

## ABOUT NONLINEAR EFFECTS OF A SIMPLE MODEL OF AN UNSTABLE BURNING - SINGING FLAME

V. V. Afanasyev<sup>1</sup>, S. V. Ilyin<sup>1</sup> and N. I. Kidin<sup>2</sup>

<sup>1</sup>*Department of Physics of Heat, Chuvash State University Cheboksary, Russia*

<sup>2</sup>*Institute for Problems in Mechanics of the Russian Academy of Sciences, Moscow, Russia*

Research of nonlinear dynamic systems, to which self-oscillatory systems with burning refer, represents scientific interest both in applied and in the fundamental respect. It is known that in such systems there may be various modes of excitation of unstable burning: soft, hard modes and every possible parametrical instability. In this work it is shown that the given modes of excitation are realized and on model of singing flame with homogeneous mixes.

Experiments were carried out in short glass pipes - resonators of length 0.65 m. and diameter 38 mm with a flat copper burner with a cross section of 16\*3,5 mm with an opportunity of varying the length fuel-supply path from 0.5 m up to 2 m.

It is experimentally shown that at use of a slot-hole burner on structure propane - air mixes and lengths fuel-supply path are the available zones of excitation and silence. At the boundaries of these areas there are subareas with a hysteresis. In these subareas conditional - steady burning which are characterized by that at small amplitudes of external indignation the system as a whole is steady is realized, but at excess of amplitude of indignation of some threshold value the system passes in an unstable mode of burning with the so-called hard mode of excitation. In experiments the hard mode of excitation was initiated on a method directed injecting. Initiation of a hard mode was carried out with the help of a cylinder with compressed air, which opened on strictly certain time (0.1sec) with the help of the electromagnetic valve. Excitation of an unstable mode of burning began with some threshold, superfluous pressure in a cylinder.

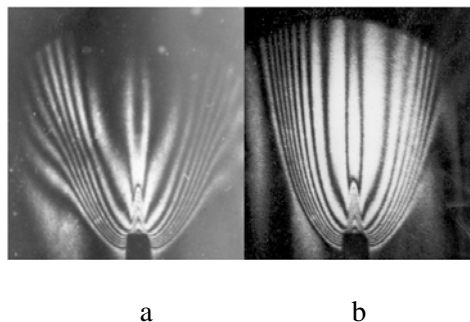


Fig.1. Interferograms of a stationary flame

As have shown by the researches, for a hard mode of excitation at the same conditions of experiment (the flow rate, concentration of a gas mixture, length fuel-supply path) there exist two various steady conditions. One corresponds to a steady condition, and another is subject to self-excitation. It is indirectly confirmed by the holographic interference methods, a stationary flame is given in the figure. Interferogram (a) is obtained before indignation and interferogram (b) - after excitation. In the both cases at the bottom of the pipe of the resonator the cap from cotton wool was established.

The research described in this paper has been supported by the Russian Foundation for Basic Research (Project No. 03-01-00823a).