I thank O. F. Newman for undertaking the statistical calculations.

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Some Preparative Details of the $Nd^{3+}/SeOCl_2$ Laser

Heller and Lempicki[1,2] have reported a liquid laser, using a solution of neodymium ions in selenium oxychloride and tin tetrachloride, which operates at room temperature. My investigations have shown that the successful operation of this system is critically dependent on the purity of the components and the method of preparation. The rapid quenching of Nd^{3+} fluorescence by impurities, containing low atomic weight elements, makes it necessary to purify carefully the solvents and exclude moisture during preparation. Impurities can also be detrimental to the optical quality of the solution. A method of preparation is described here which has been found to give a working solution. Some preliminary results using a simple cell are briefly reported.

All handling and distillations were carried out in a dry nitrogen atmosphere. 'Teflon' sleeving was used on all glass to glass joints. Selenium oxychloride (B.D.H.) was fractionally distilled at reduced pressure (60° C at 14 mm of mercury). Marked decomposition occurred if the distillation was done at or near atmospheric pressure. Tin tetrachloride (B.D.H.) was allowed to stand over mercury for 24 h before fractional distillation. The mixed solvent was made by adding selenium oxychloride to

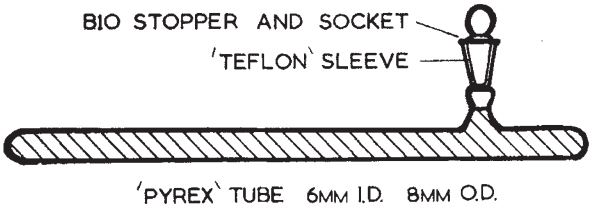

Fig. 1. 'Pyrex' cell with flame-sealed ends.

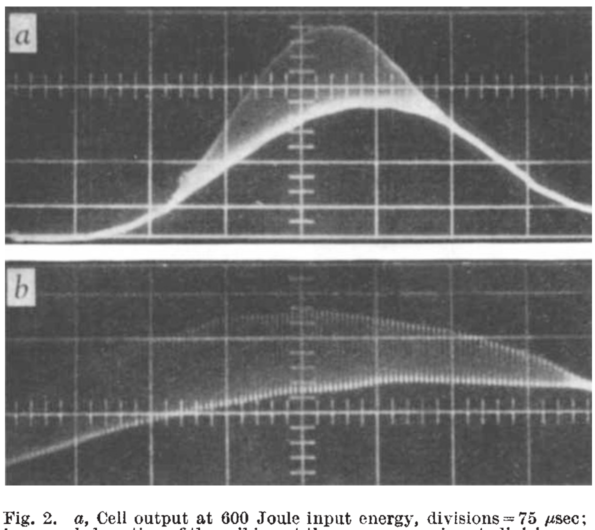

Fig. 2. *a*, Cell output at 600 Joule input energy, divisions = 75 μsec; *b*, expanded portion of the spiking at the same energy input, divisions = 20 μsec. Detector rise-time approximately 0·5 μsec.

11·5 ml. tin tetrachloride to give 50 ml. of solution. The prepared solvent was refluxed with neodymium oxide (Johnson, Matthey and Co. Ltd., 99·9 per cent) until complete solution occurred (2–3 min) and the solution was filtered through a ground-glass sinter. The rate of solution was dependent on the particle size of the oxide and further grinding may be necessary. The final solution had a pale reddish violet colour.

A 0·5 normal Nd^{3+} solution was tested in a simple cell, similar to that described recently by Lempicki and Samelson[3] (Fig. 1). This cell was pumped in a 12·5 cm long elliptical cavity, and the output, through a filter centred at 10,500 Å, band pass 300 Å, is shown in Fig. 2. Feedback occurs through total internal reflexions within the tube, and the stimulated emission is not collimated. The regular nature of the spiking is shown on the expanded time base in Fig. 2*b*. No value has been obtained for the laser threshold in this cell because the minimum energy input with the available equipment is 300 joules. A high gain for the material was, however, indicated by decreasing the pumped length of the tube to 5 mm; at an input of 600 Joules distinct spiking was still observed.

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Taylor Vortices with Eccentric Rotating Cylinders

THE stability of circumferential laminar flow between rotating concentric cylinders has been extensively investigated, the classical work being that of Taylor[1]. The effect of eccentric positioning of the cylinders, however, has received relatively little attention, although this further complication is of technological interest in connexion with operating journal bearings at very high speed in the so-called superlaminar regime. I have carried out experiments with an eccentrically positioned rotor inside a stator, the axes being parallel, and I have already described[2] how the Taylor vortex pattern still appears, but with the critical speed raised appreciably above Taylor's value for concentric cylinders.

The vortex pattern, made visible by suspending small aluminium particles in the test fluid, is substantially similar in appearance for both concentric and eccentric positioning of the cylinders, but the spacing diminishes at high eccentricity ratios (that is, displacement of centres divided by radial clearance) and the pattern then becomes confused because of reverse flow and vortex waviness.

In a recent communication[2], I described a simple and sensitive method for detecting the onset of Taylor vortices, using a small constant-temperature heated probe which traversed slowly and axially in the clearance space. The percentage increase in critical speed over the concentric value was almost the same at a given eccentricity ratio, for clearance ratios (that is, radial clearance divided by rotor radius) of 0·478 and 0·274 (ref. 2). I have now extended these measurements to six clearance ratios from 0·138 to 0·478, using oils and air as test fluids, and I have again found that the clearance ratio has little effect on the critical speed ratio.

These results, obtained using a heated probe, all showed critical speeds above those determined by visual observation, and it seemed desirable to check the determination by direct measurement of rotor torque, for this is the quantity of most practical significance. I have made