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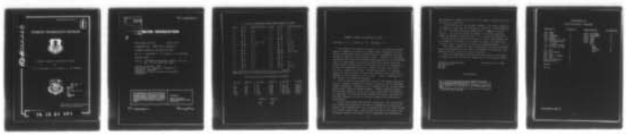

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AIR FORCE SYSTEMS COMMAND

POWERFUL LASERS ON SOLUTIONS OF DYES

by

M. I. Dzyubenko, A. M. Korobov, I. G. Naumenko

FOREIGN TECHNOLOGY DIVISION

# EDITED TRANSLATION

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## U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

| Block | Italic | Transliteration | Block | Italic | Transliteration |
|---|---|---|---|---|---|
| А а | *А а* | A, a | Р р | *Р р* | R, r |
| Б б | *Б б* | B, b | С с | *С с* | S, s |
| В в | *В в* | V, v | Т т | *Т т* | T, t |
| Г г | *Г г* | G, g | У у | *У у* | U, u |
| Д д | *Д д* | D, d | Ф ф | *Ф ф* | F, f |
| Е е | *Е е* | Ye, ye; E, e* | Х х | *Х х* | Kh, kh |
| Ж ж | *Ж ж* | Zh, zh | Ц ц | *Ц ц* | Ts, ts |
| З з | *З з* | Z, z | Ч ч | *Ч ч* | Ch, ch |
| И и | *И и* | I, i | Ш ш | *Ш ш* | Sh, sh |
| Й й | *Й й* | Y, y | Щ щ | *Щ щ* | Shch, shch |
| К к | *К к* | K, k | Ъ ъ | *Ъ ъ* | " |
| Л л | *Л л* | L, l | Ы ы | *Ы ы* | Y, y |
| М м | *М м* | M, m | Ь ь | *Ь ь* | ' |
| Н н | *Н н* | N, n | Э э | *Э э* | E, e |
| О о | *О о* | O, o | Ю ю | *Ю ю* | Yu, yu |
| П п | *П п* | P, p | Я я | *Я я* | Ya, ya |

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ë in Russian, transliterate as yë or ë.

## RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

| Russian | English | Russian | English | Russian | English |
|---|---|---|---|---|---|
| sin | sin | sh | sinh | arc sh | sinh$^{-1}$ |
| cos | cos | ch | cosh | arc ch | cosh$^{-1}$ |
| tg | tan | th | tanh | arc th | tanh$^{-1}$ |
| ctg | cot | cth | coth | arc cth | coth$^{-1}$ |
| sec | sec | sch | sech | arc sch | sech$^{-1}$ |
| cosec | csc | csch | csch | arc csch | csch$^{-1}$ |

| Russian | English |
|---|---|
| rot | curl |
| lg | log |

POWERFUL LASERS ON SOLUTIONS OF DYES

Dzyubenko, M. I., Korobov, A. M., Naumenko, I. G.

The authors of a number of works [1, 2], in noting the advantages of lasers on solutions of organic dyes, indicated the possibility of obtaining output energies which are comparable with the energy of radiation of solid-state lasers. However, the energies and powers which have been attained experimentally up to the present time are considerably less than in solid-state lasers. Thus the output energy of generation of an alcohol solution of rhodamine 6G in work [3] comprised 0.05-0.07 J (power 7-10 kW), and in [4] - 0.07-0.1 J (power 250-300 kW). Using flash lamps of a special design for the excitation of dyes, the authors of [5] were able to obtain an output energy of ~0.2 J (power ~1 MW) on rhodamine 6G, and ~0.001 J on sodium fluorescein.

In this work we are reporting on some of the energy characteristics of lasers on aqueous and alcohol solutions of the following organic compounds: rhodamine S [C], rhodamine 6G [Ж], sodium fluorescein, and 4-methyl-7-hydroxycoumarin. These compounds yielded the required radiation in the red, yellow, green and blue areas of the spectrum. The solutions were poured into quartz cuvettes with an inner diameter of 5 and 10.5 mm and length of 160 and 280 mm respectively.

Direct xenon lamps were used for excitation. The least threshold energy was observed in the case of rhodamine 6G, dissolved in alcohol, and comprised 6-7 J at a concentration of $5.0 \times 10^{-5}$ mole/l in a cuvette 160 mm long. Let us also note that in the case of an excitation energy of an order of 100 J generation was observed in the resonator, formed by the ends of the cuvette (reflection coefficient of an end ~4%).

After selection of the optimal feedback the output energy of the laser on a solution of rhodamine 6G was ~0.7 J (concentration $2.0 \times 10^{-4}$ mole/$\ell$, excitation energy 540 J, length of cuvette 160 mm). In a cuvette 280 mm in length at the same excitation energy the energy of radiation was ~1.2 J, which corresponds to ~2.5 MW and a conversion efficiency of ~0.22%. The maximum output energy of the laser on a solution of sodium fluorescein was ~0.03 J, and on a solution of 4-methyl-7-hydroxycoumarin - ~0.1 J.

The output energy of a laser on aqueous solutions of xanthene dyes was considerably lower, and the threshold of generation was higher than for a laser on alcohol solutions.

Thus our experimental results show that lasers on solutions of organic dyes can be serious competitors of solid-state lasers.

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