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Design Development and Mathematical Model of Vibrations of Plates of the Tension Regulator of the Tension Needle Sewing Sewing Machine

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ABSTRACT: The article provides an analysis of existing needle thread tension regulators in sewing machines. Considered their shortcomings. A constructive scheme and the principle of operation of the recommended thread tension regulator are presented. A mathematical model describing the forced oscillations of the plates of the tension regulator of the needle thread of sewing machines has been obtained.

KEYWORDS: sewing machine, needle thread, tension, regulator, plates, spring, stiffness, oscillation, frequency.

In a known construction, the tension regulator of the needle thread of a sewing machine consists of a rod, two convex plates put on it, between which the needle thread passes. At the slot at the end of the rod enter the end of the conical spring, which prevents turning the spring around its axis when adjusting its pressure by rotating the adjusting nut. The other end of the rod is rigidly attached to the head of the sewing machine. [1].

The disadvantage of the needle thread tension regulator is the limited range of the thread tension of various types, depending on the length, taper and other parameters of the spring.

In the device for regulating the tension of the needle thread for a sewing machine, containing two disks, between which a needle thread passes, a spring that presses the disks against each other, a control disk for actuating the pressing device [2]. The above tension regulator has the following disadvantages: the design of the pressure element with an end bevel creates a pinching force, which can lead to inconstancy of the thread tension and, as a consequence, poor-quality stitch; the complexity of the device and the limited possibility of its use of various types of sewing machines.

To simplify the design, a needle thread tension regulator was recommended, which contains a control disc for actuating a clamping element with a clamping spring, which presses two discs separated by a plate, a sleeve placed between the spring and the disc, and a clamping sleeve. All structural elements are made coaxially. In this case, the clamping sleeve is placed in the threaded hole of the control disc and is made with a figured hole in the shape of a shaft rigidly fixed in the board [3].

The main disadvantage of this design of the needle thread tension regulator is also the limited intervals of tension control of the needle thread.

In the tension regulator of the upper thread, consisting of a rod, on which two convex plates are put on. A tapered spring is put on the rod on the right side. At the same time, the curved end of the spring enters the longitudinal slot at the end of the rod. The rod is fastened with a screw in the sleeve. In turn, the sleeve is fixed in the hole on the side or frontal surface of the machine head. In addition to the tension created by the pressure of the spring, the thread in the disk regulator receives an additional tension from the friction that occurs when it covers the rod. In order to raise the presser foot, the plate regulator freely let the thread through, its core is made hollow, and a pusher is placed in this cavity. When lifting the presser foot, the pusher presses against the lintel of the shaped washer inserted into the slot of the rod. Since the pressure of the spring is transferred to the plate through the washer, when moving this washer under the action of the pusher, the pressure on the thread will be relieved [4].

We recommend a new design of the needle thread tension regulator. The needle thread tension regulator consists (Fig. 1) of the rod 1, which is rigidly fixed to the machine head. Two convex plates 2 and 3 are put on the rod 1, between which the needle thread passes (not shown in the figure). The slot 10 on the rod 1 to enter the bent end of the first conical spring 4, the large base of which rests against the plates 2 and 3 by means of the shaped washer 5. Similarly, the second left conical spring 7 is put on the rod 1, which rests the small base on the plates 2 and 3 by washer 6. The diameter of the large base of the first (right) conical spring 4 is chosen equal to the diameter of the small base of

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the second (left) conical spring 7. The other end of the conical spring 7 abuts against the adjusting nut 8, and the small base e of the first spring 4 abuts to the nut 11. The position of the adjusting nuts 8, 9 is fixed locknut.

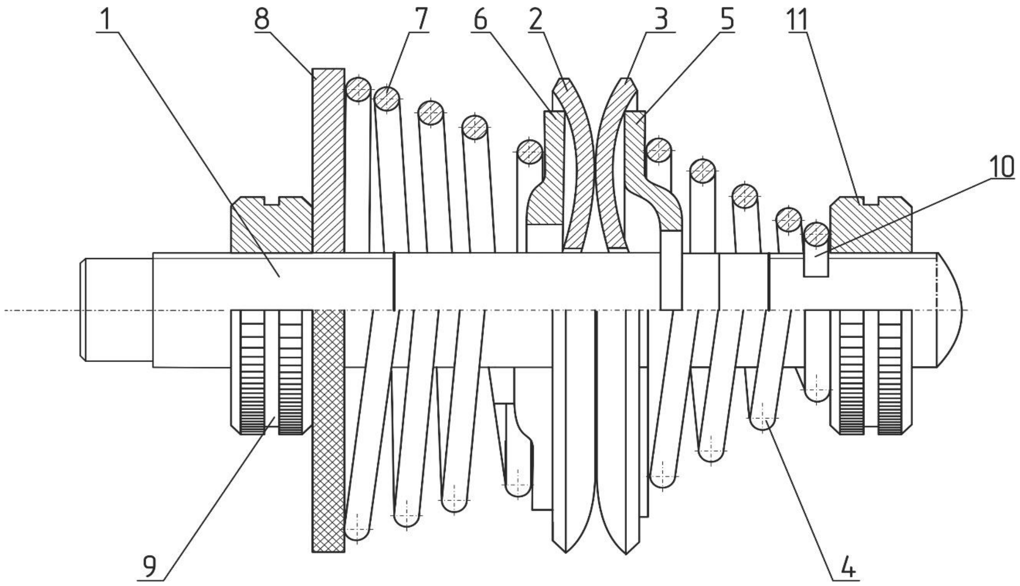

Fig.1. Tension regulator needle thread sewing machine

The design works as follows. The needle thread passes between the plates 2 and 3. If it is necessary to regulate the tension of the thread in small limits, the nut 11 rotates, which presses the plates 2 and 3 between them due to the deformation of the conical spring 4. In this case, the conical spring 7 also deforms in small limits. The plates 2 and 3 not only press the thread, increasing its tension, but also oscillating in the longitudinal direction on the rod 1 automatically establish the necessary values of the tension of the needle thread.

If it is necessary to change the tension of the needle thread within considerable limits, it is necessary to rotate the adjustable nut 8 and fix its position with the lock nut 9. At the same time, the conical spring 7 is pressed and this will result in a significant change in the tension of the needle thread by increasing the clamping force of the thread between the plates 2 and 3. At the same time the first conic spring 4 is also deformed and the needle thread tension necessary for the required mode of grinding materials in the sewing machine is set. At the same time, drastic changes in the tension of the yarn are practically eliminated, thereby reducing their breakage.

To obtain the law of the longitudinal movement of the plates of the needle thread tension regulator, a dynamic model of the oscillatory system is compiled, which is shown in Figure 2.

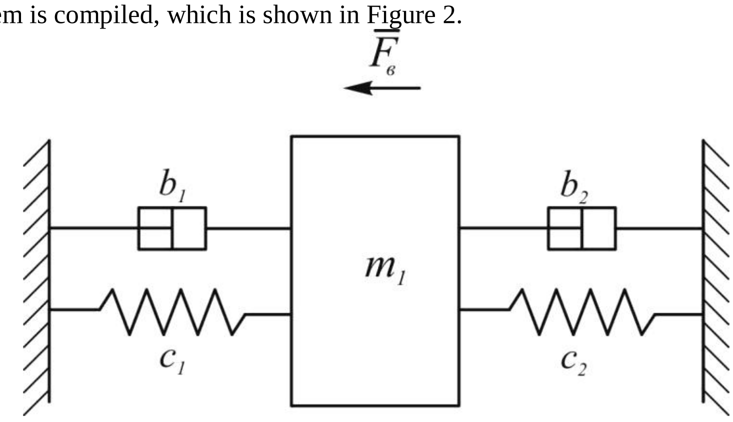

Fig.2. Dynamic model of longitudinal oscillations of regulator plates

When drawing up the differential equation of oscillations of the plates of the needle thread tension regulator, we use the Lagrange equation of the second kind [5]:

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$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot{q}}\right)-\frac{\partial T}{\partial q}+\frac{\partial \Phi}{\partial \dot{q}}+\frac{\partial \Pi}{\partial q}=Q(q)$$

where, T, П, Φ are the kinetic, potential energies and the Rayleigh dissipative function, respectively; q-edited coordinate; Q (q) - circumferential force;

For the considered oscillatory system we have:

$$T=\frac{1}{2}m_1\dot{x}^2, \Pi=\frac{1}{2}(c_1-c_2)x_1^2$$
$$\Phi=\frac{1}{2}(b_1-b_2)\dot{x}_1^2 \qquad (2)$$
$$Q(x_1)=F_b=F_н/f$$

where, m_1- the total mass of the plates; x-longitudinal plate movement; c_1, b_1-are the coefficients of stiffness and dissipation of the right spring of the regulator; c_2,$b_2$are the coefficients of stiffness and dissipation of the right spring of the regulator, $F_н$- is the longitudinal force of pressure of the needle thread on the plates; f-coefficient of friction between the needle thread and the surfaces of the plates.

Derivatives according to (1):

$$\frac{\partial T}{\partial \dot{x}}=m_1\dot{x};\ \frac{d}{dt}\left(\frac{\partial T}{\partial x}\right)=m_1\ddot{x};$$
$$\frac{\partial \Pi}{\partial x}=(c_1-c_2)x;\ \frac{\partial \Phi}{\partial x}=(b_1-b_2)\dot{x} \qquad (3)$$

Substituting (3) into (1) we obtain the differential equation of the longitudinal oscillations of the plates of the needle thread regulator of the sewing machine:

$$m_1\ddot{x}+(c_1-c_2)x+(b_1-b_2)\dot{x}=\frac{F_н}{f} \qquad (4)$$

By numerical solution (4), it is possible to obtain regularities of longitudinal oscillations of the regulator plates for different values of the controller parameters. By choosing the necessary parameters of the regulator, it is possible to provide the required limits for changing the tension of the needle thread during high-speed modes of grinding materials in a sewing machine.

REFERENCES

1. A.S. Ermakov. Equipment sewing enterprises, M., prof. Arr Publishing, 2002, 432 p. and. with. 242.
2. Germany MKI D 05 B 47/2, application N 1485156 from 19.10.69
3. Pristupa S.I., Khakhavin Yu.S. Tension regulator needle sewing thread. The patent of the Russian Federation 2134317.
4. Garbaruk V.P. Calculation and design of the main types of shuttle sewing machines. L. Mechanical Engineering, 1977, 232 p.
5. S.P.Stelkov. Introduction to the theory of oscillations, ed. Science, M., 1984, 437 p.