A SIGNAL He-Ne LASER WITH A POWER SUPPLY FROM STANDARD LINE AT 50 Hz FREQUENCY

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A simple signal He–Ne *laser is proposed operating in the* 0.9–1.4 μm *wavelength range at* λ_{max} = 1.15 μm *with a power supply from standard ACL without additional transformations.*

Frequency calibration of spectra in the near IR range always faces specific difficulties due to the lack of suitable sources of line radiation in this range.

This paper presents a small-size signal He–Ne laser operating with a power supply from standard ac supply line without additional power units. The basis for this laser is a gas-discharge source developed by I.I. Murav'ev in 1977.

The electrodes of an active element (Fig. 1) are made in the form of laminated spirals united in a double spiral. Alternating loops of the double spiral play the role of cathode and anode and owing to their identity they ensure the invariable character of plasma radiation when excited by alternating current. Cylindrical geometry of a discharge channel ensures the radial symmetry of plasma. The region of equipotential plasma is produced due to the overlapping of glow discharges in the discharge channel zone. The longitudinal plasma homogeneity is attained when choosing the distance between the loops of the double spiral on the order of magnitude of the dark cathode space. The profile of the spiral loop is chosen to provide the minimum contact surface of spirals with a quartz tube and to decrease the dusting of the quartz tube surface by the cathode material. In producing the electrodes the materials, stable to the cathode spraying, were used.

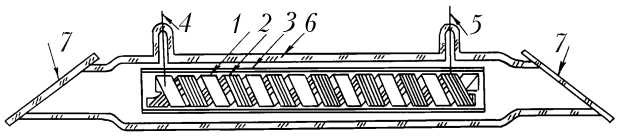

FIG. 1. The active laser element: spiral electrodes 1 and 2, a quartz tube 3, feed electrodes 4 and 5, a cell 6, output windows 7.

The experiments have shown that in the He–Ne mixture at Ne partial pressure of 0.2 Torr and He pressure of 10–20 Torr the discharge firing voltage is127 V and the operation frequency is 50 Hz. The pulse periodic generation is observed (Fig. 2) in the 0.9–1.4 μm spectral range (λ_{max} = 1.15 μm). The optimal regime for generation at λ = 1.15 μm, is performed at the Ne pressure of 0.2 Torr, the He pressure of 10 Torr, the voltage potential of 220 V, and the current of 170 mA. The amplification factor of active medium is 40% per meter. The average generation power of the laser with an active length of 10 cm is 1 to 3 mW at a consumable power of 40 W. The generation at the He red length of 632.8 nm was also recorded, however, its stability is determined by the degree of electrodes outgassing.

Compared to the lasers with spiral cathodes,[1–3] the described laser is the most low-threshold and very simple in its design.

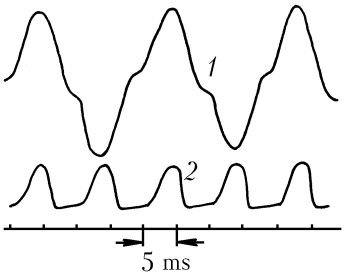

FIG. 2. Current pulses (1) and generation pulses (2); λ = 1.15 μm NeI, U = 220 W, P_{Ne} = 0.5; P_{He} = 10 Torr.

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