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Weaving of Cotton Yarn Fabrics by Water Jet Loom

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Abstract: *Waterjet looms are characterized in particular by high insertion performance and low energy consumption. These machines are used for the manufacture of light and medium weight fabrics with standard characteristics and water-repellent fiber materials, primarily multi-filament synthetic yarns. But many textile hubs like Bhiwandi,Malegaon are manufacturing cotton fabric that cannot beweaved by using waterjet looms. Due to this drawbacks waterjet looms can't be used for making cotton fabrics. This paper gives some detail regarding how to use it for cotton fabrics.*

Keywords: *flying flowers, hydrophilic fiber, steel shovel, weaving cotton yarn, weft control mechanism*

I. Introduction

Waterjet looms are used as a weaving machine for fabrics. Both air jet loom and water jet loom machines can weave rapidly. It also provides for laying different colors in the weft direction. It helps to produce uniform and higher quality fabrics. Waterjet looms are very high speed machinery in term of weaving cloths, fabrics, hosiery. It is generallyconsidering for multi filament synthetic yarn just like polyester and not for absorbent fiber like cotton.The absorbent yarn like cotton cannot be used for making cotton fabric on waterjet looms, but as compare to rapier looms (type of weaving machine used for cotton and synthesis yarn both),waterjet loom having very rapid speed(upto 600rpm).Hence it is required to make cotton fabric on waterjet looms in textile hub like Surat,Bhiwandi, Ichalkarnji, Malegaon ,which are large cotton fabric producing cities in India. Cotton fiber is favored by consumers for its better moisture absorption and breathability. So it is required to weave cotton fabric with high production rate to fulfill the customer need.

Fig. 1 Latest Waterjet Loom

II. Literature Review

Jasmin J. Hirpara(1) Water Jet machines are extensively used in East Asia. They are characterized in particular by high insertion performance and low energy consumption. These machines are produced only by few companies and are used for the manufacture of light and medium weight fabrics with standard characteristics and in water repellent fiber materials, primarily multi-filament synthetic yarns. They are characterized in particular by high insertion performance and low energy consumption. In water jet looms a water jet is propelled across the shed with the force that takes the filling yarn to the other side. In it, a pre measured length of weft yarn is carried across the loom by a jet of water. These looms are very fast with speeds u to 600 ppm and very low noise. Also they don't place much tension.

Berry Strauss(2) With a fluid weft insertion system the weft is transferred across the loom by means of the drag force of the fluid on the yarn. Like the inertia system, no solid parts are required to carry the yarn across the shed. The principal fluids used are air and water. Both air and water jet looms are commercially available and are in operation throughout the world. The water jet picking system which accelerates the weft from one side of the loom to the other by means of the fluid drag of a fluid stream acting on the yarn.

III. Problem Statement

In the water jet loom weaving, cotton yarn has been taken as a non-woven yarn. Since the elongation of cotton fiber is 7% to 12%, that's why the cotton yarn is a non-woven yarn on the water jet loom; secondly, the hydrophobic fiber has less flying flowers, and will not cause parking for no reason due to the flying flower. The water flow causes the warp and weft yarns and the fabric in the vicinity of the shed to be wet, and thus is greatly affected by factors such as the variety, state and shape of the shed. Due to various conditions, the conventional water jet loom is mostly used for weaving of yarns with a predetermined moisture regain of less than 10% and an elongation at break of more than 8.8%.

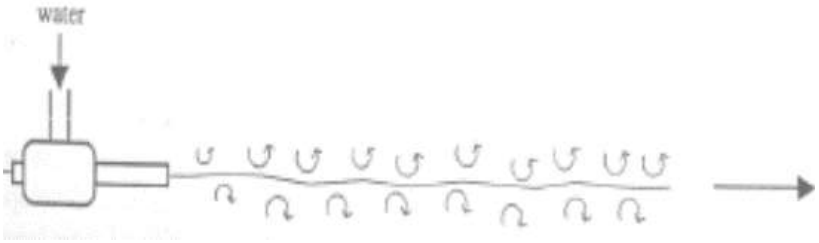

Fig. 1 Weft Insertion phenomenon in Waterjet looms

IV. Methodology

1. Weaving:

The weft insertion system in the water jet loom is based on water, and the force generated by the jet of water is used to drive the weft into the shed. There is large coefficient of friction of water with weft yarn, the traction force of the yarn can be increased, so that the water jet weft insertion has the characteristics of high speed, wide width, low noise and low power consumption. Therefore, it is currently used for weaving of hydrophobic fiber yarn. The performance of natural fiber fabrics is excellent, and the range of water jet loom expansion has become the consensus of the manufacturers of water jet loom

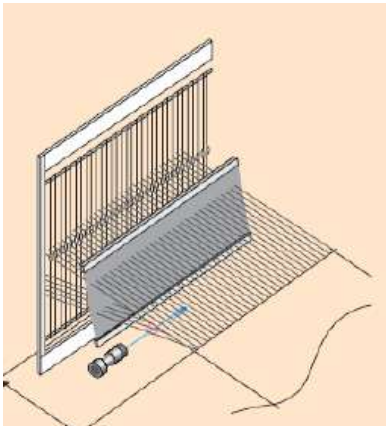

Fig. 2 Weft and water though nozzle in waterjet looms

2. Modifications and Replacements:

It is required to change the opening and closing times of the gripper. The gripper opens to release the weft yarn and start the weft insertion. The gripper closes the weft yarn to end the weft insertion. The gripper is the weft insertion mechanism of the water jet loom.

Fig. 3 Griper Mechanism of WaterJet Looms

Adjusting the relative positions of the gripper cam 1 and the gripper cam 2 controls the length of time the gripper is opened.The weft yarn is almost parallel to the steel boring during the weft insertion process. Therefore, when the sling does not hit the weft yarn after the shed is closed, the weft yarn from the gripper to the hem yarn is parallel to the steel sill and the length cannot be changed. When the weft is being driven, the weft pushes the weft yarn toward the weaving direction, at which time the weft yarn from the gripper to the stranded yarn will become the length from the gripper to the weaving position. If the weft yarn is not replenished, the weft yarn is subjected to a large elongation, and the elongation of the cotton yarn is small, which causes the weft yarn to break, so that the weaving cannot be performed normally, which is the key point that the water jet loom cannot woven the cotton yarn.

In order to solve this problem, it is necessary to add a part of the weft yarn during the beating process to achieve continuous weaving of the cotton yarn. The relative position of the gripper cam 1 and the gripper cam 2 remains unchanged, the gripper is closed before the reed is hit by the reed, maintaining the proper tension and stability of the weft, and the weft is closed, the weft is in a fully controlled state. After that, the spindle is about 315^0. When the weft yarn cam 1 is added, the cam rotor 3 is pressed downward, so that the cam link 4 swings downward, and the gripper link 5 is swung upward, and the gripper shaft 8 is pushed upward to move the gripper movable disc 9 to reopen. In the process of beating the steel shovel, the replenished weft yarn is pulled out from the holder to compensate for the problem that the elongation of the cotton weft yarn is small. At the spindle about 340^0. At this time, the supplementary weft yarn cam 1 is detached from the cam rotor 3, and the holder is closed again to prevent the weft yarn from being excessively drawn, causing other malfunctions.

3. Cleaning of cotton yarn hairiness:

Due to the short length of the cotton fiber, the surface of the cotton yarn has more fluff and is easy to fall off. Usually, the flying flower falls on the weft feeder, the gripper, the weft detecting head and the nozzle, causing the weft feeder to work abnormally and clamped.

Fig. 4 Cotton Yarn Hairiness

The device cannot hold the firm weft yarn, the nozzle works abnormally, and the weft-to-air vehicle is closed. Generally, take the method of timely cleaning. Due to manual cleaning, there are often some uncertain factors such as long cleaning period, which causes the effect of flying flowers on the performance of the machine to cause parking. When cleaning, the flying flowers are blown on other parts to cause parking. These factors will have a certain impact on the efficiency of the loom. It is an effective way to solve this problem by adding suction ports in important parts that are prone to fly flowers and achieving timely cleaning. To configure the suction device, consider the following two aspects: (1) The installation position of the suction port should be appropriate, so as to achieve the purpose of sucking away the hairiness without affecting the state of the jet flow. (2) The selection of wind pressure is closely related to the parameters of the fan, the diameter of the pipe, and the shape of the suction port. When configuring, consider economics and at the same time not affect the stability of the weft movement.

4. Process settings

For example if 20's cotton yarn is used, some fundamental options such as the pump, the cylinder diameter, the pump spring type, the needle, the nozzle holder, and the needle size are the same as those of the hydrophobic fiber yarn.

Water quaintly selection: The cut weft yarn is curved at the head of the nozzle. Water is used to straighten the weft head before the holder is opened, and observe the amount of the first water before the end of the free flight. The first amount of water is used to ensure that the weft yarn ends are straight. In case of cotton yarn is difficult to produce twist due to its large water content, and the medium first water quantity can meet the requirements, in the case of waterjet weft insertion.

To adjust the flying angle: The strength of the hydrophobic fiber yarn is higher than that of cotton yarn. To adjust a larger flight angle is more suitable for the as per the characteristics of cotton yarn. It tends reduce the latitudinal failure of the loom. Relative position of the actual injection and the reed decide the start time of injection of weft. The ejection head is adjusted as the flight restraint time is adjusted to 5 mm in front of the center of the nozzle. The flight angle of the weft is about 165°.

Adjust Constraint Flight Time: There is two phases of the weft flight, first one, the "free flight" and second one is "constrained flight". First one that is flown by the weft yarn stored by the length measuring device, and then the "constrained flight" that measures the long side flight.

"Free flight" starts with the opening of the gripper, and the yarn stored on the length measuring drum is terminated immediately. The flight speed depends on the speed of the waterjet stream and coefficient of friction of the weft yarn and the water flow. Going high, the average flying speed of the weft yarn exceeds 50m/s under the weaving condition of 120 cm width and 650 r/min.The angle of "constrained flight" can be adjusted according to the weaving requirements of the fabric, and it is the end of free flight to the gripper.

The speed of which is depending on the length of the weft feeder, and the speed is only about 35% of the "free flight". All of two "free flight" and "constrained flight" is particularly important for cotton weaving. If the weft yarn directly jumps from the higher speed at the "free flight" to the speed 0 when the gripper is closed, a large tension is applied to the weft yarn, which frequently causes the weft yarn break in the weft insertion side shed. So to overcome that the speed of the weft yarn is require to reduce from the higher speed of "free flight" to the speed of "constrained flight". The flight speed transitions to a speed of 0 when the gripper is closed, so that the tension applied to the weft yarn is moderated, and the phenomenon of weft insertion due to excessive weft tension caused by closing the gripper is eliminated.

V. Conclusion

As the cotton yarn is a hydrophilic fiber, the strength is low elongation to break is also low. Slight modification in the weft control mechanism, the cotton yarn can be waved fiber yarn of a water jet loom. The process setting of cotton yarn weaving, "constrained flight" time is an important parameter that affects the latitudinal failure rate. The "constrained flight" time can reduce the requirements on the strength of the yarn, reduce the weft woven. The purpose of mass production of cotton fabrics by water jet looms in textile mills can be gain. The quality of fabrics will meet the requirements, and the export of batch products has been realized. As cotton yarn has water abortion rate, it is required to dry after weaving, so dry cost should be introduced. At last, it is requirement from many textile industries to continuously explore and accumulate experience in future production. Weaving cotton yarn with water jet loom can improve the production rate of cotton fabric in India and will expand the usage of water jet loom.

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