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DISCUSSION

Fan Y. Chen[2]

This is a remarkable discovery. A century has passed since the invention of the first mechanical inversor, and we are now aware of the two historical inversive mechanisms: The Peaucellier cell and contraparallelogram of the Hart cell are cognates of each other. As a consequence of this, a new class of straight-line mechanisms is being introduced. Aside from theoretical interest, cognates provide alternative linkages with different link sizes and configurations, force transmission characteristics, crank rotations, and fixed pivot locations to provide a variety of design choices.

The writer would like to point out that the crossed parallelogram of Hart can directly replace the Peaucellier cell without using the quadruplanar inversor of Sylvester and Kempe. In Fig. 18, the Peaucellier cell of the first kind[3] and the crossed parallelogram of Hart are presented superimposed upon each other. By using the same mechanism configurations and notations as those of the authors, the rhombus $QK'PC''$ and the kite $B_oK'QC''$ of the Peaucellier cell are shown in solid lines, the crossed parallelogram of Hart $B^sCD^sK^s$ is shown in dashed lines, and B_oA_o and $A_o'Q$ are the auxiliary links. The steps outlined below show how to obtain one from the other:

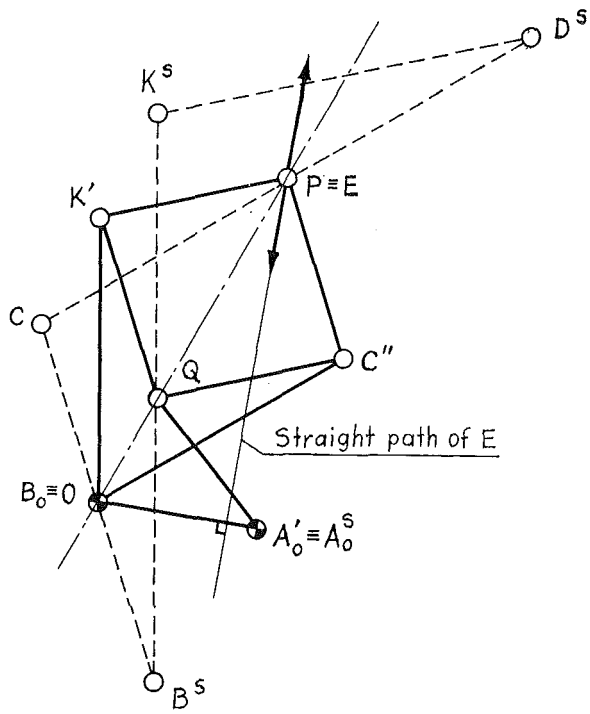

Fig. 18

1 Starting from the given Peaucellier cell, draw CP in parallel to OC'' and extend CP to D^s such that $PD^s=CP=OC''$.

2 Draw CO in parallel to PC'' and extend CO to B^s such that $OB^s=CO=PC''$.

3 From point B^s draw a straight line B^sK^s in parallel to OK' and extend it to point K^s such that $QK^s=B^sQ=OK'$.

4 Join K^sD^s to complete the construction of the crossed parallelogram of Hart.

Note that both mechanisms have the fixed centers B_o and A_o', points P, Q, and B_o are collinear, and the generating point E in common. Without difficulty, we can also show that the Peaucellier cell of the second kind is cognate to the inversor of Hart.

Furthermore, it is conceivable that all cognate mechanisms presented in the paper are extensible to become spherical mechanisms by means of stereographic projection and that some of the cognate mechanisms may be used to generate inverse-square law force (a property which the Peaucellier cells can be used to simulate, as has been shown by the discusser).[4]

[2] Associate Professor of Mechanical Engineering, Ohio University, Athens, Ohio.

[3] There are two versions of Peaucellier cell. They differ only by the relative proportions of the link length.

[4] Chen, Fan Y., "On Kinematic and Force Analysis of Peaucellier's Linkage," ASME paper No. 70-Mech-47.