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Modern textile stenting in China due to VLT® features

The use of VLT® drives substantially improved the mechanical and electrical integration of the Shaoyang Stenter Setting Machine, as well as its capabilities. Fabric production now takes place consuming less energy and more compliant with environmental protection requirements.

A stenter setting machine provides fabric stability, preventing it from shrinking etc. The machine is mainly used in the stenting and heat setting of pure cotton, polyester cotton and other blended fabrics, as well as various knitted fabrics. As textile dyeing technology continues to develop, the market needs high-quality stenter setting machines to satisfy the quality requirements. Since the demand for stender setting machines is growing, China's textile industry has now begun to export, giving the industry an annual demand of about 500 stenter setting machines.

This type of setting machine features a modular design, offers a wide variety of options to different users, and is capable of processing textile fabrics to satisfy a variety of requirements. Its nominal width ranges from 1800 mm to 3600 mm, according to the users' choice. It is suitable for pin clips, cloth grippers or dual-purpose pin clips, and can be supplied with a variety of heat sources, such as heat conduction oil, gas, electricity and steam.

Shaoyang No.2 Textile Machinery Works is the oldest professional manufacturer of stenter setting machines in China. In order to meet the market's demand for high-performance stenter setting machines, this factory has developed the 8th generation of its product – the Type M5469 Stenter Setting Machine – and has successfully exported it to countries such as Turkey, Pakistan, etc.

The nominal speed is 100 m/min, and the temperature control precision of the drying room is ± 1% of the set temperature. The machine's fabric feeding system/guide rail section, the drying room and the fabric exit area are designed based on advanced global technologies.
To controle the movements, the internationally popular frequency converter drive system has been adopted here; the synchronous control card made by Danfoss achieves the synchronous setup of the master-slave chain transmission drive, allowing random setting of the master/slave speed ratio, thus easily satisfying varying technical requirements. Excellent dynamic properties are achieved with the PID and feed-forward control parameters, making debugging and corrections extremely convenient.

Technical Requirements

The complete stenter setting machine includes: The fabric feeding and pin/clip system; the conveyor system; the fabric width adjustment system; the hot air circulation system; and the fabric exit system.

Electronic control is enabled throughout the process. In this application, the electrical control system adopts power-supply based AC variable-frequency speed control technology. The main chain is driven by the motor, controlled by the frequency converter, that acts as the main command unit for the whole machine. The rotary encoder, attached to the spline shaft, sends out the speed signal for the other follow-up units. The complete system is required to be within the speed regulating range of 1:10, thus creating a constant torque load and a low fault rate, making it convenient for maintenance, simple in operation, stable in performance, and perfectly synchronous.

The control system comprises a programmable controller, a touch screen, a frequency converter and a button switch, included to control the operation of the whole machine. Also, due to technical requirements, there is a need for extremely high precision master-slave synchronous control of the whole fabric feed and fabric exit system.

Comparison Between the Traditional Method and the New Method Using the Danfoss Frequency Converter/Synchronous Card:

The traditional stenter setting machine adopts a single line-shaft transmission and thus makes it hard to achieve a change of speed when required. So, internationally advanced enterprises, such as those in Germany, started to substitute the traditional line transmissions with multi-chain synchronous transmissions.

In line with this major trend, Shaoyang No.2 Textile Machinery Works entered into a technical co-operation with Danfoss, and finally decided to adopt their design of using a frequency converter plus the synchronous card to achieve multi-chain transmission, offering improved flexibility. Danfoss has nearly ten years of experience in the production and application of synchronous controls; its mature and reliable technologies are widely used in a wide range of applications, and meet the technical requirements of Shaoyang No.2 Textile Machinery Works completely. In addition, Danfoss provides reliable after-sales services and technical support to guarantee and ensure safe use. The actual layout of the frequency converter control cabinet is shown in Fig. 2.

Fig. 2
Wiring of the Frequency Converter

Fig. 3
Operation of the master-follower multi-chain fabric feeder (load) system.

The basic structure in the application of the stenter setting machine is as follows: The main chain is controlled by a single frequency converter by means of fieldbus communication systems; on the follower side, a Danfoss frequency converter and a synchronous control card are used, which, after obtaining accurate master-follower motor encoder signals, calculate and obtain the speed of the follower motor, thus achieving synchronous control of the master-follower motors. It is a simple control method, using a high degree of equipment integration, and provide reliable operation. In addition, various instructions can easily be sent via the fieldbus to the host link units like the PLC and the touch screen, so as to achieve automatic control functions.

Matters for Consideration Regarding the Danfoss Method:
In the stenter setting machine, a lot of electronic equipment is used which exerts a very strong electromagnetic interference on the system. In order to make the synchronous card and the frequency converter work normally, some items need to be paid attention to and observed closely during the equipment installation process, both by users and equipment manufacturers, in order to avoid unnecessary accidents during later use, and to save manpower and financial resources.

Also, in order to make the system work to maximum efficiency, both standard and regular inspections should be made, so that the synchronous card and frequency converter can achieve their optimum effect, and the advantages of the synchronous card can be fully utilized, thus ensuring that the complete system brings the maximum benefits to its users.

Application Examples:
Stenter setting machines using synchronous card are installed in many textile enterprises, e.g. in Turkey. The following example is an actual situation. The customers are very happy with the performance of the complete system, which, in spite of challenges due to the afore mentioned reasons, has achieved satisfactory results after improvements were made based on Danfoss specifications.
A stenter setting machine can be installed as a floor installation or an overhead installation. For equipment using an overhead installation, raw materials can be stored under the equipment in order to save space. The following is an actual example of a floor installation.

Fig. 4
Floor-standing Installation

Conclusion:
As a result of using the Danfoss frequency converter and synchronous card method, the new stenter setting machine utilizes AC frequency conversion technology and the synchronous speed adjustment of a PLC controlled frequency converter, and has thus achieved precise control and synchronization between master and follower units, and the online detection and monitoring of major technological parameters. This has produced a substantial improvement in its mechanical and electrical integration, as well as its capabilities, and makes fabric production more compliant with energy conservation and environmental protection requirements.

The success of the trial production of the M5469, a new type of stenter setting machine, marks a new starting point in the development of printing & dyeing machinery. It will inevitably bring sound economic and social benefits to both users and manufacturers, and it opens up bright prospects for further improvement of the quality of textile fabrics made in China, and for enhancing their market competitiveness.

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