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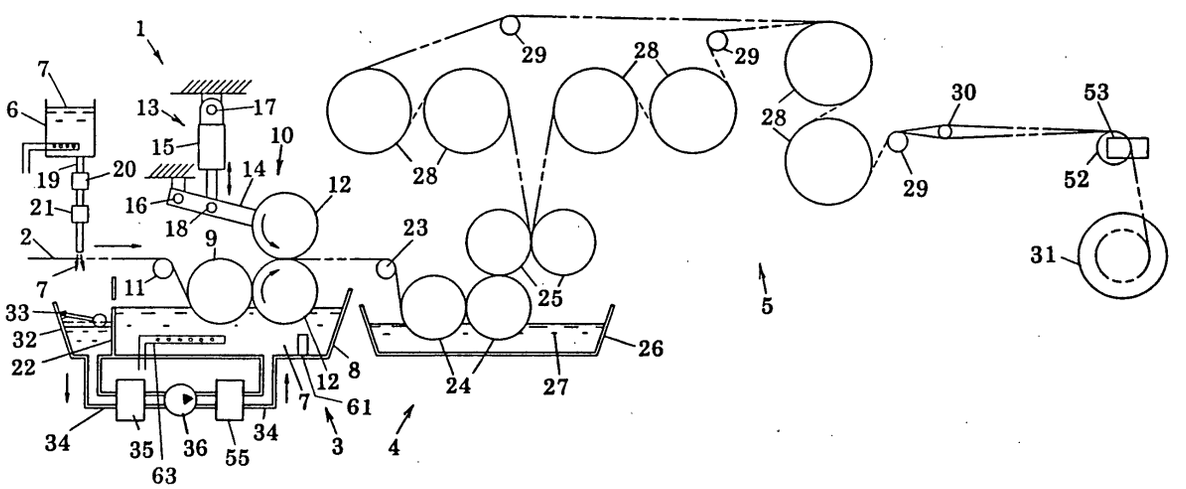
(54) Slasher

(57) A slasher (1) includes a water tank (8) containing hot water (7), a heating unit (55) provided with a heat exchanger (56) as a heat-transfer means. Heat of high-temperature steam flowing through the heat exchanger (56) is transferred through the heat exchanger (56) to the hot water (7). High-temperature steam does not liquefy in the hot water (7) and hence the quantity of the hot water (7) is not changed by the high-temperature steam. Hot water (7) moistens fibers forming warp yarns (2) satisfactorily to enhance the effect of sizing the warp yarns (2). The quantity of hot water (7) consumed by moistening the warp yarns (2) and the moisture percentage of the moistened warp yarns (2) are determined by calculation using a change in the level of the hot water (7) in the water tank (32) and the quantity of hot water (7) supplied into the water tank (32) during each water consumption measuring cycle.

FIG.1



EP 1 239 069 A2

Description

[0001] The present invention relates to a slasher provided with a moisture measuring means for measuring the moisture percentage of warp yarns in a moistening process for moistening the warp yarns by a moistening device prior to sizing, and a moisture control means for maintaining the moisture content of the warp yarns at a desired moisture percentage.

[0002] A slasher is provided with a moistening device for moistening warp yarns by immersing the warp yarns in water contained in a water tank prior to sizing the warp yarns . Water moistening the warp yarns is readily replaced and mixed with a size. Therefore moistening the warp yarns prior to sizing increases the effect of sizing following moistening and hence the necessary amount of the size can be reduced. The moistening device immerses the warp yarns in water contained in a water tank and squeezes the warp yarns with squeeze rollers . When the warp yarns are thus squeezed with the squeeze rollers, the warp yarns are moistened uniformly and excessive water is removed and returned to the water tank. The quantity of water carried away by the warp yarns can be determined by measuring the quantity of water remaining in the water tank. Thus the moisture percentage of the warp yarns can be correctly and easily determined from the quantity of water carried away by the warp and the quantity of the warp yarns processed by the slasher. The size percentage of the warp yarns can be maintained substantially at a fixed level by controlling the moisture percentage of the warp yarns on the basis of the measured moisture percentage.

[0003] The water contained in the water tank is heated efficiently by blowing steam into the water at a temperature of 60°C or above, generally, at a temperature in the range of about 80°C to about 90°C, to wet the warp yarns with hot water. Hot water seeps between fibers forming the warp yarns sufficiently and improves sizing effect. However, since part of the steam blown into the water contained in the water tank liquefies in the water contained in the water tank, the quantity of water carried away by the warp yarns cannot be correctly measured.

[0004] Accordingly, it is an object of the present invention to provide a slasher that sizes warp yarns after moistening the same, capable of moistening the warp yarns with hot water so that hot water permeates the warp yarns satisfactorily, of accurately measuring the moisture percentage of the warp yarns prior to sizing and of accurately controlling the moisture percentage of the warp yarns.

[0005] The present invention disposes a heating unit so as to be in contact with water contained in a water tank, heats the water contained in the water tank with a heat-transfer means at a predetermined temperature without affecting the quantity of the water contained in the water tank, wets the warp yarns with the hot water such that the hot water seeps between fibers forming the warp yarns to enhance sizing effect, determines the moisture percentage of the warp yarns by determining the quantity of water absorbed by the warp yarns on the basis of the quantity of water remaining in the water tank, and controls the moisture percentage of the warp yarns.

[0006] According to a first aspect of the present invention, a slasher provided with a moistening unit that moistens warp yarns by wetting the warp yarns with water contained in a water tank, a squeeze unit that squeezes the moistened warp yarns to moisten the warp yarns properly and returns superfluous water squeezed off the warp yarns to the water tank, a water supply unit having a water source and a water supply line through which water is supplied from the water source to the water tank, and a sizing unit that sizes the moistened warp yarns comprises: a heating unit including a heat-transfer means between a heating medium and moistening water for transferring heat from a heating medium to moistening water contained in the water tank to heat the moistening water at a predetermined temperature; a water consumption measuring means for measuring quantity of water consumed by the moistening unit; a yarn length measuring means for measuring length of the warp yarns processed by the moistening unit; and a moisture percentage calculating device for calculating moisture percentage of the warp yarns moistened by a moistening process by the moistening unit on the basis of the quantity of consumed water, and the quantity of processed warp yarns; wherein the water consumption measuring means and the yarn length measuring means operate synchronously for measurement

[0007] Preferably, the moistening water tank is provided with a high-temperature steam blowing device to heat water contained in the water tank, and the operation of the high-temperature steam blowing device for blowing high-temperature steam is stopped before the start of measurement of the quantity of consumed water.

[0008] Preferably, the slasher further comprises a pressure controller capable of controlling squeeze pressure used by the squeeze unit on the basis of calculated moisture percentage to adjust the moisture percentage of the warp yarns to a desired moisture percentage, and the water consumption measuring means and the through put measuring means operate synchronously for measurement.

[0009] Preferably, the water consumption measuring means includes a level sensor for measuring the level of water contained in the water tank, and the quantity of consumed water is determined through the measurement of the level of water contained in the water tank.

[0010] Preferably, the water consumption measuring means includes a flowmeter placed in the water supply line, and a level sensor, and the quantity of consumed water is determined on the basis of the quantity of water supplied into the water tank, and the level of water contained in the water tank.

[0011] Preferably, the slasher further comprises a level controller including a level sensor combined with the water

tank, and a flow control valve placed in the water supply line, the level of water contained in the water tank is measured, and the flow of water supplied to the water tank is controlled on the basis of the level of water contained in the water tank to keep the level of water contained in water tank fixed.

[0012] 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 schematic side elevation of a slasher in a preferred embodiment according to the present invention;
Fig. 2 is a block diagram of a level controller and a heating unit;
Fig. 3 is a block diagram of a moisture percentage measuring device and a moisture percentage controller; and
Fig. 4 is a block diagram of a moisture percentage measuring device in a modification.

[0013] Referring to Fig. 1 showing a slasher 1 in a preferred embodiment according to the present invention, the slasher 1 includes a moistening unit 3, a sizing unit 4 and a drying unit 5. The moistening unit 3 has a moistening water tank 8 containing hot water for moistening warp yarns 2. A high-temperature steam blowing device 63 connected to a high-temperature source is disposed in the moistening water tank 8. High-temperature steam blowing device 63 blows high-temperature steam directly into water contained in the moistening water tank 8 to heat the water before the slasher 1 starts a sizing operation. Thus, part of the high-temperature steam changes into high-temperature water in the water contained in the moistening water tank 8 to heat the water efficiently. The high-temperature steam blowing device 63 may continue to blow high-temperature steam into the water after the slasher 1 has started the sizing operation. The high-temperature steam blowing device stops blowing high-temperature steam before the start of measurement for measuring the quantity of consumed water. High-temperature steam may be blown into the water while the measurement of the quantity of consumed water is interrupted and is stopped before the measurement of the quantity of consumed water is resumed. Thus, it is possible to avoid the inaccurate measurement of the quantity of consumed water due to the addition of high-temperature steam to the water contained in the moistening water tank 8 during the measurement of the quantity of consumed water.

[0014] The moistening unit 3 immerses warp yarns 2 in hot water 7 heated at 60°C or above, preferably, at a temperature in the range of about 80°C to about 90°C, to moisten the warp yarns 2. The moistening unit 3 includes moistening roller 9 partly immersed in the hot water 7 contained in the moistening water tank 8 to moisten the warp yarns 2, and a squeeze unit 10 for squeezing superfluous water off the warp yarns 2 immersed in the hot water 7. The warp yarns 2 are guided by a guide roller 11 so as to wind around the moistening roller 9, are immersed in the hot water 7 in the moistening water tank 8, and are squeezed by the squeeze unit 10. The hot water 7 to be supplied into a level-measuring tank 32 is produced by blowing high-temperature steam into cold water contained in a water supply tank 6 or by heating with an electric heater. The hot water 7 is supplied from the water supply tank 6 through a water supply line 19 provided with a flowmeter 20 and a flow control valve 21 into the level-measuring tank 32. The flow control valve 21 is operated to control the supply of the hot water 7. The quantity of the hot water 7 supplied into the level-measuring tank 32 is measured by the flowmeter 20 serving as a water consumption measuring means . The flow control valve 21 is a solenoid valve or an electric flow regulating valve. The flow of the hot water is regulated by opening and closing the solenoid valve or regulating the opening of the electric flow regulating valve.

[0015] The hot water 7 contained in the moistening water tank 8 overflows an overflow weir 22 into the level-measuring tank 32. The highest level of the hot water 7 in the moistening water tank 8 is limited by the overflow weir 22. The level of the hot water 7 in the level-measuring tank 32 is measured by a level sensor 33 serving as a water consumption measuring means. The hot water 7 contained in the level-measuring tank 32 is returned through a return line 34, a filter 35, a pump 36 and a heating unit 55 into the moistening water tank 8. Thus the level of the hot water in the moistening water tank 8 is maintained constant by making the hot water 7 overflow the overflow weir 22 and returning the hot water 7 from the level-measuring tank 32 into the moistening water tank 8, regardless of the quantity of the hot water 7 supplied from the water supply tank 6 and the consumption of the hot water 7 by a moistening process. The heating unit 55 heats the hot water 7 at a proper heating rate to keep the hot water 7 at a desired temperature in the range of about 80°C to about 90°C.

[0016] The squeeze unit 10 has a pair of squeeze rollers 12, and a squeeze pressure adjusting device 13. The lower one of the pair of squeeze rollers 12 is partly immersed in the hot water 7 heated at a temperature in the range of about 80°C to about 90°C contained in the moistening water tank 8 . The upper one of the pair of squeeze rollers 12 is pressed against the lower squeeze roller 12 by a predetermined squeezing pressure to squeeze superfluous water off the warp yarns 2. The hot water 7 wetting the warp yarns 2 seeps between fibers forming the warp yarns 2. Thus the moistening unit 3 carries out a moistening process to moisten the warp yarns 2.

[0017] The moisture percentage of the warp yarns 2 is small when the squeeze pressure applied to the warp yarns 2 by the pair of squeeze rollers 12 is high, and is large when the squeeze pressure applied to the warp yarns 2 is low. Most part of the superfluous water wetting the warp yarns 2 is removed by the agency of the pair of squeeze rollers 12 and the squeeze pressure adjusting device 13. The squeeze pressure adjusting device 13 includes a lever 14 having

one end supported on a fixed part of the slasher 1, such as a frame, by a support shaft 16 and the other end supporting the upper squeeze roller 12, and a hydraulic cylinder actuator 15 having one end supported on a fixed part of the slasher 1, such as the frame, by a support shaft 17 and the other end pivotally joined to a middle part of the lever 14 by a pin 18.

[0018] After adjusting the moisture percentage of the warp yarns 2 by the squeeze process carried out by the squeeze unit 10, the warp yarns 2 is guided by a guide roller 23 into the sizing unit 4, which may be a generally known one. The sizing unit 4 includes a pair of sizing rollers 24 for sizing the warp yarns 2, and a pair of squeeze rollers 25. The pair of sizing rollers 24 are partly immersed in a size 27 contained in a sizing tank 26 and exert pressure to the warp yarns 2 passing between them to size the warp yarns 2. The water moistening the warp yarns 2 is replaced and mixed with the size 27 and, consequently, the size 27 permeates the warp yarns 2 deep. The pair of squeeze rollers 25 exert pressure to the sized warp yarns 2 passing between them to squeeze the superfluous size 27 off the sized warp yarns 2.

[0019] Subsequently, the warp yarns 2 is delivered to the drying unit 5. The drying unit 5 includes a plurality of heating cylinders 28 and a plurality of guide rollers 29 and dries the sized warp yarns 2. The sized warp yarns 2 are brought into contact with the surfaces of the heating cylinders 28 for drying. The sized and dried warp yarns 2 are delivered through the guide rollers 29 and a dividing rod 30 to a slasher beam 31 and are wrapped on the slasher beam 30.

[0020] Fig. 2 shows the moistening water tank 8, a level controller 37 for controlling the level of water contained in the level-measuring tank 32, and the heating unit 55 for heating the hot water 7. The level of the hot water 7 in the level-measuring tank 32 drops as the hot water 7 is consumed by the moistening operation of the moistening unit 3. Upon the detection of the drop of the level of the hot water 7 in the level-measuring tank 32 to a lower limit level, the level sensor 33 gives a signal indicating the drop of the level of the hot water 7 to the lower limit level to a water-supply controller 38. Then, the water-supply controller 38 gives a water-supply signal, i.e., a signal requesting the supply of hot water or requesting the increase of hot water supply rate, to the control valve 21 to open the control valve 21 or to increase the opening of the control valve 21. Consequently, the level-measuring tank 32 is replenished with the hot water 7 supplied from the water supply tank 6 through the water supply line 19.

[0021] The hot water 7 contained in the level-measuring tank 32 is pumped through the return pipe 34 into the moistening water tank 8 by the pump 36 so that the hot water 7 overflows the overflow weir 22 into the level-measuring tank 32 to keep the level of the hot water 7 in the moistening water tank 8 fixed. Although the flow rate of the hot water 7 squeezed off the warp yarns 2 by the squeeze unit 10 and flowing back into the moistening water tank 8 varies slightly according to squeeze pressure, the flow rate is substantially constant. Increase in the quantity of water in the moistening unit 3 is that of water in the moistening water tank 8 and the level-measuring tank 32. Since the quantity of the hot water contained in the moistening water tank 8 is thus kept constant, increase in the quantity of water in the moistening unit 3 is that of water in the level-measuring tank 32, causing the level of the hot water 7 contained in the level-measuring tank 32 to rise.

[0022] Upon the detection of the rise of the level of the hot water 7 contained in the level-measuring tank 32 to an upper limit level, the level sensor 33 gives a signal indicating the rise of the level of the hot water 7 to the upper limit level to the water-supply controller 38. Then, the water-supply controller 38 gives a water-supply stop signal, i.e., a signal requesting stopping the supply of hot water or requesting the reduction of hot water supply rate, to the control valve 21 to close the control valve 21 or to reduce the opening of the control valve 21. Consequently, supply of the hot water 7 into the level-measuring tank 32 is stopped or the flow rate of the hot water 7 flowing into the level-measuring tank 32 is reduced.

[0023] The heating unit 55 includes a heat exchanger 56 serving as a heat-transfer means. The heat exchanger 56 is provided with heat transfer-tubes 59 and is placed in the return line 34. Heating steam 57, i.e., heating medium, is passed through the heat-transfer tubes 59. The heat of the heating steam 57 is transferred through the heat-transfer tubes 59 to the moistening water 7 to heat the hot water 7 at a predetermined temperature in the range of about 80°C to about 90°C. The heating steam 57 is supplied from a high-temperature steam source 58 through a solenoid valve 60 into the heat-transfer tubes 59 of the heat exchanger 56. The temperature of the hot water 7 contained in the moistening water tank 8 is measured by a temperature gauge 61. A temperature controller 62 controls the solenoid valve 60 to keep the hot water 7 at the desired temperature in the range of about 80°C to about 90°C. The heat for heating the moistening water 7 may be provided by an electric heater or any suitable heating medium instead of by the high-temperature steam. The heat-transfer means may be an electric heater.

[0024] The hot water 7 is thus heated by the heat exchanger 56 at a temperature not lower than 60°C. The hot water 7 is able to seep between fibers forming the warp yarns deep in the moistening process. The hot water 7 thus moistening the warp yarns 2 improves the sizing efficiency of the sizing process. The heating steam 57 is not mixed into the hot water 7 in the tanks 8 and 32, and the quantity of the hot water 7 is not increased by steam. Therefore, the water consumption consumed by the moistening process can be determined through the measurement of the quantity of the hot water 7 supplied into the level-measuring tank 32 to replenish the level-measuring tank 32 and measured by the flowmeter 20.

[0025] Fig. 3 shows a moisture percentage measuring unit 51 and a moisture percentage controller 40. The moisture

percentage measuring unit 51 includes the flowmeter 20, i.e., water consumption measuring means, a length measuring device 39, i.e., processed-yarn-quantity measuring means for measuring the quantity of processed warp yarns, a take-up guide roller 52, a pulse signal generator 53, a moisture percentage calculating device 41 and a measurement controller 54.

[0026] The moisture percentage measuring unit 51 measures the quantity of processed warp yarns 2 and water consumption simultaneously. The moisture percentage measuring unit 51 determines a water consumption upon the coincidence of the quantity of the processed warp yarns 2 with a predetermined quantity, and determines the moisture percentage of the warp yarns 2 on the basis of the measured water consumption and the predetermined quantity of the warp yarns 2. The weight of the processed warp yarns 2 is determined from measured length of the processed warp yarns 2, the number of the warp yarns 2, the weight per unit length of the warp yarns 2 represented by yarn count or denier.

[0027] A divided plate is attached to the shaft of the take-up guide roller 52. The divided plate and a proximity switch attached to the frame constitute the pulse signal generator 53. An encoder may be used instead of the pulse signal generator 53.

[0028] In the moisture percentage measuring unit 51 shown in Fig. 3, the pulse signal generator 53 generates a pulse signal as the take-up guide roller 52 rotates and gives the same to the length measuring device 39. The length measuring device 39 counts the number of pulses included in the pulse signal. A main controller, not shown, controls the measurement controller 54 to give measurement signals simultaneously to the length measuring device 39 and the flowmeter 20. The length measuring device 39 is set beforehand for a count corresponding to a predetermined yarn length by a setting device 42. Upon the increase of the accumulated number of pulses of the pulse signal generated by the pulse signal generator 53 to the set count, the length measuring device 39 gives a measurement completion signal to the flowmeter 20.

[0029] Since the superfluous hot water 7 squeezed off the moistened warp yarns is returned into the moistening water tank 8 of the moistening unit 3, the water consumption consumed by the moistening unit 3 is equal to the quantity of the hot water 7 actually used for moistening the warp yarns 2. Since the predetermined length of the warp yarns 2 is a sufficiently long length, the level controller 37 opens and closes the flow control valve 21 several times, supplies the hot water 7 into the level-measuring tank 32 several times in each length measuring cycle for measuring the length of the processed warp yarns 2 to keep the level of the hot water 7 in the level-measuring tank 32 constant. Thus, the quantity of the hot water supplied into the level-measuring tank 32 measured by the flow meter 20 is substantially equal to the water consumption and can be taken as the quantity of the hot water 7 used for moistening the warp yarns 2.

[0030] The flow meter 20 gives a signal representing the measured quantity of the hot water 7 supplied to the level-measuring tank 32, i.e., water consumption, to the moisture percentage calculating device 41. The moisture percentage calculating device 41 converts the measured quantity of the consumed water into a corresponding weight, divides the weight by the weight of the predetermined length of the warp yarns 2 to calculate a moisture percentage. The calculated moisture percentage is given to a comparator 43 included in the moisture percentage controller 40.

[0031] The measuring accuracy of the flowmeter 20 in measuring the quantity of the hot water supplied 7 into the level-measuring tank 32 based on the measurement of the quantity of the hot water 7 supplied into the level-measuring tank 32 will be improved when the difference between the upper limit level, at which the supply of the hot water 7 is stopped, and the lower limit level, at which the supply of the hot water 7 is started, is reduced to supply a small quantity of the hot water 7 in each of the hot water supply cycle.

[0032] The water consumption can be accurately measured either when the hot water 7 is supplied several times or when the hot water is supplied only once in each level-measuring cycle when a measured value measured by the flow meter 20 is corrected by measuring the difference between the level at the start and the level at the end of the measuring cycle the hot water 7 contained in the level-measuring tank 32 by the level sensor 33.

[0033] A moisture percentage measuring device 51 in a modification shown in Fig. 4 measures water consumption and the quantity of the processed warp yarns 2 simultaneously. A length measuring device 39 measures the length of the warp yarns 39 upon the coincidence of a measured water consumption with a predetermined water consumption set beforehand by a setting device 47. A moisture percentage calculating device 41 calculates the moisture percentage of the warp yarns 2 on the basis of the measured length of the processed warp yarns and the predetermined water consumption by using the following expressions.

(Weight of the hot water consumed) = (Weight of the hot

water contained in the level-measuring tank at the start of

the measuring cycle) - (Weight of the hot water contained in

the level-measuring tank at the end of the measuring cycle)

+ (Weight of the hot water supplied)

(Moisture percentage) = { (Water consumption) / (Weight of

the processed warp yarns)} × 100 (%)

[0034] Referring again to Fig. 3, the moisture percentage controller 40, which controls the moisture percentage of the warp yarns 2 on the basis of the calculated moisture percentage determined by the moisture percentage measuring unit 51, includes a comparator 43, a desired moisture percentage setting device 44, a squeeze pressure controller and a hydraulic cylinder actuator 15. The comparator 43 compares the calculated moisture percentage with a desired moisture percentage set beforehand by the desired moisture percentage setting device 44. When the calculated moisture percentage is outside a control range defined by an upper and a lower control limit of the desired moisture percentage, the comparator 43 gives a squeeze pressure correction signal to the squeeze pressure controller 45. The desired moisture percentage, i.e., proper moisture percentage, is dependent on operating conditions including the type and count of the warp yarns, the concentration of the size, the materials of the size, and desired size percentage. The squeeze pressure controller 45 calculates a necessary squeeze pressure on the basis of the squeeze pressure correction and the present squeeze pressure, controls the hydraulic cylinder actuator 15 to exert a proper squeeze pressure by the pair of squeeze rollers 12 to the warp yarns 2 passing between the pair of squeeze rollers 12.

[0035] The slasher moistens the warp yarns with the hot water contained in the water tank, squeezes the moistened warp yarns by the squeeze unit to make the hot water permeate the warp yarns, measures the quantity of the processed warp yarns and the quantity of the consumed hot water simultaneously in a process of returning the superfluous hot water squeezed off the warp yarns into the water tank, and calculates the moisture percentage of the moistened warp yarns moistened by the moistening process on the basis of the calculated quantity of the processed warp yarns and the quantity of the consumed hot water. The moisture percentage of the warp yarns can be accurately determined because the quantity of the hot water used for moistening is determined directly from the quantity of the consumed hot water. The hot water heated at the predetermined temperature by the heating unit and used for moistening the warp yarns seeps between fibers forming the warp yarns. Thus the warp yarns are moistened uniformly, the water moistening the warp yarns is replaced and mixed with the size in the sizing unit, so that the individual fibers forming the warp yarns can be sized. When the warp yarns are cotton yarns, cotton fibers forming the warp yarns are coated with cotton wax, and cotton wax coating the cotton fibers prevents the size from adhering to the warp yarns. The hot water melts cotton wax and removes the same from the warp yarns to ensure satisfactory sizing. Since the heat of the heating medium, such as the high-temperature steam or the electric heater, is transferred through the heat-transfer means to the hot water contained in the water tank, hot water contained in the water tank can be heated at the proper temperature, and the heating medium is not mixed into the hot water and does not increase the quantity of the hot water contained in the water tank. Therefore, the quantity of consumed water can be accurately determined from the change in the quantity of the hot water contained in the water tank to calculate the moisture percentage accurately.

[0036] Since the high-temperature steam blowing device disposed in the water tank is used for heating the hot water contained in the water tank, and the operation of the high-temperature steam blowing device for blowing high-temperature steam is stopped before the start of measurement of the quantity of consumed water, the hot water contained in the water tank is heated directly by the high-temperature steam, part of the steam blown into the hot water contained in the water tank liquefies in the hot water to heat the hot water efficiently.

[0037] And the high-temperature steam blowing is stopped at measuring term, so that measurement of the quantity of consumed water is not inaccurate by the steam blowing.

[0038] The level sensor, i.e., the water consumption measuring means, measures the level of the hot water contained in the water tank, and the quantity of the consumed water can be easily determined from the measured level of the hot water contained in the water tank.

[0039] Since the water consumption measuring means includes the flowmeter and the level sensor, the quantity of consumed water can be easily determined on the basis of the quantity of water supplied into the water tank, and the level of the water contained in the water tank.

[0040] Since the level controller includes the level sensor combined with the water tank, and the flow control valve placed in the water supply line, the level of the hot water contained in the water tank is measured and the flow of the hot water supplied to the water tank is controlled on the basis of the level of water contained in the water tank, the level of the hot water contained in the level-measuring tank can be kept constant, and hence the quantity of consumed water is equal to the quantity of the hot water supplied into the water tank.

[0041] Since the moisture percentage of the warp yarns is adjusted to the desired moisture percentage by controlling the squeeze pressure exerted by the squeeze rollers on the warp yarns on the basis of the calculated moisture percentage, the warp yarns can be sized at a fixed size percentage by the following sizing process.

[0042] Since the high-temperature steam blowing device blows high-temperature steam into the hot water contained in the water tank to heat the water, and stops blowing high-temperature steam before the measurement of the quantity of consumed water is started, the hot water can be efficiently heated directly by the high-temperature steam blown into the hot water.

[0043] Although the invention has been described in its preferred embodiment 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.

[0044] The features disclosed in the foregoing description, in the claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. A slasher (1) provided with a moistening unit (3) that moistens warp yarns (2) by moistening the warp yarns (2) with water contained in a water tank (8), a squeeze unit (10) that squeezes the moistened warp yarns (2) to moisten the warp yarns properly and returns superfluous water squeezed off the warp yarns (2) to the water tank, a water supply unit having a water source (6) and a water supply line (19) through which water is supplied from the water source (6) to the water tank (8), and a sizing unit (4) that sizes the moistened warp yarns (2), said slasher (1) comprising:

a heating unit (55) including a heat-transfer means (56) between a heating medium (57)and moistening water for transferring heat from the heating medium (57) to moistening water contained in the water tank (8) to heat the moistening water at a predetermined temperature;
a water consumption measuring means for measuring quantity of water consumed by the moistening unit;
a yarn length measuring means for measuring length of the warp yarns processed by the moistening unit; and
a moisture percentage calculating device (41) for calculating moisture percentage of the warp yarns moistened by a moistening process by the moistening unit (3) on the basis of the quantity of consumed water, and the quantity of processed warp yarns;

wherein the water consumption measuring means and the yarn length measuring means operate synchronously for measurement.

2. The slasher (1) according to claim 1, wherein the water tank (8) is provided with a high-temperature steam blowing device (63) to heat water contained in the water tank (8), and the operation of the high-temperature steam blowing device (63) for blowing high-temperature steam is stopped before the start of measurement of the quantity of consumed water.

3. The slasher (1) according to claim 1 or 2, wherein the water consumption measuring means includes a level sensor (33) for measuring level of water contained in the water tank (32), and the quantity of consumed water is determined through the measurement of level of water contained in the water tank (32).

4. The slasher (1) according to claim 1 or 2, wherein the water consumption measuring means includes a flowmeter (20) placed in the water supply line (19), and a level sensor (33), and the quantity of consumed water is determined on the basis of quantity of water supplied into the water tank (32) and level of water contained in the water tank (32).

5. The slasher (1) according to claim 4, wherein the water tank (32) is provided with a level controller (37) including the level sensor (33), and a flow control valve placed in the water supply line, level of water contained in the water tank (32) is measured, and flow of water supplied to the water tank (32) is controlled on the basis of the level of water contained in the water tank (32)to keep the level of water contained in the water tank (32)fixed.

6. A slasher (1) provided with a moistening unit (3) that moistens warp yarns (2) by moistening the warp yarns (2) with water contained in a water tank (8), a squeeze unit (10) that squeezes the moistened warp yarns (2) to moisten the warp yarns properly and returns superfluous water squeezed off the warp yarns (2) to the water tank (8), a water supply unit having a water source (6) and a water supply line (19) through which water is supplied from the water source (6) to the water tank (8), and a sizing unit (4) that sizes the moistened warp yarns (2), said slasher

(1) comprising:

a heating unit (55) including a heat-transfer means (56) between a heating medium (57) and moistening water for transferring heat from a heating medium (57) to moistening water contained in the water tank (8) to heat the moistening water at a predetermined temperature;
a water consumption measuring means for measuring quantity of water consumed by the moistening unit;
a yarn length measuring means for measuring length of the warp yarns processed by the moistening unit;
a moisture percentage calculating device (41) for calculating moisture percentage of the warp yarns moistened by a moistening process by the moistening unit (3) on the basis of the quantity of consumed water, and the quantity of processed warp yarns; and
A squeeze pressure controller (45) for controlling squeeze pressure exerted on the warp yarns by the squeeze unit (10) to adjust moisture percentage of the warp yarns (2) to a desired moisture percentage;

wherein the water consumption measuring means and the yarn length measuring means operate synchronously for measurement.

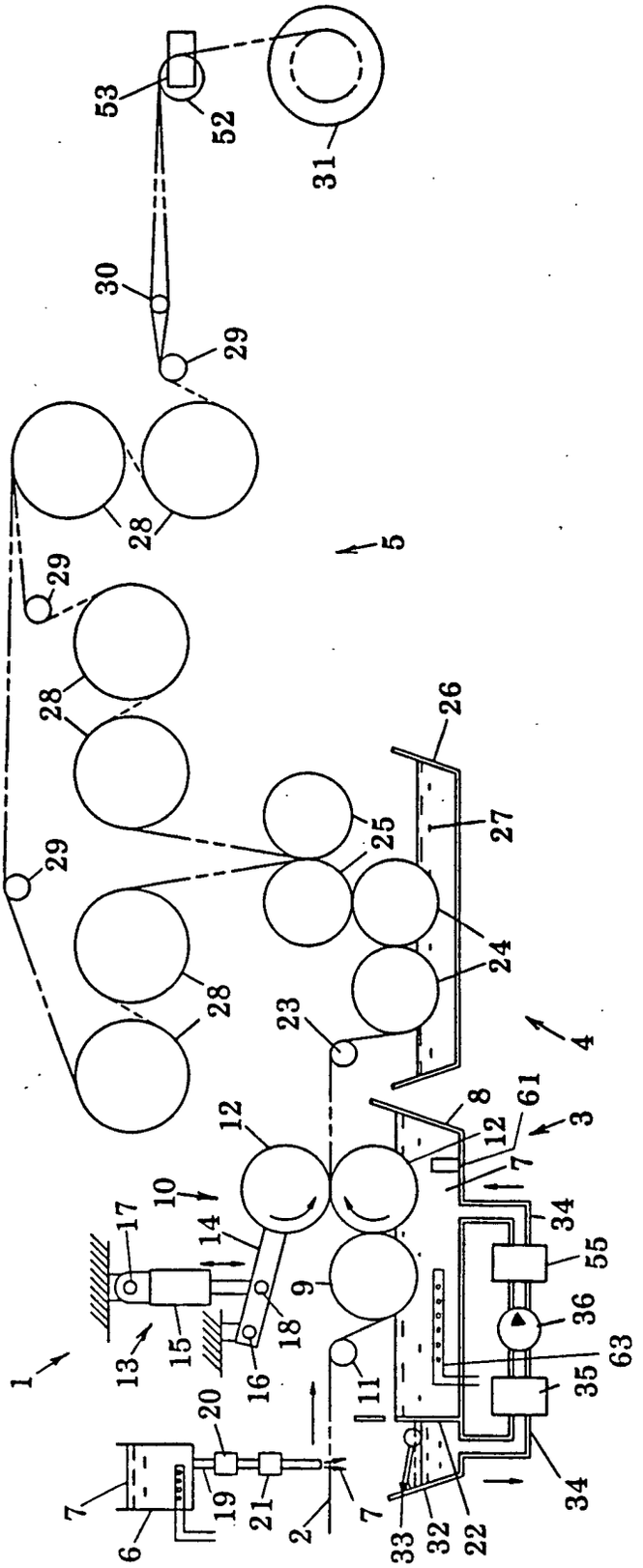
7. The slasher (1) according to claim 6, wherein the water tank (8) is provided with a high-temperature steam blowing device (63) to heat water contained in the water tank (8), and the operation of the high-temperature steam blowing device (63) for blowing high-temperature steam is stopped before the start of measurement of the quantity of consumed water.

8. The slasher (1) according to claim 6 or 7, wherein the water consumption measuring means includes a level sensor (33) for measuring level of water contained in the water tank (32), and the quantity of consumed water is determined through the measurement of level of water contained in the water tank (32).

9. The slasher (1) according to claim 6 or 7, wherein the water consumption measuring means includes a flowmeter (20) placed in the water supply line (19), and a level sensor (33), and the quantity of consumed water is determined on the basis of quantity of water supplied into the water tank (32) and level of water contained in the water tank (32).

10. The slasher (1) according to claim 9, wherein the water tank (32) is provided with a level controller (37) including the level sensor (33), and a flow control valve (21) placed in the water supply line, level of water contained in the water tank (32) is measured, and flow of water supplied to the water tank (32) is controlled on the basis of the level of water contained in the water tank (32) to keep the level of water contained in the water tank (32) fixed.

FIG.1


1
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55
61
63

FIG.2

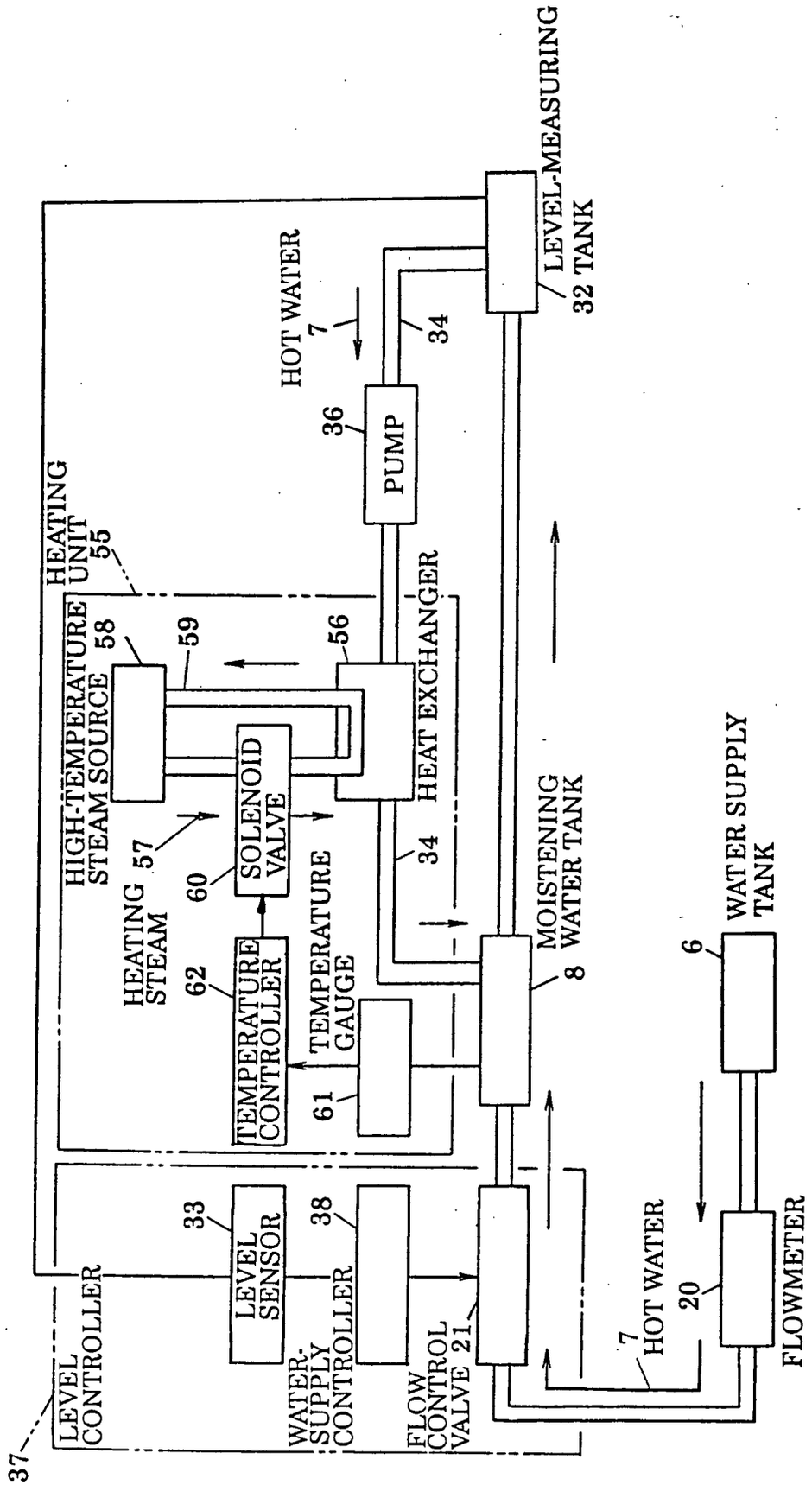

LEVEL-MEASURING TANK
32
HOT WATER
7
34
36
PUMP
HEATING UNIT
55
HIGH-TEMPERATURE STEAM SOURCE
58
59
56
HEAT EXCHANGER
SOLENOID VALVE
57
60
HEATING STEAM
62
TEMPERATURE CONTROLLER
TEMPERATURE GAUGE
61
34
MOISTENING WATER TANK
8
6
WATER SUPPLY TANK
33
LEVEL SENSOR
38
LEVEL CONTROLLER
WATER-SUPPLY CONTROLLER
FLOW CONTROL VALVE
21
37
7
HOT WATER
20
FLOWMETER

FIG.3

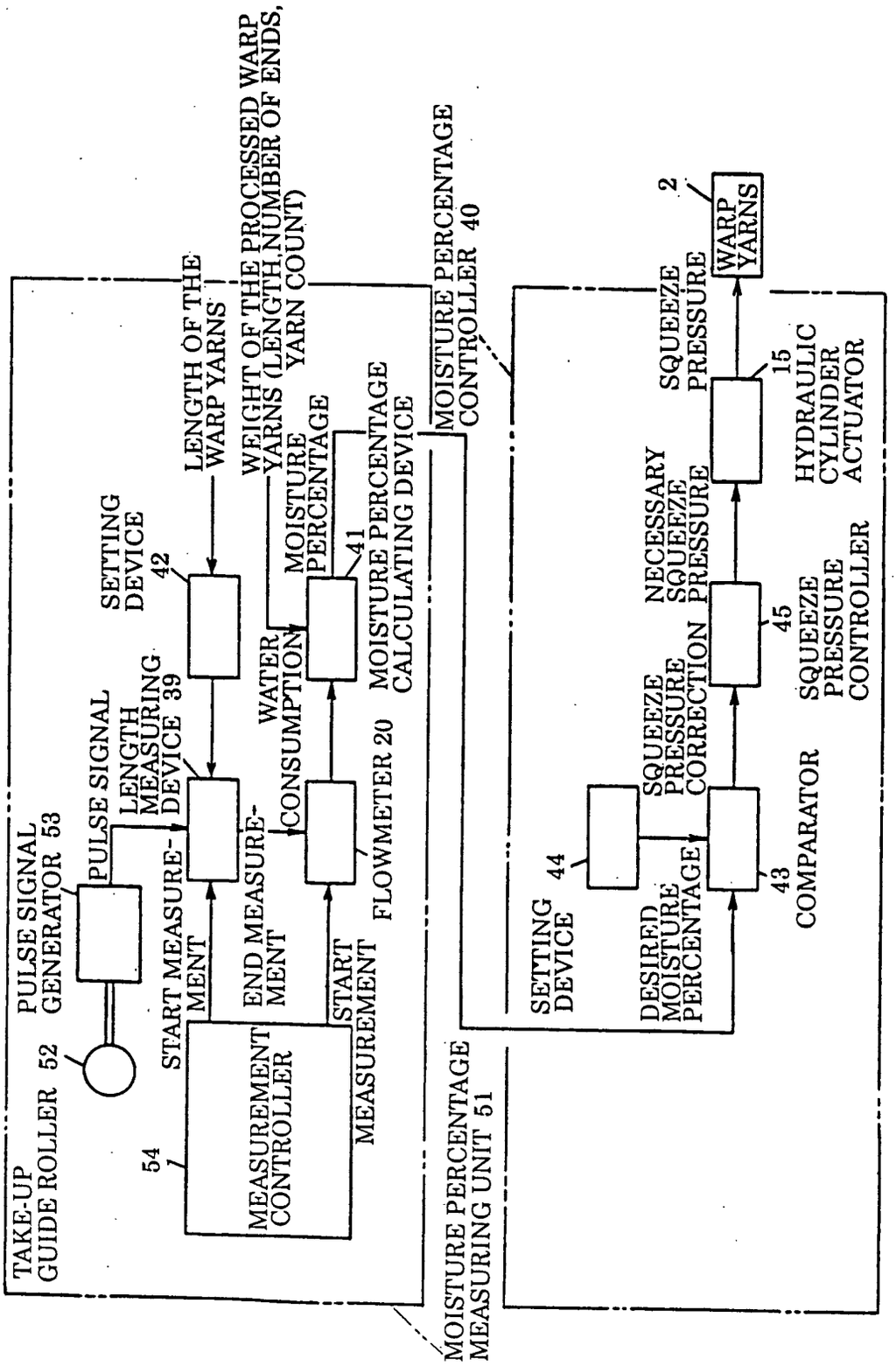
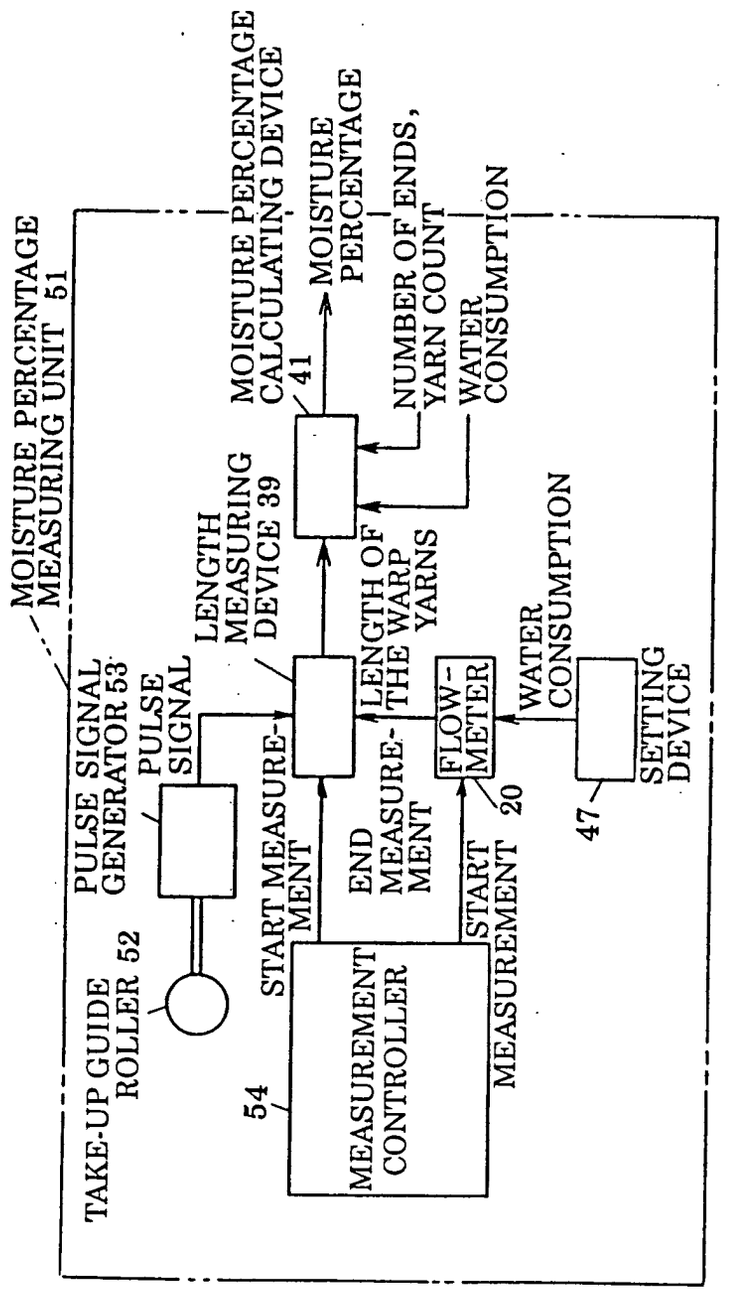

TAKE-UP GUIDE ROLLER 52
PULSE SIGNAL GENERATOR 53
PULSE SIGNAL
LENGTH MEASURING DEVICE 39
START MEASUREMENT
END MEASUREMENT
54
MEASUREMENT CONTROLLER
WATER CONSUMPTION
START MEASUREMENT
FLOWMETER 20
MOISTURE PERCENTAGE CALCULATING DEVICE
41
MOISTURE PERCENTAGE
WEIGHT OF THE PROCESSED WARP YARNS (LENGTH, NUMBER OF ENDS, YARN COUNT)
LENGTH OF THE WARP YARNS
SETTING DEVICE
42
MOISTURE PERCENTAGE CONTROLLER 40
MOISTURE PERCENTAGE MEASURING UNIT 51
SETTING DEVICE
44
DESIRED MOISTURE PERCENTAGE
SQUEEZE PRESSURE CORRECTION
43
COMPARATOR
NECESSARY SQUEEZE PRESSURE
45
SQUEEZE PRESSURE CONTROLLER
SQUEEZE PRESSURE
15
HYDRAULIC CYLINDER ACTUATOR
2
WARP YARNS

FIG.4


MOISTURE PERCENTAGE MEASURING UNIT 51
TAKE-UP GUIDE ROLLER 52
PULSE SIGNAL GENERATOR 53
PULSE SIGNAL
LENGTH MEASURING DEVICE 39
MOISTURE PERCENTAGE CALCULATING DEVICE 41
MOISTURE PERCENTAGE
NUMBER OF ENDS, YARN COUNT
WATER CONSUMPTION
54
MEASUREMENT CONTROLLER
START MEASUREMENT
END MEASUREMENT
START MEASUREMENT
LENGTH OF THE WARP YARNS
FLOW-METER 20
WATER CONSUMPTION
47
SETTING DEVICE