Analytical expression for an optimised link bar mechanism for a beta-type Stirling engine -
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The design of a mechanism for kinematic beta-type Stirling engines, where the displacer piston and the working piston share the same cylinder, is complicated. A well-known solution is the rhombic drive, but this solution depends on oil lubrication because of the gear wheels connecting the two counter rotating crank shafts. In a hermetically sealed Stirling engine it is an advantage to avoid oil in the crank case, making the application of the rhombic drive difficult. In this paper, another crank mechanism is presented, which has been developed for a 9 kW single cylinder engine. The new crank mechanism is a further development of the mechanism in a previous 9 kW engine. The crank mechanism for the beta-type Stirling engine is based on two four-link straight line mechanisms pointing up and down, respectively. The mechanism pointing upwards is connected to the working piston, while the mechanism pointing downwards is connected to the displacer piston. In the paper, an analytical analysis of an optimised link bar mechanism is presented, which can be used for determination of the geometry, the phase angle between the pistons and the in-accuracy of the straight line movement. Furthermore, the design of a mechanism for a new 9 kW engine using natural gas as fuel is presented.

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