

عنوان مقاله:

Structural Design and Performance Study of a Reciprocating Vortex Ring Generator

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خلاصه مقاله:

Vortex rings can maintain their structure during motion and achieve long-distance transport with low energy consumption, which is a fluid transport method with great energy-saving potential. In this paper, a reciprocating vortex ring generator structure is designed, which can generate two vortex rings during the reciprocating motion of one piston, making full use of the thrust in the reciprocating motion period of the piston and improving the vortex ring generation frequency compared with traditional vortex ring generators. For the characteristics of long-distance transport of vortex rings, an experimental platform is designed and built, and 277 sets of experiments are carried out with different geometric parameters. The results show that the effect of generating two vortex rings could be achieved under other parameter conditions, except for some parameter conditions where the diameter ratio $D_1/D_2 = 4$. By analyzing the influence of baffle width ratio, length ratio, and diameter ratio on the moving distance of vortex rings, the performance of the vortex ring generator is preliminarily studied. In 277 sets of experiments, the maximum moving distance ratio x_1 of vortex ring 1 is 13.7 when $L_1/L_2 = 2.4$, $D_1/D_2 = 2$, and $w_1 = 0.2$. And the maximum moving distance ratio x_2 of vortex ring 2 is 20 when $L_1/L_2 = 2$, $D_1/D_2 = 2.5$, and $w_2 = 0.2$.

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