Topic № 5
TEXTILE MACHINERY AND EQUIPMENT

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Textile Industry.
Technology of textile materials.

Plenary lecture by Prof. Goran Demboski from the University
of St. St. Cyril and Methodius in Skopje, Republic of North Macedonia

Plenary lecture by Assoc. Prof. VU Thi Hong Khanh of Hanoi University
of Science and Technology, SR Vietnam

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STUDY AND DESIGN OF AXIAL CAM OF 8-NEEDLE HEAD FOR KNITTED CORD

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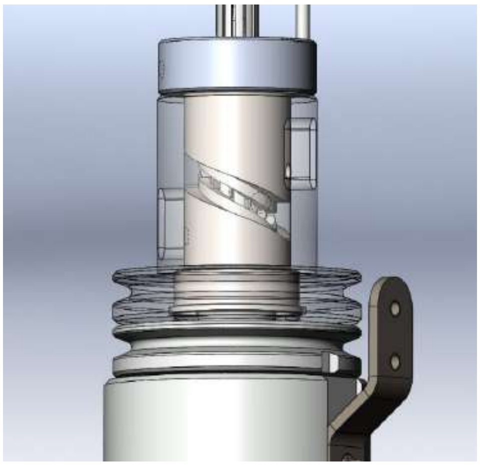
The hybrid cord knitting head is a multi-functional device for making linear textiles. The dual nature of the device is expressed in the simultaneous possibility and alternative choice of the thread receiving a knitted and/or twisted structure.

Knitting heads with 6 to 12 heads are known, in which 1 to the maximum number of needles can be loaded. The loop is formed by the vertical movement of the needles, which, according to the well-known scheme of loop formation, catch and entangle the thread. The peculiarity of this apparatus is due to the formation of 8 looped pillars for one revolution of the head. Thus, for one machine cycle/head revolution, each needle casts one row of stitches.

The essential problem lies in determining the movement of the needles from the extreme bottom to the extreme upper position. And since the needles move according to a sinusoidal law relative to the uniform rotation of the head, the question relates to determining the amplitude of the harmonic oscillatory motion.

The harmonic function of the axial cam has one argument - the angular position *α* of the head along the axis of rotation and one parameter - the movement of the head along the axis of rotation and one parameter - the movement Δ*h* of the needles. The axial cam equation consists of 2 terms:

$$\begin{cases} h = \Delta h(1 + \sin\alpha) \\ 2.\,\Delta h = H_{max} - h_{min} \end{cases}$$



Functional walls from the heel of the knitting needle are in constant contact with the guide surface from the profile of the axial cam. These walls are perpendicular to the vertical movement of the needle and therefore the leading surface of the axial cam must be parallel to the normal from the local coordinate system.

With the conditions for the cam function and the zero slope of the guide profile, the spatial model for making the axial cam is ready. It remains to measure and determine the numerical values of the model.

Subject of this article is the spatial model for making an axial cam from a knitting head for cords.

Purpose of the development consists in determining the numerical values of the guide profile with the additional condition that the movement of the knitting needles is carried out by the guide profiles of paired mirror axial cams.

Keywords: knitted cord, textile engineering, small knitting head, and axial cam.

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APPLICATION OF MODERN CARPENTRY TECHNOLOGIES FOR MAKING A HORIZONTAL HAND-OPERATED LOOM

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The successful application of hand weaving in modern times can only be achieved by combining modern engineering techniques with optimally selected materials and in-depth materials science in carpentry.

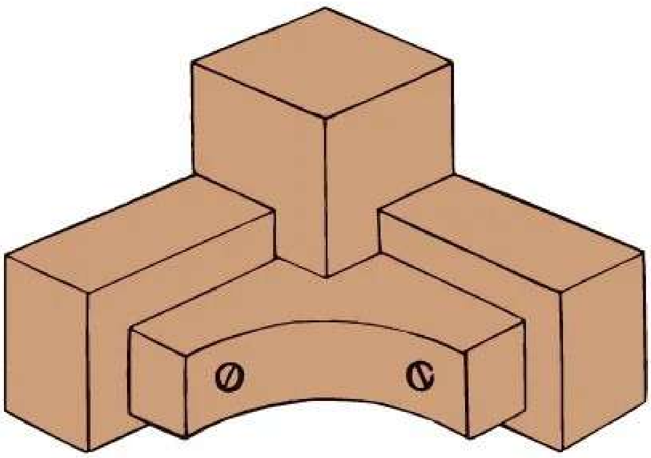
The basic principle for building a handloom follows the balance between durable construction, diverse weaving capabilities and overall ergonomics.

The essential problem consists in finding an optimal combination between the carpentry materials and the assemblies of the working bodies.

The conceptual design of the loom is based on the modularly upgraded functional groups and capabilities of the loom.

Heavy woods with a high relative density and strength are used to make the chassis. They provide stability in operation and longevity of the loom.

Light woods are suitable for moving parts operated by the hand, such as the shuttle, for example.



The bearing assemblies of the moving parts such as the main and the traction cross ensure the durability of the loom and reduced human effort when driving.

The subject of this article is to identify and direct the design of the hand loom in the direction of the materials, the machine elements of the assemblies and the general construction.

The purpose of the development is a list of the necessary carpentry materials for the various working bodies.

In addition, it is necessary to distinguish the different types of assemblies (fixed and movable) and select the appropriate machine elements.

The collected and arranged technological information leads to optimal constructive solutions.

The tasks are mainly related to the research and collection of technical data on the construction materials within the framework of the conceptual design and the applicable techniques for making and assembling the loom.

Keywords: weaving, hand looms, carpentry technology

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DESIGN TRENDS OF WEAVING TECHNIQUES IN THE FRAMES OF INTERNET OF THINGS AND SUSTAINABILITY RESTRICTIONS

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Starting the design of a new weaving loom, constructors have to do better than just a few picks faster than the previous generation. Today's world is all about connectivity, user-centric design, intuitive controls, self-learning capacities and sustainability. Four key principles serve as the starting point for the design of any perspective-weaving machine.
Smart Performance is the first requirement for any machine or feature, and the obvious indicator is the theoretical maximum speed. However, the gap between this theoretical speed and the effective speed under real-life conditions is huge. Increasing real performance also means reducing downtime to an absolute minimum. For example with *Quick Style Change*, the quickest way to get new styles up and running. Smart technology also monitors the behaviour of the yarn and the weaving process on a permanent basis. It is possible by constantly tweaking the insertion parameters using sophisticated algorithms. Smart Performance is an intelligent machine design combined with self-setting software, allowing the highest possible practical speed and best performance under real conditions.
Sustainability Inside prevents waste and reduces energy consumption; machines design has long faced up to its responsibility. Pioneering *Sumo Drive*, introduced back in 1996, has demonstrated this and it is still the most energy-efficient main drive available. *EcoFill* device reduces the waste and tries to void it completely. Breakthrough developments such as the *Blue22* generation of pre-winders make it possible to minimize the waste length even while the machine is running.

Driven by Data allows the transition of the technology parameters towards database. Data capturing conditions artificial intelligence application and the manufacturing becomes more efficient. Applications such as *ARVD II Plus, AirMaster and OptiSpeed* are becoming possible for monitoring, automatic adjustment and remote troubleshooting, to the further deploying of Industry 4.0 in the weaving industry.
Intuitive Control on the weaving machine display is the interface that controls nearly all the machine functions. Wireless-ready, robust and designed for instant readability. This user-centric approach is also embedded in the design of the overall machine, making all operations easy, intuitive and self-explanatory**.**
Subject of this article is the short presentation of sustainable trends in the weaving machines applicable in the next five years.
The purpose of the descriptive development is to acquaint the general audience with the diverse achievements and strategic goals in the textile engineering of weaving machines.

Keywords: textile engineering, weaving machines, IoT/AI, sustainable machinery