A scaled drawing from the results of the new mechanism obtained and the coupler curve of point E are shown in ***Figure 8***. After a kinematic analysis, the position diagram of the vertical movement of point E is presented in ***Figure 9***, and normalised ($\omega_2 = 1$) velocity and acceleration diagrams are given in ***Figures 10*** and ***11***, together with those belonging to the classical mechanism. As can be seen in the position diagram, point E reaches the lower dead point a little late in the new mechanism (approx. 10°), whereas a good coincidence is observed in the other sections. Since the new mechanism takes as reference the classical one in use, then it meets the demand for thread in the stitch formation.

The positive peak of velocity before the upper dead position is nearly 20% greater in comparison to the classical mechanism. The same increase is also observed in the positive peak of acceleration, resulting from the fact that the eye, which reaches the lower dead point later, moves more rapidly in order to reach the upper dead point. The velocity and acceleration have lower values in the other sections and their diagrams are in proper order.

Conclusions and discussion

A new mechanism of a more simplified structure was obtained by modifying the classical needle bar and thread take-up mechanism. Kinematic analysis revealed that the new mechanism was in conformity with classical lockstitch sewing mechanics. Besides this, it is much smaller in size compared to the classical mechanism, that is, it covers a smaller space. The increase in the peak value of acceleration may increase the tension on the thread slightly at the aforementioned crank angle coupled with an increase in the number of revolutions. However, this increase is both short-lived, as can be seen in ***Figure 11***, and occurs just before point E reaches the upper dead point. This increase does not pose a problem as the upper thread is free at this position (***Figure 9***).

In conclusion, the new mechanism has a potential use in household and industrial lockstitch sewing machines as an alternative.

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