

Preface

From the viewpoint of the engineer, some of the most demanding and sophisticated applications of technology are those required for printing. Whether the end product is an electric office typewriter, a word processing system, a printing terminal, or a high-speed system printer, its development must combine electronics, mechanical technology, the materials sciences, human factors, and a myriad of other disciplines, all in an environment of constantly changing operating requirements and increasing demands for speed, print quality, versatility, and product life. Beginning with its acquisition of the Electromatic Typewriter Company of Rochester, New York in 1933, IBM has compiled a broad and diversified history of progress in printing technology. To represent that progress, this section of our special issue reviews IBM technologies and products in four general categories of printing: 1) electric/electronic typewriters, with emphasis on the now-classic single-element SELECTRIC® technology; 2) word processing systems, from the Magnetic Tape/SELECTRIC Typewriter (MT/ST) announced in 1964 through the IBM Displaywriter System announced in June 1980; 3) electromechanical impact printers, including both line and serial-matrix printers and their many variations; and 4) laser-electrophotographic printers and subsystems, as exemplified by the 3800 System Printer and the 6670 Information Distributor, which embody a non-impact printing technology using lasers and also make use of IBM's electrophotographic, "plain-paper" reproduction (photocopying) process.

One other important printing technology is that of ink-jet printing, a moderate-speed, high-quality, non-impact printing process that generates characters as a matrix of dots from electrostatically deflected droplets of ink ejected from a nozzle in a carefully controlled stream. Among its most valuable applications is the office system or I/O device in which correspondence-quality printing is important and printing speeds of the order of 100 characters per second are required; a typical example is the IBM Office System/6. Although not represented here by an article, the ink-jet process is a significant part of IBM's progress in non-impact printing and has been reported previously in a special issue of the *Journal* (January 1977).

In the first paper of this section, Beattie and Rahenkamp describe the evolution of the typewriter from its very beginning in 1714. IBM contributions, dating from 1933, include innovations in typebar technology (most significantly the first practical modern approach to proportional spacing, typical of the IBM Executive series of typebar machines); the remarkable SELECTRIC single-element mechanism (which refined the single-element principle, made it practical for a wide variety of applica-

tions, and made possible the use of interchangeable typefaces without special tools or parts); numerous developments in ribbons, ribbon handling-and-transport mechanisms, and other supplies and materials; special-application machines (e.g., SELECTRIC-I/O subsystems, the SELECTRIC Composer, etc.); and, most recently, the Electronic Typewriter complete with internal memory, automatic formatting, and automatic error correction.

Paralleling the evolution of typewriters and office printing systems, and made possible in part by their technology, the concept of word processing as an office productivity tool has become one of the most important contributions to business efficiency of the past twenty years. In his paper, May traces IBM's participation in that process from the announcement of the MT/ST (Magnetic Tape/SELECTRIC Typewriter) in 1964. Included in his review are four major "families" of office products, the MT/ST line (1964-68), the MC/ST (Magnetic Card/SELECTRIC Typewriter, 1969-72), the workhorse Mag Card II family (1973-78, including Composers and Communicating Mag Card machines), and the OS/6 line (1976-79), along with discussions of the manner in which electronics, magnetic media, communication methods, and software have been applied to the special requirements of word processing. Also described are IBM "shared-logic" word processing systems such as the 3730 Distributed Office Communications System, the IBM 8100-based Distributed Office System, and the 5520 Administrative System. A final segment of the paper considers the Office Products Division's most recent word processing product, the IBM Displaywriter.

From about 1950 through the 1960s and 70s, the mainstay technology for output printing in data processing systems has been the high-speed impact printer. About twenty-five years ago, a change from electromechanical timing to electronic control made it possible for the first time to do on-line, "on-the-fly" printing. Since that time an enormous variety of printers and printing subsystems have evolved to handle an equally large variety of system applications. In general, however, each such printing approach can be said to fit into one of two "base" technologies—line printing, or serial-by-character (matrix) printing. Each has its own definite characteristics, and these are explained by Nickel and Kania. The number of different products covered is too great to list here but, using chronological sequence as much as possible, the authors do describe essentially every approach IBM has taken within each base technology since 1950. In line printing, sub-technologies embodying chains, bars, trains, and bands are all discussed, with one or more product examples cited for each, beginning with the 1403

Chain Printer and ending with the 3262 (a band printer with special characteristics for improved "ease of use"). In serial matrix printing, emphasis is given to the wire-matrix print head, with examples of both the "no-work" magnet (as embodied, *e.g.*, in the IBM 2213) and the "work" magnet (used first in the 3767 and subsequently in the 3287). In addition to these major technologies, the authors also review certain special applications and assess, where appropriate, what has been learned about print quality, techniques for integration of printing with other system functions, human factors and ease of use, and reliability.

In the final paper in this section, Elzinga *et al.* describe the development of IBM's electrophotographic and laser-imaging technologies. Essentially, the engineering task was to extend the copier-based electrophotographic reproduction process and combine it with high-speed laser image generation to meet new needs for system printing. In achieving that basic objective, a number of problems had to be solved: The imaging technology required a long-life, stable laser system; electrophotographic process

speeds had to be increased to levels consistent with high-speed printing; paper-handling systems had to accommodate both continuous-form and cut-sheet applications with equal reliability; and the entire process had to be controlled so as to be compatible with asynchronous computer-to-printer operation. To illustrate how these problems were solved and the new technologies are used, the authors describe two specific machines—the IBM 3800, a high-speed system printer announced in 1975, and the IBM 6670 Information Distributor, a combination copier and printer with communications capability that was announced in 1979.

Since magnetic media cannot, in general, be "read" by the human senses, and display output, while readable, is ephemeral (aside from clumsy recourse to photography), printing in some form will remain an essential part of the information resource for the foreseeable future. We hope that reading these papers will lend some insight into this complex and sometimes little-recognized field.

Editor