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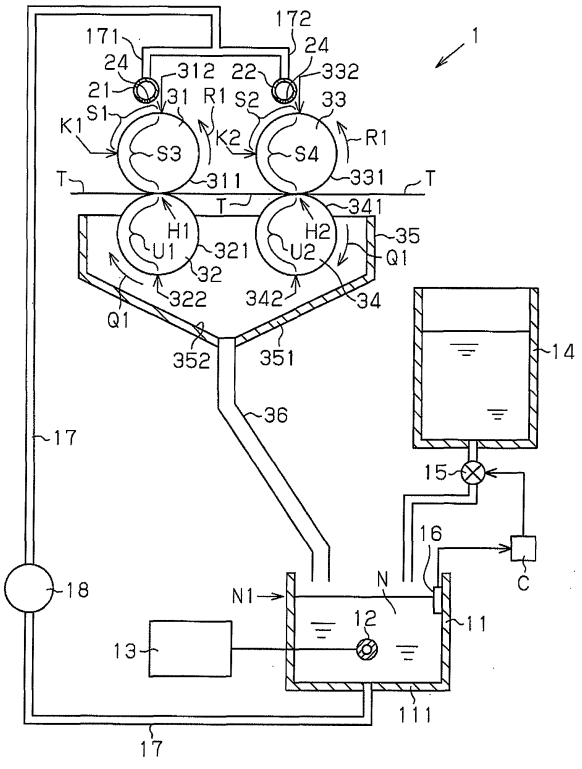
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(54) **Sizing machine**

(57) A sizing machine performs sizing by passing warp threads to which sizing solution has been applied through a pair of columnar squeeze rollers (31,32), thereby squeezing the sizing solution from the warp threads by means of squeezing effect of the squeeze rollers. The sizing machine includes a cylindrical size supplying device (21). The size supplying device (21) supplies sizing solution either to a circumferential surface of the roller (31) that is located above the warp threads passing through between the pair of rollers or to an upper side of the warp threads located upstream of the rollers. The size supplying device (21) has discharge holes (24) for discharging the sizing solution. Each discharge hole is formed as a slit (24) that extends along an axial direction of the size supplying device (21).

Fig.1



EP 1 801 279 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a sizing machine that performs sizing by passing warp threads to which sizing solution has been applied through a pair of squeeze rollers, thereby squeezing the sizing solution from the warp threads by means of squeezing effect of the squeeze rollers.

[0002] Conventionally, a type of sizing machine has been known that immerse warp threads in a size tank called size tank, and then holds the warp threads between a pair of squeeze rollers to squeeze the sizing solution from the warp threads. In such a sizing machine, since the sizing solution in the size tank adheres to warp threads so that the amount of the sizing solution is reduced, the size tank needs to be replenished with sizing solution. When a size film is formed on the liquid surface of the sizing solution, the film can adhere to the warp threads. If the warp threads are transferred to a drying process with a size film attached, the size film hardens in such a manner as to bond adjacent warp threads to each other. When being separated, the warp threads bonded by a size film are likely to be broken. Thus, the formation of such size films needs to be prevented.

[0003] Japanese Examined Utility Model Publication No. 6-34394 discloses an apparatus for preventing the formation of such size films. This apparatus replenishes a size tank with sizing solution at a greater rate than the rate at which sizing solution is taken out of the size tank, thereby causing the sizing solution to overflow, so that flow of sizing solution on the liquid surface is created. However, stagnation is likely to occur in areas of the liquid surface of the sizing solution between vertical walls of the size tank and a lower squeeze roller immersed in the sizing solution. In such sections of stagnation, size films are likely to be formed.

[0004] Japanese Examined Patent Publication No. 1-22380 discloses an apparatus that includes an upper backup roll and a lower coating roll. The apparatus supplies sizing solution to warp threads that are passed through between the backup roll and the coating roll. In this apparatus, an applicator roll contacts the circumferential surface of the lower coating roll, and a sizing solution supplying nozzle sprays sizing solution onto the circumferential surface of the applicator roll. Sizing solution deposited on the circumferential surface of the applicator roll is transferred onto the circumferential surface of the lower coating roll. After being transferred to the circumferential surface of the lower coating roll, the sizing solution is deposited onto the warp threads at a nip line between the circumferential surface of the lower coating roll and that of the upper backup roll. Since this configuration requires no size tank, the problem related to stagnation in the liquid surface of the sizing solution is not caused, unlike the sizing apparatus disclosed in Japanese Examined Utility Model Publication 6-34394.

[0005] However, in an apparatus having a configuration that transfers sizing solution deposited on the circumferential surface of an applicator roll to the circumferential surface of a lower coating roll as disclosed in Japanese Examined Patent Publication No. 1-22380, it is difficult to evenly supply an appropriate amount of sizing solution to a lower coating roll, that is, to evenly supply an appropriate amount of sizing solution to warp threads.

SUMMARY OF THE INVENTION

[0006] Accordingly, it is an objective of the present invention to provide a sizing machine that evenly supplies an appropriate amount of sizing solution to warp threads.

[0007] In accordance with one aspect of the present invention, a sizing machine that performs sizing by passing warp threads to which sizing solution has been applied through a pair of columnar squeeze rollers, thereby squeezing the sizing solution from the warp threads by means of squeezing effect of the squeeze rollers is provided. The sizing machine includes cylindrical size supplying means that supplies the sizing solution either to a circumferential surface of the roller that is located above the warp threads passing through between the pair of the squeeze rollers or to an upper side of the warp threads located upstream of the pair of the squeeze rollers.

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 size supplying device;

Fig. 2B is a cross-sectional side view showing the size supplying device; and

Fig. 3 is a plan view showing the size 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. First, a sizing machine 1 will be described.

[0010] As shown in Fig. 1, the sizing machine 1 has a size tank 11 for temporarily storing sizing solution N. A heating pipe 12 is provided in the size tank 11. Steam of a predetermined temperature is supplied to the interior of the heating pipe 12 from a steam supply source 13. Steam supplied to the interior of the 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 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.

[0011] 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 C. The controller C 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 C 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 C controls the valve 15 to open. Thus, the sizing solution N is supplied to the size tank 11 from the size supply source 14.

[0012] 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 C 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.

[0013] A supply pipe 17 is connected to a bottom wall 111 of the size tank 11. The 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 supply pipe 17 is provided with a 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 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 supply pipe 17.

[0014] As shown in Figs. 2A, 2B and 3, discharge holes 24 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 discharge holes 24. The sizing solution N is pressure fed to the interior of each size supplying device 21, 22 through both ends in the longitudinal direction (left and right ends as viewed in Fig. 3) of the size supplying device 21, 22.

[0015] 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.

[0016] 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.

[0017] As shown in Figs. 1 and 2A, the 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 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).

[0018] 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. 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).

[0019] 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.

[0020] 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 recovery pipe 36 is connected to the lowest portion of the bottom wall 351. The recovery pipe 36 extends to the size tank 11, which is located below the size receiver 35. The level of the liquid surface, 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.

[0021] Next, a procedure for applying the sizing solution N to the warp threads T will be described.

[0022] When the 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 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 pump 18.

[0023] After being pressure fed to the size supplying devices 21, 22, which function as size supplying means, the sizing solution N is discharged to the outside from the discharge holes 24. The sizing solution N discharged through the discharge holes 24 is supplied to the descending quarter cycle ranges S1, S2 of the upper squeeze rollers 31, 33. A film of the sizing solution N falls down ranges S3, S4 of the descending half the cycle (shown in Fig. 1) of the squeeze rollers 31, 33. The sizing solution N is deposited on the warp threads T at the holding portions H1, H2. 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 squeeze rollers 31, 32. Part of the size that has been deposited on the warp threads T at the holding portion H2 is squeezed from the warp threads T by the squeeze rollers 33, 34.

[0024] 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 squeeze rollers 32, 34. Part of the sizing solution N that has fallen 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. The sizing solution N is then deposited onto the warp threads T. In this manner, the sizing solution N is deposited onto the upper and lower surfaces of the warp threads T. Thus, compared to the conventional technique that applies sizing solution N to warp threads T by using only a lower squeeze roller, the permeability of sizing solution N into the warp threads T is improved.

[0025] Part of the sizing solution N that has fallen down the ascending half cycle ranges U1, U2 of the lower 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 on the inner wall surface 352 is not deposited onto the lower squeeze rollers 32, 34. That is, the lower squeeze rollers 32, 34 do not pick up the sizing solution N on the inner wall surface 352. The inner wall surface 352 of the bottom wall 351 of the size receiver 35, which is located in a position where it does not contact the lower squeeze rollers 32, 34, functions as a receiving portion that receives the sizing solution N dropping off the squeeze rollers 31 to 34. The inner wall surface 352 is always in a position where it does not contact the squeeze rollers 32, 34 during the operation, that is, under any operation condition. In other words, the inner wall surface 352 is always located at a position where it does not contact the squeeze rollers 32, 34 regardless of the operation speed of the sizing machine 1, that is, regardless of the peripheral velocity of the squeeze rollers 31 to 34. The sizing solution N that has dropped onto the inner wall surface 352 of the size receiver 35 is recovered and returned to the size tank 11 through the recovery pipe 36.

[0026] 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. The size tank 11, the supply pipe 17, and the pump 18 function as reflux means for sending the sizing solution N received by the size receiver 35 to the size supplying devices 21, 22. After passing through between the second squeeze rollers 33, 34, the warp threads T are dried by a dryer (not shown) and reeled by a reel portion (not shown).

[0027] The discharge holes 24 are formed to have shapes that permit the sizing solution N to be uniformly supplied to the warp threads T. The discharge holes 24 will now be described.

[0028] As shown in Fig. 3, the discharge holes 24, which are formed through each size supplying device 21, 22, extend along the longitudinal direction (axial direction) of the size supplying device 21, 22, that is, the longitudinal direction (axial direction) of the squeeze rollers 31 to 34. Each discharge hole 24 is formed like a slit having longer sides extending along the longitudinal direction of the size supplying device 21, 22. Also, each discharge hole 24 has a uniform width along the circumferential direction of the size supplying device 21, 22 (in other words, a width in a direction perpendicular to the longitudinal direction of the discharge holes 24). That is, each discharge hole 24 has a slit-like (rectangular) shape extending along the longitudinal direction of the size supplying devices 21, 22 in a plan view.

[0029] Linking portions 25 are located in each discharge hole 24 at predetermined intervals (in this embodiment, 25 mm). The linking portions 25 maintain the width of the discharge holes 24 (the width along the circumferential direction of the size supplying devices 21, 22) at a uniform value. That is, if each discharge hole 24 is replaced by a continuous slit extending along the longitudinal direction of the size supplying devices 21, 22, the width of the slit can hardly be maintained at a uniform value due to the physical properties of the material forming the size supplying devices 21, 22. However, by providing the linking portions 25, the width of each discharge hole 24 is prevented from being altered by internal stress produced by the sizing solution N in the size supplying devices 21, 22. The length of each linking portion 25 along the longitudinal direction of the size supplying devices 21, 22 is significantly smaller than the interval between the linking portions 25 (25 mm, in this embodiment). In this embodiment, the length of each linking portion 25 along the longitudinal direction of the size supplying devices 21, 22 is 2 mm.

[0030] Further, each of the size supplying devices 21, 22 has two discharge holes 24 arranged along the circumferential direction.

[0031] As shown in Fig. 3, the linking portions 25 of each discharge hole 24 are formed to be alternately arranged in relation to the linking portions 25 of the other discharge hole 24 in the longitudinal direction of each size supplying device 21, 22. That is, with respect to the longitudinal direction of the each supplying device 21, 22, at a position where a linking portion 25 is provided in one of the discharge holes 24, no linking portion 25 is provided in the other discharge hole 24. In other words, the linking portions 25 are arranged such that, in any given area along the longitudinal direction of each size supplying device 21, 22 along which the discharge holes 24 extend, at least one section for discharging the sizing solution N is provided in the circumference. Thus, all the sections along the longitudinal direction of each size supplying device 21, 22 discharge the sizing solution N.

[0032] The size supplying devices 21, 22 are arranged such that the discharge holes 24 extend parallel with the longitudinal direction of the squeeze rollers 31, 32, 33, 34. That is, the discharge holes 24 are arranged such that the longitudinal direction is perpendicular to the advancing direction of the warp threads T. The length of each discharge hole 24 in the longitudinal direction is longer than the width of the sheet material formed of a great number of the arranged warp threads T.

[0033] The function of the discharge holes 24 will now be described.

[0034] 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 discharge holes 24 extend along the axial direction of the size supplying devices 21, 22, and the widths of the discharge holes 24 are maintained by the linking portions 25. Therefore, the sizing solution N is discharged from the discharge holes 24 forms a film of uniform thickness.

[0035] The linking portions 25 are alternately arranged in the two discharge holes 24 in the longitudinal direction of each size supplying device 21, 22. The length of each linking portion 25 along the longitudinal direction of each size supplying device 21, 22 is significantly short. Each size supplying device 21, 22 thus substantially uniformly discharges the sizing solution N along the longitudinal direction. This prevents the sizing solution N from being unevenly supplied onto the warp threads T. That is, the sizing solution N is prevented from cracking.

[0036] This embodiment provides the following advantages.

[0037] (1) Since the discharge holes 24 extend along the axial direction of the size supplying devices 21, 22, the amount of the sizing solution N discharged from the discharge holes 24 is uniform along the axial direction of the size supplying devices 21, 22 (and the squeeze rollers 31 to 34). Accordingly, the warp threads T are uniformly supplied with the sizing solution N. Since the size supplying devices 21, 22 supply the sizing solution N to the circumferential surfaces 311, 331 of the squeeze rollers 31, 33 located above the warp threads T, an adequate amount of sizing solution N is readily supplied to the warp threads T. Therefore, an adequate amount of sizing solution N is uniformly supplied to the warp threads T.

[0038] The sizing solution N is applied to the warp threads T by supplying the sizing solution N to the circumferential surfaces 311, 331 of the squeeze rollers 31, 33 from the size supplying devices 21, 22. The warp threads T are less likely to be broken than warp threads that have been immersed in size stored in a conventional size tank. This is because if size is applied to warp threads by immersing the warp threads in size stored in a size tank, the concentration and viscosity of the size are likely to vary depending on positions on the warp threads, and the deposit efficiency of the size is thus likely to vary. In contrast, since the sizing solution N is uniformly supplied to the circumferential surfaces 311, 331 of the squeeze rollers 31, 33 from the size supplying devices 21, 22, and the sizing solution N is then applied to the warp threads T, the deposit efficiency of the sizing solution N is maintained at a favorable level. The reason why the deposit efficiency varies when warp threads are immersed in size stored in a size tank is believed to be that it is difficult to appropriately control the deposit efficiency of the size.

[0039] In contrast, the amount of the sizing solution N deposited on the warp threads T is adjusted by changing the supplying amount of the sizing solution N to the size supplying devices 21, 22 in the present embodiment. Also, the configuration of the discharge holes 24 permits the sizing solution N to be uniformly supplied to the warp threads T. The deposit efficiency of the size on the warp thread T is thus set to a favorable and uniform level. Broken threads are thus hardly produced.

[0040] The flow rate of the sizing solution N for properly setting the deposit efficiency of the sizing solution N on the warp threads T is readily adjusted, for example, by adjusting the rotation speed of the pump 18. Further, since the sizing solution N is deposited onto the upper and lower surfaces of the warp threads T, the permeability of the sizing solution N into the warp threads T is improved. This increases the bonding area among the fibers forming the warp threads T, which reduces the number of broken threads in a loom.

[0041] (2) Each of the first and second size supplying devices 21, 22 has the linking portions 25, which maintain the widths of the discharge holes 24 at a uniform value. The widths of the discharge holes 24 are prevented from being altered by internal stress produced in the size supplying devices 21, 22. Therefore, each of the size supplying devices 21 discharges a uniform amount of the sizing solution N along the longitudinal direction of the discharge holes 24.

[0042] (3) The linking portions 25 of each discharge hole 24 are formed to be alternately arranged in relation to the linking portions 25 of the other discharge hole 24 in the longitudinal direction of each size supplying device 21, 22. That is, each linking portion 25 in one of the dis-

charge holes 24 is not located at the same position, in the longitudinal direction of the size supplying device 21, 22, as any of the linking portions 25 in the other discharge hole 24. Thus, all the sections along the longitudinal direction of each size supplying device 21, 22 discharge the sizing solution N. As a result, each size supplying device 21, 22 substantially uniformly discharges the sizing solution N along the longitudinal direction.

[0043] (4) The descending quarter cycle ranges S1, S2 are ranges on the upper squeeze rollers 31, 33 that descend to the warp threads T as the squeeze rollers 31, 33 rotate. The sizing solution N discharged from the size supplying devices 21, 22 is received by the descending quarter cycle ranges S1, S2, which descend to the warp threads T. The sizing solution N received by the descending quarter cycle ranges S1, S2 reliably reaches the warp threads T in the vicinity of the holding portions H1, H2. The descending quarter cycle ranges S1, S2 are favorable portions to lead an appropriate amount of size discharged from the size supplying devices 21, 22 onto the warp threads T.

[0044] (5) The warp threads T are held at the holding portion H1, where the circumferential surface 311 of the upper squeeze roller 31 and the circumferential surface 321 of the lower squeeze roller 32 face each other. Also, the warp threads T are held at the holding portion H2, where the circumferential surface 331 of the upper squeeze roller 33 and the circumferential surface 341 of the lower squeeze roller 34 face each other. The transfer pathway of the warp threads T extends along the tangent of the circumferential surfaces 311, 321 of the holding portion H1, and along the tangent of the circumferential surfaces 331, 341 of the holding portion H2. That is, the warp threads T pass through the holding portions H1, H2 without being bent. The configuration that allows the warp threads T to pass through the holding portions H1, H2 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.

[0045] (6) The sizing solution N that has been dropped into the size receiver 35 does not stay in the size receiver 35, but moves to the size tank 11. The size receiver 35, which does not store the sizing solution N, has a simple construction as compared to the prior art size tank (size box). The size receiver 35, which does not store the sizing solution N, is more compact than the prior art size tank (size box). Also, amount of used sizing solution N is reduced.

[0046] (7) In the case of a conventional sizing machine that immerses warp threads in size in a size tank, when the sizing machine is stopped as necessary, that is, when rotation of squeeze rollers is topped to stop the movement of warp threads, the size is hardened in the vicinity of the holding portions of a pair of squeeze rollers. This can form marks of hardened size. In contrast, in the present embodiment, when the sizing machine is stopped, the sizing solution N is prevented from being hardened at the holding portions H1, H2 by continuously supplying the sizing solution N from the size supplying devices 21, 22. Therefore, it is possible to stop the sizing machine for a longer period than the prior art. This improves the safety of procedures such as processes for broken threads.

[0047] The above mentioned embodiment may be modified as follows.

[0048] In the above embodiment, the size receiver 35 is located directly below the squeeze rollers 31 to 34. However, the size receiver 35 may be omitted, and the size tank 11 may be located directly below the squeeze rollers 31 to 34. In this case, the level of the liquid surface N1 of the sizing solution N in the size tank 11 at which the supply of the sizing solution N from the size supply source 14 to the size tank 11 should be stopped needs to be set further lower than the lower squeeze rollers 32, 34, so that the lower squeeze rollers 32, 34 do not pick up the sizing solution N. In this case, the liquid surface N1 functions as a receiving portion.

[0049] In the illustrated embodiment, the single pump 18 is used for pressure feeding the sizing solution N to the first size supplying device 21 and the second size supplying device 22. However, two pumps 18 may be provided so that each pump 18 is used for pressure feeding the sizing solution N to one of the size supplying devices 21, 22. In this configuration, by changing the rotation speed of each pump 18 corresponding to one of the size supplying devices 21, 22, the amount of the sizing solution N to be supplied to the first squeeze rollers 31, 32 and the amount of the sizing solution N to be supplied to the second squeeze rollers 33, 34 can be independently controlled. In other words, the amount of the sizing solution N to be supplied to the first squeeze rollers 31, 32 can be differed from the amount of the sizing solution N to be supplied to the second squeeze rollers 33, 34. This further improves the deposit efficiency of the sizing solution N.

[0050] In the illustrated embodiment, the sizing solution N is supplied to the circumferential surfaces 311, 331 of the squeeze rollers 31, 33, which are the upper ones of the squeeze rollers 31, 32, 33, 34. However, the sizing solution N may be supplied to the upper surface of the warp threads T in a portion upstream of the upper squeeze rollers 31, 33.

[0051] The sizing machine 1 of the illustrated embodiment has the first squeeze rollers 31, 32 and the second squeeze rollers 33, 34. However, the pair of the first squeeze rollers 31, 32 or the pair of the second squeeze rollers 33, 34 may be omitted.

[0052] In the illustrated embodiment, each size supplying device 21, 22 has two discharge holes 24. However, the number of the discharge holes 24 may be changed to any number. For example, the number of the discharge holes 24 may be one, or three or more.

[0053] In the illustrated embodiment, each size supplying device 21, 22 has the linking portions 25 to maintain the widths of the discharge holes 24 at a uniform value. However, as long as the widths of the discharge

holes 24 are maintained, the linking portions 25 do not need to be provided.

[0054] In the illustrated embodiment, the linking portions 25 in each discharge hole 24 are alternately arranged in relation to the linking portions 25 in the adjacent discharge hole 24. However, the positions of the linking portions 25 may be changed as long as, in any given area along the longitudinal direction of each size supplying device 21, 22 along which the discharge holes 24 are arranged, at least one section for discharging the sizing solution N is provided in the circumference.

[0055] In the illustrated embodiment, each size supplying device 21, 22 may have auxiliary holes for discharging the sizing solution N. Each auxiliary hole is located in the same axial position as and in the vicinity of one of the linking portions 25. The auxiliary holes permit an amount of the sizing solution N has not been discharged due to the presence of the linking portions 25 to be discharged. Accordingly, the thickness of the film of the sizing solution N discharged by the size supplying devices 21, 22 is made further uniform.

[0056] In the illustrated embodiment, the size supplying devices 21, 22 are arranged such that the longitudinal direction of the discharge holes 24 (the axial direction of the size supplying devices 21, 22) is perpendicular to the advancing direction of the warp threads T. However, as long as the discharge holes 24 extend to cover the entire width of a sheet of a great number of the arranged warp threads T, the discharge holes 24 may extend in a direction oblique with respect to the advancing direction of the warp threads T.

[0057] A sizing machine performs sizing by passing warp threads to which sizing solution has been applied through a pair of columnar squeeze rollers, thereby squeezing the sizing solution from the warp threads by means of squeezing effect of the squeeze rollers. The sizing machine includes a cylindrical size supplying device. The size supplying device supplies sizing solution either to a circumferential surface of the roller that is located above the warp threads passing through between the pair of rollers or to an upper side of the warp threads located upstream of the rollers. The size supplying device has discharge holes for discharging the sizing solution. Each discharge hole is formed as a slit that extends along an axial direction of the size supplying device.

Claims

1. A sizing machine that performs sizing by passing warp threads (T) to which sizing solution (N) has been applied through a pair of columnar squeeze rollers (31 to 34), thereby squeezing the size from the warp threads (T) by means of squeezing effect of the squeeze rollers (31 to 34), the sizing machine comprising:

cylindrical size supplying means (21, 22) that supplies the sizing solution (N) either to a circumferential surface of the roller (31, 33) that is located above the warp threads (T) passing through between the pair of the squeeze rollers (31 to 34) or to an upper side of the warp threads (T) located upstream of the pair of the squeeze rollers (31 to 34),

the sizing machine being **characterized in that** the size supplying means (21, 22) has a discharge hole (24) for discharging the sizing solution (N), the discharge hole (24) being formed as a slit that extends along an axial direction of the size supplying means (21, 22).

2. The sizing machine according to claim 1, **characterized in that** the discharge hole (24) extends in a direction that intersects an advancing direction of the warp threads (T).

3. The sizing machine according to claim 1 or 2, **characterized in that** the discharge hole (24) has a width in a direction perpendicular to its longitudinal direction, the discharge hole (24) being formed to have a uniform width along the longitudinal direction.

4. The sizing machine according to any one of claims 1 to 3, **characterized in that** the discharge hole (24) has a width in a direction perpendicular to its longitudinal direction, wherein a linking portion (25) is provided in the discharge hole (24), the linking portion (25) maintaining the widths of the discharge hole (24) at a uniform value.

5. The sizing machine according to claim 4, **characterized in that** the discharge hole is one of a plurality of discharge holes (24) arranged in a direction perpendicular to the longitudinal direction, wherein the linking portion (25) in one of the discharge holes is located in a different position, with respect to the axial direction of the size supplying means (21, 22), from the linking portion (25) in at least one of the other discharge holes.

6. The sizing machine according to claim 1, **characterized in that** the size supplying means (21, 22) is arranged to supply the sizing solution (N) to a range in a circumferential surface of the upper squeeze roller (31, 33) from a top to a position that is one quarter of a cycle away from the top along the rotation direction.

7. The sizing machine according to any one of claims 1 to 6, **characterized in** by a size receiver (35) located below the pair of the squeeze rollers (31 to 34) to receive the sizing solution (N) dropping off the pair of the squeeze rollers (31 to 34), the size receiver (35) having a size receiving portion (352) at a position where the size receiving portion does not contact the

lower squeeze roller.

8. The sizing machine according to claim 7, **characterized in that** the size receiver (35) is constructed not to store the sizing solution (N) so that the sizing solution (N) is dropped to a size tank (11) located below the size receiver (35).

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

Fig.1

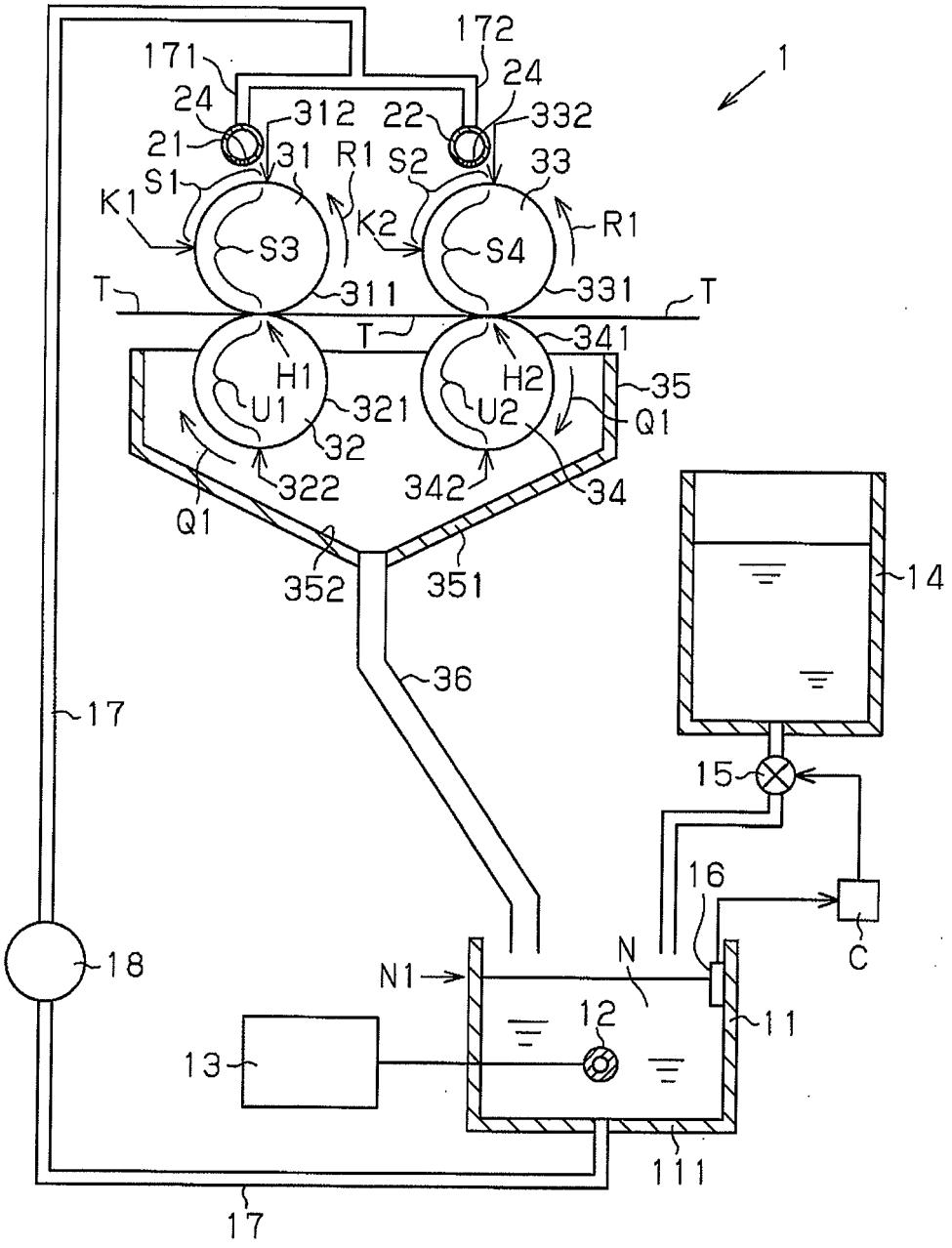

172
171
24
24
312
22
332
1
21
31
R1
S2
33
S1
K1
K2
R1
S3
S4
T
311
331
T
T
341
H1
H2
35
U1
321
U2
Q1
32
322
342
34
Q1
352
351
14
36
17
15
16
18
N1
N
C
12
11
13
111
17

Fig.2A

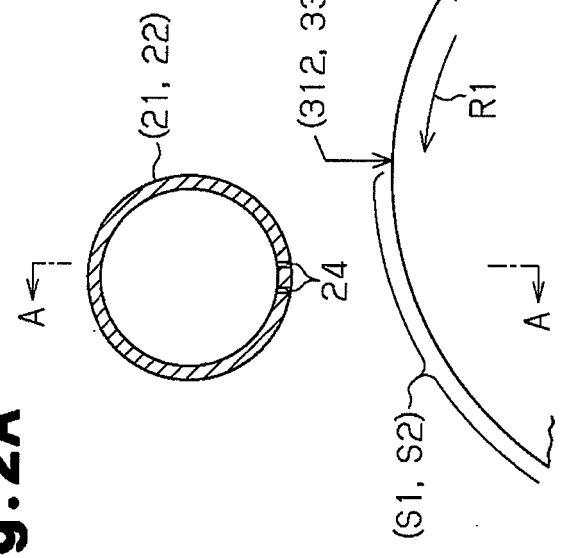


Fig.2B

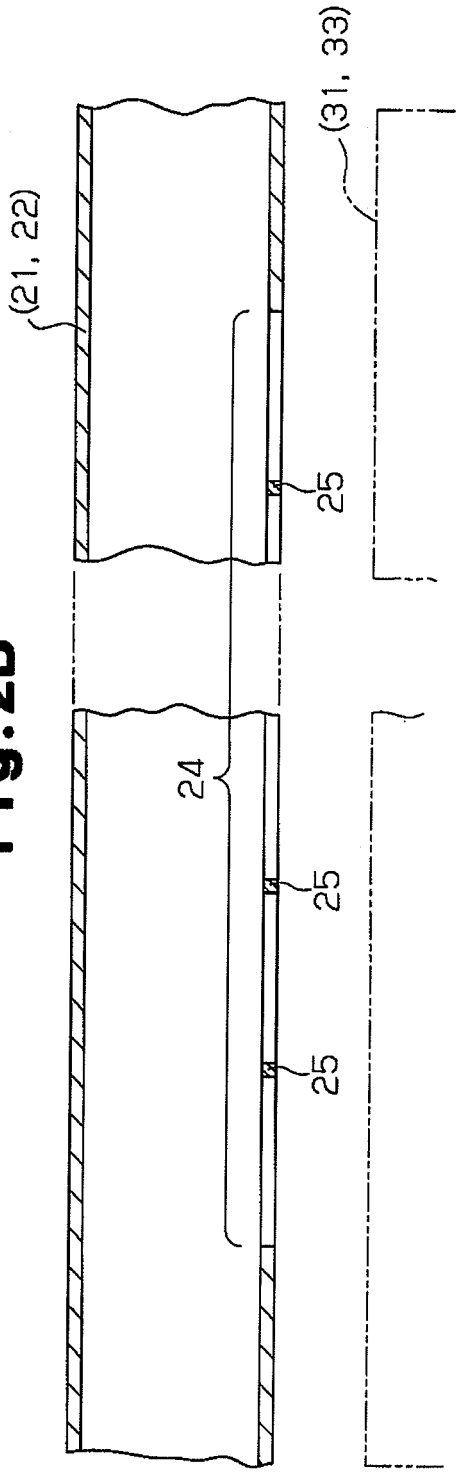
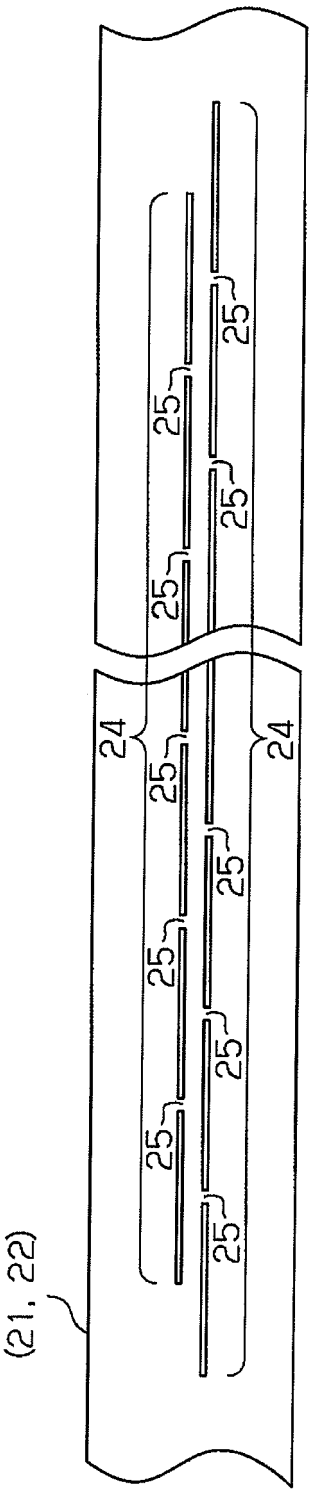


Fig.3



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EUROPEAN SEARCH REPORT

Application Number
EP 06 12 7057

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