

Development and Prospect of Automatic Inspection System for Fabric Defects

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Abstract: Summarize the development of automatic inspection system for fabric defects. The main problems existing in traditional manual cloth inspection are pointed out. The development of automatic cloth inspection technology at home and abroad is reviewed. The classification and detection requirements of fabric defects are introduced. This paper probes into the functions and related technologies of automatic cloth inspection system, and looks forward to the prospect of automatic cloth inspection technology. It is considered that the use of automatic cloth inspection machine can improve labor productivity; Automatic cloth inspection machine is an important measure to upgrade the textile industry and get rid of labor-intensive industries, and it is an inevitable trend of future development.

Keywords: Fabric defects, Cloth inspection machine, Inspection speed, Detection rate, Manual cloth inspection.

1. Introduction

The inspection of fabric defects is the main basis for evaluating the quality and grade of fabrics. Usually, the scores are evaluated according to the influence degree, size and post-processing requirements of the defects, and the defects are cleared, repaired or sheared to ensure the genuine rate of post-processed products, which is of great economic significance to textile production enterprises. Traditional textile enterprises have finishing workshops, which are responsible for the inspection, reexamination and repair of fabrics, and are equipped with corresponding equipment; There are also fabric defect detection after fabric pre-shrinking, entering finishing and other processes.

Traditional manual cloth inspection is not fast, with low output and poor efficiency. Manual cloth inspection has certain technical requirements and vision requirements for inspectors. Long-term vision concentration is easy to cause eye fatigue and occupational diseases, and the labor intensity is not low. Generally, the inspectors can only detect 200 per hour. There are about 10 defects. If it exceeds this range, it is easy to miss inspection and misjudge. Nowadays, functional and high-performance fiber fabrics are widely used in aerospace, aviation, military engineering, navigation and other territorial areas, so it is necessary to find zero defects and zero leakage in the fabrics. Inspection, manual cloth inspection is difficult to achieve. Manual cloth inspection is subjective by inspectors. Due to the limitations of consciousness, personality, environment, cognition and other factors, the test results are very low. The consistency is difficult, the difference is big, and the reprehensibility and consistency are poor. Workers' inspection measure the need to allocate more labor. Relevant information shows that: general biography, there are 2.5 cloth inspectors and 2.8 cloth inspectors for 500 looms in three shifts. Cloth repair, but also deserve to go up the corresponding sampling personnel and other auxiliary people. Member, at the same time equipped with the corresponding cloth inspection machine and material [1]. Pass and test cloth width of the loom is small, which is not suitable for the width requirements of modern looms. If the width is widened transformation, it is necessary to reduce

the speed and increase the burden of cloth inspectors. Overall, manual cloth inspection is of great work intensity and backward productivity for workers, and there are problems such as high rate of missed inspection, which can't keep up with the production speed of loom. And increasing the width of the fabric.

Improving the detection rate, accuracy and inspection speed of fabric defects has become the bottleneck of current development, so the automatic inspection technology of fabric defects has emerged as the times require, becoming one of the examples of intelligent and automatic weaving process.

2. Development of Automatic Cloth Inspection Technology

Automatic cloth inspection has certain difficulty, which existed abroad many years ago. Related research, but so far, there has been no report of large-scale popularization and use. The research on automatic cloth inspection technology in China started late, We should seize the opportunity, be driven by innovation, and catch up.

2.1. Uster company's visoter automatic cloth inspection system

In 1983, USTER Company began to develop the automatic cloth inspection system. In 1987, USTERVISOTER came out in Paris, saying that four units had been put into use, but because of the high price, it failed to batch production [2]. Then, an imaging system based on neural grid was developed, and a unique device for scanning and distinguishing yarn defects and a device for evaluating fabric quality were developed, which can score, grade and locate the yarn defects of fabrics. The cost of hardware and software has also been reduced, and products can replace manual cloth inspection. However, in recent years, the development progress is not fast and the market share is not high.

2.2. Automatic cloth inspection system of EVS company

Israel EVS Company, belonging to Israel Military Industry Group, is the first professional textile visual inspection

company in the world, with a history of more than 20 years. More than 20 countries around the world have used its automatic cloth inspection system, the number of which is nearly 1,000, and many domestic enterprises have cooperated with it, such as Guangdong Esquel, Beijiang Textile, Changzhou Black Peony, Shandong Demian, etc [3].

The first generation product, I-TeX100, was observed and tested by computer system, can automatically detect yarn defects, save, locate, evaluate, maximum inspection. Measure the fabric width of 330cm, the running speed of 300m/min, and the minimum defect of 0.5mm. The second generation product, I-TeX200, is mainly suitable for the inspection of single-color dyed fabrics. I-tex2000, the third-generation product, can inspect all kinds of fabrics, including denim and craft fabrics, with a speed of 300m/min and a width of 600cm. The latest product IQ-TeX4, which has many improvements compared with previous products, has the highest detection speed of 1000m/min, and can realize automatic roll change. This product has been included in the glass fiber test standard.

2.3. On-line inspection system for loom defects of Barco Company

Barco's Cyclops loom defect detection system is produced by a multinational company headquartered in Belgium [4]. Fabric defect monitoring system is installed at the output of Brola, which can scan fabric warp and cloth surface defects, send out shutdown or alarm signals, input information into database, make defect distribution map, etc. On-line inspection of looms has practical value, but each loom needs one set, so the cost is high. In addition, the company also has a real-time monitoring and detection system for knitting mills, which can detect the density and set value of knitting terry in real time. If the deviation exceeds the specified value, it can give an alarm or stop the machine.

The author thinks that some fabric defects are easy to produce and do great harm to specific products, so it is a quick and economical way to design an on-line automatic detection device for this defect, which is convenient to remove or repair in time. For example, for industrial filter cloth, if the yarn gap in the fabric is consistent, that is, the mesh size is consistent, a special control sensor can be used for inspection and monitoring.

2.4. Fs200 photoelectric automatic cloth inspection machine

Fs200 photoelectric automatic cloth inspection machine is a recent innovation in China. The principle of automatic cloth inspection equipment is similar to that of foreign countries, and the cloth inspection speed can be set at 30m/min and 60m/min [4]. Using a set of high-resolution CCD cameras, the defect detection is complete, the positive inspection rate is high, and the misjudgment rate is low. The width of fabric inspection is less than 2.2m. The machine has a smooth design, a self-cleaning cloth surface traction system, and is quite distinctive. The author thinks that this product has great development potential, deserves praise, and should continue to innovate and develop.

3. Classification and Detection Requirements of Fabric Defects in Automatic Cloth Inspection

Fabric defects are complicated, including spinning yarn defects and weaving defects spots, printing and dyeing

defects, etc. This article only deals with the spinning and weaving shapes. The fabric defects were analyzed as follows.

The fabric defects formed by spinning include uneven yarn evenness, coarse warp, staggered weft, double yarn, doffing weft, weak twist, strong twist, foreign fiber, yellow and white yarn, colored warp, colored weft, greasy yarn, coal ash yarn, knotted yarn, wrinkled skirt, etc [2]. Yinluo new electronic yarn cleaner has been widely used in the bobbin, which can remove most yarn defects, such as long and thick knots, short and thick knots, details, double yarns, knots, different yarns, color yarn, etc., but the total removal efficiency can only reach 70% ~ 80%, and there are still defects that are missed. For example, once a long piece of coarse warp is missed, it will cause continuity of many, even dozens of defective cloth, for automatic inspection. Cloth put forward higher requirements.

The defects formed by weaving are obviously the focus of automatic cloth inspection, and the main including horizontal, thin and dense roads, double yarns, doffing, thin weft, skipping (skipping, jumping), warp shrinkage, weft shrinkage, hundreds of feet (referring to twill), bad edges, side bracing defects, warp breakage, holes, foreign matter weaving, oil stains, yarn dragging, foreign fibers, cotton balls, cloth blooming, etc. In weaving, we should focus on controlling the defects such as crosspieces, sparse roads, double yarns, jumping flowers, broken warp, holes in hundreds of feet, etc. Once the above defects occur, they should be separately classified and marked, and graded; Such as continuous or repeated multiple times. Now, you must give an alarm and stop the machine in time.

4. Discussion on the Function and Related Technology of Automatic Cloth Inspection System

4.1. Functions of automatic cloth inspection system

The function of automatic cloth inspection is to inspect cloth online or offline. Measure the fabric defects, determine the location of the defects, according to the size and danger of the defects. Classification and scoring of damage and influence degree, and warning of serious defects. Or stop or cut. At present, testing fabrics include common. With basic weave and varied weave, fabric materials include cotton, hemp, silk, wool, chemical fiber and blended yarn fabrics, etc., which are mainly used in weaving at present. Things. The production capacity of automatic cloth inspection system equipment should be significantly higher than that of manual labor. The output of cloth inspection is even higher than several times, and the positive inspection of cloth inspection is carried out automatically. The rate should be higher than that of manual cloth inspection, and the missed detection rate and misjudgment rate should be much lower than that of manual cloth inspection. Manual cloth inspection.

4.2. Discussion on related technologies of automatic cloth inspection

Automatic fabric inspection speed can be up to 120 m/min, up to 300 m/min. Check the speed, machine width and defects. How much, the detection speed should be adjustable.

The lighting system should ensure that fabric defects can be clearly found, and it is general. The LED of transmission light source or reflection light source with strong brightness

is high. Effective light source, infrared ray, ultraviolet ray, ultrasonic wave, laser, special light sources such as polarized light can distinguish special yarn defects such as foreign fibers.

Fabric defect image scanning system is the heart of fabric inspection machine [5]. Early high-resolution cameras are used, and now charge couples are widely used. The camera and the fabric scan synchronously to obtain the image signal of fabric defects, and transmit to the computer to digitize and analyze. Usterfab-Riscan has adopted neural network system in recent years, and its processing capacity is equivalent. With 500 personal computers, the yarn defects can be checked accurately. In order to ensure that all fabric defects are inspected without leakage, Usterfab-Riscan selects 2 to 8 scanning cameras. Eviq-TEX 4 is equipped with 3 detection lines and 12 cameras.

Automatically detected yarn defects need to be classified, scored or graded by computer, fixed on the fabric at the same time, printed and marked, so as to facilitate tracking and processing. In serious cases, it is necessary to stop cutting, lowering, etc. and give an alarm. Automatic cloth inspection system adopts accurate meter length changer. We can't use the positioning method of manual paper threading to detect defects, but we often use new methods such as printing adhesive labels at the edge of cloth, showing and hiding ink labels, and printing ink stains with ultraviolet rays. Computer yarn defect data can be stored for a long time, plotted and statistically analyzed, and networked with computer control center.

5. Development Prospect of Automatic Cloth Inspection Technology

With the rapid development of new technologies such as artificial intelligence, it has become mature in technology and management to imitate human logical thinking, visual, auditory and tactile perception, and human limb movements to realize automatic cloth checking. Automatic cloth inspection and development conforms to the development direction of our country's human intelligence. The use of automatic fabric inspection machine can reduce the number of people involved in fabric defect inspection, improve labor productivity, reduce costs and reduce workers' labor intensity. At the same time, rely on the detection data to guide the reduction of weaving defects. Automatic cloth inspection machine is an important measure to upgrade textile industry and get rid of labor-intensive, and it is an inevitable trend of future development. Research and development of automatic

cloth inspection machine. Personnel must study hard, learn from others' strengths, digest and absorb foreign advanced experience, and create automatic cloth inspection equipment that is more suitable for China's national conditions and has higher cost performance.

6. Conclusion

The running output of fabric defect detection equipment is related to fabric width, the number of defects is related to the inspection speed. Under the same fabric width, dynamic detection speed is significantly higher than manual detection. The correct rate of fabric defect detection should reach more than 95%, and the missed rate should be less than 5%, so as to ensure that the national standard score of 4 points can be used to detect the defects such as cross-bar, thin and dense road, double yarn, skip, warp breakage, hundred-foot hole, etc. Self-moving cloth inspection should display the position of defects in real time, and record, classify or score them. The detection accuracy should reach 0.05mm. For severe defects, alarm and stop the machine in time. The defect classification data of automatic cloth inspection can provide scientific basis for reducing defects in the previous process.

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