The properties of DPPH, as is well known [3], depend strongly on the method by which it is prepared. The values of t_m and δH given in the table agree with the published data. It can be stated that the exchange integral, and hence the temperature T_{cr} in the sample DPPH (I) will be higher. Indeed, in our experiments the EPR signal of the sample DPPH(II) vanished at a higher temperature. The obtained temperature difference for the two samples turned out, however, to be unexpectedly large (by 3 - 4 times).

The magnetic properties of the radical DPPH can be satisfactorily described by the one-dimensional Ising model with allowance for a weak interaction between the chains; it is this interaction which leads to the existence of the phase transition (see, e.g., [4, 5]). In our case it can be shown that the possible difference in the solvent-molecule concentration is insufficient to account fully for the observed difference in T_{cr}. It must apparently be assumed that the exchange integrals within the chains are also different in the samples DPPH (I) and DPPH (2).

We note in conclusion that measurements of the phase-transition temperatures, at different frequencies, of DPPH samples crystallized from different solvents, in conjunction with x-ray structure data, make it possible in principle to investigate experimentally the dependence of the exchange interaction on the distance.

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GASDYNAMIC LASER USING HYDROCARBON-AIR MIXTURE COMBUSTION PRODUCTS

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The purpose of this study was to ascertain the feasibility of using the combustion products of hydrocarbon-air mixtures as laser media for the development of high-power gasdynamic lasers (GDL).

The ideas underlying the production of GDL were developed in [1, 2]. The use of a $CO_2 + N_2$ mixture for GDL was first proposed in [3, 4]. Various types of GDL were subsequently developed on the basis of these ideas [5 - 10]. Particular interest attaches to the use of the combustion products of hydrocarbon fuels to obtain laser media.

The laser described in the present paper is a quasicontinuous GDL operating on hydrocarbon-air mixture combustion products. The fuel in the first experiments was acetylene, which has a high reaction rate and whose combustion products have the minimum water-vapor content relative to the number of produced CO_2 molecules.

A schematic diagram of the experimental setup is shown in Fig. 1. It consists of a combustion chamber 1, an expansion chamber 2, a double planar supersonic nozzle 3, a multipass resonator cavity 4, and a vacuum chamber 5. Prior to the experiment, the entrance into the nozzle from the combustion-chamber side was covered with membrane 6, making it possible to evacuate the nozzle, the resonator, and the vacuum chamber to the required pressure. The combustion chamber, a channel of 70 mm diameter and 1.5 mm length, was then filled with an acetylene-air mixture of definite composition. The mixture was ignited with a spark plug 7, and the combustion process was registered with a piezoelectric pressure pickup 8.

In the combustion process, the pressure in the combustion chamber increased, the membrane was broken, and the combustion products entered the expansion chamber. The main purpose of the expansion chamber was to increase appreciably the stream cross section, by widening it to 50 cm,

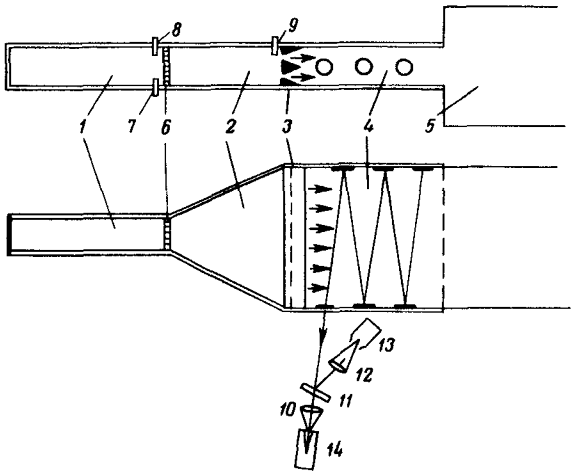

Fig. 1

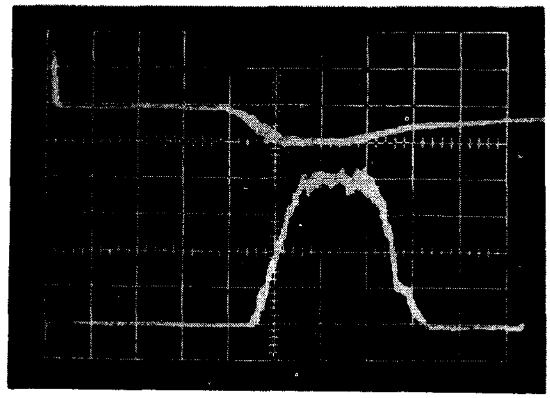

Fig. 2

making it possible to increase the resonator length. The stagnation pressure in the expansion chamber ahead of the nozzle was measured with a second pre-calibrated piezoelectric pressure pickup 9.

The nozzle insert 3 comprised a double supersonic planar nozzle with variable critical cross section. The height of the critical section of the nozzle was 1 mm, and the half-angle was 15°.

After expansion in the zupersonic nozzle, the combustion products entered a resonator cavity 50 cm wide and 50 mm high. The side walls 4 of the resonator cavity had each three unified adjusting devices with mirrors, with the aid of which 1, 2, 3, 4, and 5 pass resonators could be assembled.

The vacuum chamber had a volume of 1 cubic meter and served to maintain the vacuum in the resonator cavity during the course of the experiment.

The resonator was made up of two mirros with reflection coefficients 80 and 100%. The laser radiation was gathered by lens 10 and was registered by energy measuring device 14. The laser-pulse waveform was measured by diverting part of the laser-beam energy with a plane-parallel plate 11 and lens 12, and registering it with a ge-Au photoresistor 13.

In each experiment, we recorded simultaneously the stagnation pressure, the radiation-pulse waveform as a function of the time, and the laser-emission energy integrated over the time of the pulse. This made it possible to determine the radiation power and its variation with time.

Typical oscillograms of the pressure ahead of the nozzle (upper trace) and of the radiation power (lower trace) are shown in Fig. 2. In this experiment, the maximum stagnation pressure ahead of the nozzle was 4.0 atm, and the temperature of the combustion products was 2200°K.

From an analysis of the power and pressure oscillograms it follows that the onset and quenching of the lasing occurs at an expansion-chamber pressure on the order of 2 atm.

It was of particular interest to investigate the dependence of the generation power on the resonator characteristics. An increase in the length of the multipass resonator was accompanied in our case by an increase in the distance between the critical cross section and the last pass. It turned out that when the number of passes increased from one to four, the energy and the generation power increased, owing to the increase of the resontator length and hence of the gain, and owing to the est ablishment of more favorable lasing conditions for our output mirror with reflection coefficient 0.8. Increasing the number of passes to five caused a decrease in the energy and generation power, owing to the decrease of the gain along the stream by relaxation processes.

The dependence of the generation power on the acetylene concentration in the mixture was investigated with a three-pass resonator. The results of these experiments, at a stagnation pressure 4 atm, are shown in Fig. 3 and indicate that the generation power increases gradually when the acetylene concentration is increased from 4.5%. The optimal power was reached in our

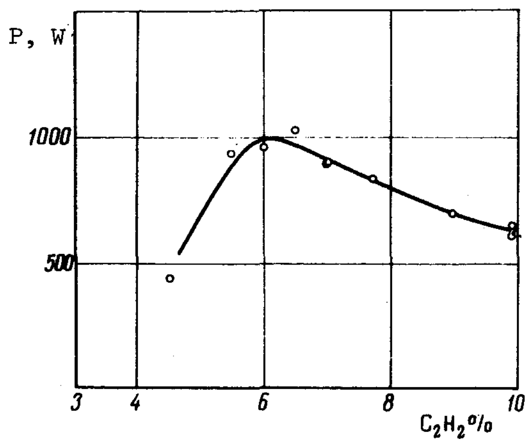

Fig. 3

in our experiments at an acetylene concentration of the order of 6% and amounted to 1.0 kW at a pulse duration 20 - 30 msec. With further increase of the acetylene concentration, to 10%, the power decreased gradually to 600 W. Such a variation of the generation power is connected with the behavior of the gain. Measurements have shown that the gain decreases when the acetylene concentration in the mixture rises above 6%, owing to the increased concentration of the water vapor in the combustion products and to the corresponding increase of the asymmetrical-mode deactivation rate, which leads to a decrease in the inversion. When the acetylene concentration drops below 6%, the gain also decreases, for in this case the combustion temperature and the inversion also decrease. Further increase of the power calls for the use of higher stagnation pressures and for an optimal geometry of the nozzle.

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CERTAIN CHARACTERISTICS OF INELASTIC PROTON-NUCLEON INTERACTIONS AT 200 GeV/c

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We separated 294 proton-proton and 337 proton-neutron quasifree inelastic collisions out of 4078 events of inelastic interaction of protons with momentum 200 GeV, found in 1438 m of proton tracks in nuclear emulsion. Analysis of the angular characteristics of the secondary charged relativistic particles shows that the showers are anisotropic up to maximum multiplicity and are inhomogeneous, probably as a result of the tendency of the particles to cluster.

We report here certain results of an analysis of the angular distributions of secondary

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