# 26PB11 A 110J HIGH ENERGETIC FLASHLAMP-PUMPED DYE LASER

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## 1.Introduction

Powerful and tunable laser in visible region are expected to be realized, for the purpose of high resolution spectroscopy and laser sensing. However, it is not so easy to achieve both high energy and good tunability.

In this paper , we would like to report a high energetic dye laser pumped by linear flashlamps with a laser output of 110J.

## 2.Construction of the apparatus

Fig.1 shows the schematic diagram of the dye laser developed in our laboratory. A large diameter dye cell is placed on the center of 4 fold elliptical cylindrical reflector, and pumped by air-filled flashlamps (9.5$\phi$ *420mm)

Fig.2 shows the cross section of a high input energy linear flashlamp. The flashlamp envelope is a clear quartz tube with a 2mm thickness. The electrodes are connected to the quartz envelope with silicon tubes, to avoid the lamp failure by a strong shock wave.

Fig.3 shows the schematic diagram of the flashlamp circuit. Every lamp is driven by each 2 stage Marx-bank circuit and the combined 4 circuits are controlled by a main gap switch $G_1$. In addition to this circuit, a simmer mode circuit is employed to realize a reliable lamp discharge and a laser output increment.

The capacitors are 8*10$\mu$ F, 15kV, and the maximum input energy is 9kJ within 10$\mu$ S.

All circuit are connected by flat and wide copper plates to reduce the circuit resistance and the remained inductance as low as possible.

## 3.Cavity configuration

The strong saturation of the laser output was seen at first when the plane cavity was employed. Therefore, we employed a confocal cavity, as shown in Fig.4(b), that is, we achieved a high output energy by setting the cavity length l shorter than the focal length R and make it possible to get a good cavity condition when pumped.

## 4.Characteristics of laser output

Fig.5 shows the laser output energy versus the cavity length with a $\phi$ 28 dye cell and $2*10^{-4}$ mol/l Rhodamine 6G in ethanol. The maximum energy is obtained at the cavity length of 89 cm.

Fig.6 is the output energy versus the input energy when the apparatus parameters are optimized. The parameters are as follows;

Dye cell : $\phi$ 44*420mm
Mirror : R=30%, 1m
Cavity length: 89cm
Dye : R-6G $0.7*10^{-4}$mol/l in ethanol

The laser output increases linearly for the input energy, and the maximum output of 110J was obtained at the 10kJ input.

## 5.Conclusion

We have developed a powerful dye laser with an output of 110J and 10 sec pulse width. We hope this apparatus will be very useful for the laser rader and many other applications.

**References**

1)M.Jyumonji, H.Uchiyama: The Rev. of Laser Engineering,vol.17,No.5(1989) pp.346-357
2)M.Jyumonji, H.Uchiyama: The Rev. of Laser Engineering,vol.14,No.6(1986) pp.524-531

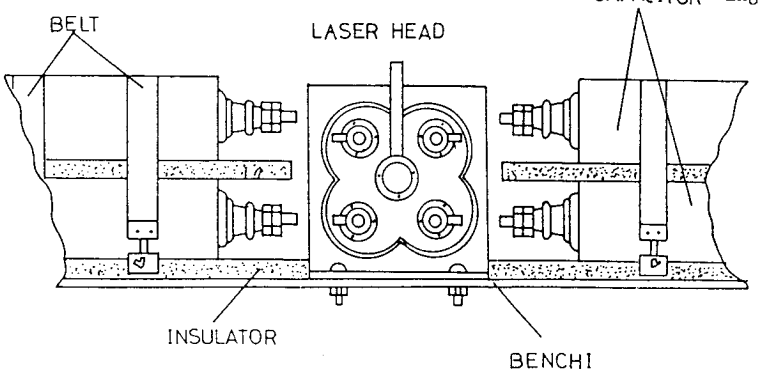


Fig.1 Schematic diagram of the high-energy linear flashlamp-pumped dye laser.

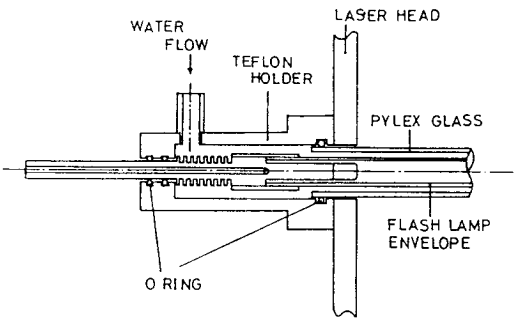


Fig.2 Cross-section of the high input energy linear flashlamp.

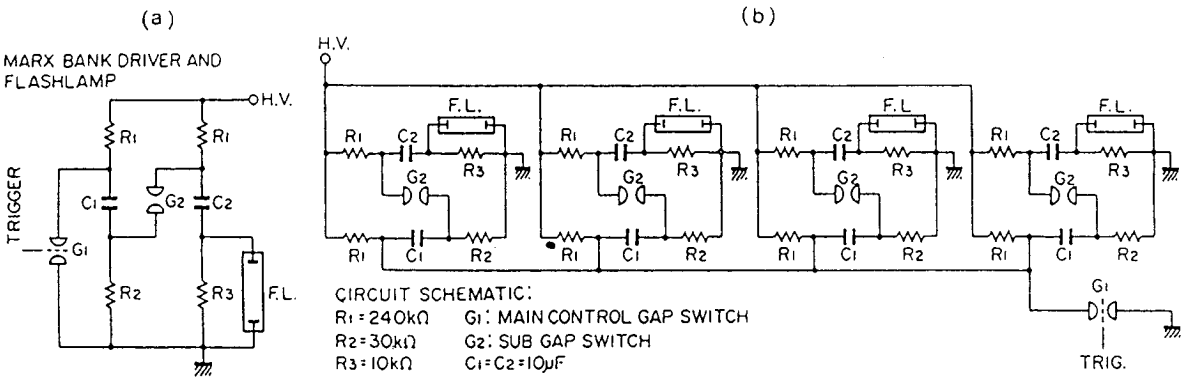


Fig. 3 Schematic diagram of the flashlamp driver. (a) Fundamental Marx-bank driver for one flashlamp; (b) Extended Marx-bank driver circuit for 4 flashlamps.

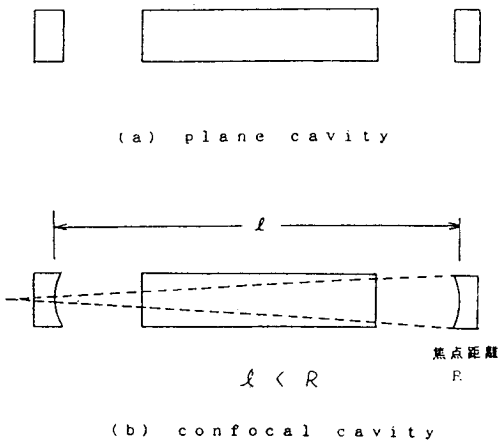


Fig. 4 Schematic diagram of the resonator. a, Plane cavity; b, confocal cavity.

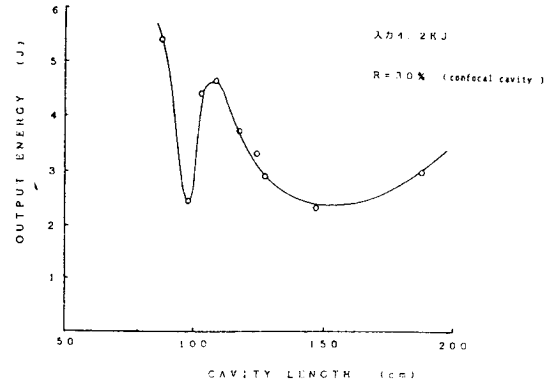


Fig. 5 Output energy charateristics of a $\phi$ 28 dye cell.

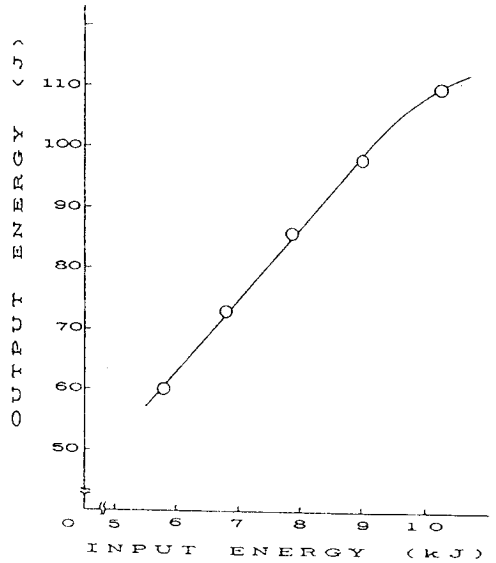


Fig. 6 Output energy charateristics of a $\phi$ 44 dye cell.