The instability of a plane wave in a nonlinear medium with $\epsilon' > 0$ against perturbations of the field or of the medium may also affect directly the structure of the field radiated by a laser, especially in those cases when the field is acted upon, besides the nonlinearity of the active medium, also by the nonlinearity of other materials placed for various purposes inside the laser cavity (for example, when saturating shutters are used).

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1) Assumptions concerning the role of self-localization in induced scattering of light were made earlier [3].

2) The self-focusing length L_f of an axially-symmetrical beam with a Gaussian amplitude distribution can be estimated approximately with the formula $L_f = ka^2(W_b W_{cr}^{-1} - 1)^{-1/2}$, where a is the beam radius, W_b the beam power, W_{cr} the minimum beam power required for autolocalization. This result follows from Eq. (8) of Talanov's paper [5].

3) The instability of a plane wave in a nonlinear dielectric was noted by R. V. Khokhlov at the 1st All-union Symposium on Nonlinear Optics (Minsk, June 1965).

4) An arbitrary perturbation can be represented as a superposition of such fields.

5) The invariance of Eq. (1) against the substitutions $\mathcal{E} \to \alpha\mathcal{E}$, $\vec{r}_\perp \to \alpha\vec{r}_\perp$, $z \to \alpha^2 z$ always enables us to go over from the given numerical values to physically realizable values of $\mathcal{E}_0$ and $e \ll 1$ [7].

RETARDED NONSTATIONARY RERADIATION OF ELECTROMAGNETIC SIGNALS BY A PARAMETRICALLY REGENERATED FERRITE

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Nonstationary parametric amplification of electromagnetic oscillations of frequency f/2 (where f is the pump frequency) were observed for the first time in a magnetized ferrite, the instant of emission of the amplified signal being ratarded relative to the pump front. The experiments were carried out with single-crystal yttrium-iron-garnet ferrite, having a saturation magnetization $4\pi M_0 = 1750$ G and a resonance-curve $2\Delta H = 2 - 3$ Oe. The ferrite samples measured 1 - 3 mm and had arbitrary shapes - unfinished pieces, discs, or spheres. They were placed in a resonator with $Q \sim 600$ tuned to the pump frequency $f = 9340$ Mcs. The signal of frequency $f/2 = 4670$ Mcs was applied and extracted with the aid of a coupling loop. The pump magnetic field was polarized parallel to the constant magnetic field, and the pump power used in the experiments was 0.2 - 1.3 W. These values of pump power exceed the power threshold for parametric excitation of spin waves [1], but are insufficient for noticeable parametric regeneration of magnetostatic oscillations in the ferrite. The described effect took place at several fixed values of the constant magnetic field, which ranged from 1000 to 2700 Oe in our experiments.

The degree of surface finish or the dimensions and shape of the sample had no noticeable influence on the described phenomena. All the experiments were made at room temperature with or without forced air cooling.

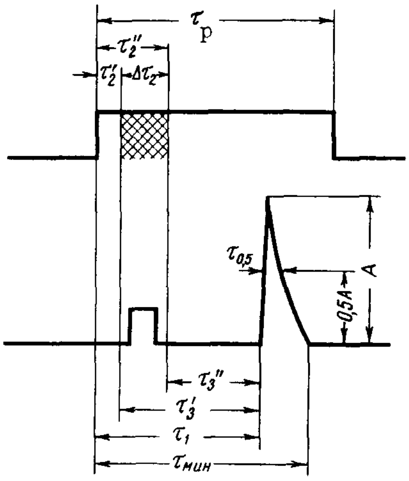

Fig. 1. Schematic diagram of the time sequence of the occurring processes.

The time sequence of the occurring processes is shown in Fig. 1. The upper figure represents schematically the detected pump oscillations, and τ_p is the duration of the pump pulse. The lower figure shows the envelopes of the input and reradiated signal pulses.

We have noted the following characteristic features of the observed phenomenon:

1. There exists a certain "active" time interval during which retarded reradiation at the same frequency takes place in the presence of a signal of frequency f/2. If the input signal is situated outside the "active" interval, then no reradiation is observed. The start and end of the "active" interval are denoted in Fig. 1 by τ_2' and τ_2''. The duration of the "active" interval $\Delta\tau_2 = \tau_2'' - \tau_2'$, and the times τ_2' and τ_2'' themselves, depend very strongly on the pump power and do not depend on the duration of the signal radio pulse. Thus, with increase in pump power from 0.2 to 1.3 W the duration of the "active" interval decreases from 60 to 1 μsec.

2. If the input signal lies in the "active" interval, raradiation takes place, and its start is retarded both relative to the pump front (τ_1 on Fig. 1) and relative to the "active" interval (τ_3' and τ_3'' on Fig. 1). These delay times depend strongly on the pump power, increasing with decrease of the latter. The maximum delay time between the start of the "active" interval and the reradiation instant τ_3' amounted to about 80 μsec in our experiments. The reradiated signal has the form of a radio pulse with carrier $f/2 = 4670$ Mc and with rather steep leading front. The duration of the reradiation radio pulse $\tau_{0.5}$ does not depend on the duration of the signal pulse and is determined by the pump power.

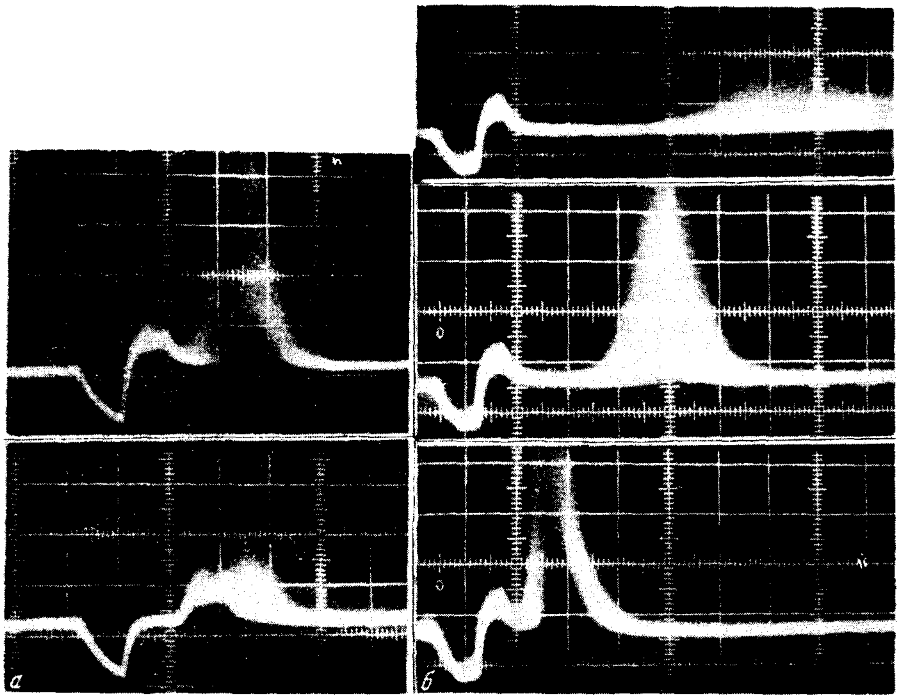

Fig. 2. Oscillograms of the occurring processes. Left to right: pause in pump, input pulse, raradiated pulse. Each horizontal division is 10 μsec. a - In the upper picture the signal pulse falls in the "active" interval and the reradiated pulse is observed, while in the lower picture the signal pulse is moved out of the "active" interval and there is no reradiation. b - Oscillograms illustrating the decrease of the delay time of the reradiated pulse with increasing pump power. the pump power increases from top to bottom from 0.2 to 1.3 W.

3. To observe the effects described above it is necessary that the pump be present continuously during the time from the pump front to the end of the reradiation pulse (τ_{min} on Fig. 1). If $\tau_1 < \tau_p < \tau_{min}$, then the corresponding decrease is observed in the duration of the reradiated radio pulse, and when $\tau_p < \tau_1$ the latter is not observed at all. If the pump is interrupted for an arbitrarily small instant of time during the interval from 0 to τ_1, no reradiation is observed.

The power gain, defined as the ratio of the maximum amplitude of the reradiated radio pulse to the amplitude of the input signal, fluctuated with variation of the pump power in the range from 4 to 25 dB, the maximum gain corresponding to a pump power of 0.35 W.

All the foregoing is illustrated by the oscillograms of Fig. 2.

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