WARP THREADS STRESS VARIATION DURING HANDLOOM WEAVING

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The weaving cycle for making a weft involves three basic actions that begin with the opening of the shed, promotion the weft by the shuttle and beating-up the weft to the end of the fabric through the reed brought by the batten. For industrial weaving machines, the longitudinal displacement of the warp is achieved within the weaving cycle by unwinding the weaving warp and pulling the raw fabric from the work area. At the hand weaving looms, the longitudinal displacement of the warp threads goes beyond the weaving cycle and follows the possible movement of the batten between the heddle frames and the end of the woven fabric. The maximum stroke of the batten is constructively limited between the heddles and the bearers of the take-up roller at the front end point. With each beating-up of the next weft, this front end point of the weaver's reed reversing motion is shifting back to the heddles. The reason for this is the overlapping of wefts, one after the other, and the longitudinal immobility of the warp and the fabric in the work area. The main result is the shortening of the base length of shed. Its height remains unchanged and therefore, after each beaten weft the tension in the main threads increases. Thus, it changes the conditions of intercrossing and mutual working of the warp and weft threads. From this point of view, hand weaving is not limited by the thread-binding technique but requires additional knowledge and skills on textile materials. Subject of this paper is the variation in the tension of the warp threads during the weaving on hand horizontal looms. Aim of the work is to establish the analytical relationships between the geometric parameters of the handlooms and the variation of mechanical conditions in the hand weaving. Performance tasks include bibliography research, technological observation, measuring of constructional proportions and calculations. Main question in the teaching of weaving technique is looking for the section or the balance between the complex analytical description and the practical skills for the weaving cycle adjustment.

Key Words: hand weaving loom, textile craft, warp stress, vocational education

1. INTRODUCTION

Recently, the idea of a new conception of weaving machines in industry has become more and more important. The rational grain in this idea is the anthropomorphic beginning in the weaving cycle, which is reproduced as autonomous movements of the working organs of the machine [1]. The implementation of the concept of autonomous propulsion of the working organs is left to the mechatronics.

The realisation of the weaving cycle as a repetitive element of tissue formation remains the unchanged principle of weaving. The usual weaving cycle consists of shed formation, insertion and beatin up of the weft, and longitudinal displacement of the warp threads. In manual weaving, the unwinding of the loom beam and the release of a certain length from the warp is carried out after a certain number of drawn and beat up wefts, Figure 1. This means that there are two weaving cycles in the hand weaving with a warp brake. The short cycle includes the

formation of the weaving shed, insertion and beat up of the weft. The secondary cycle includes a number of short cycles (about 200 wefts), unwinding of the weaving and winding of the fabric.

Figure 1, Handloom – shed formation

2. WARP EXTENSION COMPUTATION

Within the secondary weaving cycle, the geometric parameters of the weaving shed are changed, as shown in Figure 2.

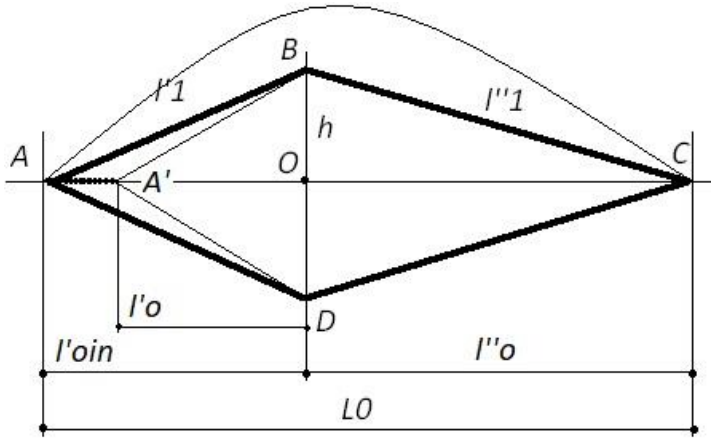

Figure 2, Parameters of the weaving shed

For the purposes of the present work, a manual loop with the following loading parameters of the linear density threads - $T_t 200\ tex, 100 - Cotton$.

Table 1, Handloom weaning paramaters

base length, L_0, mm	forward length, l_0'	rearward length, l_0''	shed height, h	Warp run-in, a_w, %	Initial module, $E_f, cN/tex$	Picks up, $D_d, wefts/mm$
1100	400	700	70	7.0	10.0	2.0

The extension of the warp threads can be considered in three main levels.
On the first level, which is constant, the extension of the warp threads is caused only by the formation of the weaving shed:

$$L_1 = \sqrt{l_0'^2 + h^2} + \sqrt{l_0''^2 + h^2} \quad (1)$$

On the second level, the extension of the warp threads depends on the shortening of the basic length of the weaving shed - L_0. This is the result of the consistent beating up of the wefts without undoing the warp.

$$L_1 = \sqrt{\left(l_0' - \frac{n_{weft}}{D_d}\right)^2 + h^2} + \sqrt{l_0''^2 + h^2} \quad (2)$$

At the third level, the extension of the warp threads also depends on WARP running in - a_0.

$$L_1 = \sqrt{\left(l_0' - \frac{n_{weft}}{D_d}\right)^2 + h^2} + \sqrt{l_0''^2 + h^2} + n_{weft}\frac{a_0}{100D_d} \quad (3)$$

With a constant initial module, the resulting stress increases proportionally along with the extension.

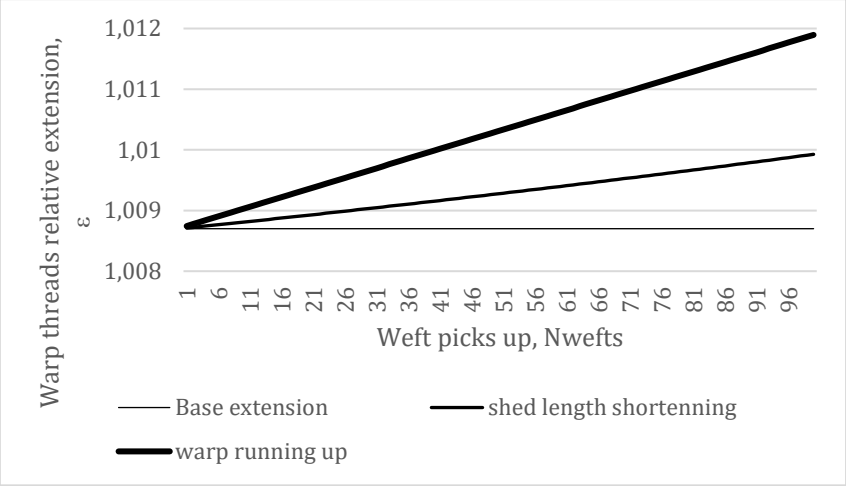

Figure 3, Variation of the warp threads extension during handloom weaving

2. CONCLUSION

Hand weaving provides good training opportunities for textile professionals in the field of weaving technology at all. Distinguishing the formation of the weaving shed from the longitudinal displacement of the warp threads shapes the essence of the stressed weaving warp. Weaver senses the varying stress in the weaving warp and regulates the stroke of the slay to achieve a uniform weft density of the fabric.

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