COMBUSTION OF FUEL–AIR MIXTURE IN GAS CAVITY UNDER THE BOTTOM OF THE HIGH-SPEED VESSEL

S. M. Frolov¹, S. V. Platonov², K. A. Avdeev¹, V. S. Aksenov¹, V. S. Ivanov¹, A. E. Zangiev¹, A. S. Koval¹, and F. S. Frolov¹

¹N. N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation
²Nizhniy Novgorod, Russian Federation

Abstract: A numerical study of the possibilities to reduce drag and to create additional thrust for the vessel with an artificial gas cavity under the bottom by means of organizing stationary combustion of fuel–air mixture in the cavity has been performed. It is shown that feeding the fuel mixture in the cavity and its subsequent burning under the bottom of the vessel can significantly increase the efficiency of the cavity with respect to the horizontal and vertical components of forces acting on the vessel by the gases in cavity. The results suggest that appropriate revision of the longitudinal profiling of bottom contours, for example, creating a cascade of transverse redans, may increase the horizontal force to the values, capable of ensuring the vessel to move with the target speed, and refuse in the future from the use of traditional screw propellers.

Keywords: high-speed vessel; artificial gas cavity; hydrodynamic drag; combustion; impulse of horizontal force

Acknowledgments

This work was supported by the Russian Foundation for Basic Research (project ofi-m 16-29-01065).

References


Received November 15, 2016

Contributors

Frolov Sergey M. (b. 1959) — Doctor of Science in physics and mathematics, head of department, N. N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation; scientific head, Noncommercial Partnership Center of Pulse Detonation Combustion, 4 Kosygin Str., Moscow 119991, Russian Federation; professor, National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), 31 Kashirskoe Sh., Moscow 115409, Russian Federation; smfrol@chph.ras.ru

Platonov Sergey V. (b. 1971) — Candidate of Science in technology, Nizhniy Novgorod, Russian Federation; platsv@yandex.ru

Avdeev Konstantin A. (b. 1971) — Candidate of Science in technology, specialist, Noncommercial Partnership Center of Pulse Detonation Combustion, 4 Kosygin Str., Moscow 119991, Russian Federation; senior research scientist, N. N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation; kaavdeev@mail.ru

Aksenov Victor S. (b. 1952) — Candidate of Science in physics and mathematics, senior research scientist, N. N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation; designer, Noncommercial Partnership Center of Pulse Detonation Combustion, 4 Kosygin Str., Moscow 119991, Russian Federation; associate professor, National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), 31 Kashirskoe Sh., Moscow 115409, Russian Federation; v.aksenov@mail.ru

Ivanov Vladislav S. (b. 1986) — Candidate of Science in physics and mathematics, senior research scientist, N. N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation; ivanov.vls@gmail.com

Zangiev Alan E. (b. 1989) — research engineer, N. N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation; sydra777@gmail.com

Koval' Alexey S. (b. 1985) — research engineer, N. N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation; designerd, Noncommercial Partnership Center of Pulse Detonation Combustion, 4 Kosygin Str., Moscow 119991, Russian Federation; senior lectures, National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), 31 Kashirskoe Sh., Moscow 115409, Russian Federation; ASKoval@mephi.ru
Frolov Fedor S. (b. 1981) — Candidate of Science in physics and mathematics, senior research scientist, N.N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, 4 Kosygin Str., Moscow 119991, Russian Federation; senior specialist, Noncommercial Partnership Center of Pulse Detonation Combustion, 4 Kosygin Str., Moscow 119991, Russian Federation; f.frolov@chph.ru