

Kinematics Study of Rapier Driven by a Coupled Crank-Variable Pitch Screw System in Weaving Machine

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Abstract

In shuttle less weaving machine, the threads are inserted along width of the cloth by using two rapiers placed on its flexible tape wound on oscillating rapier wheels which are situated at both sides of the machine. A mechanism driving each rapier wheel consists of a slider-crank engaged with the helicoids variable pitch screw. The kinematical study of the mechanism is divided into the analysis of two sub-mechanisms: 1) a slider-crank 2) the slider engaged with screw. At the end of the axis of the screw the rapier wheel is fixed. The displacement of the slider-crank along the axis of the screw and rotation of the screw are calculated. Three types of variable helix geometry namely a) cycloidal b) 2-3 polynomial c) 3-4-5 polynomial type is considered. The relations between rotation of crank (input) and the corresponding angular rotation of the screw (output) producing oscillatory motion of the screw are obtained for three cases of helix geometry by graphical method and the output is symmetrical about the crank rotation of 180°. It is found that the polynomial type produces lower acceleration and velocity but a considerable dwell of screw and also the rapier wheel than that of cycloidal type.

Keywords: Rapier weaving, Slider-crank mechanism, Screw mechanism, Variable pitch screw