil reservoirs having cross-sectional areas that are different from each other.

[0038] Then, a sintered compact powder with the oiling nozzle shape was obtained by firing the compact powder with the oiling nozzle shape obtained above in an air atmosphere by keeping the highest temperature of 1680°C for 1 hour. Then, a finishing process was performed by use of a barrel finishing machine to obtain the samples.

[0039] Note that four oil reservoirs were provided and that the oil reservoirs in individual samples had the cross-sectional areas listed in Table 1. The four oil reservoirs are referred to as the first oil reservoir, the second oil reservoir, the third oil reservoir, and the fourth oil reservoir in the order of proximity to the oil discharge hole. In addition, the cross-sectional area of the first oil reservoir is denoted by S1, the cross-sectional area of the second oil reservoir is denoted by S2, the cross-sectional area of the third oil reservoir is denoted by S3, the cross-sectional area of the fourth oil reservoir is denoted by S4. In addition, in the cross-section taken along the fabric path, the corner on the feed-in section side of each oil reservoir had a radius of curvature of 0.34 mm and the corner on the feed-out section side thereof also had a radius of curvature of 0.34 mm.

[0040] Then, a fabric was guided by each sample, and then the length of time until damage was observed in the fabric was measured. The fabric used in this measurement was a 75-denier and 36-filament polyester fabric having a rectangular cross-section and containing 1.2% by mass of titanium oxide with an average crystalline particle diameter of 1.2 μm . An aqueous emulsion oil was used as the oil and was supplied to the fabric in an amount of 2 to 4% by mass of the mass of the fabric. Note that the fabric was fed at a speed of 5000 m/min. Results are shown in Table 1.

[Table 1]

Sample No.	S1 (mm ²)	S2 (mm ²)	S3 (mm ²)	S4 (mm ²)	S1/S4	Time (hr)
1	0.30	0.34	0.38	0.42	0.7	350
2	0.42	0.42	0.42	0.42	1.0	370
3	0.42	0.42	0.42	0.38	1.1	400
4	0.42	0.40	0.39	0.38	1.1	460
5	0.42	0.40	0.39	0.35	1.2	490
6	0.42	0.40	0.38	0.28	1.5	510
7	0.42	0.36	0.30	0.25	1.7	500
8	0.42	0.36	0.30	0.23	1.8	490
9	0.42	0.36	0.29	0.21	2.0	480
10	0.42	0.36	0.29	0.19	2.2	440

[0041] The results shown in Table 1 indicate that the length of time until damage was observed in the fabric was a relatively short time of 350 hours for Sample 1 in which the largest cross-sectional area was S4. In addition, the length of time until damage was observed in the fabric was a relatively short time of 370 hours for Sample No. 2 in which the cross-sectional areas had a relationship of $S1 = S2 = S3 = S4$. In contrast, the length of time until damage was observed in the fabric was a relatively long time of at least 400 hours for each of the Samples Nos. 3 to 10 in which the largest cross-sectional area was S1. This reveals that the damage to the fabric 1 is suppressed if in the oiling nozzle, the cross-sectional area S1 of the first oil reservoir--the closest oil reservoir to the oil discharge hole--is the largest one of all the

cross-sectional areas of the plurality of oil reservoirs.

[0042] In addition, a comparison of Samples Nos. 3 and 4 shows that Sample No. 4 having cross-sectional areas gradually decreasing from S1 to S4 had a longer time until damage was observed in the fabric. This reveals that if in the oiling nozzle, the cross-sectional areas had a relationship of $S1 > S2 > S3 > S4$, damage to the fabric 1 are further suppressed.

[0043] In addition, of all Samples Nos. 3 to 10, Samples Nos. 5 to 9 had longer times of at least 480 hours until damage was observed in the fabric. This reveals that if in the oiling nozzle, the cross-sectional area S1 is 1.2 to 2.0 times as large as the cross-sectional area S4, damage to the fabric 1 are further suppressed.

Example 2

[0044] Next, samples were fabricated so that the radius of curvature of the corner on the feed-in section side in the first oil reservoir differed from the radius of curvature of the corner on the feed-out section side therein. Note that the method of fabricating each sample was the same as the method of fabricating Sample No. 6 in Example 1 except that the radii of curvature of the corners on the feed-out section side in the first oil reservoir of the samples were as listed in Table 2. It should be noted that Sample No. 11 is identical to Sample No. 6 in Example 1. In the first oil reservoir, the radius of curvature of the corner on the feed-in section side is denoted by A1, and the radius of curvature of the corner on the feed-out section side is denoted by B1.

[0045] Then, a fabric was guided by each sample, and then the length of time until damage was observed in the fabric was measured in the same way as in Example 1. Results are shown in Table 2.

[Table 2]

Sample No.	A1 (mm)	B1 (mm)	Time (hr)
11	0.34	0.34	510
12	0.34	0.21	540

[0046] The results shown in Table 2 indicate that Sample No. 12 had a longer time of 540 hours until damage was observed in the fabric than in the case of Sample No. 11. This reveals that if in the oiling nozzle, the radius of curvature A1 of the corner on the feed-in section side in the first oil reservoir is larger than the radius of curvature B1 of the corner on the feed-out section side therein, damage to the fabric 1 is further suppressed.

Example 3

[0047] Next, samples were fabricated so that the radius of curvature of the corner on the feed-in section side in each of a plurality of oil reservoirs differed from the radius of curvature of the corner on the feed-out section side therein. Note that the method of fabricating each sample was the same as the method of fabricating Sample No. 12 in Example 2 except that the radii of curvature of the corners on the feed-out section side in the plurality oil reservoirs of the samples were as listed in Table 3. It should be noted that Sample No. 13 is identical to Sample No. 12 in Example 2. In the second oil reservoir, the radius of curvature of the corner on the feed-in section side is denoted by A2, and the radius of curvature of the corner on the feed-out section side is denoted by B2. In addition, in the third oil reservoir, the radius of curvature of the corner on the feed-in section side is denoted by A3, and the radius of curvature of the corner on the feed-out section side is denoted by B3. In addition, in the fourth oil reservoir, the radius of curvature of the corner on the feed-in section side is denoted by A4, and the radius of curvature of the corner on the feed-out section side is denoted by B4.

[0048] Then, a fabric was guided by each sample, and then the length of time until damage was observed in the fabric was measured in the same way as in Example 1. Results are shown in Table 3.

[Table 3]

Sample No.	A1 (mm)	B1 (mm)	A2 (mm)	B2 (mm)	A3 (mm)	B3 (mm)	A4 (mm)	B4 (mm)	Time (hr)
13	0.34	0.21	0.34	0.34	0.34	0.34	0.34	0.34	540
14	0.34	0.21	0.34	0.21	0.34	0.21	0.34	0.21	560

[0049] The results shown in Table 3 indicate that Sample No. 14 had a longer time of 560 hours until damage was observed in the fabric than in the case of Sample No. 13. This reveals that if in the oiling nozzle, the radii of curvature of the corners on the feed-in section side in the plurality of oil reservoirs are larger than the radii of curvature of the

corners on the feed-out section side therein, damage to the fabric 1 is further suppressed.

Example 4

[0050] Next, samples were fabricated so that the radii of curvature of the corners on the feed-in section side in a plurality of oil reservoirs differed from each other. Note that the method of fabricating each sample was the same as the method of fabricating Sample No. 14 in Example 3 except that the radii of curvature of the corners on the feed-in section side in the plurality oil reservoirs of the samples were as listed in Table 4. It should be noted that Sample No. 15 is identical to Sample No. 14 in Example 3.

[0051] Then, a fabric was guided by each sample, and then the length of time until damage was observed in the fabric was measured in the same way as in Example 1. Results are shown in Table 4.

[Table 4]

Sample No.	A1 (mm)	A2 (mm)	A3 (mm)	A4 (mm)	Time (hr)
15	0.34	0.34	0.34	0.34	560
16	0.34	0.30	0.32	0.27	580
17	0.34	0.32	0.30	0.27	600

[0052] The results shown in Table 4 indicate that Samples Nos. 16 and 17 had longer times of at least 580 hours until damage was observed in the fabric than in the case of Sample No. 15. This reveals that if in the oiling nozzle, of all the radii of curvature of the corners on the feed-in section side in the plurality of oil reservoirs, the radius of curvature A1 of the corner on the feed-out section side in the first oil reservoir is the largest, damage to the fabric 1 is further suppressed.

[0053] In addition, Sample No. 17 had a longer time of 600 hours until damage was observed in the fabric than in the case of Sample No. 16. This reveals that if in the oiling nozzle, the radii of curvature of the corners on the feed-in section side in the oil reservoirs had a relationship of $A1 > A2 > A3 > A4$, damage to the fabric 1 is further suppressed.

Example 5

[0054] Next, samples were fabricated so that the radii of curvature of the corners on the feed-out section side in a plurality of oil reservoirs differed from each other. Note that the method of fabricating each sample was the same as the method of fabricating Sample No. 17 in Example 4 except that the radii of curvature of the corners on the feed-out section side in the plurality oil reservoirs of the samples were as listed in Table 5. It should be noted that Sample No. 18 is identical to Sample No. 17 in Example 4.

[0055] Then, a fabric was guided by each sample, and then the length of time until damage was observed in the fabric was measured in the same way as in Example 1. Results are shown in Table 5.

[Table 5]

Sample No.	B1 (mm)	B2 (mm)	B3 (mm)	B4 (mm)	Time (hr)
18	0.21	0.21	0.21	0.21	600
19	0.21	0.19	0.20	0.18	620
20	0.21	0.20	0.19	0.18	640

[0056] The results shown in Table 5 indicate that Samples Nos. 19 and 20 had longer times of at least 620 hours until damage was observed in the fabric than in the case of Sample No. 18. This reveals that if in the oiling nozzle, of all the radii of curvature of the corners on the feed-out section side in the plurality of oil reservoirs, the radius of curvature B1 of the corner on the feed-out section side in the first oil reservoir is the largest, damage to the fabric 1 is further suppressed.

[0057] In addition, Sample No. 20 had a longer time of 640 hours until damage was observed in the fabric than in the case of Sample No. 19. This reveals that if in the oiling nozzle, the radii of curvature of the corners on the feed-out section side in the oil reservoirs had a relationship of $B1 > B2 > B3 > B4$, damage to the fabric 1 is further suppressed.

Reference Signs List

[0058]

- 1: Fabric
- 10: Oiling nozzle
- 20: Inter-mediate section
- 30: Feed-in section
- 5 40: Feed-out section
- 50: Oil discharge hole
- 60: Oil reservoir
- 61: First oil reservoir
- 62: Second oil reservoir
- 10 63: Third oil reservoir
- 64: Fourth oil reservoir
- 70: Oil supply path

Claims

1. An oiling nozzle comprising:

a feed-in section;
a feed-out section; and
a middle section located between the feed-in section and the feed-out section and configured to be in contact with a fabric,
wherein the middle section includes:

an oil discharge hole located at a position on the feed-in section side; and
a plurality of groove-shaped oil reservoirs located at a position on the feed-out section side of the oil discharge hole and perpendicular to a path of the fabric, and
in a cross-section taken through a path of the fabric, a first oil reservoir that is closest one of all the plurality of oil reservoirs to the oil discharge hole has the largest cross-sectional area.

2. The oiling nozzle according to claim 1,
wherein cross-sectional areas in the plurality of oil reservoirs have a relationship of $S_1 \geq S_2 \geq \dots \geq S_n$ (provided that $S_1 \neq S_n$),
where $S_1, S_2, \dots, S_n$ denote the cross-sectional areas of the plurality of reservoirs in an order from the one closest to the oil discharge hole to the one remotest from the oil discharge hole.

3. The oiling nozzle according to claim 2,
wherein the cross-sectional area S_1 is from 1.2 to 2.0 times as large as the cross-sectional areas S_n .

4. The oiling nozzle according to any one of claims 1 to 3,
wherein the first oil reservoir has a larger radius of curvature of a corner on the feed-in section side than a radius of curvature of a corner on the feed-out section side.

5. The oiling nozzle according to any one of claims 1 to 3,
each of the plurality of oil reservoirs has a larger radius of curvature of a corner on the feed-in section side than a radius of curvature of a corner on the feed-out section side.

6. The oiling nozzle according to any one of claims 1 to 5,
wherein of all the radii of curvature of corners on the feed-in section side of the plurality of oil reservoir, the first oil reservoir has the largest radius of curvature of a corner on the feed-in section side.

7. The oiling nozzle according to any one of claims 1 to 5,
wherein radii of curvature of corners on the feed-in section side in the plurality of oil reservoirs have a relationship of $A_1 \geq A_2 \geq \dots \geq A_n$ (provided that $A_1 \neq A_n$),
where $A_1, A_2, \dots, A_n$ denote the radii of curvature of corners on the feed-in section side in the plurality of oil reservoirs in an order from the closest one to the oil discharge hole to the one remotest from the oil discharge hole.

8. The oiling nozzle according to any one of claims 1 to 7,

wherein of all the radii of curvature of corners on the feed-out section side of the plurality of oil reservoirs, the first oil reservoir has the largest radius of curvature of a corner on the feed-out section side.

9. The oiling nozzle according to any one of claims 1 to 7,
wherein radii of curvature of corners on the feed-out section side in the plurality of oil reservoirs have a relationship of $B_1 \geq B_2 \geq \dots \geq B_n$ (provided that $B_1 \neq B_n$),
where $B_1, B_2, \dots, B_n$ denote the radii of curvature of corners on the feed-out section side in the plurality of oil reservoirs in an order from the closest one to the oil discharge hole to the one remotest from the oil discharge hole.

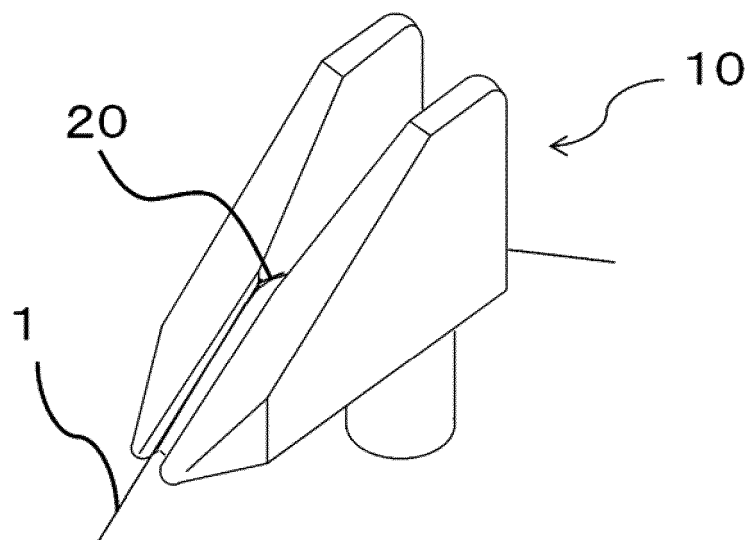


FIG. 1

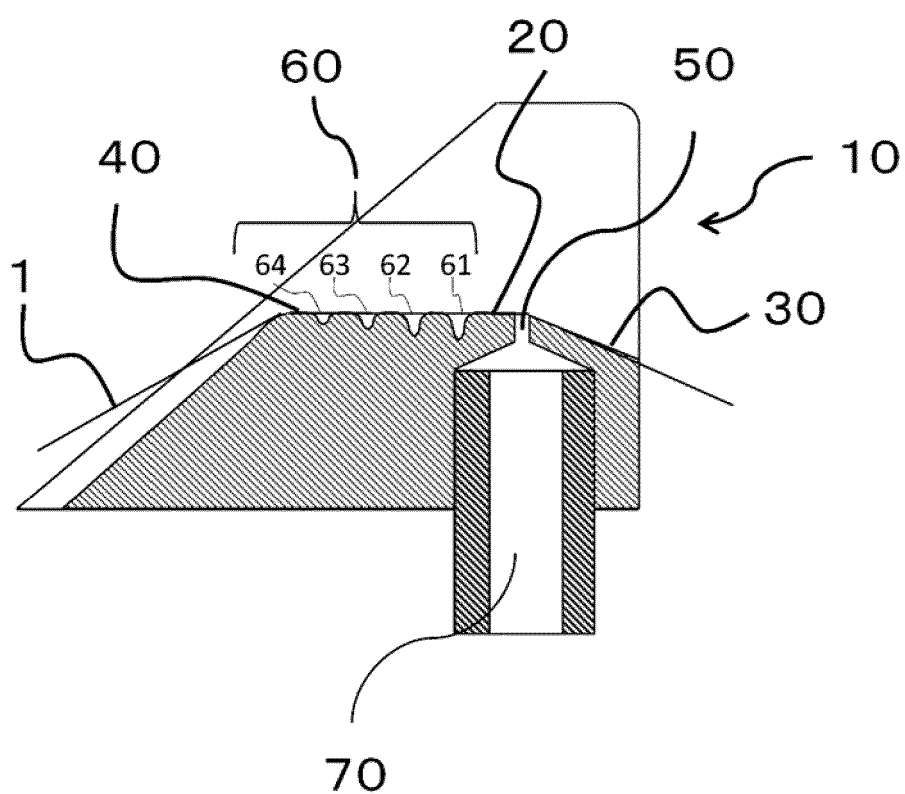


FIG. 2

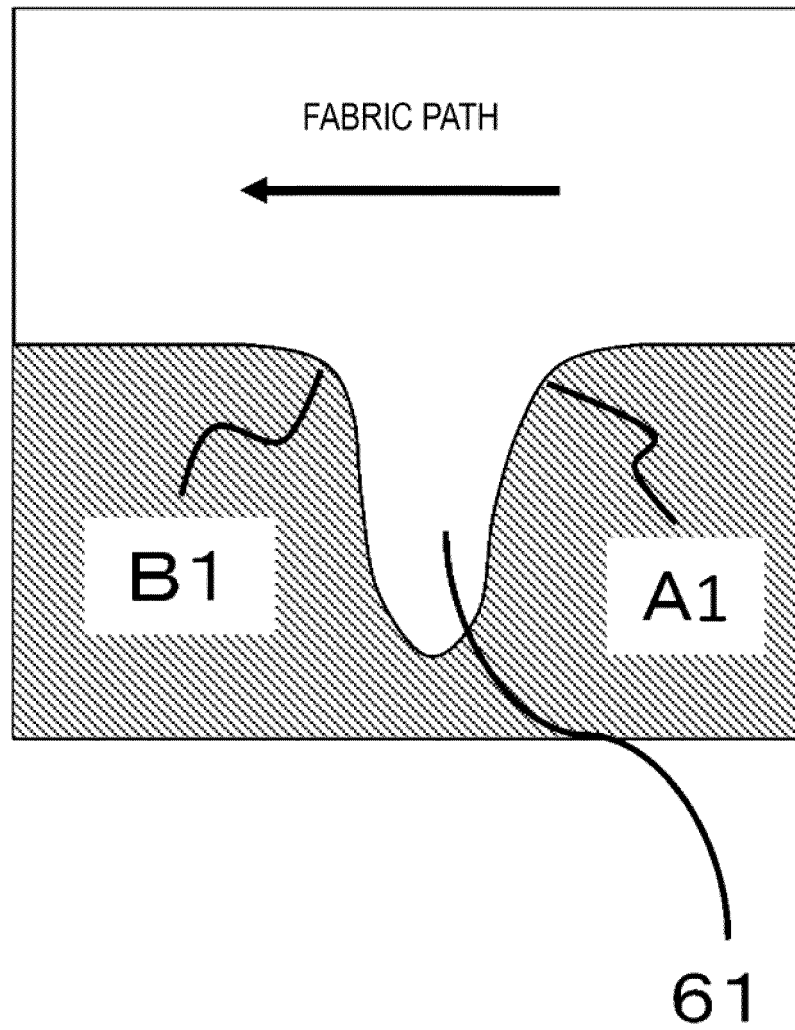


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/023584

A. CLASSIFICATION OF SUBJECT MATTER

D01D5/096(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)

D01D5/096

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2017
 Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2008-303497 A (Yugen Kaisha JTC), 18 December 2008 (18.12.2008), claim 1; fig. 6 (Family: none)	1-3 4-9
A	JP 10-102315 A (Kyocera Corp.), 21 April 1998 (21.04.1998), fig. 1, 2; paragraph [0025] (Family: none)	1-9
A	JP 7-252716 A (Yuasa Yarn Guide Engineering Co., Ltd.), 03 October 1995 (03.10.1995), fig. 6 (Family: none)	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

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"T"

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"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search

24 July 2017 (24.07.17)

Date of mailing of the international search report

01 August 2017 (01.08.17)

Name and mailing address of the ISA/

Japan Patent Office

3-4-3, Kasumigaseki, Chiyoda-ku,

Tokyo 100-8915, Japan

Authorized officer

Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H71995252716 B [0003]