

Colorado Hydro Plant a Milestone

On 30 July, the Ames Hydroelectric Generating Plant was dedicated as a national Electrical Engineering Milestone. This single-phase, alternating-current plant high in the Colorado Rockies was started up in 1891 to transmit electricity 2.6 miles to the mill at the Gold King Mine. As a pioneering demonstration of the practical value of transmitting electrical power, the Ames plant set a significant precedent in the U.S. for much larger plants at Niagara Falls and elsewhere.

In 1888, the Rocky Mountains around Telluride, Colorado, were still rich in gold. Unfortunately, the gold in surface deposits had played out and extensive tunneling was required to bring up the low-grade ore that remained. Moreover, large quantities of ore had to be crushed and processed to remove the gold. Tunneling and milling took power. Originally dependent on steam power, the gold mines had depleted the surrounding forests for fuel. They were increasingly relying on coal, brought up the mountains by burro for around \$40 per ton, resulting in typical energy bills of \$2,500 per month. Obviously, even a gold mine could not afford this sort of expense, and one, the Gold King Mine, decided to do something about it.

The Gold King, owned by the San Miguel Gold Mining Co. of Telluride, was on the verge of bankruptcy. To extract the mine from its financial morass, the owners brought in attorney Lucien Nunn. He pointed out that the mine could easily show a profit, *if* it could reduce its power costs to no more than \$100 per horsepower-year. About 2,000 feet in altitude and 3 miles in distance separated the mine, at 12,000 feet, from the abundant water power of a branch of the San Miguel River near Ames in the gorge below. Various methods of transmitting this power were considered, including direct and alternating current.

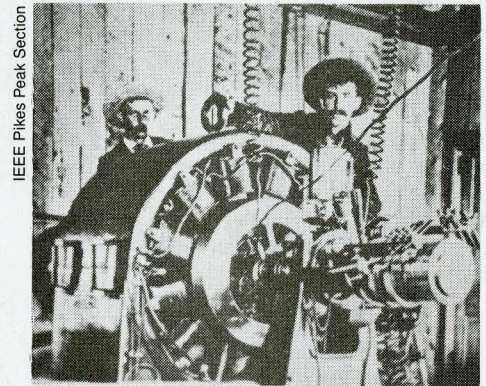
The generation of electric power was still a new enterprise in 1888; Edison's direct-current Pearl Street station had opened only six years earlier. Transmission of alternating current was

even younger; William Stanley's experimental installation for Westinghouse, in Great Barrington, Massachusetts, went into operation late in 1886. Though it is unclear who made the final decision in favor of alternating current for the Gold King Mine, Lucien Nunn was in charge of getting the plant built. To do this, he enlisted the help of his brother. Paul Nunn's job as chief engineer was difficult from the start. He later wrote,

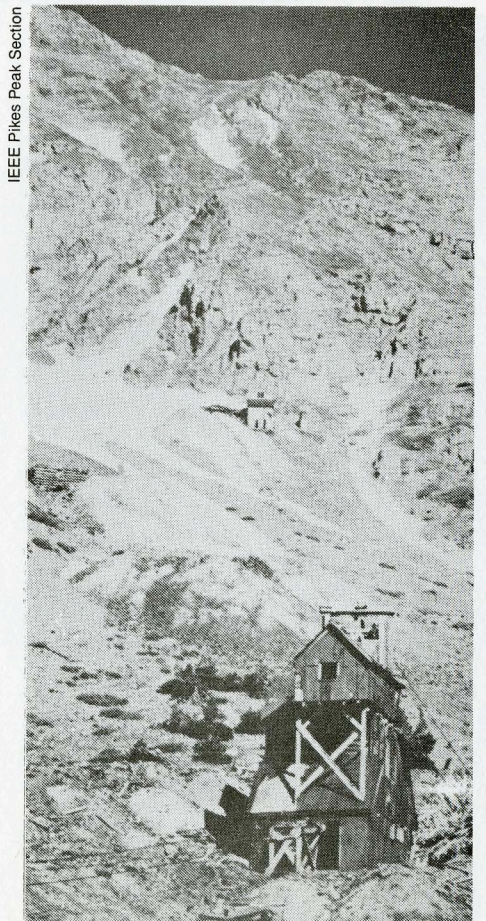
During the investigation which followed and while selecting apparatus, little but incredulity or ridicule was encountered. Eastern investors in the enterprise were annoyed by predictions of prominent engineers, and discouraged by their insistence, that the experiment would prove a miserable failure and the expenditure go for naught. . . . Difficulties caused by ice at 40 deg. below zero, by speed control over unusually high water pressure, by avalanche, by blizzard, by electric storms unknown in low altitudes, and many other troubles, now generally forgotten, but then most serious, marked every step of progress!

Two identical single-phase Westinghouse alternators served as the generator for the power plant and the motor for the mill at the mine. The 100-hp alternators operated at 3,000 volts, 133 cycles per second. The separately-excited generator was belt-driven from a 6-ft. Pelton waterwheel; the self-exciting motor was brought up to synchronous speed by a single-phase induction motor. Jaw switches were used to close circuits and arc-light plugs to open them. Tales were told of workers having to fan out 6-ft. arcs drawn by breaking the circuit with their hats. The plant only had voltmeters and ammeters because, as Paul Nunn reminisced in 1927, "We did not know what watts were, and we would not have known what to do with them."² The 2.6-mile-long transmission line of bare No. 3 copper wire experienced losses of less than 5%.

Soon after the Ames plant started up in
(continued on page 2)



Above, one of the original 100-hp Westinghouse alternators installed at Ames. Below, the Gold King Mine, above the timberline in the Colorado Rockies.



Telegraph Milestone Dedicated

On 7 May, Samuel Morse and Alfred Vail's public demonstration of practical telegraphy at Morristown, NJ (see *Newsletter* No. 17), was dedicated as an Electrical Engineering Milestone. The dedication took place at Historic Speedwell, a national historic site in Morristown that preserves part of the Vail homestead farm, including the building in which Morse and Vail conducted their experiments and demonstrations. The ceremony was organized by the IEEE North Jersey Section and Historic Speedwell.

Victor Zourides, IEEE Region I Director, opened the program with the story of the work that preceded the 1838 demonstration of the telegraph. He then presented the Milestone plaque, which reads,

In this building, in January 1838, Samuel F.B. Morse and Alfred Vail first demonstrated publicly crucial elements of their telegraph system, using instruments that Vail had constructed during the previous months. Electrical pulses, transmitted through two miles of wire, caused an electromagnet to ink dots and dashes (grouped to represent letters and

The *Newsletter* reports on the activities of the Center and on new resources and projects in electrical history. It is published thrice yearly by the Center for the History of Electrical Engineering, Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, NY 10017 (212-705-7501).

IEEE History Committee 1988

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Historic Speedwell



Victor Zourides, IEEE Region I Director (right), and Myles Morrison, President of the Board of Trustees of Historic Speedwell.

words) on a strip of paper.

Commercialization began in 1844 when funding became available. The plaque was accepted by Myles C. Morrison, III, President of the Board of Trustees of Historic Speedwell, who related the history of the site. Richard Waldron, Associate Director of the New Jersey Historical Commission, concluded the program with a talk on New Jersey's rich technological heritage. At the reception following the ceremony, guests were invited to view Speedwell's exhibit on the history of telegraphy, which featured some of Morse and Vail's telegraph instruments along with a wealth of archival material.

IEEE Fellowship in Electrical History

Applications are currently being accepted for the 1989-90 Fellowship in Electrical History. Funded by a grant from the IEEE Life Member Fund, the Fellowship is for either one year of full-time graduate work in the history of electrical science and technology at a college or university of recognized standing, or for up to one year of independent research for a recent Ph.D. graduate in the same field. For a pre-doctoral recipient, the Fellowship stipend is \$9,000, with an additional amount of up to \$2,000 to pay academic tuition and fees. The stipend is \$11,000 for a post-doctoral recipient.

The Fellow is selected on the basis of a complete description of the proposed research, college transcripts, letters of recommendation, and additional information supplied on the application form. For pre-doctoral candidates, the award is conditional upon acceptance of the candidate into an appropriate graduate program in history at a school of recognized standing.

Students with undergraduate degrees in engineering as well as those having degrees in the sciences or humanities are invited to apply. The deadline for receipt of applications for the 1989-90 academic year is 1 February 1989. Application forms may be obtained from the Center for the History of Electrical Engineering.

From page 1 . . .

the Spring of 1891, the company opened a school to prepare the men needed to run the plant. Known as the Telluride Institute, the school provided training in machinery, wiring, insulation, repairs, and alternating-current theory, along with shop work in wood and metal. The Institute's facilities also included a technical library and test room.

The success of the plant from the outset led to the constant growth of the system. In 1892, the transmission distance was increased to ten miles and then, in 1894, to fourteen. The equipment was continually upgraded as well and, in 1896, the synchronous system was replaced with Tesla's induction system. By 1911, the Telluride Power Co., which was separated from the San Miguel Gold Mining Co. in 1896, operated eight generating stations producing more than 40,000 hp that supplied 600 miles of transmission line in three states.

IEEE Pikes Peak Section Chairman John Reinert opened the program dedicating the Ames Plant as an Electrical Engineering Milestone. Charles Wright, member of the IEEE History Committee, spoke on the history of the plant and Mary Alys Lillard, IEEE Region 5 Director, presented the Milestone plaque. Closing remarks were made by Larry Day, Vice-President of the Colorado-Ute Electric Association, which owns and operates the modern plant at the site of the original Ames station. A reception followed the ceremony.

The IEEE Electrical Engineering Milestones Program serves to foster awareness of electrical engineering history and to preserve and document significant achievements in electrical and electronics engineering through Milestone site dedications. The Program is supervised by the IEEE History Committee and administered by the Center for the History of Electrical Engineering.

¹Nunn, Paul N. "Pioneer Work of the Telluride Power Company." In *Transactions of the International Electrical Congress, St. Louis, 1904*, vol. 2, 411. Albany, NY: J.B. Lyon Co., 1905.

²Nunn, Paul N. "We Did Not Know What Watts Were. . ." *General Electric Review* 59, no. 5 (September 1956): 45.

A Center for Electrical History in Brazil

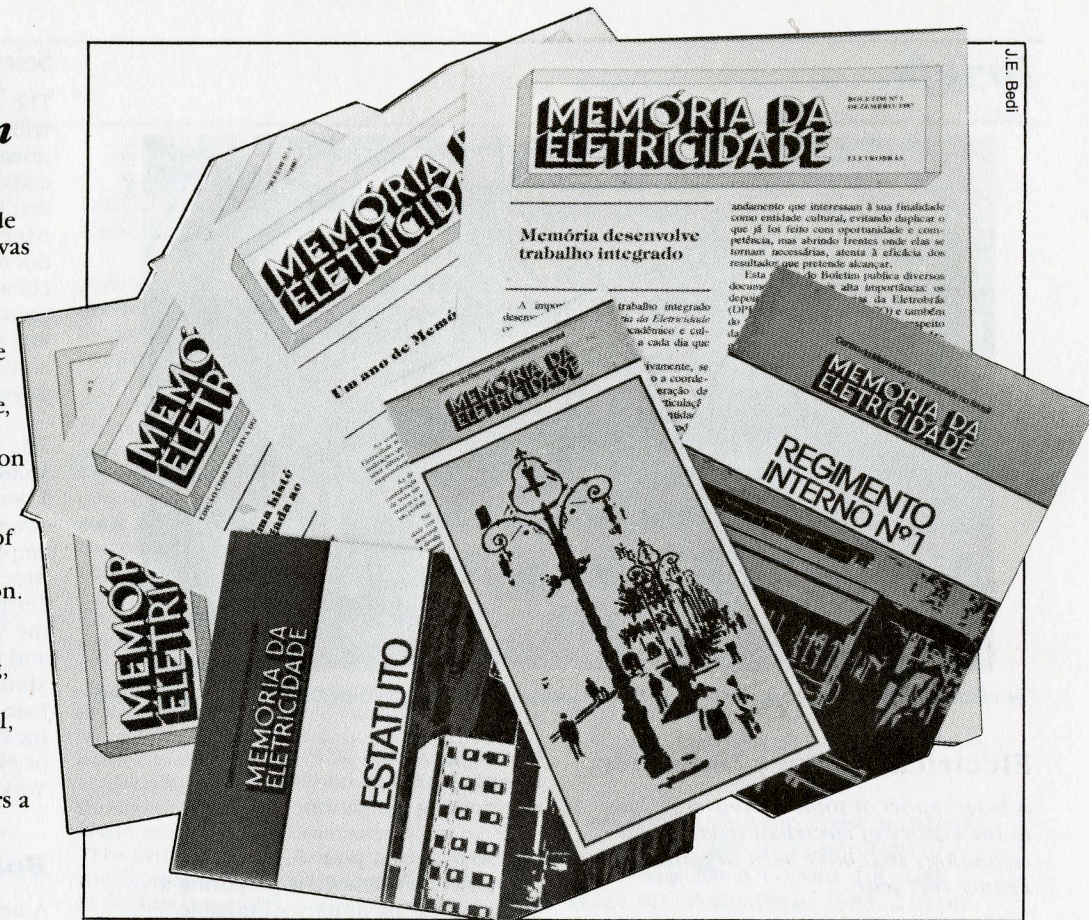
The Centro da Memória da Eletricidade no Brasil (Memória da Eletricidade) was founded on 16 October 1986 by the Centrais Elétricas Brasileiras S.A. (Eletrobrás) and several other electric utilities and associations in Brazil. The Memória, a non-profit organization registered with the Ministry of Culture, seeks to encourage the collection, preservation, study, and communication of the history of electricity in Brazil. Through its activities, the Memória hopes to make its public more aware of the role played by the electric power sector in the development of the nation.

Programs of the Memória da Eletricidade are linked with collecting, organizing, and preserving materials relating to the archival, bibliographical, technological, architectural, and environmental heritage of the electric power sector. Thus, the Memória offers a variety of research and information services to specialists and the general public. These include

- compiling databases of information relating to electrical engineering heritage;
- carrying out and coordinating research;
- evaluating projects; and
- planning, coordinating, and producing exhibits, courses, seminars, educational and cultural activities, and programs that illustrate and interpret the heritage of electric power in Brazil.

For example, an intensive bibliographical and documentary survey is in progress, along with a general inventory of the non-archival holdings of electric power utilities. The information gained from these studies is available both in a central database and in the preliminary edition of the *Guia de Fundos Documentais do Setor Elétrico* (Guide to the Documentary Sources of the Electric Power Sector). The two-volume *Guia* contains information on the history of electric power utilities as well as on these firms' archival holdings. It is hoped that the *Guia* will thus serve as a model for the documentation and preservation of Brazil's electrical heritage.

To supplement the *Guia*, a study of picture sources in the electric power sector has been completed. A collection of scholarly writings on the history of electric power is also being developed. Besides this, the library, which specializes in the history of Brazil's



Some recent publications issued by the Centro da Memória da Eletricidade no Brasil.

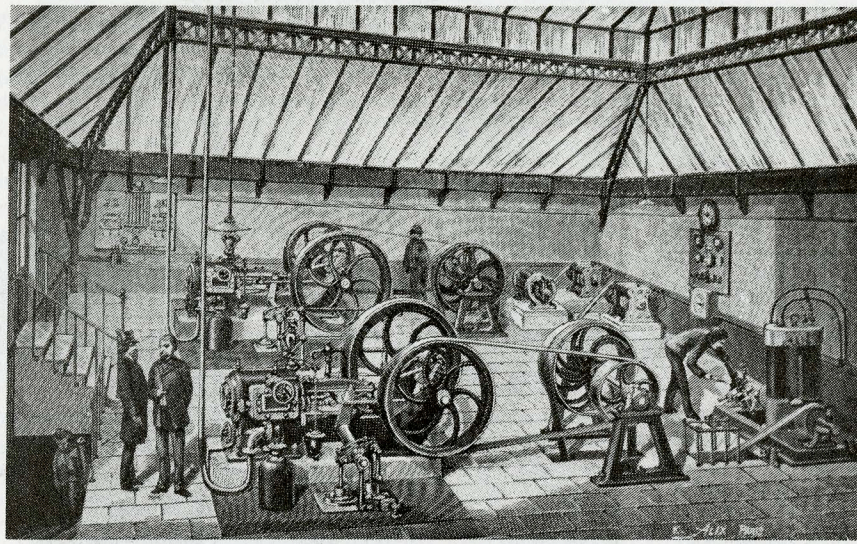
electric utilities, was recently opened to the public. In addition, a temporary exhibition area has been created. The philatelic exhibit, "Rios Prisioneiros, Energia em Liberdade" ("Imprisoned Rivers, Power Made Free"), was the inaugural show.

The Memória da Eletricidade has an active publications program as well. The *Boletim* is distributed regularly to the industry and to the cultural and academic communities. This newsletter reports on museums, organizations, and seminars and meetings devoted to electrical history both within Brazil and internationally. For example, the *Boletim* has included articles on the Museum of Technology in São Paulo, the Association pour l'Histoire de l'Électricité en France, the IEEE Center for the History of Electrical Engineering, and the Fundação Nacional Pró-Memória, a Brazilian national endowment supporting historical projects. Reviews of books and theses that focus on electric power in Brazil are also included in the *Boletim*, along with information on the history and current projects of Brazil's utility companies and on the activities of the Centro da Memória and its staff.

The Memória has also issued a descriptive brochure and two annual reports. In addition, several books have been published. These include *Avaliação da Segurança de Barragens Existentes* (Safety Evaluation of Existing Dams); *Energia e Desenvolvimento no Brasil* (Power and Development in Brazil); *Roteiro Básico para Memória Técnica de Usinas Hidrelétricas* (Basic Guide to the Technical Documentary Register of Hydroelectric Plants); *Roteiro Básico para Memória Técnica de Usinas Termelétricas* (Basic Guide to the Technical Documentary Register of Thermal Plants); and *Projeto Gráfico para Memórias Técnicas* (Graphic Project for Technical Documentary Registers). The Memória da Eletricidade has also researched and published the book *Panorama do Setor de Energia Elétrica no Brasil* (Panorama of the Electric Power Sector in Brazil).

For more information on the Centro da Memória da Eletricidade no Brasil, contact Orcelia Barroso, Executive Director, Centro da Memória da Eletricidade no Brasil, Memória da Eletricidade; Av. Presidente Vargas, 435 9º andar; 20071—Rio de Janeiro—RJ Brasil (021-211-5391).

Briefs...



The electrical machine room of the new Ecole Centrale, from the journal *Electricité*, 25 July 1885.

Electrical History in France

A brief report of some activities related to the history of electrical science and technology that have been organized in France this year . . .

discussion of the influence of the telegraph service on electrical engineering education.

The Association pour l'Histoire de l'Electricité en France is preparing a biographical dictionary of notable French electrical engineers and electricians of the nineteenth and twentieth centuries. The project is headed by Fabienne Cardot, General Secretary of the Association, and the research group will consist of Henri Morsel, Girolamo Ramunni, and Andre Thepot. For details, contact the Association at 9 Avenue Percier, 75008 Paris, France.

A meeting on scientific archives in France was held on 25 February at the Cité des Sciences et de l'Industrie. The morning session focused on institutional archives, including the central library of the Musée d'Histoire Naturelle, the archival services of the Academie des Sciences, and the archives of the Ecole Polytechnique. In the afternoon, the archives of individuals, including French physicists Paul Langevin and Alfred Kastler, were discussed.

National Cataloguing Unit for the Archives of Contemporary Scientists

The National Cataloguing Unit for the Archives of Contemporary Scientists (NCUACS) has been established at the University of Bath. It will continue the work of the former Oxford-based Contemporary Scientific Archives Centre (CSAC). The Director of the Cataloguing Unit is Dr. R. Angus Buchanan, who also heads the University of Bath's Centre for the History of Technology, Science and

Society. Peter Harper, who had been with the CSAC for four years, is the Unit archivist. The NCUACS has recently completed work on a collection of chemist and teacher Harold Warris Thompson's papers, and is currently working on several other collections, including those of aeronautical engineer Arthur R. Collar and physicist John Kendrew.

Scientific Collaborations Project

The AIP Center for History of Physics will conduct a long-term archival research project on scientific collaborations. The AIP Center reports that the project will "study the complex issues facing the historical documentation of multi-institutional collaborations in physics and allied sciences." The initial phase of the project will involve a two-year study of collaborations in the field of high-energy physics.

The project staff will include historians, archivists, physicists, and sociologists. Their work will examine experiments conducted since the early 1970s, with an emphasis on those performed at the Brookhaven National Laboratory, the Fermi National Accelerator Laboratory, the Stanford Linear Accelerator Center, and the Newman Laboratory of Nuclear Studies. For further information, contact Joan Warnow, Associate Manager, Center for History of Physics, American Institute of Physics, 335 East 45th Street, New York, NY 10017.

Bosscha Genootschap

A new society for electrical history, named *Bosscha Genootschap*, was recently formed at Delft University of Technology at Delft, The Netherlands. The society takes its name from the nineteenth-century Dutch physicist Johannes Bosscha, who investigated the causes of galvanic polarization and developed corollaries that simplify applications of Ohm's Law. At the first meeting of the *Genootschap*, members discussed the possibility of organizing activities related to the history of electrical engineering. For details, write to J.M. Brans, Dept. of Electrical Engineering, Delft University of Technology, P.O. Box 5031, 2600 GA Delft, The Netherlands.

Antenna

The Society for the History of Technology's Special Interest Group on the History and Impact of Communications Technologies has recently published the first issue of its newsletter, *Antenna*. The newsletter includes information on exhibits, meetings, recent publications, and other activities related to the history of communications technology. *Antenna* will be published three times a year. For details, write to Milton Mueller, Editor, *Antenna*, Annenberg School of Communications, University of Pennsylvania, 3620 Walnut St., Philadelphia, PA 19104.

New Publications...

The Newsletter's "Publications" section was prepared with the assistance of Thomas J. Higgins of the University of Wisconsin.

Books

Clark R. Mollenhoff. *Atanasoff: Forgotten Father of the Computer*. Ames: University of Iowa Press, 1988. 274 pp.

Atanasoff examines the life of John Vincent Atanasoff, concentrating on his building of the Atanasoff-Berry Computer (ABC) and the controversy that arose concerning the invention of the electronic digital computer. Mollenhoff's belief that the first electronic digital computer was the ABC, rather than the ENIAC (Electronic Numerical Integrator and Computer) developed by John Mauchly and J. Presper Eckert, strongly influences the narrative. The first few chapters discuss Atanasoff's early life, and introduce Clifford Berry, the graduate student who assisted Atanasoff in building the ABC.

The book describes Atanasoff and Mauchly's early correspondence and Mauchly's visit to Iowa in 1941, when Atanasoff and Berry demonstrated their progress on the ABC for Mauchly. Atanasoff's activities during World War II and the work of Mauchly and Eckert on the ENIAC are mentioned briefly. Mollenhoff also summarizes Atanasoff's activities after the war, showing how Atanasoff's career moved away from computer development.

To support his statements regarding the ABC's priority over the ENIAC, Mollenhoff discusses at length the suit filed by the Honeywell Co. and Control Data against Sperry Rand concerning the validity of the latter's patents on the ENIAC. Honeywell and Control Data claimed that Atanasoff was the true inventor of the electronic digital computer, not Mauchly. The extensive preparations Honeywell made before going to court are detailed, including the construction of a replica of the ABC prototype, built from specifications in a manuscript prepared by Atanasoff in 1939 (the original ABC was inadvertently dismantled and discarded at Iowa State in 1948).

Atanasoff and Mauchly's testimony about Mauchly's visit in 1941 and the development of the ABC are described in detail. Mollenhoff concludes the book with Judge Earl R. Lawson's decision, rendered on 19 October 1973, that Mauchly "derived" some of his ideas for the ENIAC computer from Atanasoff's work, and with a discussion of Eckert's feelings about the trial and Atanasoff and Mauchly's activities after the trial.

Clark R. Mollenhoff is a Pulitzer Prize winning reporter and author. He teaches journalism at Washington and Lee University in Lexington, VA.

Robert Slater. *Portraits in Silicon*. Cambridge, MA: MIT Press, 1987. 361 pp.

Portraits in Silicon tells the story of the development of the computer through biographies of thirty-four pioneers in the computer field. Slater groups these biographies into eight separate chronological and topical sections which trace the metamorphosis of the computer from its conception to its present day form and usage. By combining standard biographical information with discussions of the subjects' goals, motivations, work, and the many obstacles they overcame, Slater's history of the field is told from the individual's perspective.

The first three sections of *Portraits in Silicon* discuss the early computer pioneers who dreamed about, built, and sold the first computers. "The Conceptualizers" conceived of a machine which would quickly and accurately perform the arduous and intricate equations involved in solving physics and engineering problems. Slater describes designs from Babbage's Difference Machine to Shannon's first internal computer program. "The Early Inventors" focuses on the people and approaches involved in the construction of the first computers. Konrad Zuse built a mechanical machine while Aiken's Mark I was electromechanical. The Atanasoff-Berry Computer and ENIAC introduced electronic, digital technology while the SAGE Computer System heralded the beginning of internal core memories in computers. "The Early Entrepreneurs" sold these first computers to customers including universities and the United States government. They also sold the idea of manufacturing computers to large companies. The origins of the IBM and Sperry-Rand corporations are discussed.

Slater then focuses on the people who improved computers. In "Making the Computer Smaller and More Powerful," William Shockley speaks about his life and the invention of the first reliable junction transistor. Robert Noyce and Jack Kilby discuss their invention of the microchip. Ted Hoff's standardized, programmable, single-chip microprocessors allowed for the mass production of computers. "The Hardware Designers," like Seymour Cray, constantly modify their computers to achieve greater efficiency in performing specific tasks.

Portraits in Silicon also discusses the introduction of computers into mainstream American society. "The Software Specialists," like Grace Hopper and Gary Kildall, develop operating systems, programming languages, and word-processing packages that make computers easy to use. "Bringing Computers to the Masses" focuses on the commercialization of computers by people such as Steven Jobs and Adam Osborne, who built Silicon Valley into the center of the computer industry. The final section, "Computer Science Pioneer" is a profile of computer-science scholar David Knuth.

Robert Slater is a reporter for the Jerusalem Bureau of *Time* magazine and, at times, works for United Press International and *Newsweek*.

Other Recent Books

John R. Ausubel and H. Dale Langford, eds. *Lasers: Invention to Application*. Washington, DC: National Academy Press, 1987. 134 pp.

E.G. Bowen. *Radar Days*. Bristol, UK: Adam Hilger, 1987. 231 pp.

John H. Bryant. *Heinrich Hertz: The Beginning of Microwaves*. IEEE Catalogue No. 88TH0221-1. New York: IEEE, 1988. 50 pp.

Alice R. Burks and Arthur W. Burks. *The First Electronic Computer: The Atanasoff Story*. Ann Arbor: University of Michigan Press, 1987. 350 pp.

C. David Chaffee. *The Rewiring of America*. Orlando, FL: Academic Press, 1988. 241 pp.

Christine Hardyment. *From Mangle to Microwave: The Mechanization of Household Work*. Oxford, UK, and Eidith, NY: Polity Press, 1988. 220 pp.

C. Curtis Herskind and Marvin M. Morak, eds. *A History of Mercury-Arc Rectifiers in North America*. New York: IEEE, 1987. 230 pp.

Rolf Hochhuth. *Alan Turing: Erzählung*. Hamburg: Rowohlt Taschenbuch Verlag GmbH, 1987. 189 pp.

Penny Sparke. *Electrical Appliances*. Surrey, UK: Unwin Hyman, 1987. 112 pp.

Peter F. Yanczer. *The Mechanics of Television: The Story of Mechanical Television*. St. Louis, MO: P.F. Yanczer, 1987. 182 pp.

Articles

Anderson, Leland I. "Letter to the Editor on the Tesla Centennial." *IEEE Institute* 12, no. 8 (August 1988): 3.

Aspray, William. "An Annotated Bibliography of Secondary Sources on the History of Software." *Annals of the History of Computing* 9, nos. 3/4 (1988): 291-343.

Baird, Malcolm. "Letter to the Editor (on the History of the RTS)." *Television: Journal of the Royal Television Society* 24, no. 6 (1987): 323.

Barresi, Anthony L. "Edgar B. Gordon: Teacher to a Million." *Transactions of the Wisconsin Academy of Sciences, Arts, and Letters* 75 (1987): 57-65.

New Publications (cont.)

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- Coel, Margaret. "Keeping Time by the Atom." *American Heritage of Invention & Technology* 3, no. 3 (Winter 1988): 42-48.
- Crabtree, Stan. "Proof of Signal Hill: Marconi's 1901 First Transmission Across the Atlantic Lacked Definitive Proof—until 1902." *Canadian Electronics Engineering* 31 (Nov. 1987): 31-32.
- Döring, Herbert. "Rückschau auf 50 Jahre Klystronentwicklung." In *100 Jahre Elektromagnetische Wellen* (Proceedings of the Heinrich Hertz Symposium, Karlsruhe, 14-15 March 1988), 85-98. Frankfurt am Main: VDE-Zentralstelle Tagungen, 1988.
- Duda, James W. "The Evolution of Automated Meter Reading." *Public Utilities Fortnightly* 121, no. 13 (1988): 20-25.
- Elliott, Robert S. "The History of Electromagnetics as Hertz Would Have Known It." *IEEE Transactions on Microwave Theory and Techniques* 36, no. 5 (1988): 806-823.
- Fain, Deborah. "Early Telecommunications Firm Now a Century Old." *The Office* 107, no. 4 (1988): 92-93.
- Goebel, Gerhardt. "Adriano de Paiva und das Fernsehen." *Archiv* 39, no. 4 (1987): 384-392.
- "History Notebook: The Electronics Era." In *Electrical Engineering: Purdue University: State of the School*, 10-14. Lafayette, IN: Purdue University, 1987.
- Hobson, Philip T. "Letter to the Editor (on the History of the RTS)." *Television: Journal of the Royal Television Society* 24, no. 6 (1987): 323.
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- Kraus, John D. "Heinrich Hertz—Theorist and Experimenter." *IEEE Transactions on Microwave Theory and Techniques* 36, no. 5 (1988): 824-829.
- Lawren, Bill. "Rediscovering Tesla." *Omni* 10, no. 6 (March 1988): 64-68, 116-117.
- Lions, J. "The Australian Computer Journal: Twenty Years On." *The Australian Computer Journal* 19, no. 4 (1987): 185-189.
- Lodge, J.A. "Thorn EMI (Electric and Musical Industries) Central Research Laboratories—An Anecdotal History." *Physics in Technology* 18, no. 6 (1987): 258-268.
- Mackintosh, Allan R. "Dr. Atanasoff's Computer." *Scientific American* 259, no. 2 (August 1988): 90-96.
- Meiksins, Peter. "The 'Revolt of the Engineers' Reconsidered." *Technology and Culture* 29, no. 2 (1988): 219-246.
- Molella, Arthur P. "Inventing the History of Invention." *American Heritage of Invention & Technology* 4, no. 1 (Spring/Summer 1988): 22-30.
- Olson, C. Marcus. "The Pure Stuff: A Memoir (on Producing Pure Silicon)." *American Heritage of Invention & Technology* 4, no. 1 (Spring/Summer 1988): 58-63.
- "On the Twenty-Fifth Year of the Journal *Geomagnetism and Aeronomy*." *Geomagnetism and Aeronomy* 27, no. 1 (1987): 1ff.
- Perkins, William C. "(Letter to the Editor on) The ABCs of Computers." *IEEE Institute* 12, no. 8 (August 1988): 3.
- Powers, Kerns H. "The Treacherous Road to High Definition Television." *Television: Journal of the Royal Television Society* 24, no. 6 (1987): 313-317.
- "ROARS (Royal Omani Amateur Radio Society) Celebrates an Anniversary." *QST* 72, no. 3 (March 1988): 68.
- Santo, Brian. "(Heinrich Hertz Centennial:) Making Waves at 100." *IEEE Spectrum* 25, no. 5 (May 1988): 58-60.
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- Speake, G.D. "Marconi: 50 Years On." *GEC Review* (General Electric Co., Great Britain) 3, no. 3 (1987): 165-170.

Stix, Gary. "At Motorola: New Alliances, New Management." *IEEE Spectrum* 25, no. 7 (July 1988): 39-43.

Stockman, Harry S. "Useful Network Theorems: A Compilation of Network Theorems Used by Sercolab in International Publishing Since 1950." Sercolab (East Dennis, MA) Publication, June 1988.

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Wagner, B. "100 Jahre Drehstrommotor." In *Elektro-Jahre*, 25-31. Würzburg: Vogel, 1987.

Weldon, James O. "The Early History of U.S. International Broadcasting from the Start of World War II." *IEEE Transactions on Broadcasting* 34, no. 2 (1988): 82-86.

Werner, Dietrich. "Jubiläen (: 30th Anniversary of the Founding of the Control Engineering Journal *Messen-Steuer-Regeln*)." *MSR* 30, no. 11 (1987): cover 2.

Wise, George. "William Stanley's Search for Immortality." *American Heritage of Invention & Technology* 4, no. 1 (Spring/Summer 1988): 42-49.

Unpublished Manuscripts

Presented at "Telecom at 150: Progress, Promises, Policies," a conference commemorating the 150th anniversary of the telegraph, held at Princeton, NJ, 21-22 June.

John Carey, Greystone Communications. "The Diffusion of New Telecommunications Services: What Has Made Them Succeed?"

Reese Jenkins, Thomas A. Edison Papers Project, Rutgers University. "National Policy and Industrial Structure: An Historical Approach."

Carolyn Marvin, University of Pennsylvania. "When Old Technologies Were New."

Special Issues

IEEE Power Engineering Review Vol. 8, No. 2, January 1988.

Commemorating the IEEE Power Engineering Society's 25th anniversary, this issue includes articles on the Society's history and awards, and a listing of its Fellows.

Meetings . . .

Society for the History of Technology

The Society for the History of Technology (SHOT) will hold its annual meeting on 20-23 October at the Hagley Museum and Library in Wilmington, DE. In addition to the paper sessions, the program will include the presentation of the IEEE Life Members' Prize in Electrical History and the annual meeting of the Jovians, the SHOT Special Interest Group for Electrical History. Several papers on electrical history are scheduled, including,

- Ed Cass (Northeastern University), "Superconductivity."
- John Peter Collett (University of Oslo), "The Spreading of a New Technology: Electronics in Norway, 1945-1970."
- Peter C. Costello (Adelphi University), "The Consequences of Misunderstanding Technology: The Federal Communications Commission's Allocation of Television Channels."
- Gregory B. Field (University of Massachusetts), "'Electricity for All': The Electric Home and Farm Authority and a Technology of Mass Consumption."
- Gabrielle Hecht (University of Pennsylvania), "Technology and Patriotism in France: Perceptions of Nuclear Technology, 1945-1955."
- Paul W. Henriksen (University of Illinois), "Big Science in World War II: A Comparison of the MIT Radiation Laboratory and Los Alamos."
- David M. Introcaso (Arizona State University), "The Salt River Project: Pioneers of Hydroelectricity."

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- Milton Mueller (University of Pennsylvania), "From Competition to 'Universal Service': The Emergence of Telephone Monopoly in the U.S., 1907-1921."

- Frederik Nebeker (Princeton University), "The Use of Punched-Card Machines in Meteorology."

- Bradford W. Scharlott (Trinity University), "The Impact of Communications Technology on the Cincinnati Merchants' Exchange."
- Diane Zimmerman Umble (University of Pennsylvania), "The Telephone Comes to Amish Country: A Case Study of Resistance in Pennsylvania, 1890-1917."

For further information on the SHOT annual meeting, contact Lawrence Owens, Chair, SHOT 1988 Program Committee, Dept. of History, Herter Hall, University of Massachusetts, Amherst, MA 01003.

Giovanni Giorgi Symposium

A symposium will be held on 21-22 September 1988 in Torino, Italy, to commemorate Giovanni Giorgi and his contributions to electrical metrology on the golden anniversary of the confirmation of the Giorgi (MKS) System. The symposium is co-sponsored by a number of electrical and electronics organizations, including the International Union of Radio Science, the Associazione Elettrotecnica ed Elettronica Italiana, the IEEE Italy Sections, and the electrical engineering departments of the Polytechnic of Torino. In addition to the paper sessions, a tour of the metrological departments of the Istituto Elettrotecnico Nazionale Galileo Ferraris is also planned. For more information, contact Prof. C. Egidi, Dip. Elettronica,

Politecnico di Torino, Corso Duca degli Abruzzi, 24, 10129 Torino, Italy (011 556 7200; TELEX 220646 POLITICO).

International Telecommunications Conference

The Association pour la Recherche Historique des Télécommunications is sponsoring an international conference on the history of telecommunications that will take place in Paris toward the end of this year; exact dates will be announced in September. The papers will be organized along four themes—the emergence of telecommunications technologies and their relationship with science; the role of telecommunications in international politics and commercial strategies; the influence of telecommunications in economic and social development; and the development and utilization of telecommunications technology in commercial and educational institutions. For details, contact Patrice Carre, Conference Working Committee, Association pour la Recherche Historique des Télécommunications, C.P.E. Murat (C.H.T.), 5 Avenue du Général Sarrail, 75016 Paris, France.

SPSE Annual Conference

The 42nd annual conference of the Society for Imaging Science and Technology will be held at the Marriott Hotel in Boston on 14-19 May 1989. The conference will feature a symposium honoring the work of Harold E. Edgerton. The symposium will highlight "Doc" Edgerton's pioneering achievements in strobe illumination; high-speed, elapsed-time, and underwater photography; and sonar imaging. For more information, contact P.J. Forness, SPSE, 7003 Kilworth Lane, Springfield, VA 22151.

Exhibitions and Museums . . .

Exhibits on the History of Computing

Three museums are mounting extensive new exhibits on the history of computing. The first of these opened at the *Deutsches Museum* in Munich on 7 May. The Computer Science and Automation Hall traces the development of computers chronologically, beginning with early analog and digital geometrical devices and computing apparatus. This opening section features planimeters, sectors, and mathematical tables, as well as examples from the museum's rich collection of 18th- through early 20th-century mechanical calculating instruments.

The exhibit continues with the electromechanical machines of Konrad Zuse, displaying a replica of the Z3 of 1941 and the original Z4 of 1944. General-purpose, electronic, digital computers are represented by UNIVAC I (1951) built by Remington Rand, the PERM (Programmgesteuerte Elektronische Rechenanlage München, 1952-56) constructed by Piloty and Sauer, and other commercial computers of the 1950s. Sections on cryptological devices, peripherals, logical instruments, analog computing machines, and process-control computers are also included. The exhibition concludes with present-day computers. Microprocessors, microcomputers, programming techniques, and software are highlighted in this section. A demonstration area allows visitors to explore computing technology on their own.

A special gallery of the Computer Science and Automation Hall is devoted to microelectronics. An opening

discussion on the development of semiconductors leads into a section on the production of pure silicon and other materials used as base materials for microchips. The manufacture of integrated circuits is also illustrated. An expanded microelectronics exhibit is scheduled to open next year.

On 27 August of this year, the *Computer Museum* in Boston will open its first traveling exhibition, "Computers in Your Pocket: The History of Hand-held Calculators," at the Science Museum of Virginia in Richmond. This hands-on, historical exhibition of rare and unusual calculators from around the world chronicles the basic human need to count and remember with tools that can be carried. Among the most significant of the artifacts exhibited are Samuel Morland's 1666 mechanical pocket calculator, a set of Napier's bones, and the pioneering scientific hand-held calculator, the HP35 (1972). The exhibit's interactive devices include a giant slide rule and the two-gear Webb Adder, patented in the U.S. in 1869.

"Computers in Your Pocket" was funded by Hewlett-Packard. It was organized by the Computer Museum and is being circulated by the Smithsonian Institution Traveling Exhibition Service. The exhibit will travel for two years.

In the planning stage at the Smithsonian's *National Museum of American History* (NMAH) is a major new permanent exhibit on information technologies. "FYI: The Emerging Information Age," the current working title, is scheduled to

open in March 1990. The show will examine the history and social and cultural significance of information technologies from 1837 to the present, focusing on communications and processing devices.

Six sections are planned for "FYI." The "Introduction" will give visitors an overview of the exhibit's themes and lead them into "Information Technology in Society: 1837-1939." This section will discuss the history and impact of communications technologies, such as telegraphy, telephony, radio, and television, along with that of processing technologies, represented by calculators, cash registers, typewriters, and other business equipment. The growth of electronics technology will be highlighted in the transitional section on "World War II: The Information War;" cryptological devices and the ENIAC will be included here. In "Information Technology in Society: 1946-1990," the evolution of information systems, such as the IBM 360, will be presented, enhanced by examples of changes in system components for encoding, moving, storing, processing, and decoding information. The exhibit's "Conclusion" will take the form of a synthesis video presentation, from which visitors will exit to the "Gallery Study" of interactive devices complementing those used throughout the exhibit.

"FYI: The Emerging Information Age" will be another in the NMAH's series of new permanent exhibits on U.S. technological and social history. The exhibit is being developed by a core group of Smithsonian staff, including David Allison, Jon Eklund, Bernard Finn, and Marie Mattson, in consultation with historians and industry sponsors. The firm of Pamela Rogow and Jeffrey Bernstein, which produced the traveling exhibit, "Chips and Changes," will design "FYI."



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