2.7 A, and 0.17 nsec at 4.3 A in Figs. 1a, 1b, and 1c, respectively. There was no self-modulation of the spontaneous emission below threshold (the brightness at different currents was equalized with light filters). Self-modulation periods of approximately 0.05 nsec were observed in other diodes with threefold excess over threshold. In addition to synchronous self-modulation of the emission from all the individual glowing regions of the active layer, as seen in the figure, non-synchronous modulation with unequal periods for different points were observed in diodes with sharply isolated glowing points, probably owing to the difference in their local thresholds and to the inhomogeneous distribution of the injection-current density.

It must be noted that the observed amplitude self-modulation with period shorter than 0.1 nsec may make an appreciable contribution to the line broadening of semiconductor lasers.

The calculation presented above was made essentially in the single-mode approximation. Therefore to compare the calculated and experimental data it is necessary to supplement the latter with spectral measurements, which permit an estimate of the mode content in the emission. The time-dependent characteristics themselves should be subjected to a microphotometric analysis. Even now, however, we can already note that the calculated and experimental values of the self-modulation period as a function of the injection current level agree in order of magnitude.

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USE OF ARTIFICIAL METEORS FOR LASER PUMPING

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Recent papers [1,2] report the use of the energy of an explosion or a flame jet for laser pumping. In these investigations the pump light flash was produced either by magnetohydrodynamically obtained electric energy, or by the glow of gas in an explosion shock wave [2].

We discuss in this paper certain possibilities of using artificial meteors, or rapidly moving objects accelerated by gunshot, to pump medium-power lasers.

The energy of a shot from a modern weapon $\mathcal{E}_0 \simeq mv^2/2$ ranges from several kJ (ordinary rifle) to several hundred kJ (cannon) at a possible repetition frequency 10 - 30 shots per second (at an efficiency ~1% this can yield an output energy ~10 J - 1 kJ).

To generate a powerful energy-release pulse it is desirable to attain high velocities (>3 - 5 km/sec), attainable by using small accelerated masses (light shell materials, hollow bullets and projectiles, etc.). Zel'dovich and Leipunskii [3] obtained high velocities for light bullets with the aid of a relatively simple procedure.

From the equation for the bullet acceleration [4]

$$m\dot{v} = p_0 s\{1 - [(\gamma - 1)/2](v/c_0)\}^{2\gamma/(\gamma-1)}$$

it is easily seen that the efficiency with which energy is acquired decreases only when $v \to v_{lim} \simeq 2c_0/(\gamma - 1)$, where c_0, p_0 and γ are the speed of sound, the initial pressure, and the adiabatic exponent of the gunpowder gases.

The possibility of obtaining fast bodies offers several mechanisms for converting the bullet energy into pump energy.

1. Flash of Light from a Fast Body

When a body moves at high speed v in a gas, intense gas glow is produced in the compression wave [3]. The energy lost by the body is determined by the deceleration force F. If $F \simeq kv^2$, then $d\mathcal{E}/dx = -2k\mathcal{E}/m$, the bullet energy varies like $\mathcal{E} = \mathcal{E}_0 \exp(-2kx/m)$, and the velocity like $v = v_0 \exp(-kx/m)$. We see therefore that the path covered in decelerating to the critical value, $l \simeq (m/2k)\ln(\mathcal{E}_0/\mathcal{E}_{cr})$, depends little on the muzzle energy, but strongly on the bullet mass. For large speeds and blunt bullets $k \simeq s\rho_0$, where s is the cross section of the bullet and ρ_0 the air density. For example, taking $m \sim 1$ g, $s \simeq 0.5$ cm^2, $\rho_0 \simeq 1.3 \times 10^{-3}$ g/cm^3, and $\ln(\mathcal{E}_0/\mathcal{E}_{cr}) \simeq 0.1$, we obtain $l \sim 1$ m for the path at which the velocity is maintained at a high level.

At high velocities, the compression of the gas ahead of the nose of the bullet heats the gas in the shock wave strongly, to a temperature [3] $T \simeq \mu v^2/2C_M$, where μ is the molecular weight and C_M the specific heat per mole of gas. For example, at $v \simeq 3$ km/sec the attainable temperature is on the order of thousands of degrees and can cause an intense flash (especially when the bullet moves through a jet of gas having high emissivity in the required section of the spectrum, when the shock waves collide with bullets moving towards them or with a wall, etc.). In this case an appreciable fraction of the bullet energy can go over into the radiation. Attempts to use the non-uniformity of the excitation or dissociation of the gas by the moving body to produce stimulated emission are also of interest.

2. MHD Generation of Electric Energy by a Fast Body

A fast conducting body (bullet, shell) can be used to produce electric energy by "induction" as the body moves transversely to a strong magnetic field if a circuit is produced for the current through the body (not only by metal busses, but also by the gas ionized by the moving body itself).

If the field gradients ahead and behind the moving body are large (if the field does not have time to penetrate into the closed circuit through the body), the body is acted upon by a pressure $p_H \sim H^2/8\pi$. This pressure may be comparable with the gasdynamic pressure $p \simeq \rho_0 v^2$ at fields $H \gtrsim \sqrt{8\pi\rho_0} v \simeq 10^5$ Oe at $v \simeq 5$ km/sec. If the dimensions l of the region where the field is localized are commensurate with the range covered before the gas loses appreciable energy, then the pulse power $W_e \simeq \mathcal{E}_0^2 v/l \simeq mv^3/l$ may reach in the case of bullets [3] several dozen megawatts at $v \sim 3$ km/sec and $l \simeq 30$ cm.

If the body does not crowd out the magnetic field completely, the deceleration force is $F \sim jHV/c \simeq \sigma vH^2V/c^2$, where $j = \sigma E_{ind} \simeq \sigma vH/c$ is the current density in the bullet, σ the conductivity of the moving section of the circuit, and V is its volume.

The described method can be used to construct compact pump systems for laboratory lasers without resorting to capacitor banks.

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TRANSVERSE HEAT TRANSFER IN A MOLECULAR-THERMAL STREAM PRODUCED IN A GAS OF NONSPHERICAL MOLECULES IN THE PRESENCE OF A MAGNETIC FIELD

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As is well known, the transport coefficients of gases are altered by a magnetic field (see [1-7]). This effect does not reverse sign when the direction of the magnetic field is reversed ("even" effect). Knaap and Beenakker, developing the theoretical method of Kagan and Maksimov [7] for the investigation of transport phenomena in a magnetic field, reached the conclusion that if a temperature gradient grad T is produced in a direction perpendicular to the magnetic field H, then heat flow will be produced in a direction perpendicular to $\vec{H}$ and to grad T [8]. The effect results from the tensor character of the heat conduction coefficient (λ) of the gas in a magnetic field. The resultant temperature difference reverses sign when the magnetic field direction is reversed ("odd" effect). A similar effect was predicted by Korving et al. in O_2, N_2, and HD [9] [1)]. Theoretical predictions of the odd effect were made also in a published paper by Kagan and Maksimov [10]. In accord with [8,10], the following formula holds:

$$\epsilon_{odd} = (\Delta\lambda_{odd}/\lambda) = -a\{[\xi/(1 + \xi^2)] + 2[2\xi/(1 + 4\xi^2)]\}, \qquad (1)$$

where $\Delta\lambda_{odd}$ is the change of the heat capacity in the odd effect, $\xi = k\mu_{odd}H/p$, μ_{odd} is the