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MATERIAL MOVEMENT MECHANISM FOR UNIFORM MOVEMENT OF DENSE MATERIAL IN A SEWING MACHINE

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ABSTRACT
The article provides a mechanism for moving the material at a uniform movement of dense material in a sewing machine. The constructional scheme of the mechanism for moving the material is presented.

Key words: Sewing machine, thread guide, compound, rubber, stitch, foot, rigidity, friction force, material.

INTRODUCTION

At the present time in the world of modern business under conditions of fierce market competition among the most urgent problems of sewing enterprises are the efficiency of technological processes and the quality of manufactured products. The successful resolution of these issues is primarily associated with the introduction of new technologies and the equipping of technological processes for the production of garments with modern high-performance equipment. Sewing machine building is a fast growing industry that consumes high technology, so the emergence of new equipment for enterprises producing garments is inevitable. At present, industrial sewing companies and enterprises of consumer services have a wide variety of sewing equipment with advanced technological capabilities.

Sewing equipment is extremely diverse because of the variety of technological operations performed by sewing machines and depending on the design of machines and their control principles. Adjusting the mechanism for moving the material in the sewing machine company Juki (Japan), is as follows. The movement of the material lower rail 11 (Fig. 1) is adjusted by turning the lever 1 after loosening the nut 2. If it is turned counterclockwise (when viewed from the front of the machine), the displacement will increase. The upper rail 36 material displacement is adjusted by turning lever 5 after loosening nut 3. Turning it anticlockwise will increase the movement of rail 36. In order to secure the stitching, the operator moves the crank 4 downwards. Lifting height of the lower lath 11 is adjusted by turning the rocker 10 after loosening the screw 9. The teeth of the lath should rise 1 mm above the needle plate.

The position of the tines of the rack 11 in the slots in the needle plate is adjusted by turning the rocker 14 after loosening the tightening screw 13, if the rack 11 is to be moved across the platform of the machine. If it is necessary to move the rail 11 along the platform loosen the screws 9 and 13 and rocker 10 and 14 together with the lever 12 move along the shafts 8, 15. The lifting height of the upper lath 36 and the foot 34 is adjusted by moving the threaded rod 26 along the slot in the rocker arm 27. If the threaded rod 26, together with the front head of the connecting rod 24, is lowered, the vertical movements of the upper rack 36 and foot 34 will increase. The timing of the vertical movements of the upper rack 36 and foot 34 is adjusted by turning the main shaft after loosening the eccentric shaft screws 23 22. The position of the upper rail 36 relative to the foot 34 is adjusted by turning the rocker 29 after loosening the tightening screw 28. The vertical position of the foot 34 relative to the upper rail 36 is adjusted by vertical movement of the rod 18 after loosening the screws 19, 17 of the coupling 16.

The position of the upper lath 36 relative to the foot 34 across the machine platform is adjusted by turning the frame 32 after loosening the rocker screw 30 31. The vertical position of the upper lath 36 relative to the foot 34 and the parallelism of their horns is adjusted by moving the upper lath 36 vertically along the rod 33 or by turning the lath 36 after loosening the screw 35.

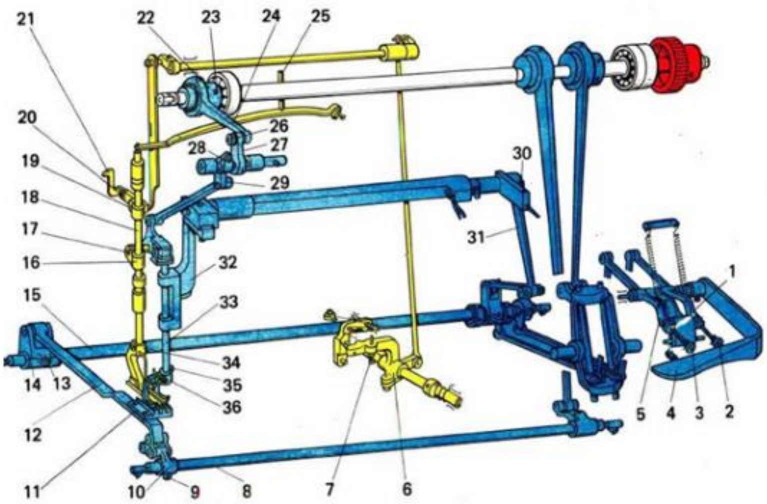


Figure 1. Design diagram of the material handling mechanism

Sewing quality, machine productivity, labour and maintenance costs are greatly influenced by the mechanisms that transport the product during machining.

Types of transport mechanisms. In sewing machines, mainly three types of fabric transport mechanisms are used: toothed rack, grooved roller and toothed rack, grooved roller and bottom transport ring.

The slat conveyor transports the fabric by the forces of the teeth of the slat gripping the material and pressing the material against the upper spring-loaded foot or roller. The material of the battens is usually caught by the teeth every time the main shaft is turned, so the semi-finished product moves intermittently. The quality of the stitch, and therefore the quality of the product depends largely on the sewing machine equipment and the skill of the worker. Fluted (serrated) roller conveying is mainly used for stitching leather, where the roller can have an intermittent rotating movement, while if the conveying is performed by a roller and a bottom conveying ring, they rotate continuously (Fig. 2).

The following requirements are placed on the rack-and-pinion conveyor belts: 1. The transport should take place with the smallest possible deviations from the set value and should end at certain angles of rotation of the main shaft. Preferably, the fabric feed should start after the stitch is tightened and end before the needle enters the fabric.

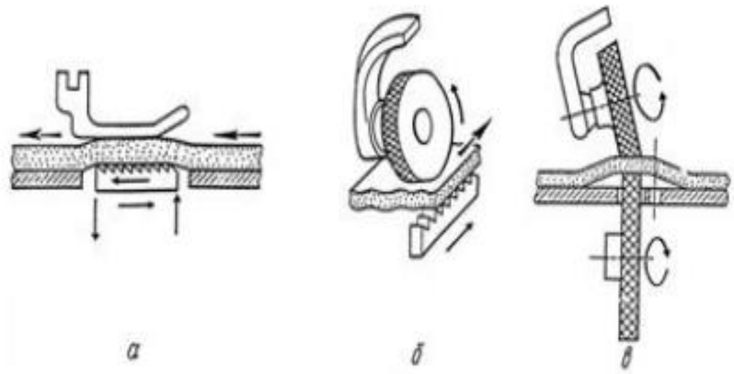


Fig. 2. Crosslinking transport mechanisms: a - Rack and pin; b - Rack and roller; c - Roller and bottom conveyor ring

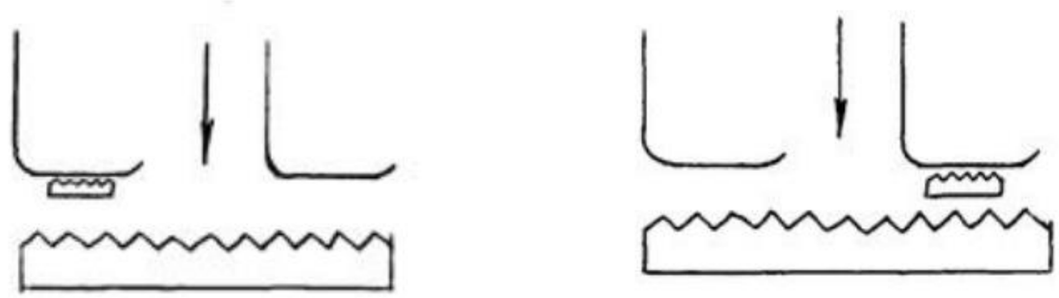
This would give a stroke angle of 50-60°. In existing machines, however, this is approx. 110°. Thus, the stitch is tightened after the fabric has moved a large proportion of the stitch pitch, and the hole in the fabric is offset in relation to the hole in the needle plate. This increases the tension of the thread when it is pulled out of the hook set, and therefore the possibility of thread breaks. In addition, the loose stitch may be caught between the foot and the needle plate, and the thread tensioner will not tighten the stitch, but will wind off the thread from the bobbin. The machine will then loop from the bottom.

2. In order to reduce inertial loads at the moment of feed, the rack's acceleration should be minimal and change smoothly, without jerking. It is desirable that the direction of horizontal components of the rack teeth acceleration does not coincide with the direction of material movement. In this case, the forces of inertia of the workpiece to be fed will contribute to its advancement.

3. The rake teeth must not leave visible marks on the workpiece and must not damage the fabric during transport. The profile of the teeth and their height are selected according to the type of physical and mechanical properties of the fabric. The penetration of the battens into the fabric is largely dependent on the pressure of the presser foot which can be adjusted by means of a screw or a nut.

4. A stitch pitch regulator must be provided in the transport mechanism. In universal machines, the stitch pitch is adjustable in the range 1-5 mm. In heavy duty machines, the stitch pitch can be varied up to 10-12 mm. Some machines have a reverse feed of the fabric for tacking stitches. The most common are rack and pinion mechanisms: the slat and presser foot. Rails can be 2-threaded for light to medium materials and 3-4-threaded, which are used in twin needle machines and with a large distance between the needles. The foot usually follows the shape of the lath.

The press force on the presser foot is chosen for the following reasons: on the one hand it is necessary to ensure constant contact between the presser foot and the rail when moving the material, but on the other hand an excessive increase in press force can lead to irreversible deformation of the material, an increase in the forces acting in the hinges of the mechanism, and therefore premature wear of the mechanism. Incorrect choice of nip force can lead to variations in stitch size at different machine speeds. An important factor in machine performance is the trajectory of the rake teeth. The most common is an eliptical trajectory. Due to the unevenness of the slat speed when moving the material, it can lead to fabric seating. Therefore, a rectangular rake path is preferable. However, at high speeds high forces of inertia occur, consequently leading to vibration and wear on the mechanism. For this reason the trajectory is optimised by bringing the upper section of the trajectory closer to a straight line. To eliminate seating of relatively rigid materials a mechanism with a deflecting needle which moves synchronously with the material and prevents sliding of layers is used. This method is not suitable for elastic, non-rigid materials. For such materials, a differential mechanism with two slats is used when milling without seating. For example, the Juki HZL E40. A similar mechanism can also be used for sewing over a material, e.g. chain stitch machines. If only one layer of fabric needs to be tacked, a separating plate is inserted into the machine. The most rational, but more complex mechanism is the one with upper and lower slats, which clamp the material and move it synchronously. This type of mechanism makes it possible to move materials that are difficult to transport without a landing. Two types can be distinguished:



a b

a) a pulling mechanism with the top rail behind the needle (for grinding stiff, heavy materials);
b) pusher mechanism where the upper rail is in front of the needle (for sewing easily deformable materials or parts made at an angle to the warp thread)

Double-rail mechanisms with a swivelling needle are available, e.g. on the Juki HZL E40. These are used for complex operations, such as edging workpieces. There are three ways of adjusting the stitch length:

- Changing the length of the slave or drive arm of the mechanism or eccentric;
- Changing the trajectory of the slave link in the controller by changing the position of the movable support of this link. This is the most common mechanism in speed machines;

- Changing the angle between the axis of a link engaged in a complex plane-parallel movement and the guide of that link.

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