

# PROPAGATION OF DETONATION IN A CHAMBER OF SPECIAL SHAPE FILLED BY HYDROGEN-AIR MIXTURE

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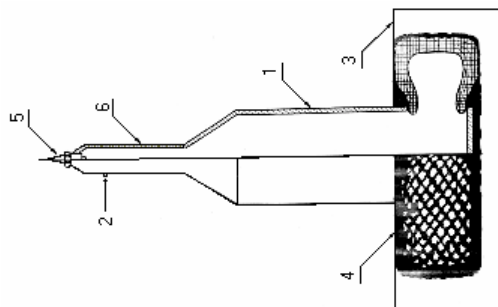
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Key words: self-sustained detonation, hydrogen-air mixture.

It is well known that the detonation is widely used in a many technological processes. Therefore, the natural question is arisen about the providing the stable working of the devices, prevention of non-controlled explosions and guarantee of safety for the staff.

The present paper is devoted to the investigation of the possible configurations of the device for the worn-out tires destruction. The principal sketch of the device is presented in the Fig.1. This pictures is that one, witch has been used for the numerical calculations. It is supposed that the detonation wave is initiated with help of electrical discharge (5) near the closed end of narrow tube (6) and later it propagates into part of the device, which is the combination of conical

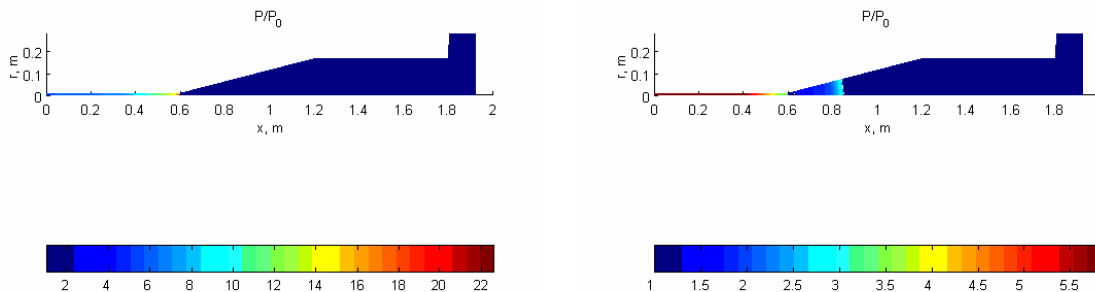


**Figure 1.** The principal sketch of the worn-out tires destruction. 1 – detonation chamber, 2 – combustibile gas supplying system, 3 – working chamber, 4 – tire, 5 – spark plug, 6 – pre-chamber.

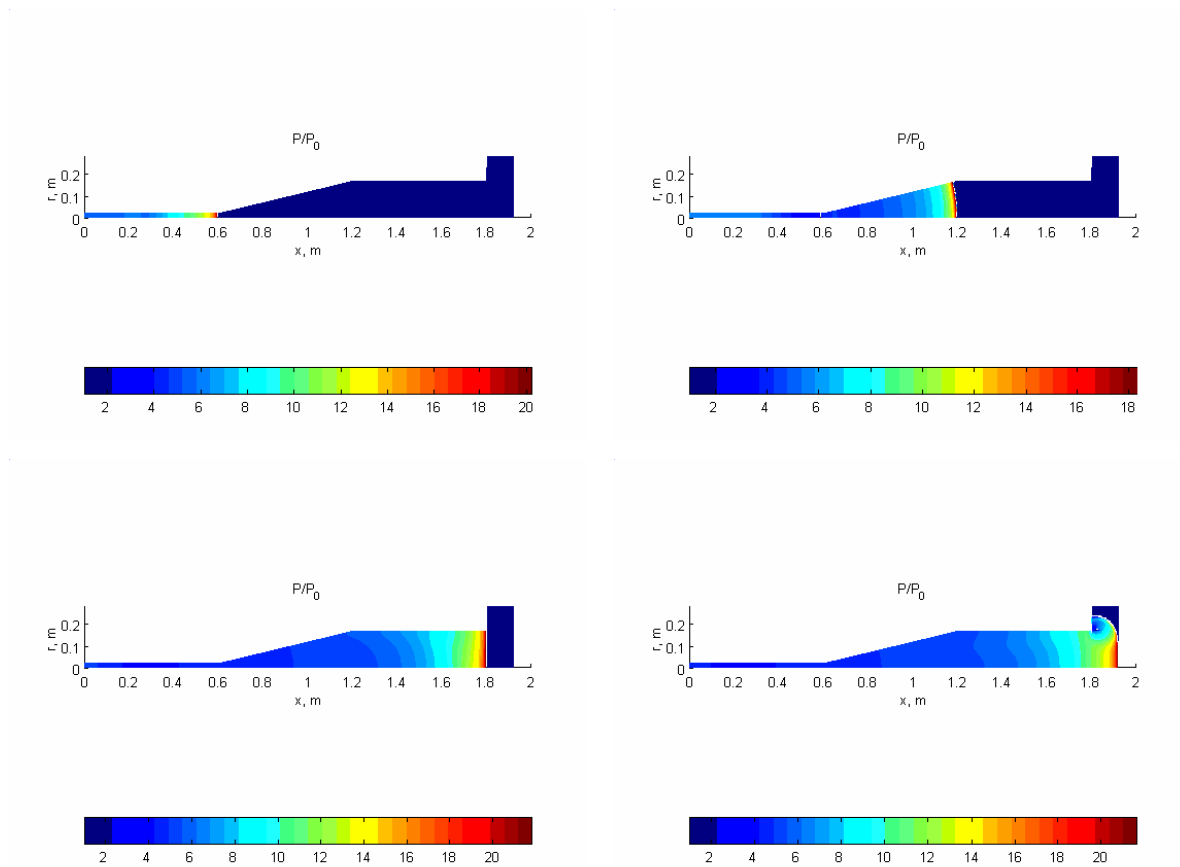
and cylindrical tubes (1), and at last come into the working part (3), where the tire (4) is placed. To get the necessary destroyed loads on the tire the detonable mixture amount should be enough, but not so that damages the construction of the device. The other problem is to form self-sustained detonation wave using the initiator of enough small energy. It is necessary to remark that the hydrogen-air mixture is used and therefore the products of explosion don't contain ecological dangerous pollution.

Following from the position mentioned above the devices of different configurations and different dimensions are investigated in the paper. The time dependences of the pressure at the critical points of the internal surface of the chamber are recorded. The study is carried out by numerical method based on the Godunov's scheme [1]. The equations describing the axial-symmetrical inviscid flows are used jointly with equations of chemical kinetics for hydrogen-air mixture [2].

The calculations have shown that under defined parameters of the device it is possible to obtain the self-sustained detonation, which produce the destroying effect on the tire placed into the working chamber. According to the obtained results it is possible to recommend the appropriate parameters of the device. The pictures illustrated the full flow pattern and the time dependences of the pressure at the chamber walls and at the tire are presented in the paper. The example of pressure fields in the case of detonation wave failure in the conical part of the device is presented in the Fig.2. The example of pressure fields in the case when the detonation is formed is presented in the Fig.3. Fig.4 illustrates the propagation of detonation wave inside the working chamber just in this case.



**Figure 2.** The example of pressure fields in the case of detonation wave failure in the conical part of the device.



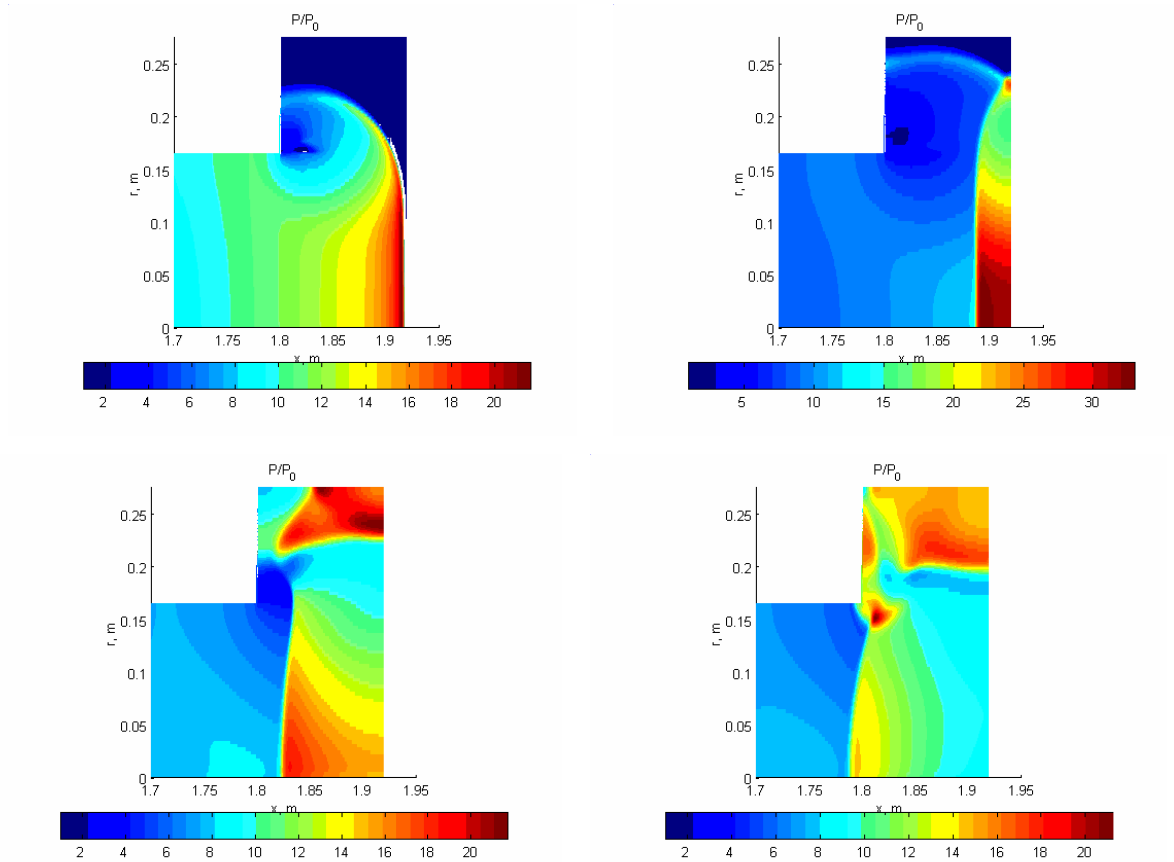
**Figure 3.** The example of pressure fields in the case when detonation wave is formed.

### Acknowledgement

This work has been supported by the Russian Foundation for Basic Research (Grant No. 02-01-00110) and by INTAS (Grant No. 01-0792).

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**Figure 4.** The pressure field variation with time inside the working chamber during the detonation wave propagation.