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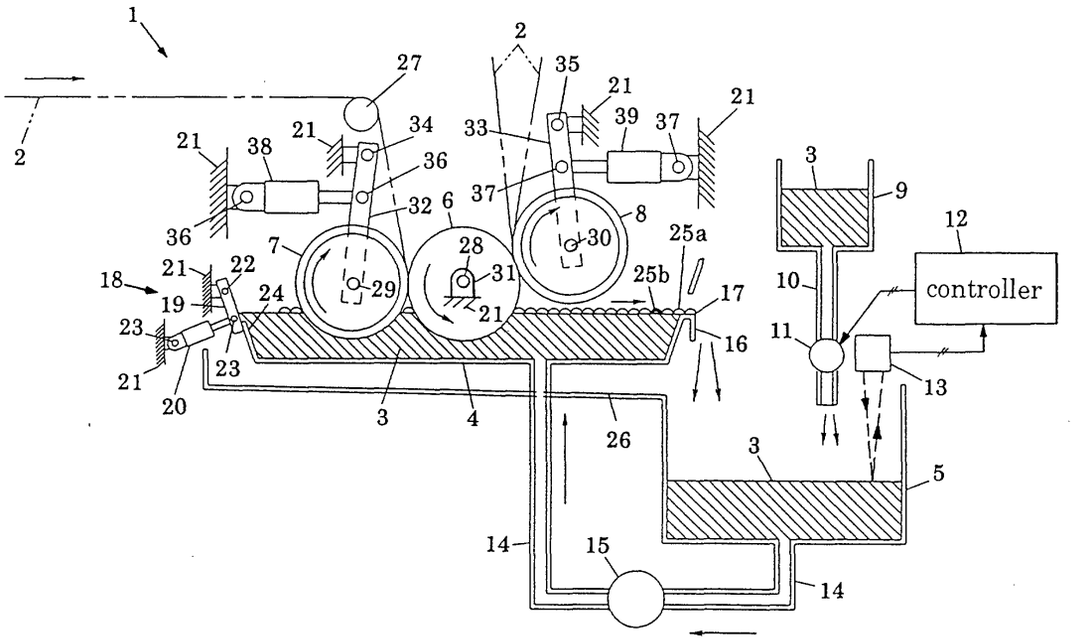
(54) Method of removing bubbles and floating matters from sizing tank included in slasher

(57) A slasher (1) has a sizing tank (4) provided with a movable weir (18). The level of the movable weir (18) is lowered temporarily below a predetermined level of a sizing solution (3) contained in the sizing tank (4) while the slasher (1) is in a steady-state operation to let scum including bubbles (25a) and floating matters (25b) floating on the surface of the sizing solution (3) overflow the movable weir (18) so that the scum is removed from the sizing tank (4) while the slasher (1) is in the steady-state operation.

FIG. 1



EP 1 302 583 A2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a method of removing bubbles and floating matters floating on the surface of a sizing solution contained in the sizing tank of a slasher.

Description of the Related Art

[0002] A slashing method disclosed in JP-A No. 116830/1994 changes the level of the surface of a sizing solution in the sizing tank of a slasher between a level for a steady-state operation and a level for a low-speed slashing operation by adjusting the height of a movable weir. The surface of the sizing solution is adjusted to a low level for the steady-state operation to suppress the formation of bubbles in the sizing solution owing to mixing air in the sizing solution by the stirring and scattering action of a sizing roller. However, even this known slashing method is unable to avoid the formation of bubbles on the surface of the sizing solution, the formation of a size film over the surface of the sizing solution due to the stagnation of the sizing solution, breakage of the size film into small masses of the condensed sizing solution, and the floating of the small masses on the surface of the sizing solution. Although the floating matters including those bubbles and the small masses of the condensed sizing solution overflow the weir of the sizing tank together with the sizing solution and move away from the surface of the sizing solution, the floating matters accumulate in the vicinity of the weir as time passes. The accumulated floating matters touch a warp of warp yarns on the slasher directly or are brought into contact with the warp by the sizing roller, and adhere to the warp to deteriorate the quality of the sized warp yarns.

[0003] Moisture evaporates from the bubbles and the floating matters as the bubbles and the floating matters drift on the surface of the sizing solution and, consequently, change gradually into masses of a high-viscosity gelled size. If the warp touches the floating matters floating on the surface of the sizing solution or the masses of the gelled size are applied to the warp by the sizing roller, the masses of the gelled size adhere to the warp, and the masses of the gelled size adhering to the warp spread when the warp is squeezed. Consequently, the warp is irregularly slashed, the adjacent warp yarns are bonded together after the warp has been dried to make it difficult for a dividing rod to separate the bonded warp yarns from each other. The floating matters adhered to the warp and dried fall off the warp in particles in the following processes, impedes the shedding of the warp on a loom, and reduces weaving efficiency.

SUMMARY OF THE INVENTION

[0004] Accordingly, it is an object of the present invention to prevent the adhesion of bubbles formed by stirring a sizing solution contained in a sizing tank with a rotating sizing roller, and floating matters of the condensed sizing solution formed due to the stagnation of the sizing solution in the sizing tank to a warp on a slasher, and to prevent the irregular slashing of the warp and the deterioration of the quality of sized warp yarns.

[0005] The present invention combines a movable weir with a sizing tank containing a sizing solution so that the height of the movable weir is adjustable, lowers level of the movable weir temporarily below a predetermined level of the sizing solution to remove scum including bubbles and masses of the condensed sizing solution floating on the surface of the sizing solution from the sizing tank. Thus, the scum including bubbles and masses of the condensed sizing solution floating on the surface of the sizing solution are removed to prevent those from adhering to the warp.

[0006] According to a first aspect of the present invention, a scum-removing method removes bubbles and floating matters floating on a sizing solution contained in a sizing tank included in a slasher, which supplies a sizing solution to the sizing tank, maintains the surface of the sizing solution in the sizing tank at a predetermined level for a steady-state operation, immerses at least a sizing roller partly in the sizing solution contained in the sizing tank, and applies the sizing solution to a warp of warp yarns by the sizing roller. The scum-removing method includes temporarily lowering a level of a movable weir combined with the sizing tank to a level lower than the predetermined level of the surface of the sizing solution while the slasher is in the steady-state operation to remove the bubbles and the floating matters from the surface of the sizing solution.

[0007] Since the level of the movable weir combined with the sizing tank is lowered temporarily, the bubbles and the floating matters floating on the surface of the sizing solution are able to overflow the movable weir together with the sizing solution and can be removed from the sizing tank. Thus, the direct adhesion of the bubbles and the floating matters to the warp, and application of the bubbles and the floating matters to the warp by the sizing roller can be prevented and the warp can be stably and uniformly slashed.

[0008] In the scum-removing method according to the present invention, the sizing tank is provided with plural weirs, at least one of them is movable, and the movable weir is operated to lower the level of the sizing solution contained in the sizing tank temporarily below the predetermined level for the steady-state operation to remove the bubbles and the floating matters floating on the surface of the sizing solution contained in the sizing tank from the sizing tank.

[0009] Bubbles and the floating matters formed in the vicinity of the plurality of weirs can be removed via the

nearby weirs. Since at least one of the weirs is a movable weir, the bubbles and the floating matters can be efficiently discharged via the movable weir, the bubbles and the floating matters are spread wide over the surface of the sizing solution contained in the sizing tank, the amount of the bubbles and the floating matters drifting around the rollers partly immersed in the sizing solution is reduced, so that the adhesion of the bubbles and the floating matters to the warp can be prevented.

[0010] In the scum-removing method according to the present invention a timer gives a timing signal indicating time for lowering the level of the movable weir to a controller, and the controller controls the movable weir according to the timing signal given thereto by the timer such that the movable weir performs a level-lowering cycle of lowering the level thereof for a predetermined time periodically while the slasher is in the steady-state operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The above and other objects, features and advantages of the present invention will become more apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a typical side elevation of a slasher in a state where a movable weir is set at a normal position for a steady-state operation ;

Fig. 2 is a typical side elevation of the slasher in a state where the movable weir is set at a floating matter removing position for removing floating matters;

Fig. 3 is a block diagram of a controller included in the slasher shown in Fig. 1;

Fig. 4 is a fragmentary typical side elevation of a sizing tank included in a slasher and provided with another movable weir in a state where the movable weir is set at a normal position for a steady-state operation ; and

Fig. 5 is a typical side elevation, similar to Fig. 4, showing the movable weir shown in Fig. 4 in a state where the movable weir is set at a floating matter removing position for removing floating matters.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] Referring to Figs. 1 and 2 showing a slasher 1 that carries out a method of removing bubbles and floating matters from sizing solution in a preferred embodiment according to the present invention, the slasher 1 has a sizing tank 4 containing a size solution 3 to be applied to a warp 2 of warp yarns, a sizing solution supply tank 5 for supplying the sizing solution of a predetermined composition to the sizing tank 4, a sizing roller 6, a first squeeze roller 7 and a second squeezing roller 8. The sizing solution 3 contained in a reserve tank 9 is supplied through a supply pipe 10 when a solenoid valve 11 placed in the supply pipe 10 is opened. The solenoid valve 11 is controlled for opening and closing by a controller 12. The controller 12 measures the level of the surface of the sizing solution 3 contained in the sizing solution supply tank 5 by, for example, an ultrasonic level finder 13. The controller 12 closes the solenoid valve 11 to stop supplying the sizing solution to the sizing solution supply tank 5 upon the rise of the level of the surface of the liquid solution 3 to an upper limit level, and opens the solenoid valve 11 to start supplying the sizing solution to the sizing solution supply tank 5 upon the fall of the level of the surface of the liquid solution 3 to a lower limit level. The ultrasonic level finder 13 emits an ultrasonic signal toward the surface of the sizing solution 3 contained in the sizing solution supply tank 5, measures the time interval between the emission of the ultrasonic signal and the return of its echo from the surface of the sizing solution to determine the level of the surface of the sizing solution 3. The sizing solution 3 contained in the sizing solution supply tank 5 is supplied continuously through a circulation pipe 14 having one end connected to the bottom of the sizing tank 4 and the other end connected to the sizing solution supply tank 5 by a circulation pump 15 placed in the circulation pipe 14.

[0013] The surface of the sizing solution 3 contained in the sizing tank 4 is adjusted to a predetermined level by a fixed weir 16 having an upper edge 17 and disposed on the front end wall of the sizing tank 4. As shown in Fig. 1, the sizing solution 3 overflows the fixed weir 16 and returns into the sizing solution supply tank 5, so that the surface of the sizing solution 3 in the sizing tank 4 is maintained at the predetermined level. The sizing tank 4 is provided, in addition to the fixed weir 16, a movable weir 18 to carry out the method of removing bubbles and floating matters according to the present invention. The movable weir 18 includes a movable plate 19 contiguous with the back end wall of the sizing tank 4, and a cylinder actuator 20 for driving the movable plate 19 for movement toward and away from the back end wall of the sizing tank 4. An upper end part of the movable plate 19 is supported pivotally on a frame 21 by a pivot shaft 22. The cylinder actuator 20 has opposite ends pivotally connected to a lower end part of the movable plate 19 and the frame 21 with two connecting pins 23, respectively. Normally, the movable plate 19 is pressed against the back end wall of the sizing tank 4. In this state, the upper edge of the movable plate 19 is at a level higher than that of the upper edge 24 of the back end wall of the sizing tank 4. When necessary, the movable plate 19 is separated from the back end wall of the sizing tank 4 by the cylinder actuator 20 as shown in Fig. 2 to permit the sizing solution 3 to flow over the upper edge 24 of the back end wall of the sizing tank 4 together with bubbles 25a and floating matters 25b, such as films of the condensed sizing solution 3, floating on the surface of the sizing solution 3 contained in the sizing tank 4. The bubbles 25a and the floating matters 25b discharged from the sizing tank 4 return through a recovery passage

26 into the sizing solution supply tank 5. The upper edge of the movable plate 19 is at a level higher than that of the upper edge 17 of the fixed weir 16, and the upper edge 24 of the back end wall of the sizing tank 4 is at a level lower than that of the upper edge 17 of the fixed weir 16.

[0014] The sizing roller 6 is partly immersed in the sizing solution 3 contained in the sizing tank 4. The warp 2 guided by a guide roller 27 is wound around the sizing roller 6 to immerse the warp 2 in the sizing solution 3 to that the warp 2 is soaked with the sizing solution 3. The first squeeze roller 7 is disposed on the warp-receiving side of the sizing roller 6 to press the warp 2 against the sizing roller 6. The second squeeze roller 8 is disposed on the warp-delivering side of the sizing roller 6 to squeeze the warp 2 soaked with the sizing solution 3 so that the surplus sizing solution 3 is removed from the warp 2 and the warp 2 is impregnated satisfactorily with the sizing solution 3.

[0015] The sizing roller 6 has a shaft 28 supported by bearings 31 at a fixed position on the frame 21. The sizing roller 6 is driven for rotation in the direction of the arrow. The first squeeze roller 7 and the second squeeze roller 8 have shafts 29 and 30 supported by levers 32 and 33, respectively. The levers 32 and 33 are supported for swinging by shafts 34 and 35, respectively, on the frame 21. A first cylinder actuator 38 has opposite ends pivotally joined to the frame 21 and the lever 32 with pins 36, respectively. The levers 32 and 33 are supported for swinging by shafts 34 and 35, respectively, on the frame 21. A second cylinder actuator 39 has opposite ends pivotally joined to the frame 21 and the lever 33 with pins 37, respectively. Pressures to be applied to the sizing roller 6 by the first squeeze roller 7 and the second squeeze roller 8 are adjustable by the cylinder actuators 38 and 39, respectively. The first squeeze roller 7, similarly to the sizing roller 6, is immersed partly in the sizing solution 3. The surfaces of the first squeeze roller 7 and the second squeeze roller 7 are coated with rubber layers, respectively, to apply pressure uniformly to the entire width of the warp 2 for squeezing so that the warp 2 is sized uniformly.

[0016] Fig. 3 shows circulating passages for circulating the sizing solution 3, and a controller 12 for controlling the solenoid valve 11, and the movable plate 19 of the movable weir 18. While the slasher 1 is in the steady-state operation, the controller 12 measures the level of the surface of the sizing solution 3 in the sizing solution supply tank 5 by the level finder 13. Upon the detection of the fall of the surface of the sizing solution 3 to the lower limit level by the level finder 13, the solenoid valve 11 is opened to replenish the sizing solution supply tank 5 with the sizing solution 3 contained in the reserve tank 9. Upon the rise of the surface of the sizing solution 3 in the sizing solution supply tank 5 to the upper limit level, the level finder 13 sends a signal indicating the rise of the surface of the sizing solution 3 in the sizing solution supply tank 5 to the upper limit level to the controller 12. Then, the controller 12 closes the solenoid valve 11 to stop supplying the sizing solution 3 from the reserve tank 9 to the sizing solution supply tank 5. The pump 15 pumps the sizing solution 3 contained in the sizing solution supply tank 5 into the sizing tank 4. While the movable plate 19 of the movable weir 18 is held contiguously with the back end wall having the upper edge 24, the sizing solution 3 overflows the fixed weir 16 having the upper edge 17, and the overflowed sizing solution 3 returns to the sizing solution supply tank 5. Thus, the surface of the sizing solution 3 in the sizing solution supply tank 5 is maintained at the predetermined level corresponding to the level of the upper edge 17.

[0017] While the slasher 1 is in the steady-state operation, at least the sizing roller 6 is immersed partly in the sizing solution 3 and is rotated. The warp 2 is sized by bringing the same into contact with the sizing roller 6 coated with the sizing solution 3 or by winding the same around the sizing roller 6 and immersing the same in the sizing solution 3.

[0018] While the sizing solution 3 is stirred and scattered repeatedly by the rotating sizing roller 6 partly immersed in the sizing solution 3, the first squeeze roller 7 and the second squeeze roller 8 during a slashing process, air is mixed in the sizing solution 3 to form the bubbles 25a, and the bubbles 25a floats on the surface of the sizing solution 3. Water evaporation from the sizing solution 3 staying in the vicinity of the side and end walls of the sizing tank 4 forms a film of the condensed sizing solution 3 over the surface of the sizing solution 3. The film of the condensed sizing solution 3 is broken into floating matters 25b of the condensed sizing solution 3 by the stirring action of the sizing roller 6 and the first squeeze roller 7. The floating matters 25b floats on the sizing solution 3. Although part of the bubbles 25a and the floating matters 25b overflows the fixed weir 16 of the sizing tank 4 together with the sizing solution 3, the amount of the bubbles 25a and the floating matters 25b increases gradually with time, the bubbles 25a and the floating matters 25b gather in the vicinity of the fixed weir 16, and a collection of the gathered bubbles 25a and the floating matters 25b extends near to the sizing roller 6. The controller 12 operates the movable weir 18 at predetermined intervals while the slasher 1 is in steady-state operation. Upon the reception of a level-lowering signal from a timer 40, the controller 12 drives the cylinder actuator 20 to separate the movable plate 19 from the back end wall of the sizing tank 4 as shown in Fig. 2 to lower the surface of the sizing solution 3 temporarily to a level corresponding to the upper edge 24 of the back end wall of the sizing tank 4 lower than the predetermined level. Consequently, the sizing solution 3 flows toward the back end wall of the sizing tank 4 and the bubbles 25a and the floating matters 25b spread over the surface of the sizing solution 3. Then, the bubbles 25a and the floating matters 25b floating in the vicinity of the fixed weir 16, in addition to those floating in the vicinity of the movable weir 18 overflow movable

weir 18 together with the sizing solution 3.

[0019] A large amount of the bubbles 25a and the floating matters 25b overflows the lowered movable weir 18, i.e., the back end wall having the edge 24 of the sizing tank 4, together with the sizing solution 3 and is removed from the sizing tank 4. Thus, the direct adhesion of the bubbles 25a and the floating matters 25b formed by air mixed in the sizing solution 3 and fragments of the film of the condensed sizing solution 3 formed due to the evaporation of water from the sizing solution 3 to the warp 2, and application of the bubbles 25a and the floating matters 25b to the warp 2 by the sizing roller 6 can be prevented and the warp 2 can be stably and uniformly slashed.

[0020] A predetermined time after the separation of the movable plate 19 from the sizing tank 4, the timer 40 gives a level-raising signal to the controller 12. Then, the controller 12 drives the cylinder actuator 20 to join the movable plate 19 to the back end wall of the sizing tank 4 to raise the surface of the sizing solution 3 to the level corresponding to that of the fixed weir 16, and then the sizing solution 3 starts overflowing the fixed weir 16 and the surface of the sizing solution 3 is maintained at the predetermined level. Then, the sizing solution 3 flows toward the fixed weir 16 and the bubbles 25a and the floating matters 25b spread wide over the surface of the sizing solution 3. The time of duration of the low level, the time of duration of the high level, and the number of changing times by the hour are dependent on the condition of the sizing solution 3, the rate of formation of the bubbles 25a and the floating matters 25b, and time necessary for removing the bubbles 25a and the floating matters 25b. For example, the time of duration of the high level is determined so that the bubbles 25a and the floating matters 25b started gathering in the vicinity of the fixed weir 16 do not spread near to the sizing roller 6 in this time. The time of duration of low level is determined so that the surface of the sizing solution 3 is able to fall to a level corresponding that of the upper edge 24 of the back end wall of the sizing tank 4 and the bubbles 25a and the floating matters 25b can be properly removed from the sizing tank 4 in this time.

[0021] As mentioned above, the sizing tank 4 is provided with a plurality of weirs and at least one of those weirs is the movable weir 18. While the slasher 1 is in steady-state operation, the sizing solution 3 flows together with the bubbles 25a and the floating matters 25b alternately toward the fixed weir 16 and toward the movable weir 18, and the sizing solution 3 overflows the sizing tank 4 together with the bubbles 25a and the floating matters 25b gathered in the vicinity of the weirs. Thus, the bubbles 25a and the floating matters 25b are discharged over the nearby weir, namely, the fixed weir 16 or the movable weir 18, and the flowing direction of the sizing solution 3 changes. Therefore, the bubbles 25a and the floating mattes 25b spread wide over the surface of the sizing solution 3 in the sizing tank 4, and are discharged together with a large amount of the sizing solution 3 from the movable weir 18. Therefore, the bubbles 25a and the floating matters 25b do not drift around the sizing roller 6 and the amount of the bubbles 25a and the floating matters 25b that adhere to the warp 2 is less than that of those that adhere to a warp on a conventional slasher.

[0022] Figs. 4 and 5 show another movable weir 18 including a movable plate 19 having a lower part pivotally connected by a pin 22 to a bracket attached to the outer surface of the back end wall of a sizing tank 4, and a cylinder actuator 20 having opposite ends pivotally connected to a frame 21 and an upper part of the movable plate 19 by pins 23, respectively. The level of the upper edge 24 of the weir 18, namely, the upper edge of the movable plate 19, can be adjusted by adjusting the overall length of the cylinder actuator 20. When the operating rod of the cylinder actuator 20 is projected to set the movable weir 18 at a normal position for a steady-state operation as shown in Fig. 4, the movable plate 19 is pressed against the back end wall of the sizing tank 4, and the level of the upper edge 24 of the movable plate 19 is higher than that of the upper edge 17 of a fixed weir 16. When the operating rod of the cylinder actuator 20 is retracted to set the movable weir 18 at a floating matter removing position for removing bubbles 25a and floating matters 25b from the sizing tank 4 as shown in Fig. 5, the movable plate 19 is separated from the back end wall of the sizing tank 4, and the level of the upper edge 24 of the movable plate 19 is lower than that of the upper edge 17 of the fixed weir 16, so that the bubbles 25a and the floating matters 25b overflow the movable weir 18 together with the sizing solution 3. Although the level of the surface of the sizing solution 3 lowers slightly and the size pickup of the warp decreases slightly while the movable weir 18 is set at the floating matter removing position, the level of the upper edge 24 of the movable weir 18 is raised as high as possible to reduce the effect of the fall of the surface of the sizing solution 3 on the size pickup.

[0023] The sizing tank 4 may be provided with only the movable weir 18. When the sizing tank 4 is provided with only the movable weir 18, the level of the upper edge 24 of the movable weir 18 (the movable plate 19) set at the normal position corresponds to that of the edge 17 of the fixed edge 16 shown in Figs. 1 to maintain the surface of the sizing solution 3 at the predetermined level. When the movable weir 18 is set at the floating matter removing position, the edge 24 of the movable plate 19 is set at a level lower than the predetermined level of the surface of the sizing solution 3 to permit the bubbles 25a and the floating matters 25b to overflow the movable weir 18.

[0024] Although the invention has been described in its preferred embodiments with a certain degree of particularity, obviously many changes and variations are possible therein. It is therefore to be understood that the present invention may be practiced otherwise than as specifically described herein without departing from the

scope and spirit thereof.

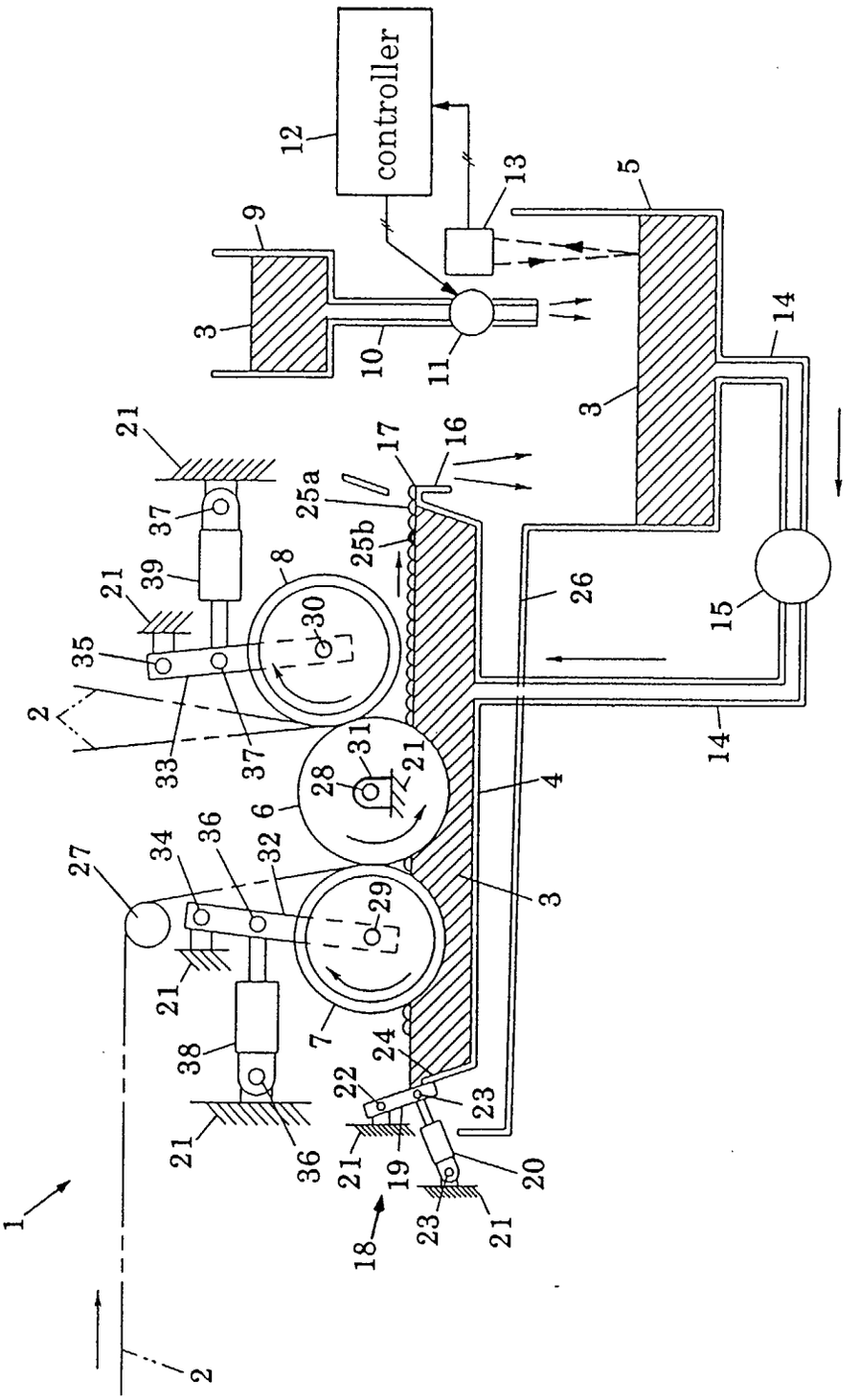
Claims

1. A scum-removing method of removing bubbles (25a) and floating matters (25b) floating on a sizing solution (3) contained in a sizing tank (4) included in a slasher (1), which supplies a sizing solution (3) to the sizing tank (4), maintains the surface of the sizing solution (3) in the sizing tank (4) at a predetermined level for a steady-state operation, immerses at least a sizing roller (6) partly in the sizing solution (3) contained in the sizing tank (4), and applies the sizing solution (3) to a warp (2) of warp yarns by the sizing roller (6), said scum-removing method comprising temporarily lowering a level of a movable weir (18) combined with the sizing tank (4) to a level lower than the predetermined level of the surface of the sizing solution (3) while the slasher (1) is in the steady-state operation to remove the bubbles (25a) and the floating matters (25b) from the surface of the sizing solution (3).

2. The scum-removing method according to claim 1, wherein the sizing tank (4) is provided with plural weirs (16) (18), at least one of them is movable, and the movable weir (18) is operated to lower the level of the sizing solution (3) contained in the sizing tank (4) temporarily below the predetermined level for the steady-state operation to remove the bubbles (25a) and the floating matters (25b) floating on the surface of the sizing solution (3) contained in the sizing tank (4) from the sizing tank (4).

3. The scum-removing method according to claim 1 or 2, wherein a timer (40) gives a timing signal indicating time for lowering the level of the movable weir (18) to a controller (12), and the controller (12) controls the movable weir (18) according to the timing signal given thereto by the timer (40) such that the movable weir (18) performs a level-lowering cycle of lowering the level thereof for a predetermined time periodically while the slasher (1) is in the steady-state operation.

FIG. 1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9
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11
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25b
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2
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FIG. 2

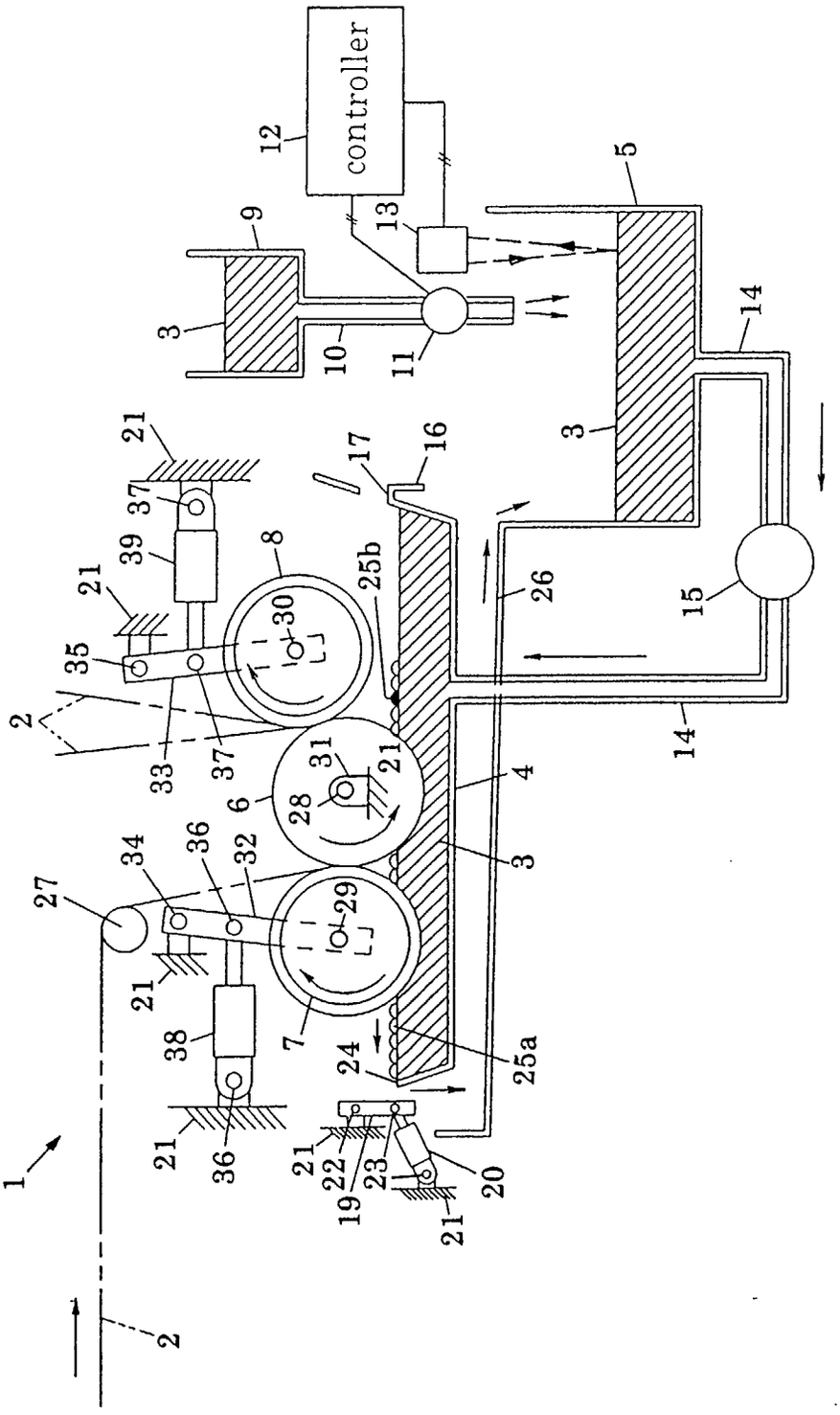
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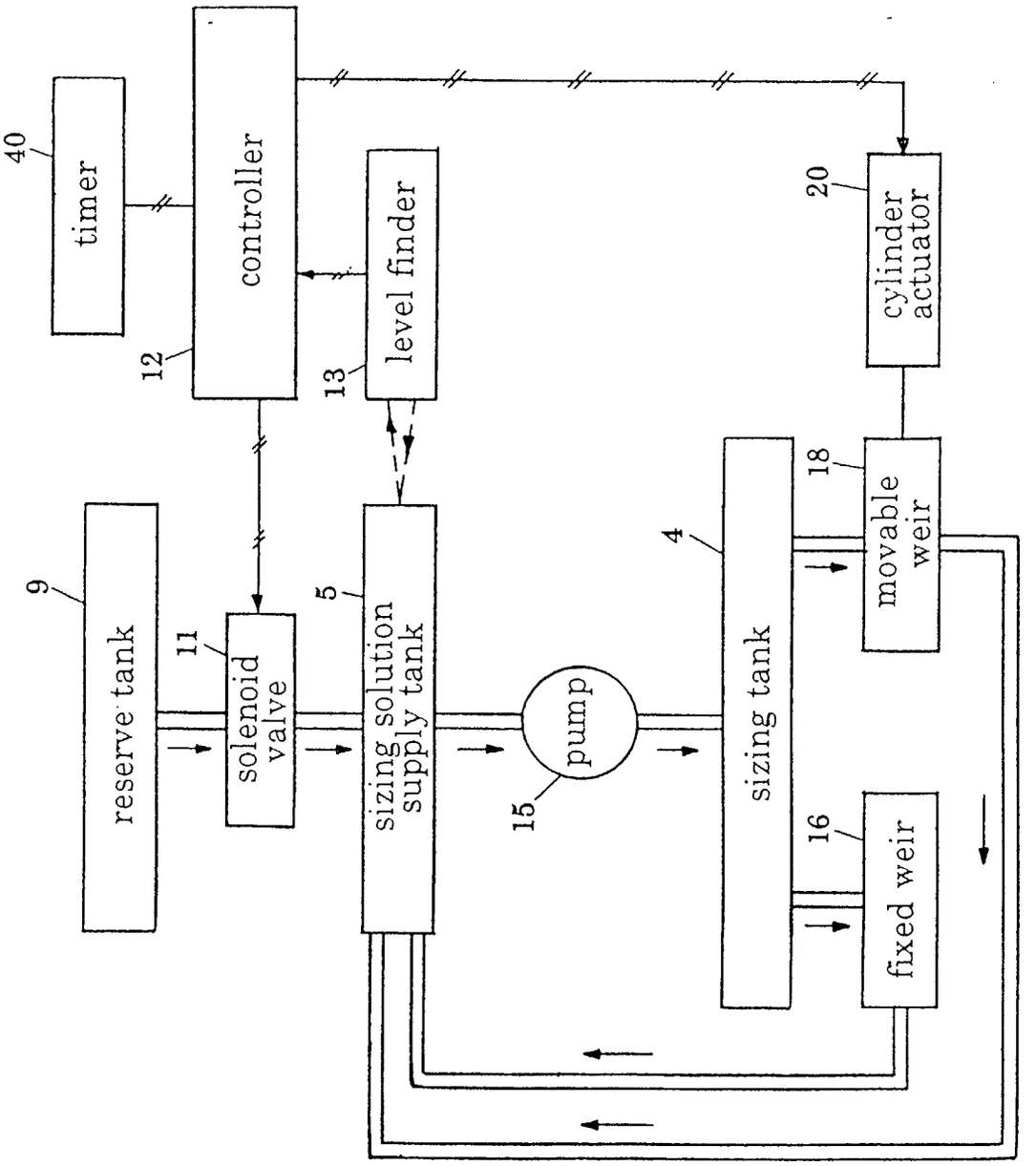
FIG. 3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sizing tank
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movable weir
18
fixed weir
16

FIG. 4

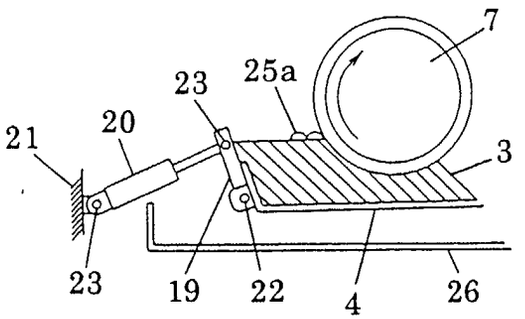

FIG. 5