lieve it unlikely that many scientists, art historians, collectors, artists or forgers will find his discussions of their individual specialities inane or oversimplified. Most will experience a broadened understanding of the entire field. (Of course, the possibility exists that, in the case of the reader who is a practicing forger, this will not be entirely desirable.)

The only disappointing aspect of this book is a degree of incompleteness. Fleming ends rather abruptly, without giving the reader any substantive overview of current problems or trends in authenticity research. Similarly, recently introduced techniques such as the laser microprobe and amino-acid dating go unmentioned. Finally, in terms of balance, the authentication of stone sculpture (in particular, the important and fascinating controversies surrounding a number of Egyptian collections) deserves a chapter. Perhaps these will form the basis for a second volume or second edition of this otherwise fine book.

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Gasdynamic Lasers: An Introduction

J. D. Anderson, Jr
180 pp. Academic, New York, 1976. $17.50

The gasdynamic laser represents a unique and interesting subfield of laser research for two particular reasons. First, in spite of its success, the period of really active research on this laser lasted less than five years. Second, the research was carried out largely by a group that had been previously outside the main laser establishment—namely, the aerophysicists, who in earlier times concerned themselves more with rocket propulsion and similar problems.

As with a rocket engine, in a gasdynamic laser the gas mixture starts out in high-temperature equilibrium in a reservoir (in large systems, this is generated by a combustion process) and then cools very rapidly ($\approx 10^8$ K/sec) by expansion through a supersonic nozzle. If the lower laser level relaxes more rapidly than the upper level during this cooling process, one creates a population inversion. The concept was suggested in 1965 by Abe Hertzberg and Ian Hurle, who attempted unsuccessfully to invert electronic transitions in xenon.

In the late sixties, however, application of this approach to vibrational transitions in CO_2 by scientists at the Avco-Everett Research Laboratory proved phenomenally successful in producing relatively compact, high-power lasers, and the entire subject was classified. By the time declassification began in 1970, the first-generation CO_2-N_2-H_2O system had been developed. Subsequent research has produced a second-generation CO_2 and CO lasers of this type; in addition, there have been some recent, but so far unsuccessful, attempts to produce an electronic-transition gasdynamic laser based on the atom-recombination reactions that produce afterglows. But the major research activity ended in the early seventies.

John D. Anderson Jr, formerly of the Naval Ordnance Laboratory and now at the Department of Aerospace Engineering of the University of Maryland, has expanded a set of lectures he gave at the von Karman Institute for Fluid Dynamics (Brussels) in 1974 into a short monograph that reviews the gasdynamic laser to date. Anderson has been active in the field since its inception, and a substantial fraction of the material presented represents his work or that of his colleagues.

Basically, the book describes the CO_2-N_2-H_2O gasdynamic laser in some detail, starting with the kinetic equations and continuing with a description of the coupling to the gasdynamic nozzle-flow equations. A major part of the book consists of comparisons between experimental and theoretical results for small signal gain and power output and of parametric studies to optimize those quantities. Anderson also devotes chapters to sources of beam distortion, to combustion generators, to gas-mixing schemes, to aerodynamic windows and to diffusers. Diffusers constitute specially designed flow channels, which convert the low-pressure supersonic flow to high-pressure subsonic flow for dumping to the atmosphere. In practice, the diffuser accounts for a large fraction of the size and weight of a practical gasdynamic laser, which imposes problems best left to the specialist. Anderson briefly describes the CO laser and the special vibrational-relaxation effects that make it possible, but he does not mention the electronic-transition approaches.

This well organized, easy-to-read monograph does not tell the reader how to design a gasdynamic laser. Rather, it describes what has been done and provides a thorough guide to the literature (with only 93 references!). Not surprisingly, the book has a definite fluid-dynamics orientation, and it will undoubtedly prove useful to graduate students in that field. It will also appeal to engineers and scientists who want a thorough introduction to gasdynamic lasers. For those familiar with the field, Anderson has provided a nice summary, although the only previously unpublished work is a study of uncertainties in kinetic rates on calculated CO_2 gains.

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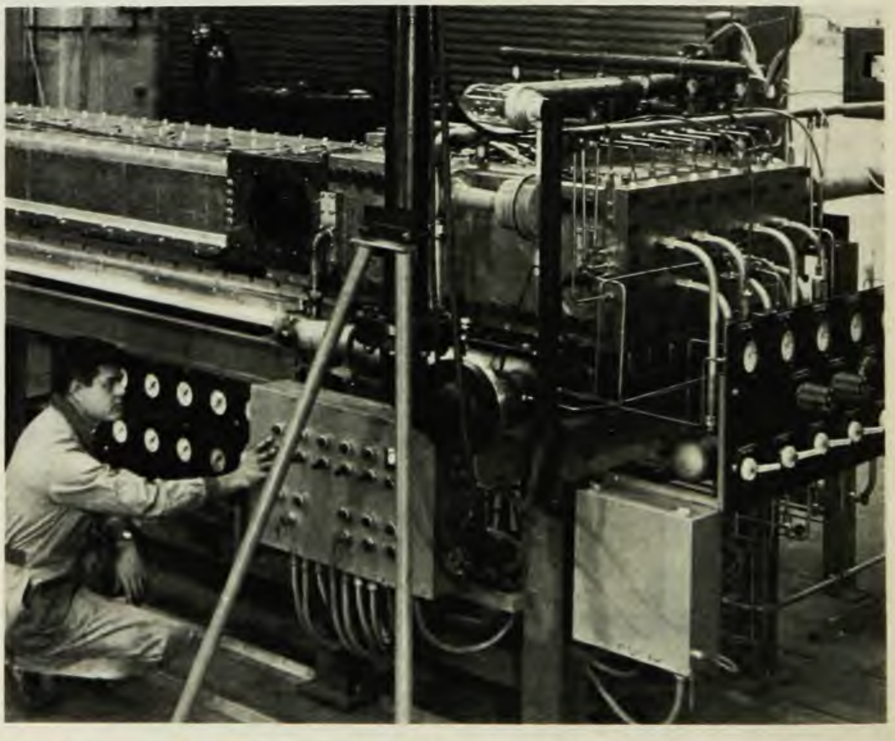

Thermally pumped gasdynamic laser. Hot, high-pressure carbon monoxide expands through supersonic nozzles, the flow itself producing a population inversion. A beam of laser energy is extracted perpendicular to the flow in a mirrored cavity. (Avco Everett Research Laboratory).