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ANALYSING AND IMPROVING THE DYNAMICS OF SEWING MACHINE FABRIC FEED MECHANISMS

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Abstract:

The article examines how sewing machine fabric transportation mechanisms work and the factors that affect their quality. It also analyses the design factors that determine their dynamic performance and suggests ways to improve their design for better dynamic characteristics and increased reliability.

Keywords: sewing machine, fabric transportation, dynamics, reliability, design.

INTRODUCTION

The dynamic characteristics of the transporting working bodies play a crucial role in determining the quality of the material handling process in sewing machines.

It is important to ensure uniformity and accuracy of fabric delivery to the seam zone to avoid uneven stitches and defects in the seam.

This article examines the key operational needs of fabric transport mechanisms and proposes methods to optimize their design for enhanced performance and dependability.

REQUIREMENTS FOR THE DYNAMICS OF TRANSPORTATION

To ensure proper operation of the sewing machine, the transport mechanisms for fabric must feed the fabric uniformly and accurately into the processing zone during all operating modes. Meeting the dynamic characteristics demands is crucial for achieving this goal:

- minimized dynamic loads on working elements and supports to reduce vibration and noise;
- high speed - minimum acceleration and braking times;
- no self-exciting vibrations at all operating speeds;
- high dynamism coefficient - the ratio of maximum speed to average speed;
- the traction force is minimal.

The design parameters and drive characteristics of the mechanisms determine these requirements.

Here are the basic requirements for the dynamics of fabric transport mechanisms in the apparel industry:

1. Maintaining a stable fabric transport speed throughout the entire technological process is crucial to prevent uneven material feeding and stitching defects.
2. To guarantee a seamless ride, it is crucial to prevent jerks and shocks. Sudden alterations in acceleration or deceleration may lead to the stretching or deformation of the fabric.
3. The synchronization with moving mechanisms, such as the needle and thread puller, is a task that requires a confident and diplomatic approach. To prevent needle or thread breakage, it is essential to synchronize the driving elements with the moving mechanisms, such as the needle and thread puller. This will ensure optimal performance and prevent any potential issues.
4. To prevent longitudinal displacement of the fabric layers, it is imperative that the fabric remains stationary around the working elements of the conveyor's kinematic path.

Minimise dynamic loads and vibration to reduce noise and improve durability. This contributes to comfortable working conditions for operators.

The quality and reliability of the electrical drive control system of the conveyor mechanism therefore has a direct impact on the productivity and quality of the products in the garment industry.

ANALYSIS OF THE DYNAMIC CHARACTERISTICS OF THE MAIN TYPES OF MECHANISMS

Sewing machines use various types of transport mechanisms, including toothed:

1. Toothed rails can be driven by either electromagnetic or cam mechanisms.
2. Roller and belt conveyors with an electric motor.
3. Mechanically driven friction mechanisms.

Rack and pinion mechanisms are known for their high speed, which is due to the small moving mass of the links. However, the presence of gaps in the gearing can cause pulsations in the tractive force.

The belt transmission provides smooth operation and low vibration and is suitable for many applications. However, for high-precision positioning, a more rigid system may be necessary.

However, the gear mechanism offers high load capacity and accuracy, achieving a maximum speed of 6 m/s and acceleration of up to 10 m/s^2. It is important to consider

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the trade-offs between the two options when selecting the appropriate mechanism for your application. However, the gear mechanism offers high load capacity and accuracy, achieving a maximum speed of 6 m/s and acceleration of up to $10\frac{m}{s^2}$.

The chain drive delivers high-speed performance with low noise, enabling fabric movement speeds of up to 8 m/s with an acceleration of 15 $\frac{m}{s^2}$.. The chain drive delivers high-speed performance with low noise, enabling fabric movement speeds of up to 8 m/s with an acceleration of 15. Although non-uniform movement may occur due to geometric errors in the links, our expertise in this area ensures that we can minimize any potential issues.

Each mechanism type has its own dynamic advantages and disadvantages. The optimal variant is determined by specific technological tasks and process requirements.

Modern drive control systems can expand parameter control to increase productivity and material processing quality.

OPPORTUNITIES FOR IMPROVEMENT IN THE DESIGN OF MECHANISMS

It is recommended in order to improve the dynamic and operational characteristics of transport mechanisms:

- Use closed kinematic drive chains with flexible elements to reduce dynamic loads.
- Use electric drive motors with optimal speed and power characteristics.
- Installation of damping elements and vibration isolators.
- Use precision lubricated rolling bearings to reduce friction.
- Use of working elements made of wear-resistant materials.
- Selection of rational kinematics and shape of working elements to ensure smooth running.
- Installation of feedback sensors and servo drives for precise speed control.

The application of these measures will significantly improve the dynamic characteristics and durability of fabric transport mechanisms, which will have a positive impact on the quality and productivity of sewing machines.

CONCLUSION

The paper analyses the main dynamic requirements of the fabric transport mechanisms of sewing machines. Design factors influencing the dynamic performance and ways of their improvement are considered. The implementation of the proposed measures will increase the productivity and reliability of sewing machines.

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