Section 1. INDUSTRIAL TECHNOLOGIES AND EQUIPMENT

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DESIGN OF THE LEVER MECHANISM OF THE EDGE FORMING OF THE WEAVING MACHINE

ПРОЕКТИРОВАНИЕ РЫЧАЖНОГО МЕХАНИЗМА КРОМКООБРАЗОВАНИЯ ТКАЦКОГО СТАНКА

Butkewich W.[1], Piotuch A., Dubanewich D., Kulandin A.
Vitebsk State Technological University, Republic of Belarus
E-mail: [1]Butkevich@mail.ru
Буткевич В.Г.[1], Пиотух А.А., Дубаневич Д.Т., Куландин А.С.
Витебский государственный технологический университет, Республика Беларусь

ABSTRACT

MECHANISM, MACHINE TOOL, FABRIC, RESEARCH, WORK, SCHEME, CAM

The paper deals with the design of the lever mechanism of the edge former of the Dornier weaving machine with an anti-four-link. The kinematics of the lever part of the mechanism is investigated depending on the crank rotation angle.

АННОТАЦИЯ

МЕХАНИЗМ, СТАНОК, ТКАНЬ, ИССЛЕДОВАНИЕ, РАБОТА, СХЕМА, КУЛАЧОК

В работе рассмотрены вопросы проектирования рычажного механизма кромкообразователя ткацкого станка фирмы Dornier с античетырехзвенником. Исследована кинематика рычажной части механизма в зависимости от угла поворота кривошипа.

Improving the quality and expanding the product range in the textile industry is closely linked with the use of new progressive technologies and new technological equipment. High-performance weaving machines with various ways of weft thread laying are used in the textile industry. Rapier and pneumatic weaving looms, as well as looms with small-size thread guides, allow to produce a wide range of high-quality fabrics. The machines are distinguished by a high level of automation of the fabric production process, a wide range of threading widths, the possibility of using various shedding mechanisms, heald lifting carriages etc.

It is necessary to pay attention to edge structure choice by threading of cloth wear in the weaving machine. The edge former serves to form the fabric edge of various structures and is a connection of lever mechanisms with cams [1–3]. Research is devoted to the calculations of an edge formation mechanism. There is a significant number of works in which the problem of wearing of the cams working surfaces and the mechanical systems parts of the weaving machines are presented. For the sample estimation of the rational arrangement of the kinematic pairs, the scheme of the diaxial crank-rocker-mechanism of the edge knives of the Dornier weaving machines with anti-four-link mechanism was considered, that is, when the pusher and rocker arm are located opposite to each other (Fig. 1).

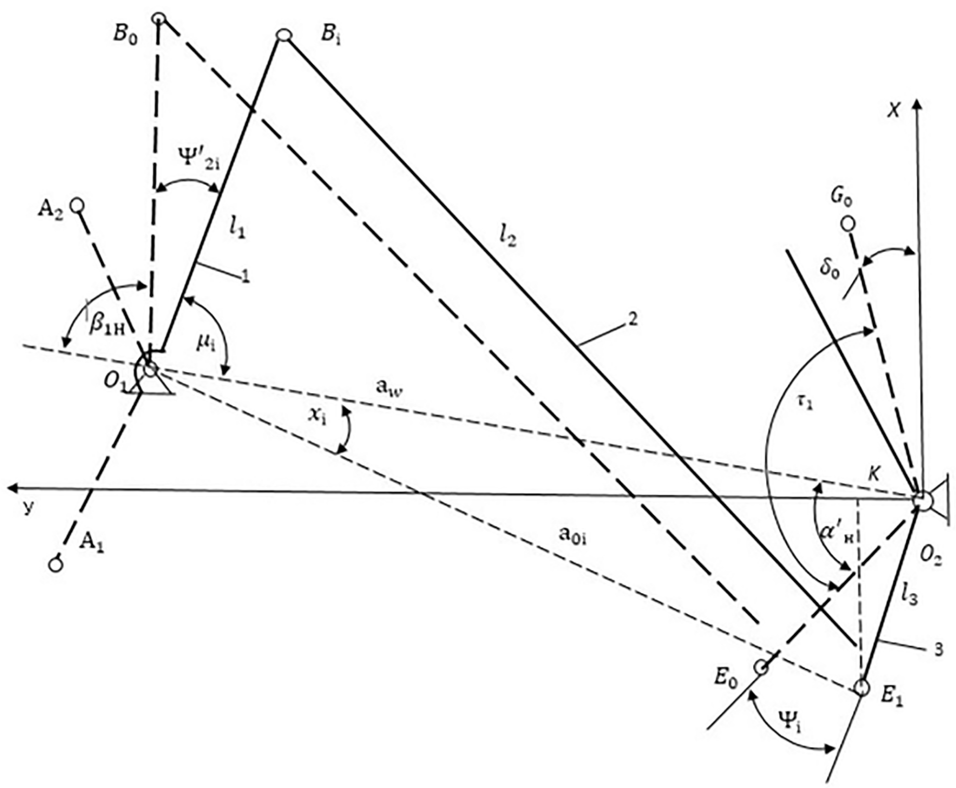

Figure 1 – Diaxial crank-rocker mechanism with anti-four-link unit

The scheme (Fig. 1) assumes a change in the direction of the cam rotation to the opposite.

The initial data include the following values: design angle T_1, α'_0 – the angle between the y and a_W axes where y is the coordinate axis, a_W – is the center distance, β_{1H} is the initial coordinate of the pusher in relation to the line of centers

O_1, O_2, is the initial coordinate of link *3 3*(l_3) relative to the center distance, δ_0 is the angle between the X-axis (vertical axis) and the link of two-shoulder levers $E_0O_2G_0$. Point K – projection of point E_i – on the line of centers O_1.

$$\text{tg}X_i = \frac{E_i\,K}{O_2\;K} = \frac{l_3 \sin(\alpha'_H + \Psi_i)}{a_w - l_3 cos(\alpha'_H + \Psi_i)}. \tag{1}$$

Of $\Delta O_1B_iE_i$: $\int (l_2)^2 = l_1^{\,2} + a_{0i}^{\,2} - 2l_2a_{0i}cos\,(\mu_i + x_i)$

$$\mu_i + x_i = \arccos \frac{l_1^2 + a_{0i}^2 - (l_2)^2}{2l_2\,a_{0i}}. \tag{2}$$

Of $\Delta O_1B_iE_i$: $\int a_{0i}^{\,2} = a_w^{\,2} + l_3^{\,2} - 2l_3a_w(\alpha'_н + \Psi_i)$

$$\mu_i = 180° - \beta_{1H} - \Psi'_{2i} \quad \text{or} \quad \Psi'_{2i} = 180° - \beta_{1H} - \mu_i \tag{3}$$

It follows from (1) and (2) that

$$\mu_i = \arccos \frac{l_1^2 + a_{0i}^2 - (l_2)}{2l_1 a_i} - \text{arctg}\,\frac{l_3 \sin(\alpha'_H + \Psi_i)}{a_w - l_3 cos(\alpha'_H + \Psi_i)} \tag{4}$$

After substituting (3) and (4), we get

$$\mu_i = \arccos \frac{l_1^2 + a_w^2 + l_3^2 - 2a_w l_3 cos(\alpha'_H + \Psi_i) - (l_2)^2}{2l_1\sqrt{a_w^2 + l_3^2 - 2a_w l_3 cos(\alpha'_H + \Psi_i)}} - \text{arctg}\,\frac{l_3 \sin(\alpha'_H + \Psi_i)}{a_w - l_3 cos(\alpha'_H + \Psi_i)} \tag{5}$$

Finally, the analogue of the motion law of the cam mechanism pusher $\Psi'_{2i}(S, \varphi)$ will be:

$$\Psi'_{2i} = 180° - \beta_{1H} - \arccos \frac{l_1^2 + a_w^2 + l_3^2 - 2a_w l_3 cos(\alpha'_H + \Psi_i) - (l_2)^2}{2l_1\sqrt{a_w^2 + l_3^2 - 2a_w l_3 cos(\alpha'_H + \Psi_i)}} + \tag{6}$$
$$+ \text{arctg}\,\frac{l_3 \sin(\alpha'_H + \Psi_i)}{a_w - l_3 cos(\alpha'_H + \Psi_i)}$$

This solution method can be applied to other variants of the link design $E_0O_2G_0$.

As a result of the work the following conclusions can be drawn:

1. The study of the kinematics of the lever part of the edge-forming mechanism

depending on the angle of crank rotation makes it possible to design the cam profile at different lengths of the links.

2. The backing of the lengths of the links of the mechanism lever part allows to create this mechanism with the most rational transmission angles, providing the lowest loads in the kinematic pair of cam-pusher.

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