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(71) Applicant: **KABUSHIKI KAISHA TOYOTA JIDOSHOKKI**
Kariya-shi,
Aichi-ken (JP)

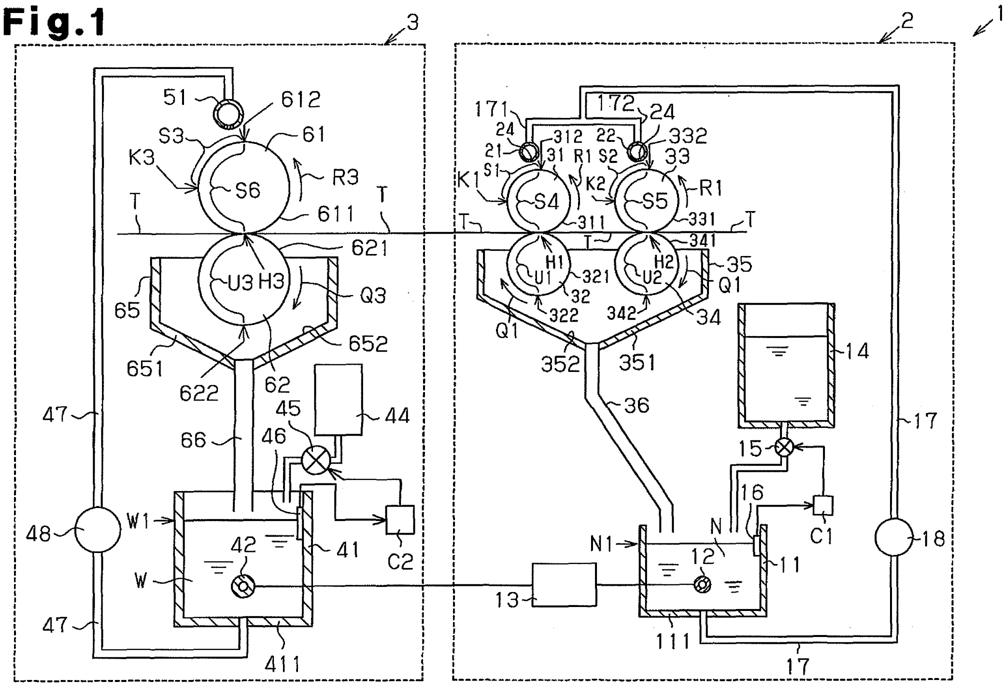
(72) Inventor: **Umemura, Yoshifumi**
Kabushiki Kaisha Toyota Jidoshokki
Aichi 448-8671 (JP)

(74) Representative: **TBK-Patent**
Bavariaring 4-6
80336 München (DE)

(54) Moistening apparatus in sizing machine

(57) A moistening apparatus (3) in a sizing machine (1) for squeezing water from warp threads (T) wet with water prior to application of sizing solution to the warp threads (T) has a pair of squeeze rollers (61,62). The squeeze rollers (61,62) hold the warp threads (T) from above and below. The squeeze rollers (61,62) have a water supplying device (51) that supplies water either to a circumferential surface of the roller (61) that is located above the warp threads (T) passing through between the rollers (61,62) or to an upper side of the warp threads (T) located upstream of the rollers (61,62). The water supplying device (51) has water discharge holes (54), each of which is formed like a slit having longer sides extending along the longitudinal direction of the water supplying device (51).

Fig.1



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a moistening apparatus in a sizing machine, which moistening apparatus passes warp threads that are wet with water through a pair of squeeze rollers, thereby squeezing water from the warp threads by means of squeezing effect of the squeeze rollers.

[0002] Moistening warp threads with water prior to application of sizing solution to the warp threads improves the efficiency of the size application and reduces the required amount of the sizing solution. Typically, after warp threads are immersed in water of 80°C to 90°C in a water tank, the moistened warp threads are dehydrated until the moisture content of the warp threads becomes a predetermined value. Thereafter, sizing solution is applied to the warp threads.

[0003] A device for moistening warp threads is disclosed in Japanese Laid-Open Patent Publication No. 2002-309477. The device of the publication includes an immersion roller immersed in water in a water tank and a squeeze roller that is located above the surface of the water in the water tank. The squeeze roller is pressed against the circumference of the immersion roller. Warp threads are wound about the immersion roller, and held between the circumference of the immersion roller and the squeeze roller. The warp threads are immersed in the water in the water tank and thus moistened.

[0004] However, after being immersed in the water in the water tank, the warp threads cannot be sufficiently hydrated even if the warp threads are squeezed by the squeeze roller. As a result, the moisture content (the amount of water/weight of warp) tends to be inappropriate. Accordingly, Japanese Laid-Open Patent Publication No. 2002-235272 discloses a device in which warp threads are sprayed with water ejected from nozzles instead of being immersed in water in a water tank.

[0005] However, since the device disclosed in Japanese Laid-Open Patent Publication No. 2002-235272 sprays misted water or water droplets onto warp threads at an increased rate, it is difficult to evenly supply water to all the warp threads. This results in an uneven water content of the warp threads. Therefore, it is difficult to moisten the warp threads at an appropriate water content.

SUMMARY OF THE INVENTION

[0006] Accordingly, it is an objective of the present invention to provide a moistening apparatus of a sizing machine that readily moistens warp threads so that the threads have a proper water content.

[0007] To achieve the foregoing and other objectives, and in accordance with one aspect of the present invention, a moistening apparatus in a sizing machine is provided. The moistening apparatus has a pair of squeeze rollers, which hold warp threads wet with water from above and below prior to application of sizing solution to the warp threads, thereby squeezing water from the warp threads. The apparatus includes water supplying means that supplies water either to a circumferential surface of the roller that is located above the warp threads passing through between the pair of the rollers or to an upper side of the warp threads located upstream of the pair of the rollers. The water supplying means has a water discharge hole. The discharge hole is formed as a slit that extends along an axial direction of the water supplying means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is a diagrammatic view showing a sizing machine according to one embodiment of the present invention;
Fig. 2A is a longitudinal cross-sectional view illustrating a water supplying device;
Fig. 2B is a cross-sectional side view showing the water supplying device; and
Fig. 3 is a plan view showing the water supplying device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] One embodiment of the present invention will now be described with reference to Figs. 1 to 3.

[0010] As shown in Fig. 1, a sizing machine 1 includes a sizing apparatus 2 for applying sizing solution to warp threads T and a moistening apparatus 3 for moistening the warp threads T prior to the size application.

[0011] The sizing apparatus 2 has a size tank 11 for temporarily storing sizing solution N. A size heating pipe 12 is provided in the size tank 11. Steam of a predetermined temperature is supplied to the interior of the sizing solution heating pipe 12 from a steam supply source 13. Steam supplied to the interior of the sizing solution heating pipe 12 heats the sizing solution N in the size tank 11 so that the sizing solution N is not hardened. The amount and temperature of the steam supplied to the size heating pipe 12 from the steam supply source 13 are adjusted such that the temperature of the sizing solution N in the size tank 11 is in a desired temperature range, for example, between 90°C and 95°C, inclusive.

[0012] The size tank 11 is connected to a size supply source 14 that stores the sizing solution N to be supplied to the size tank 11. When the amount of the sizing solution N in the size tank 11 falls to or below a certain amount, the size supply source 14 supplies the sizing solution N to the size tank 11. Specifically, the size supply source 14 is connected to the size tank 11 through a valve 15. The valve 15 is controlled by a controller C1. The controller C1 is connected to a level sensor 16 that detects the level of a liquid surface N1 of the sizing solution N in the size tank 11. The controller C1 receives liquid surface level information from the level sensor 16 and controls the opening state of the valve 15 based on the liquid surface level information. Specifically, when the level of the liquid surface N1 of the sizing solution N in the size tank 11 falls below a predetermined level, the controller C1 controls the valve 15 to open. Thus, the sizing solution N is supplied to the size tank 11 from the size supply source 14.

[0013] When the level of the liquid surface N1 of the sizing solution N in the size tank 11 reaches or surpasses the predetermined level, the controller C1 controls the valve 15 to close. Accordingly, the supply of the sizing solution N from the size supply source 14 is stopped. The level of the liquid surface N1 of the sizing solution N in the size tank 11 is thus maintained in a certain range.

[0014] A size supply pipe 17 is connected to a bottom wall 111 of the size tank 11. The size supply pipe 17 is branched into a first branch pipe 171 and a second branch pipe 172. The first branch pipe 171 is connected to a first size supplying device 21, and the second branch pipe 172 is connected to a second size supplying device 22. The size supplying devices 21, 22 are both cylindrical (pipe-shaped). The size supply pipe 17 is provided with a size adjusting pump 18 between the bottom wall 111 of the size tank 11 and the branch portion of the first branch pipe 171 and the second branch pipe 172. The size adjusting pump 18 pressure feeds the sizing solution N in the size tank 11 to the first size supplying device 21 and the second size supplying device 22 through the size supply pipe 17.

[0015] Size discharge holes 24 for discharging the sizing solution N are formed in the circumferential wall of each of the first and second size supplying devices 21, 22. After being pressure fed to the size supplying devices 21, 22, the sizing solution N is discharged to the outside from the size discharge holes 24.

[0016] A pair of vertically arranged first squeeze rollers 31, 32 are provided directly below the first size supplying device 21. The first squeeze rollers 31, 32 are columnar and extend along the longitudinal direction (axial direction) of the first size supplying device 21. The first squeeze roller 31 is arranged above the first squeeze roller 32.

[0017] A pair of vertically arranged second squeeze rollers 33, 34 are provided directly below the second size supplying device 22. The second squeeze rollers 33, 34 are columnar and extend along the longitudinal direction (axial direction) of the second size supplying device 22. The second squeeze roller 33 is arranged above the second squeeze roller 34.

[0018] As shown in Fig. 1, the size discharge holes 24 of each size supplying device 21, 22 are arranged in a range S1, S2 of descending one quarter of a cycle after the top of the corresponding upper squeeze roller 31, 33 when viewed in the vertical direction. That is, the size discharge holes 24 of each size supplying device 21, 22, when viewed in the vertical direction, are in a range from the top 312, 332 of the corresponding squeeze roller 31, 33 to a position that is one quarter of a cycle away from the top 312, 332 along the rotation direction R1 (that is, the boundary K1, K2 between the upper half cycle and the lower half cycle).

[0019] The pair of the first squeeze rollers 31, 32 and the pair of the second squeeze rollers 33, 34 each tightly hold a great number of the warp threads T forming a sheet. That is, a great number of the warp threads T forming a sheet are passed through between the first squeeze rollers 31 and 32 and between the second squeeze rollers 33 and 34. A great number of the warp threads T are sent from the moistening apparatus 3 to the sizing apparatus 2. The upper squeeze rollers 31, 33 are controlled to rotate in a direction of arrow R1 (counterclockwise), and the lower squeeze rollers 32, 34 are controlled to rotate in a direction of arrow Q1 (clockwise).

[0020] A circumferential surface 311 of the upper first squeeze roller 31 and a circumferential surface 321 of the lower first squeeze roller 32 hold the warp threads T at a holding portion H1, in which the circumferential surfaces 311, 321 face each other. The transfer pathway of the warp threads T extends along the tangent of the circumferential surfaces 311, 321 of the squeeze rollers 31, 32 at the holding portion H1. A circumferential surface 331 of the upper second squeeze roller 33 and a circumferential surface 341 of the lower second squeeze roller 34 hold the warp threads T at a holding portion H2, in which the circumferential surfaces 331, 341 face each other. The transfer pathway of the warp threads T extends along the tangent of the circumferential surfaces 331, 341 of the squeeze rollers 33, 34 at the holding portion H2.

[0021] A size receiver 35 is provided directly below the squeeze rollers 31, 32, 33, 34. A bottom wall 351 of the size receiver 35 is dented downward. The bottom wall 351 is at a position where it does not contact the squeeze rollers 32, 34. A size recovery pipe 36 is connected to the lowest portion of the bottom wall 351. The size recovery pipe 36 extends to the size tank 11, which is located below the size receiver 35. The level of the liquid surface N1, at which supply of the sizing solution N from the size supply source 14 to the size tank 11 is stopped, is lower than the size receiver 35.

[0022] The moistening apparatus 3 will now be described.

[0023] The moistening apparatus 3 has a water tank 41 for temporarily storing water W. A water tank heating pipe 42 is provided in the water tank 41. Steam of a predetermined temperature is supplied to the interior of the water tank heating pipe 42 from the steam supply source 13. The amount and temperature of the steam supplied to the water tank heating pipe 42 from the steam supply source 13 are adjusted such that the temperature of the water W in the water tank 41 is in a desired temperature range, for example, between 90°C and 95°C, inclusive.

[0024] The water tank 41 is connected to a water supply source 44 that stores the water W to be supplied to the water tank 41. When the amount of the water W in the water tank 41 falls to or below a certain amount, the water supply source 44 supplies the water W to the water tank 41. Specifically, the water supply source 44 is connected to the water tank 41 through a valve 45. The valve 45 is controlled by a controller C2. The controller C2 is connected to a level sensor 46 that detects the level of a liquid surface W1 of the water W in the water tank 41. The controller C2 receives liquid surface level information from the level sensor 46 and controls the opening state of the valve 45 based on the liquid surface level information. Specifically, when the level of the liquid surface W1 of the water W in the water tank 41 falls below a predetermined level, the controller C2 controls the valve 45 to open. Accordingly, water is supplied to the water tank 41 from the water supply source 44.

[0025] When the level of the liquid surface W1 of the water W in the water tank 41 reaches or surpasses the predetermined level, the controller C2 controls the valve 45 to close. Accordingly, the supply of the water W from the water supply source 44 is stopped. The level of the liquid surface W1 of the water W in the water tank 41 is thus maintained in a certain range.

[0026] A water supply pipe 47 is connected to a bottom wall 411 of the water tank 41. An end of the water supply pipe 47 is connected to a cylindrical (pipe-shaped) water supplying device 51, which functions as water supplying means. A water adjusting pump 48 is located on the water supply pipe 47. The water adjusting pump 48 pressure feeds the water W from the water tank 41 to the water supplying device 51 through the water supply pipe 47.

[0027] As shown in Figs. 2A to 3, water discharge holes 54 are formed in and extend through the circumferential wall of the water supplying device 51. After being pressure fed to the water supplying device 51, the water W is discharged to the outside from the water discharge holes 54. The water W is pressure fed to the interior of the water supplying device 51 through both ends in the longitudinal direction (left and right ends as viewed in Fig. 3) of the water supplying device 51.

[0028] A pair of vertically arranged third squeeze rollers 61, 62 are provided directly below the water supplying device 51. The squeeze rollers 61, 62 are columnar and extend along the longitudinal direction (axial direction) of the water supplying device 51. The squeeze roller 61 is arranged above the squeeze roller 62. As shown in Figs. 1 and 2A, the water discharge holes 54 are arranged in the range S3 of descending one quarter of a cycle after the top of the upper squeeze roller 61 when viewed in the vertical direction. That is, the water discharge holes 54, when viewed in the vertical direction, are in a range from the top 612 of the squeeze roller 61 to a position that is one quarter of a cycle away from the top 612 along the rotation direction R3 (that is, the boundary K3 between the upper half cycle and the lower half cycle)

[0029] The pair of the third squeeze rollers 61, 62 hold a great number of the warp threads T forming a sheet. That is, a great number of the warp threads T forming a sheet are passed through between the squeeze rollers 61 and 62. The upper squeeze roller 61 is controlled to rotate in a direction of arrow R3 (counterclockwise). The lower squeeze roller 62 is controlled to rotate in a direction of arrow Q3 (clockwise).

[0030] A circumferential surface 611 of the upper squeeze roller 61 and a circumferential surface 621 of the lower squeeze roller 62 hold the warp threads T at a holding portion H3, in which the circumferential surfaces 611, 612 face each other. The transfer pathway of the warp threads T extends along the tangent of the circumferential surfaces 611, 621 of the squeeze rollers 61, 62 at the holding portion H3. After passing through the holding portion H3 of the squeeze rollers 61, 62, the warp threads T are sent to the sizing apparatus 2.

[0031] A water receiver 65 is provided directly below the third squeeze rollers 61, 62. A bottom wall 651 of the water receiver 65 is dented downward. The bottom wall 651 is at a position where it does not contact the third squeeze roller 62. A water recovery pipe 66 is connected to the lowest portion of the bottom wall 651. The water recovery pipe 66 extends to the water tank 41, which is located below the water receiver 65. The level of the liquid surface W1, at which supply of the water W from the water supply source 44 to the water tank 41 is stopped, is lower than the water receiver 65.

[0032] Next, a procedure for moistening the warp threads T with the water W and applying the sizing solution N to the warp threads T will be described.

[0033] When the water adjusting pump 48 is activated while the third squeeze rollers 61, 62 are rotating, the water W in the water tank 41 is pressure fed to the water supplying device 51 by the water adjusting pump 48. The flow rate of water supplied to the water supplying device 51 is readily adjusted, for example, by adjusting the rotation speed of the water adjusting pump 48.

[0034] The water in the water supplying device 51 is discharged through the water discharge holes 54. The water discharged through the water discharge holes 54 is supplied to the descending quarter cycle range S3 of the cycle of the third squeeze roller 61. The water W falls down a range S6 of the descending half the cycle (shown in Fig. 1) of the upper third squeeze roller 61. The water W is deposited on the warp threads T at the holding portion H3. Part of the water W that has been deposited on the warp threads T at the holding portion H3 is squeezed from the warp threads T by the third squeeze rollers 61, 62.

[0035] The water W squeezed out of the warp threads T falls down a range U3 of the ascending half cycle of the lower squeeze roller 62. That is, as shown in Fig. 1, the water W squeezed out of the warp threads T falls from the holding portion H3 to a position that is half cycle away in a direction opposite to the rotation direction Q3 of the squeeze roller 62 (that is, to the lowest portion 622 of the circumferential surface 621).

[0036] Part of the water W that falls down the ascending half cycle range U3 of the lower squeeze roller 62 is moved to the holding portion H3 as the lower squeeze roller 62 rotates, and is deposited onto the warp threads T. Part of the water W that falls down the ascending half cycle range U3 of the lower squeeze roller 62 falls to an inner wall surface 652 of the bottom wall 651 of the water receiver 65.

[0037] The water W on the inner wall surface 652 is not deposited onto the lower squeeze roller 62. That is, the lower squeeze roller 62 does not pick up water on the inner wall surface 652. The inner wall surface 652 of the bottom wall 651 of the water receiver 65, which is located in a position where it does not contact the lower squeeze roller 62, functions as a receiving portion that receives water dropping off the squeeze rollers 61, 62. The inner wall surface 652 is always in a position where it does not contact the squeeze roller 62 during the operation, that is, under any operation condition. In other words, the inner wall surface 652 is always located at a position where it does not contact the squeeze roller 32 regardless of the operation speed of the sizing apparatus 2, that is, regardless of the peripheral velocity of the squeeze rollers 31, 32. The water that has dropped onto the inner wall surface 652 of the water receiver 65 is recovered and returned to the water tank 41 through the water recovery pipe 66.

[0038] The water W that has been recovered and returned to the water tank 41 is sent to the water supplying device 51 again by the water adjusting pump 48. The water tank 41, the water supply pipe 47, and the water adjusting pump 48 function as reflux means for sending water received by the water receiver 65 to the water supplying device 51. After passing through between the third squeeze rollers 61, 62, the warp threads T are sent to the sizing apparatus 2.

[0039] When the size adjusting pump 18 is activated while the squeeze rollers 31, 32, 33, 34 are rotating, the sizing solution N in the size tank 11 is pressure fed to the size supplying devices 21, 22 by the size adjusting pump 18. The flow rate of the sizing solution N supplied to the size supplying devices 21, 22 is readily adjusted, for example, by adjusting the rotation speed of the size adjusting pump 18.

[0040] After being pressure fed to the size supplying devices 21, 22, the sizing solution N is discharged to the outside from the size discharge holes 24. The sizing solution N discharged through the size discharge holes 24 is supplied to the descending quarter cycle ranges S1, S2 of the upper squeeze rollers 31, 33. The sizing solution N falls down ranges S4, S5 of the descending half cycle of the squeeze rollers 31, 33 and is deposited, in the holding portions H1, H2, onto the moistened warp threads T sent from the moistening apparatus 3. Part of the sizing solution N that has been deposited on the warp threads T at the holding portion H1 is squeezed from the warp threads T by the first squeeze rollers 31, 32. Part of the sizing solution N that has been deposited on the warp threads T at the holding portion H2 is squeezed from the warp threads T by the second squeeze rollers 33, 34.

[0041] The sizing solution N squeezed out of the warp threads T falls down ranges U1, U2 of an ascending half cycle of the lower squeeze rollers 32, 34. That is, as shown in Fig. 1, the sizing solution N squeezed out of the warp threads T falls from the holding portions H1, H2 to the lowest portions 322, 342 of the circumferential surfaces 321, 341 of the lower squeeze rollers 32, 34. Part of the sizing solution N that falls down the ascending half cycle ranges U1, U2 of the lower squeeze rollers 32, 34 is moved to the holding portions H1, H2 as the lower squeeze rollers 32, 34 rotate, and is deposited onto the warp threads T. Part of the sizing solution N that falls down the ascending half cycle ranges U1, U2 of the squeeze rollers 32, 34 falls to an inner wall surface 352 of the bottom wall 351 of the size receiver 35. The sizing solution N that has dropped into the size receiver 35 is recovered and returned to the size tank 11 through the size recovery pipe 36.

[0042] The sizing solution N that has been recovered and returned to the size tank 11 is sent to the size supplying devices 21, 22 again by the pump 18. After passing through between the squeeze rollers 33, 34, the warp threads T are dried by a dryer (not shown) and reeled by a reel portion (not shown).

[0043] The water discharge holes 54 are formed to have shapes that permit the water W to be uniformly supplied to the warp threads T. The water discharge holes 54 will now be described.

[0044] As shown in Fig. 3, the water discharge holes 54, which are formed through the water supplying device 51, extend along the longitudinal direction (axial direction) of the water supplying device 51, that is, the longitudinal direction (axial direction) of the squeeze rollers 61, 62. Each water discharge hole 54 is formed like a slit having longer sides extending along the longitudinal direction of the water supplying device 51. Also, each water discharge hole 54 has a uniform width along the circumferential direction of the water supplying device 51 (in other words, a width in a direction perpendicular to the longitudinal direction of the water discharge holes 54). That is, each water discharge hole 54 has a slit-like (rectangular) shape extending along the longitudinal direction of the water supplying device 51 in a plan view.

[0045] Linking portions 55 are located in each water discharge hole 54 at predetermined intervals (in this embodiment, 25 mm). The linking portions 55 maintain the width of the water discharge holes 54 (the width along the circumferential direction of the water supplying device 51) at a uniform value. That is, if each water discharge hole 54 is replaced by a single continuous slit extending along the longitudinal direction of the water supplying device 51, the width of the slit can hardly be maintained at a uniform value due to the physical properties of the material forming the water supplying device 51. However, by providing the linking portions 55, the width of each water discharge hole 54 is prevented from being altered by internal stress produced by the water W in the water supplying device 51. The length of each linking portion 55 along the longitudinal direction of the water supplying device 51 is significantly smaller than the interval between the linking portions 55 (25 mm, in this embodiment). In this embodiment, the length of each linking portion 55 along the longitudinal direction of the water supplying device 51 is 2 mm.

[0046] Further, the water supplying device 51 has two water discharge holes 54 arranged along the circumferential direction of the water supplying device 51.

[0047] As shown in Fig. 3, the linking portions 55 of each the water discharge hole 54 are formed to be alternately arranged in relation to the linking portions 55 of the other water discharge hole 54 in the longitudinal direction of the water supplying device 51. That is, with respect to the longitudinal direction of the water supplying device 51, at a position where a linking portion 55 is provided in one of the water discharge holes 54, no linking portion 55 is provided in the other water discharge hole 54. In other words, the linking portions 55 are arranged such that, in any given area along the longitudinal direction of the water supplying device 51 along which the water discharge holes 54 extend, at least one section for discharging the water W is provided in the circumference. Thus, all the sections along the longitudinal direction of the water supplying device 51 discharge the water W.

[0048] The water supplying device 51 is arranged such that the water discharge holes 54 extend parallel with the longitudinal direction of the third squeeze rollers 61, 62. That is, the water discharge holes 54 are arranged such that the longitudinal direction is perpendicular to the advancing direction of the warp threads T. The length of each water discharge hole 54 in the longitudinal direction is longer than the width of the sheet material formed of a great number of the arranged warp threads T.

[0049] The function of the water discharge holes 54 will now be described.

[0050] When the water W is pressure fed to the water supplying device 51, the water discharge holes 54 discharge the water W to the outside. The water discharge holes 54 extend along the axial direction of the water supplying device 51, and the widths of the water discharge holes 54 are maintained by the linking portions 55. Therefore, the water W discharged from the water discharge holes 54 forms a film of uniform thickness.

[0051] The linking portions 55 are alternately arranged in the two water discharge holes 54 in the longitudinal direction of the water supplying device 51. The length of each linking portion 55 along the longitudinal direction of the water supplying device 51 is significantly short. The water supplying device 51 thus substantially uniformly discharges the water W along the longitudinal direction. This prevents the water W from being unevenly supplied onto the warp threads T. All the warp threads T therefore have an appropriate water content.

[0052] This embodiment provides the following advantages.

(1) Since the water discharge holes 54 extend along the axial direction of the water supplying device 51, the amount of water discharged from the water discharge holes 54 is uniform along the axial direction of the water supplying device 51 (and the squeeze rollers 61, 62). Accordingly, the warp threads T are uniformly supplied with the water W. Since the water supplying device 51 supplies the water W to the circumferential surface 611 of the squeeze roller 61 located above the warp threads T, an adequate amount of water W is readily supplied to the warp threads T. Therefore, an adequate amount of the water W is readily supplied to all the warp threads T. All the warp threads T therefore have an appropriate water content.

(2) The water supplying device 51 has the linking portions 55, which maintain the widths of the water discharge holes 54 at a uniform value. The widths of the water discharge holes 54 are prevented from being altered by internal stress produced in the water supplying device 51. Therefore, the water supplying device 51 discharges a uniform amount of the water W along the longitudinal direction.

(3) The linking portions 55 of each water discharge holes 54 are formed to be alternately arranged in relation to the linking portions 55 of the other water discharge hole 54 in the longitudinal direction of the water supplying device 51. That is, each linking portion 55 in one of the water discharge hole 54 is not located at the same position in the longitudinal direction of the water supplying device 51 as any of the linking portions 55 in the other water discharge hole 54. Thus, all the sections along the longitudinal direction of the water supplying device 51 discharge the water W. As a result, the water supplying device 51 substantially uniformly discharges the water W along the longitudinal direction.

(4) The descending quarter cycle range S3 is an range on the third squeeze roller 61 that descends to the warp threads T as the third squeeze roller 61 rotates. The water W discharged from the water supplying device 51 is received by the descending quarter cycle range S3, which descends to the warp threads T. The water W received by the descending quarter cycle range S3 reliably reaches the warp threads T in the vicinity of the holding portion H3. The descending quarter cycle range S3 is a favorable portion to lead an appropriate amount of water discharged from the water supplying device 51 onto the warp threads T.

(5) The warp threads T are held at the holding portion H3, where the circumferential surface 611 of the upper squeeze roller 61 and the circumferential surface 621 of the lower squeeze roller 62 face each other.

The transfer pathway of the warp threads T extends along the tangent of the circumferential surfaces 611, 621 of the squeeze rollers 61, 62 at the holding portion H3. That is, the warp threads T pass through the holding portion H3 without being bent. The configuration that allows the warp threads T to pass through the holding portion H3 without bending the warp threads T reduces the number of bent portions of the warp threads T, thus reduces the damages to the warp threads T due to bending.

(6) The water W that has been dropped into the water receiver 65 does not stay in the water receiver 65, but moves to the water tank 41. The water receiver 65, which does not store the water W, has a simple construction as compared to the prior art water tank. The size of the water receiver 65, which does not store the water W, can be reduced as compared to that of the prior art water tank.

[0053] The above mentioned embodiment may be modified as follows.

[0054] In the above embodiment, the water receiver 65 is located directly below the third squeeze rollers 61, 62. However, the water receiver 65 may be omitted, and the water tank 41 may be located directly below the third squeeze rollers 61, 62. In this case, the level of the liquid surface W1 of water in the water tank 41 at which the supply of the water W from the water supply source 44 to the water tank 41 should be stopped needs to be set further lower than the lower squeeze roller 62, so that the lower squeeze roller 62 does not pick up the water W. In this case, the liquid surface W1 functions as a receiving portion.

[0055] In the illustrated embodiment, the water W is supplied to the circumferential surface 611 of the squeeze roller 61, which is the upper one of the third squeeze rollers 61, 62 receiving the warp threads T. However, the water W may be supplied to the upper surface of the warp threads T in a portion upstream of the squeeze roller 61.

[0056] In the illustrated embodiment, the configuration of the sizing apparatus 2 may be replaced by a known configuration. For example, it may be configured that the warp threads T are immersed in the sizing solution N in a size box (size tank) for storing the sizing solution N, and then, the sizing solution N is squeezed from the warp threads T by holding the warp threads T between a pair of squeeze rollers.

[0057] In the illustrated embodiment, the water supplying device 51 has two water discharge holes 54. However, the number of the water discharge holes 54 may be changed to any number. For example, the number of the water discharge holes 54 may be one, or three or more.

[0058] In the illustrated embodiment, the water supplying device 51 has the linking portions 55 to maintain the widths of the water discharge holes 54 at a uniform value. However, as long as the widths of the water discharge holes 54 are maintained, the linking portions 55 do not need to be provided.

[0059] In the illustrated embodiment, the linking portions 55 in each water discharge hole 54 are alternately arranged in relation to the linking portions 55 in the adjacent water discharge hole 54. However, the positions of the linking portions 55 may be changed as long as, in any given area along the longitudinal direction of the water supplying device 51 along which the water discharge holes 54 are arranged, at least one section for discharging the water W is provided in the entire circumference.

[0060] In the illustrated embodiment, the water supplying device 51 may have auxiliary holes for discharging the water W. Each auxiliary hole is located in the same axial position as and in the vicinity of one of the linking portions 55. The auxiliary holes permit an amount of water that has not been discharged due to the presence of the linking portions 55 to be discharged. Accordingly, the thickness of the film of the water W discharged by the water supplying device 51 is made further uniform.

[0061] In the illustrated embodiment, the water supplying device 51 is arranged such that the longitudinal direction of the water discharge holes 54 (the axial direction of the water supplying device 51) is perpendicular to the advancing direction of the warp threads T. However, as long as the water discharge holes 54 extend to cover the entire width of a sheet of a great number of the arranged warp threads T, the water discharge holes 54 may extend in a direction oblique with respect to the advancing direction of the warp threads T.

[0062] A moistening apparatus in a sizing machine for squeezing water from warp threads wet with water prior to application of sizing solution to the warp threads has a pair of squeeze rollers. The squeeze rollers hold the warp threads from above and below. The squeeze rollers have a water supplying device that supplies water either to a circumferential surface of the roller that is located above the warp threads passing through between the rollers or to an upper side of the warp threads located upstream of the rollers. The water supplying device has water discharge holes, each of which is formed like a slit having longer sides extending along the longitudinal direction of the water supplying device.

Claims

1. A moistening apparatus in a sizing machine, the moistening apparatus having a pair of squeeze rollers, the squeeze rollers holding warp threads wet with water from above and below prior to application of sizing solution to the warp threads, thereby squeezing water from the warp threads, the apparatus being **characterized by:**

water supplying means that supplies water either to a circumferential surface of the roller that is located above the warp threads passing through between the pair of the rollers or to an upper side of the warp threads located upstream of the pair of the rollers, wherein the water supplying means has a water discharge hole, the discharge hole being formed as a slit that extends along an axial direction of the water supplying means.

2. The moistening apparatus according to claim 1, **characterized in that** the water discharge hole extends in a direction that intersects an advancing direction of the warp threads.

3. The moistening apparatus according to claim 1 or 2, **characterized in that** the water discharge hole has a width in a direction perpendicular to its longitudinal direction, the water discharge hole being formed to have a uniform width along the longitudinal direction.

4. The moistening apparatus according to any one of claims 1 to 3, **characterized in that** the water discharge hole has a width in a direction perpendicular to its longitudinal direction, wherein a linking portion is provided in the water discharge hole, the linking portion maintaining the widths of the water discharge hole at a uniform value.

5. The moistening apparatus according to claim 4, **characterized in that** the water discharge hole is one of a plurality of water discharge holes arranged in a direction perpendicular to the longitudinal direction, wherein the linking portion in one of the water discharge holes is located in a different position, with respect to the axial direction of the water supplying means, from the linking portion in at least one of the other water discharge holes.

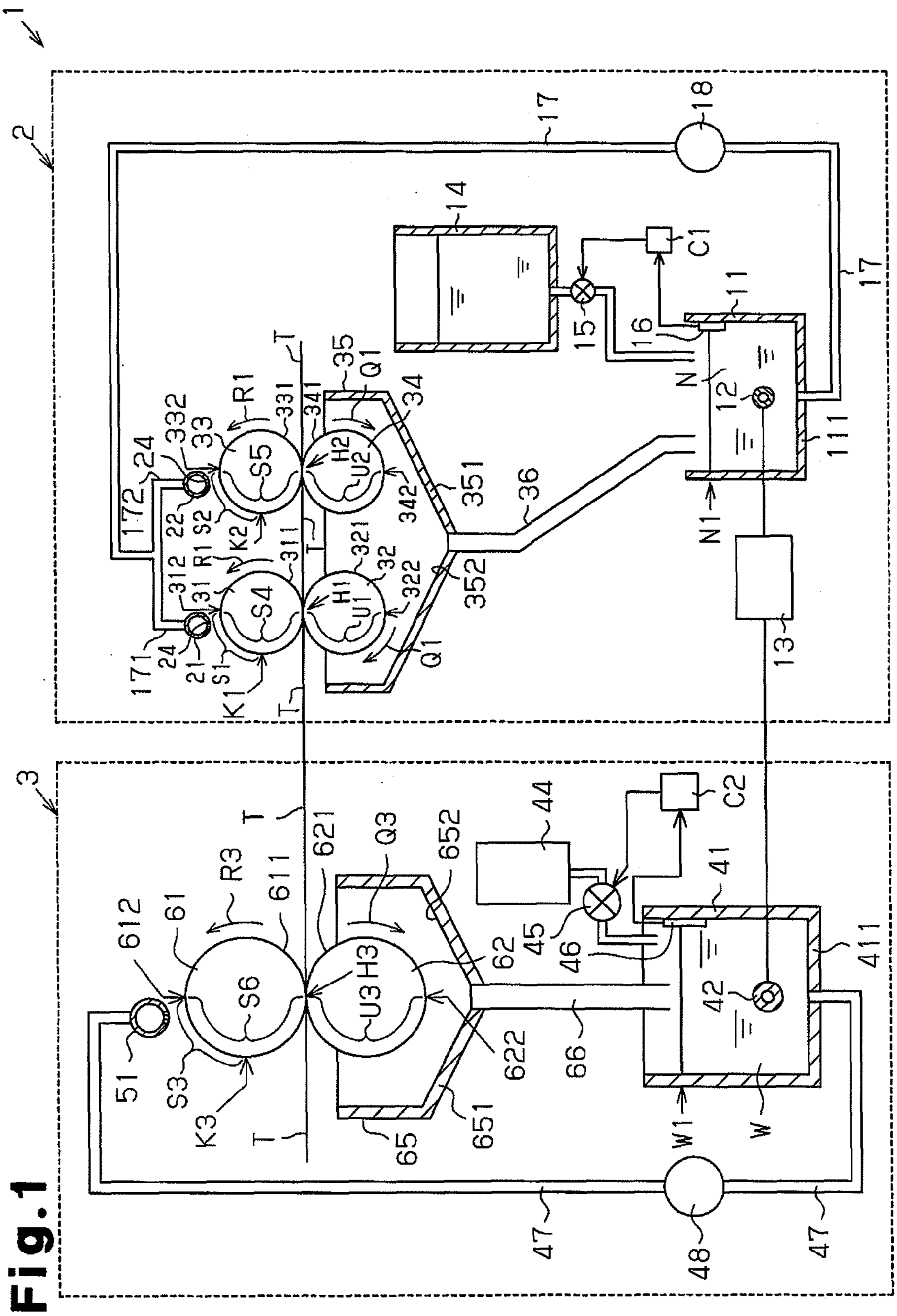
6. The moistening apparatus according to claim 1, **characterized in that** the water supplying means is arranged to supply water to a range in a circumferential surface of the upper squeeze roller from a top to a position that is one quarter of a cycle away from the top along the rotation direction.

7. The moistening apparatus according to any one of claims 1 to 6, **characterized, in by** a water receiver located below the squeeze rollers to receive water dropping off the rollers, the water receiver having a water receiving portion at a position where the water receiving portion does not contact the squeeze roller located below the warp threads.

8. The moistening apparatus according to claim 7, **characterized in that** the water receiver is constructed not to store water so that the water is dropped to a water tank located below the water receiver.

9. The moistening apparatus according to any one of claims 1 to 8, **characterized in that** a transfer pathway of the warp threads is defined to extend along a tangent of sections of the circumferential surfaces of the squeeze rollers that hold the warp threads.

10. The moistening apparatus according to any one of claims 1 to 9, **characterized in that** the water supplying means is a cylindrical body that extends in a direction intersecting the advancing direction of the warp threads.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322
312
31
S4
H1
U1
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Fig.1

Fig.2A

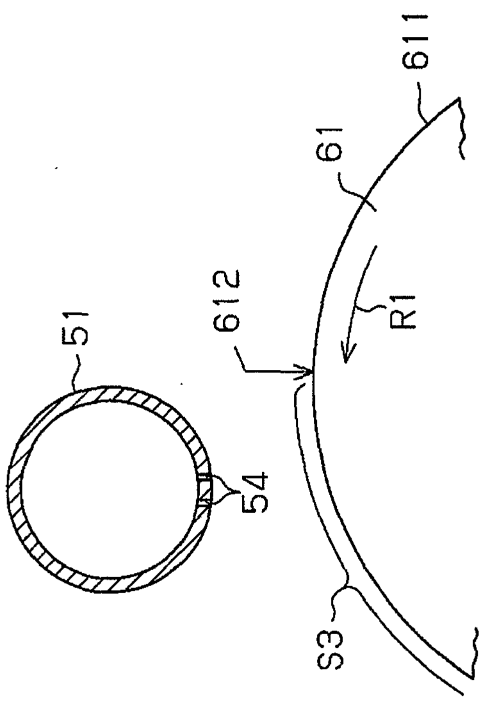


Fig.2B

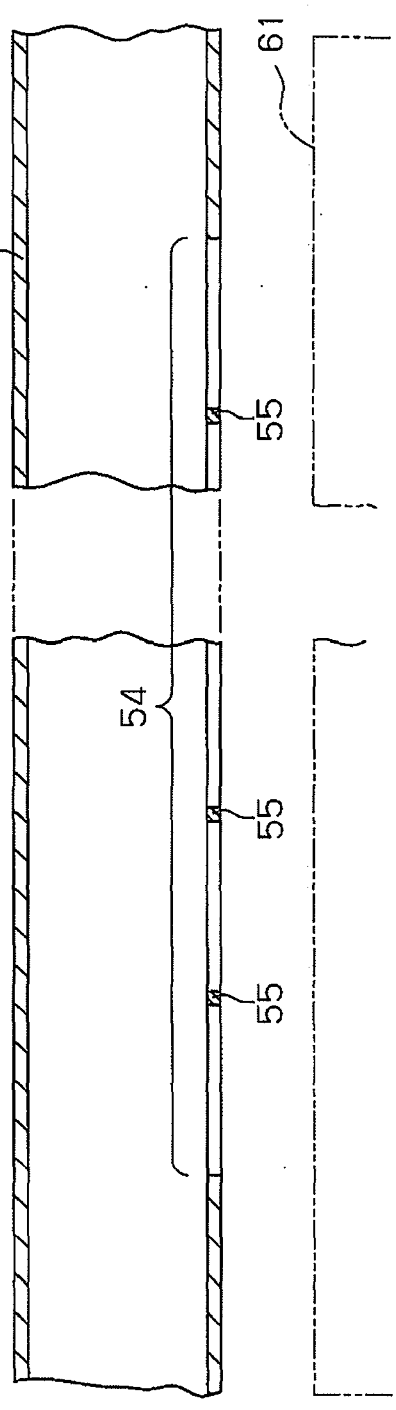
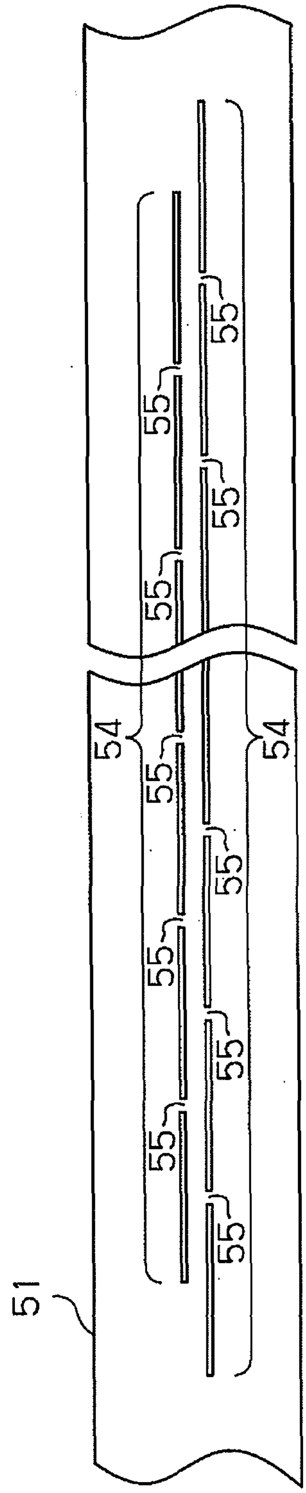


Fig.3



REFERENCES CITED IN THE DESCRIPTION

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