

ANALYTICAL STUDIES OF WEFT TENSION ON PROJECTOR MACHINES

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Annotasiya: Maqolada mitti mokili dastgohlarda bosh valni bir aylanishida arqoq ipi tarangligining o'zgarishi arqoq ipini zarbsiz uzatish va to'xtatish mexanizmlarining analitik tadqiqoti keltirilgan. Arqoq ipini tarangligi, inobatga olingan burchak, radius va ishqalanish koeffitsienti, shu bilan birgalikda arqoq ipini qattqlik koeffitsienti formulalari olingan

Tayanch so'zlar: taranglik, arqoq ipi, mashinalar, koeffitsiyent, orasidagi burchak, gazlamalar.

Abstract : This paper presents analytical studies of changes in weft tension in non-impact weft feed and braking mechanisms during a cycle of projector looms. Formulas for weft tension are derived, taking into account the angle, radius, and friction coefficient, as well as the weft stiffness coefficient.

Key words : tension , weft thread , machines , coefficient , angle between, fabrics .

Аннотация: В работе приведены аналитические исследования изменения натяжения точной нити в безударных механизмах подачи и торможения уточины за цикл работы прожекторных станков. Получены формулы натяжения уточины, учитывающие угол, радиус и коэффициент трения, а также коэффициент жесткости точной нити.

Ключевые слова: натяжения, точной нити, станков, коэффициент, угол между, ткани.

Fabric formation is due to the value of the pre-knock tension of the weft yarn, which is created over a very short period of time during the weft period, and the fabric formation character is determined by the properties of the weft (rigidity, friction coefficient, etc.).

During certain operating periods of the weft loom, the weft tension should be different. The reinforcing thread tension should be minimal during the slider's movement through the groove, and at the end of the slider at the groove exit, the reinforcing thread should have an additional tension that prevents loop formation in the groove from the side of the receiving box. During the return period of the weft, it is necessary to stretch the weft with a compensator, while the weft should have maximum tension to prevent weft looping and proper fabric formation [1].

The tension of the weft threads before weft beating can be determined by the following expression

$$T = T_o + T_k + T_t \quad (1)$$

T_o - preliminary filling (running branch) tension of the weft, created by a constant braking device;

T_k is the tension (of the running branch) of the weft, depending on the stiffness of the weft thread, the coefficient and the angle of friction in the eye of the compensator;

T_t is the additional tension of the weft created by the rolling element (load) or friction of the brake surface of the shoe, determined by the position of the compensator.

Pre-tensioning (of the incoming branch) is determined

$$T_o = 2 N f \quad (2)$$

N - normal pressure on the thread in the brake device;

f - coefficient of friction of the thread in the tension device.

According to L. Euler, the relationship between the advancing branch T_o and the descending branch T_k has the following expression and depends on the friction angle (α) and the friction coefficient (f) of the thread on the compensator eye

$$T_k = T_o \exp(f \cdot \alpha) \quad (3)$$

The friction angle α of the thread on the compensator eye can be determined

$$\alpha = \varphi + \beta$$

φ is the angle between the advancing thread branch and the horizontal in the compensator eye; β is the angle between the descending thread branch and the horizontal in the compensator eye.

The angle between the advancing (φ) and descending (β) branches of the thread and the horizontal in the eye of the compensator is determined

$$\varphi = (90^\circ - \varphi_1) \quad \beta = (90^\circ - \beta_1)$$

φ_1 - the angle between the oncoming thread branch and the vertical in the eye of the compensator; β_1 is the angle between the oncoming thread branch and the vertical in the eye of the compensator.

Where is it determined from?

$$\operatorname{tg} \varphi_1 = \frac{l_1}{S} \quad \operatorname{tg} \beta_1 = \frac{l_2}{S}$$

l_1 - the distance from the thread guide to the compensator eye on the side of the oncoming thread branch;

l_2 - the distance from the thread guide to the compensator eye on the side of the running thread branch;

S - compensator span.

Taking into account that l_1 and l_2 are constant quantities and can be determined practically on a loom $l_1 = l_2 = 75$ mm, and the value of S of the compensator movement has a range from 0 to 200 mm then it is possible to determine the values of the angles φ , φ_1 , β , β_1 and the friction angle α of the weft on the eye of the compensator. From the results of calculating the angles φ , φ_1 , β , β_1 and the friction angle of the thread in the eye depending on the position of the weft compensator, it follows that the maximum friction angle α of the thread about the eye is at the extreme upper position of the weft compensator.

Euler's formula (3) yields the same thread tension T_k for a given wrap angle α and the tension of the approach thread T_o , regardless of the shape of the guide eye on which the weft is located. For example, for round cylinders of different diameters and with the same wrap angles, the thread tension is the same. It's clear that the thread tension cannot be the same for different cylinder guide shapes along which the weft is positioned. For some cylinder shapes, it may be higher, and for others, lower. For a thread of length l sliding along a circle, with an arc of coverage equal to $(r \cdot \alpha)$ and depending on the stiffness of the weft, the thread tension (T_k) has the form

$$T_k = \frac{2K_n \cdot r \cdot f}{1 + f^2} \left(e^{f\alpha} + \frac{1 - f^2}{2f} \cdot \sin \alpha - \cos \alpha \right) \quad (4)$$

K_n - the stiffness of the weft thread, depending on the type of fiber and the linear density of the yarn, cN/mm;

f is the coefficient of friction of the thread on the guide eye of the compensator;

α is the angle of friction of the thread against the guide eye of the compensator;

r is the friction radius of the thread against the guide eye of the compensator.

Using formula (4), we calculated the weft tension T_k depending on the compensator position for different values of the friction radius, friction coefficient, and weft thread stiffness. Analysis of the obtained results shows that with increasing parameters r , f , and Kn , the weft thread tension increases, with the friction coefficient and thread stiffness having the greatest influence.

The thread tension T_m created by the rolling element of the compensator is determined by

$$T_T = 2 \cdot f \cdot Q_o \cdot \frac{S}{l}$$

$Q_o \cdot \frac{S}{l}$ - the normal pressure on the rolling element wear has a variable value and depends on the position of the compensator, i.e. the swing angle ψ of the compensator;

Q_o - cargo weight;

l is the length of the compensator.

Table 1 shows the results of calculating the filling tension (T_o), the tension from the rigidity of the duck (T_k) on the eye of the compensator, the tension created by the load (T_t) in the compensator depending on the position of the compensator.

Table 1

Results of the calculation of the duckbill tension depending on the position of the compensator

Tension of weft threads, sn.	Compensator travel, mm, S									
	20	40	60	80	100	120	140	160	180	200
Filling tension of the weft, sn., T_o .	5	5	5	5	5	5	5	5	5	5
The weft tension depends on the thread stiffness in the compensator sn., T_k .	1.4	2.7	3.3	4.0	4.3	4.4	4.5	4.5	4.5	4.5
Duck tension in the compensator From cargo, sn., T_t .	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	4.9
Total duck tension, sn., T.	6.9	8.7	9.8	11.0	11.8	12.4	13.0	13.5	14.0	14.4

Analysis of the table shows that the total tension (T) of the duckbill increases as the compensator moves upward.

Therefore, the proposed formulas take into account the stiffness of the weft (type and linear density of the thread), the coefficient of friction, the friction radius, the position of the compensator and the load pressure on the thread in the compensator.

Thus, analytical studies of the tension of the weft threads in the new weft braking and feeding system were carried out, and patterns of change in the tension of the weft were obtained depending on the friction radius, friction coefficient, friction angle, weft rigidity, and the position of the compensator.

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