IEEE CENTER FOR THE HISTORY OF ELECTRICAL ENGINEERING

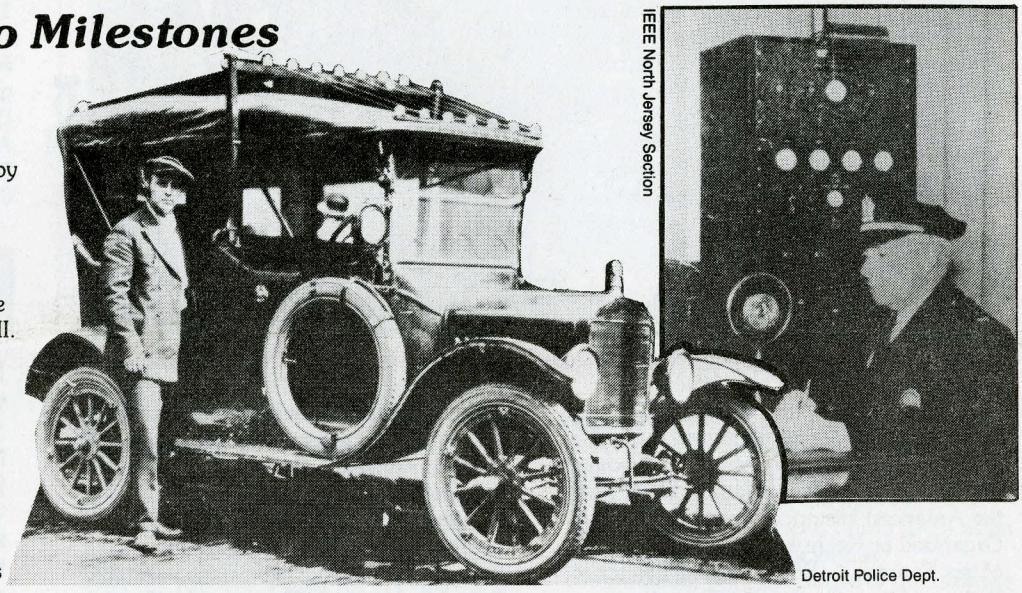
Newsletter Number 13 Fall 1986

Three Mobile-Radio Milestones

Three pioneering achievements in land-mobile radio have been approved as national Electrical Engineering Milestones by the IEEE. Nominated by the Southeastern Michigan, North Jersey, and Connecticut Sections, in conjunction with the IEEE Vehicular Technology Society, the Milestones mark three breakthroughs in the history of mobile radio prior to World War II.

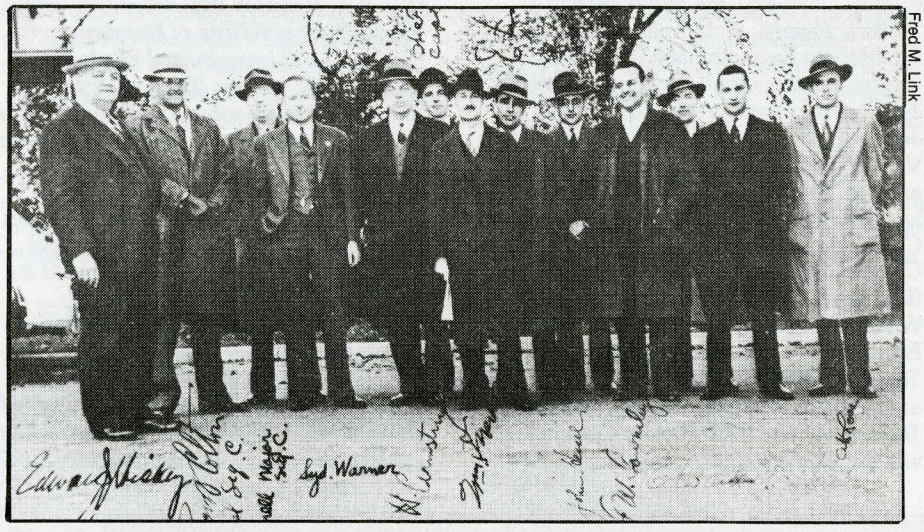
The first of these occurred at Detroit on 7 April 1928, when that city's Police Department commenced one-way radio communications with its patrol cars on a permanent basis. The project had begun in 1921, when Police Commissioner William Rutledge authorized setting up an experimental station at police headquarters and predicted that the "wireless telephone will bring a new era in police work." Seven years passed before that era began, however, as problems with low-gain vacuum tubes, interference from motor noise and trolley power lines, and changing licensing decisions by the Federal Radio Commission (FRC) plagued the Detroit system. Many of the problems were resolved in late 1927 when Patrolman Kenneth Cox and Robert L. Batts, an engineering student, designed a much-improved receiver around the newly invented screen-grid tube. Moving the radio station away from the noisy downtown area, devising a better antenna system, and providing fixed tuning also contributed to the success of the station that proved the practicality of land-mobile radio.

The feasibility of two-way police communications was demonstrated five years later by the Bayonne, NJ, Police Department, site of the second Mobile-Radio Milestone. Lieutenant Vincent J. Doyle, the radio operator for the Bayonne unit, applied for a construction permit from the FRC for a two-way station on 7 October 1932, and was granted the permit on 22 December. In March 1933, Doyle and Frank A. Gunther, chief engineer at Radio Engineering Laboratories (REL) on Long Island, went on the air with a two-way system consisting of superregenerative receivers and noncrystal-controlled transmitters built by REL. Since the equipment operated at 34,600 kc, more than ten times higher than the frequency of one-way systems, it was cheaper, lighter in weight, and less prone to many types of interference. Two-way police radio became standard throughout the country following the well-publicized work at Bayonne.



IEEE North Jersey Section

Detroit Police Dept.



Fred M. Link

Three breakthroughs in mobile-radio technology have been designated as IEEE Electrical Engineering Milestones. Antenna wires were strung along the roof of the first Detroit police radio car in 1921 (upper left); Bayonne's police dept. started using a two-way system in 1933 (upper right); experts inspect the Connecticut State Police's two-way FM system in 1940 (above).

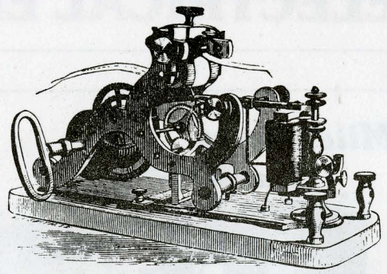
The third Mobile-Radio Milestone marks the introduction of FM. In 1939, Edward J. Hickey, Commissioner of the Connecticut State Police, asked Daniel Noble, a professor of electrical engineering at the University of Connecticut, to design a mobile-radio system for the State Police. A one-way system was suggested, but Noble, who had designed two-way AM and FM broadcast stations, recommended a two-way, FM station. Receiving the go-ahead from Hickey, Noble drew up a circuit design and specifications, from which a practical unit was built by Fred Budelman, chief engineer of the Fred M. Link Company. Noble later said that the success of the system was due to choosing phase modulation, selecting proper station sites, using rooftop antennas on the cars, and employing different transmitting frequencies for the base station and mobile units. The system began operations at Hartford in 1940, signaling the nationwide switch from AM to FM.

Ceremonies dedicating the Milestones will be held in Detroit, Bayonne, and Hartford this spring.

Telegraphy in History

Next year marks the 150th anniversary of the practical development of a revolutionary communications technology – the electromagnetic telegraph. The pioneering work in 1837 of Charles Wheatstone and William Cooke in England and of Samuel F.B. Morse and Alfred Vail in the United States proved the technical feasibility of a communications medium that radically changed the conduct of business transactions, military campaigns, diplomacy, and many other aspects of life. Telegraphy was the earliest application of electricity on a large scale – the forerunner of the modern profession of electrical engineering.

Smithsonian Institution



Morse telegraph register, ca. 1860

Current interest in the history of telegraphy is wide ranging. Historians are considering the social and political consequences of telegraphy, in addition to the more traditional focus on the origins of this technology. Evidence of this new interest is seen in sessions at meetings of the Society for the History of Technology (SHOT) and the American Historical Association (AHA). Organized by Keith A. Nier, Assistant Editor of the Thomas A. Edison Papers Project at Rutgers University, the SHOT session – "Politics, Patents, and Profits in Telegraphy: Establishing Revolutionary Technology"– was held at the annual meeting in October. Three papers were presented: Richard R. John, Jr. (Harvard University), "A Failure of Vision? The Jacksonians, the Post Office, and the Telegraph, 1844-1847," Paul B. Israel (Edison Papers), "Inventive and Corporate Strategy: Western Union and Competition," and Donard de Cogan (University of Nottingham), "From Technical Wonder to Profitable Investment: The Economics of 19th-Century North Atlantic Telegraphy." Nier chaired the SHOT session, and James E. Brittain, Georgia Institute of Technology and IEEE History Committee, was the Commentator.

The session, also organized by Nier, to be held at the AHA meeting in Chicago on 29 December is "Societies and Telegraphs after 1850: International Perspectives on the Interactions of Technology and Social Forces". Four papers will be presented at the session: Andrew J. Butrica (Edison Papers), "Women in Telegraphy: Transatlantic Contrasts and Parallels," Keith A. Nier, "The Perplexing Fate of the Quadruplex: Phantom Wires and Technological Myths," Daniel R. Headrick (Roosevelt University), "Gutta-Percha: A Case of Resource Depletion and International Rivalry," and Robert A. Rosenberg (Edison Papers), "Intraurban Telegraphy: The Nerve of Some Cities." The session will be chaired by Louis P. Galambos, Johns Hopkins University.

Other recent work on this subject includes a paper by M. Norton Wise (University of California, Los Angeles), "The Role of the Telegraph in British Electromagnetic Theory," which was given at the October meeting of the History of Science Society, and a paper by Paul Israel, "From Public Vision to Corporate Strategy: The Changing Context of American Invention as Evidenced by the Telegraph Industry," to be presented at the April 1987 meeting of the Organization of American Historians. A further indication of the increased interest in the history of telegraphy is that two recent IEEE Fellows in Electrical History, Andrew Butrica and Paul Israel, chose this topic for their Ph.D. dissertations (see *Newsletter* No. 12, Summer 1986, page 1).

For information on an informal interest group in the history of telegraphy, contact Dr. Keith A. Nier, Assistant Editor, Thomas A. Edison Papers Project, Van Dyck Hall, Rutgers University, New Brunswick, NJ 08903 (201-932-8511).

MEETINGS

NCPH/SHFG Joint Meeting

The National Council on Public History (NCPH) and the Society for History in the Federal Government (SHFG) will hold a joint meeting on 24-26 April 1987 in Washington, DC. The meeting will address the historical relationship of science, technology, and medicine to government activities, including the military, and to public policy. Papers on public history methodology, research, historiography, applied history, and professional issues will be presented.

For details, contact the Society for History in the Federal Government, Box 14139, Benjamin Franklin Station, Washington, DC 20044.

Organization of American Historians

The April 1987 meeting of the Organization of American Historians (OAH) will include a session on "High Technology and History: New Perspectives on Industrial Research and American Business, 1870-1930." Papers at the session will be presented by Darwin Stapleton, on the development of research facilities in the Cleveland area during the years 1870-1930; W. Bernard Carlson and A.J. Millard, on independent research laboratories set up by inventors (notably that of Thomas Edison); and Gail Cooper, on the American Society of Heating and Ventilating Engineers Research Laboratory during the 1920s. The session will be chaired by Louis Galambos, Johns Hopkins University. Commentators will be Margaret Graham, Boston University, and Robert Garnet, AT&T Company.

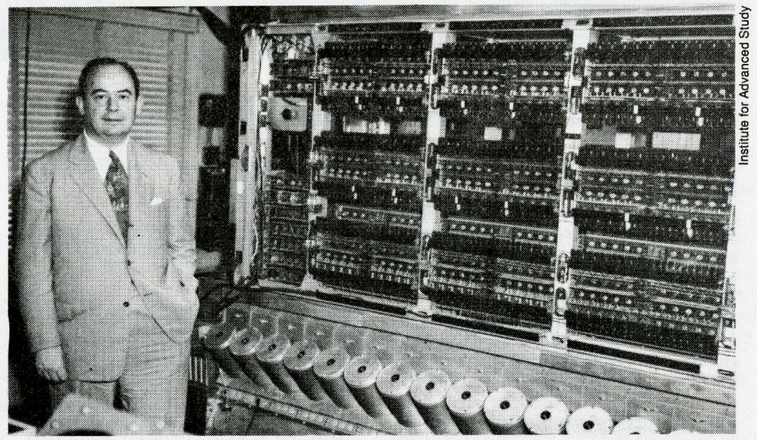
For more information on the session contact W. Bernard Carlson, Humanities Division, School of Engineering, University of Virginia, Charlottesville, VA 22901 (804-924-3425). Exact dates and location of the meeting will be announced at a later date.

BRIEFS

International Conference on Induction Machines

A special technical conference on the "Evolution and Modern Aspects of Induction Machines" was held in Torino, Italy, on 8-11 July 1986. The conference commemorated the centennial of Galileo Ferraris's discovery of the principle of the induction motor and took place at the Politecnico di Torino, where Ferraris was a professor of physics.

Among the many papers presented at the sessions were those by R.R. Kline on "Science and Engineering Theory in the Invention and Development of the Induction Motor, 1879-1897," C. Egidi on "Galileo Ferraris, the Discoverer of the Rotating Magnetic Field," K.P. Kovacs, L. Kiss, and G. Ujhazy on "Prof. Galileo Ferraris and the Ganz Transformer," G. Kovacs on "Activity of Ganz Electric in the Field of Induction Machines: Kando's Locomotive, Blathy's Induction Watthour Meter," and L. Abraham on "Control of Squirrel Cage Motor: A Survey on the Methods with Regard to the History." In addition, a historical exhibit (see page 8) complemented the sessions. Copies of the exhibit catalogue and conference proceedings may be requested from the Dipartimento di Elettrotecnica, Politecnico di Torino, C.so Duca degli Abruzzi, 24, 10129 Torino, Italy.



Institute for Advanced Study

John von Neumann and the Institute for Advanced Study computer, ca. 1955.

CBI Research on von Neumann

A two-year grant has been awarded by the National Science Foundation to William Aspray, Associate Director of the Charles Babbage Institute Center for the History of Information Processing (CBI), for a project on "John von Neumann's Development of the Computer as a Scientific Instrument." The CBI reports that Aspray will consider "the change that arose in numerical methods in the period of 1945-1957 to accommodate the computer; the changing role of computation in sciences as the punched card tabulator, the differential analyzer, and the desk calculator were replaced by the stored program computer; the changes in the scientific and the technological disciplines to which the computer was applied; the importance of the Institute for Advanced Study (IAS) as an international center of scientific computation; the importance of the Institute and Princeton University as an educational leader for a new group of computer-oriented scientists and mathematicians; the role of von Neumann in scientific research on the IAS and other early computers; and the establishment of computing as a mathematical science." Aspray will not consider von Neumann's involvement in the design of computing equipment, as this area has been extensively researched by others.

Texas Instruments Artifact Project

A project to collect artifacts relating to the history of microelectronics will get underway this fall at the Texas Instruments Company in Dallas. Elliot Sivowitch, Specialist in Electronics at the Smithsonian's National Museum of American History (NMAH), will work with TI personnel in Dallas to locate, identify, and describe artifacts to be shipped to the museum. Financial support for the project, which is directed by Dr. Bernard S. Finn, Curator of the museum's Division of Electricity, will be provided in part by the IEEE Life Member Fund.

The current effort is a continuation of an earlier Smithsonian-IEEE project in microelectronics history. In 1983, Bruce Hevly, a summer intern supported by the IEEE Life Member Fund, worked with Dr. Finn, Mr. Sivowitch, and Dr. Robert Friedel, then Director of the IEEE Center for the History of Electrical Engineering, to identify and locate microelectronics artifacts in the United States. These were donated to NMAH and are the core of a small exhibit on microelectronics that opened in February 1984 (See *Newsletters* Nos. 3 and 5, June 1983 and Spring 1984). Items collected for the exhibit include early chips manufactured by Zilog, Synertek, RCA, and Intel, crystals made by Gordon Teal, and a Regency Radio from Willis Adcock at TI. The museum has received additional artifacts since 1983, some of which have been added to the exhibit.

To support the current project, TI has made a major effort to locate artifacts and has already identified more than 300. The company has also assigned a retired employee to catalogue the items and to work with Mr. Sivowitch while he is in Dallas. It is expected that crystals, crystal pullers, printed crystal slices, masks, printed-circuit testing apparatus, early radios, Polaroid cameras with TI circuitry, integrated circuits made by Jack Kilby, and other items will be sent to the Smithsonian as a result of the project.

SAIEE Historical Interest Group

The Historical Interest Group (HIG) of the South African Institute of Electrical Engineers (SAIEE), founded in 1983 (see *Newsletter* No. 5, Spring 1984), organized a variety of activities during 1985, including lectures, publications, a tour of the Klip power station near Vereeniging (now torn down), and the acquisition of materials for its library and proposed museum.

X-ray equipment from the early 1930s, appliances from the 1920s, a Brush wire recorder, a Wheatstone bridge, nuclear electronic equipment from 1960, and an ICT Punchcard reproducing machine were collected for the proposed engineering museum. Among the many books acquired for the HIG library were seven volumes of the 1911 *Cyclopedia of Applied Electricity* and four volumes of the 1920 *New Electrical Encyclopedia*, as well as other books related to the history of electrical science and technology.

NEW PUBLICATIONS

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

Books

J.D. Poulter. *An Early History of Electricity Supply: The Story of the Electric Light in Victorian Leeds.* London: Peter Peregrinus, 1986. 212 pp.

An Early History of Electricity Supply is the fifth volume in the IEE History of Technology Series. It provides a thorough case study of electric illumination in Leeds from 1880 to the early 1900s.

J.D. Poulter begins the story with the first public demonstration of electric illumination in Leeds at an 1880 political rally. From there the focus of the book broadens to take into account the early development of electric generation and illumination in Europe and the United States, including Charles Parsons's work on steam turbines and the dispute between Thomas Edison and Joseph Swan over the invention of the incandescent light. Poulter then discusses unsuccessful early attempts (all using arc lighting) at marketing electric illumination in Leeds and describes the first installations of electric lights in several of the town's public buildings. The bulk of the text relates the story of the successful Yorkshire House-to-House Co., from its formation after the passage of the second Electric Lighting Act in 1888 to its takeover by the Leeds Corporation in 1898.

J.D. Poulter is the District Engineer for the Leeds North District of the Yorkshire Electricity Board's West Yorkshire Area.

W. Harry Prevey (ed.) *Electricity – The Magic Medium.* Thornhill, Ontario: The IEEE Canadian Region, 1985. 183 pp.

Electricity – The Magic Medium is a centennial project sponsored by the IEEE Canadian Region. The bilingual book, with pages alternating in French and English, consists of four sections covering 100 years of electrical engineering in Canada.

The first section focuses on the Canadian electric industry, taking into account the topics of communications, electric power, electric utilities, and electrical manufacturing. Canadian electrical engineering and technology education is presented in the following section. Among the topics discussed here are early electrical engineering programs, radio, French language programs in engineering, the computer age, women in electrical engineering, and the emergence of technological institutes.

The past, present, and future of the Canadian electric industry is the focus of the third section, which predicts a positive future based on the historical patterns of the industry's development and its favorable ranking among the electric industries of other nations. The final section relates the story of the IEEE Canadian Region, discussing the formation of the Region by members of the Institute of Radio Engineers and the American Institute of Electrical Engineers, Canadian Conferences, the IEEE McNaughton Learning Resource Centers, and IEEE Regional Awards.

W. Harry Prevey is a consulting engineer in Ontario, Canada, and is president of Prevey Consulting Services, Ltd.

S.S. Swords. *Technical History of the Beginnings of Radar.* London: Peter Peregrinus, 1986. 325 pp.

The *Technical History of the Beginnings of Radar* is the sixth and most recent volume in the IEE History of Technology Series. It discusses at length the technical history of radar development up to the outbreak of World War II, concentrating on the 1930s.

Swords first provides the reader with technical information on the principles of radar and then begins the narrative with the work of several pioneers in radar development, such as that of Christian Hulsmeyer, Hans Dominik, and Nikola Tesla in the early 1900s. He discusses many predecessors of radar, including early aircraft detection devices and early electromagnetic distance-finding methods, and three British designs for radio-wave detection from the late 1920s and early 1930s.

Swords next summarizes the first uses of radar in Germany, the United States, France, Italy, Japan, Russia, Holland, and Hungary. An entire chapter is then devoted to the development of radar in Great Britain and covers radar in the British armed forces during the 1930s, the Chain Home system, transmitters and receivers, and radar countermeasures. Swords concludes his book with the development of the magnetron and its impact on radar technology. Several appendixes give further technical details on many of the topics mentioned in the text. *A Technical History of the Beginnings of Radar* provides good insight into the technical origins of radar, especially in Great Britain.

S.S. Swords is a retired commandant of the Irish army signal corps, maintaining a commission as a reserve officer. He is presently an engineering science lecturer at Trinity College.

Maurice V. Wilkes. *Memoirs of a Computer Pioneer.* Cambridge, MA: MIT Press, 1985. 240 pp.

This autobiography of computer inventor Maurice Wilkes is the third offering in the MIT Press Series in the History of Computing. After discussing his childhood and education, the author describes his role in the development of radar, which began in 1939 and continued through World War II. From this experience, Wilkes believes that computer engineering is indebted to radar as much as it is to earlier calculating machines. At the end of the war, Wilkes began to work on computers again, having had previous experience with analog computers at Cambridge University.

Once learning of the ENIAC at the University of Pennsylvania, Wilkes recognized the advantages of digital computing, which he brought to England in 1945. In the spring of 1949, Wilkes's EDSAC, modeled after the American EDVAC, was operating in Cambridge – one year before US engineers began using a comparable machine (the SEAC). Thus, Wilkes's EDSAC is generally regarded as the first stored-program electronic digital computer. He then developed the idea of microprogramming, in 1950, which became an important technology for future computers.

Maurice Wilkes retired from Cambridge University in 1980 and is now a senior consulting engineer at the Digital Equipment Corporation.

Other Recent Books

Fabienne Cardot (ed.) *La France Des Électriciens 1880-1980: Actes du deuxième colloque de l'Association pour l'histoire de l'électricité en France.* Paris: Presses Universitaires de France, 1986. 464 pp.

Ole Immanuel Franksen (ed.) *Six Stories (of Electrical Engineering History).* Birkerød, Denmark: Strandbergs Forlag, 1986. 171 pp. Translated from the original Danish edition published in 1984 and sponsored by the IEEE Denmark Section.

Tom McArthur and Peter Waddell. *The Secret Life of John Logie Baird.* London: Century Hutchinson Ltd., 1986. 274 pp.

Forrest M. Mims III. *Siliconnections: Coming of Age in the Electronics Era.* New York: McGraw-Hill, 1985. 208 pp.

Akio Morita with Edwin M. Reingold and Mitsuko Shimomura. *Made in Japan: Akio Morita and the Sony Corporation.* New York: Dutton, 1986.

Joseph B. Murdoch. *Illumination Engineering: From Edison's Lamp to the Laser.* New York: Macmillan, 1985. 560 pp.

Iris Newsom (ed). *Wonderful Inventions: Motion Pictures, Broadcasting, and Recorded Sound at the Library of Congress.* Washington, DC: Library of Congress, 1985. 384 pp.

Hartmut Pogge von Strandmann (ed.) *Walter Rathenau: Industrialist, Banker, Intellectual and Politician, Notes and Diaries 1907-1922.* Oxford, UK: Oxford University Press, 1986. 340 pp.

Wallace Tucker and Karen Tucker. *The Cosmic Inquirers: Modern Telescopes and Their Makers.* Cambridge, MA: Harvard University Press, 1986. 221 pp.

Esmond Wright. *Franklin of Philadelphia.* Cambridge, MA: Harvard University Press, 1986. 404 pp.

NEW PUBLICATIONS (cont.)

Articles

Amor, D.F. "The Graphical Methods of Sumpner, Drysdale and Marchant: Solving the Kelvin Equation," *IEE Proceedings,* 133, Pt. A (Sept. 1986), 387-393.

Atherton, Tony. "A History of Ohm's Law," *Electronics & Power,* 32, No. 6 (June 1986), 467- 471.

Bissell, C.C. "Karl Küpfmüller: A German Contributor to the Early Development of Linear Systems Theory," *International Journal of Control,* 44 (1986), 977-989.

Brittain, James E. "The Alexanderson Radio Alternator and the Distinction Between Engineering and Science," *Proceedings of the Radio Club of America,* 60, No. 1 (May 1986), 3-8.

Cartwright, Carol Lohry. "Rock Island: The Personification of Chester H. Thordarson (Chicago Electrical Inventor and Businessman)," *Wisconsin Magazine of History,* 69, No. 3 (Spring 1986), 211-227.

Cox, R.C. "The Development of Survey Instrumentation, 1780-1980," *Survey Review,* 28 (Jan. 1986), 234-255.

Döring, H. "Gottfried Eckart – 80 Jahre," *Archiv für Elektronic und Übertragungstechnik,* 40,(1986), 202.

Duffy, M.C. "The Electric Power Industry and Exemplary Techniques," *IEE Proceedings,* 133, Pt. A, No. 3 (May 1986), 159-172.

Godfrey, A. Blanton. "The History and Evolution of Quality in AT&T," *AT&T Technical Journal,* 65, No. 2 (March-April 1986), 9-68.

Haines, Roger W. "Computer-Based Environmental Control Systems: Their History and Development," *Energy Engineering,* 83, No. 2 (1986), 11-17.

Hausen, Jürgen. "Das transatlantische Telegrafiekabel – Teil 1," *Nachrichtentechnische Zeitschrift,* 39 (August 1986), 568-572.

Hyman, Ray. "Parapsychological Research: A Tutorial Review and Critical Appraisal," *IEEE Proceedings,* 74 (June 1986), 823-849.

Köstler, Günter. "A Decade of Experience with Optical Cable Systems," *Siemens Telecom Report,* 9, No. 3 (1986), 143-147.

Levere, Trevor H. "Magnetic Instruments in the Canadian Arctic Expeditions of Franklin, Lefroy, and Nares," *Annals of Science,* 43 (1986), 57-76.

Linder, Ernest G. and James E. Brittain. "(Correspondence on) The Magnetron," *Physics Today,* 39, No. 1 (Jan. 1986), 115-116.

McConnell, Anita. "The Scientific Life of William Scoresby Jr, with a Catalogue of his Instruments and Apparatus in the Whitby Museum," *Annals of Science,* 43 (1986), 257-286.

Mascarenhas, S. "Bernhard Gross: The Man and the Scientist," *IEEE Transactions on Electrical Insulation,* EI-21 (June 1986), 243-244.

Mazuzan, George T. " 'Very Risky Business:' A Power Reactor for New York City," *Technology & Culture,* 27 (April 1986), 262-284.

Meyer, A.S. "A Perspective on the South African Electrical Manufacturing Industry," *Elektron,* 3, No. 4 (April 1986), 3-11.

Miskoe, W.I. "The Centenary of Modern (Electric) Welding, 1885-1985: A Commemoration," *Welding Journal,* 65, No. 4 (April 1986), 19-26.

Moore, Glenis. "Hertha Ayrton – First Lady of the IEE," *Electronics & Power,* 32 (Aug. 1986), 583-585.

Morgan, P.F.A. "Highlights in the History of Telecommunications," *Telecommunications Journal,* 53 (1986), 138-149.

Mosbeck, Alfred. "Begrussung und Ansprache anlasslich der 75-Jahr-Feier der Oesterreichischen Brown Boveri – Werke AG," *Elektrotechnik und Machinenbau,* 103 (1986), 198-199.

Nelson, David L. and C. Gordon Bell. "The Evolution of (Computer) Work Stations," *IEEE Circuits and Devices Magazine,* 2, No. 4 (July 1986), 12-16.

Neufeld, M. Lynne and Martha Cornog. "Database History: From Dinosaurs to Compact Discs," *Journal of the American Society for Information Science,* 37, No. 4 (1986), 183-190.

Ottewell, Mike. "Technology Evolution in Airborne Fighter Radars," *Electronics & Power,* 32, No. 6 (June 1986), 473-475.

Thomas, Bruce M. "A Review of the Early Developments of Circular-Aperture Hybrid-Mode Corrugated Horns," *IEEE Transactions on Antennas and Propagation,* AP-34, No. 7 (July 1986), 930-935.

Tinkham, Michael. "(Notes on the History of) Superconductivity," *Physics Today,* 39, No. 3 (March 1986), 22-23.

Vermeulen, D.J. and G.D. Walker, "Dr. Henrik van der Bijl and the Vacuum Tube," *Elektron,* 3, No. 4 (April 1986), 30-36.

Young, Peter. "The History of the STC (Standard Telephones and Cables Limited)," *IEE Proceedings,* 133, Pt. A, No. 5 (July 1986), 319-327.

Special Issues

Annals of the History of Computing

Vol. 8, No. 1 (Jan. 1986). A special issue devoted to the IBM 650. Contains four engineering articles on the IBM 650, featuring the SSEC (Selective Sequence Electronic Calculator), the magnetic-drum calculator, the Wooden Wheel computer, and "optimum programming"; seven articles on university applications of the IBM 650, including material on Carnegie-Mellon, Information Processing Language V, and the GAT compiler; and seven articles on programming aids and applications, featuring a 1955 computation seminar, the FORTRANSIT program, the Wolontis-Bell Interpreter, the IBM 650 at Savannah River, and the solution of simultaneous equations.

Vol. 8, No. 3 (July 1986). A special issue commemorating the 25th anniversary of AFIPS (American Federation of Information Processing Societies). Contains three articles of background information, three articles of reflections and perspectives on AFIPS, an article on Harry H. Goode (one of the founders of AFIPS), and an article on the history of AFIPS.

Bulletin d'histoire de l'électricité

Special Issue, 1986. "Cent ans d'électricité dans le lois," by Jean-Claud Colli, fills the entire issue. This essay consists of summaries of the principal legislative and regulatory texts relating to electricity in France from 1880 to 1980.

The Historical Technologist

Bulletin 4 (March 1986). Published by the Niagara Society for Industrial History, Niagara Falls, Ontario, Canada, *Bulletin 4* contains a major article on the International Railway Company's Niagara Falls hydroelectric generating station, featuring a history of the station, the station's layout, and drawings, pictures, and tables of machinery used at the station. Two smaller articles on arc lamps and railroad semaphore signals appear at the end of the issue.

IEE Proceedings

Vol. 133, Pt. J, No. 3 (June 1986). A special issue on the first 20 years of optical communications. Contains articles on the origin of optical communications (including the U.S. Navy's entry into the field of fiber optics), optoelectrical technology, dielectric-fiber surface waveguides, and possible future applications for optoelectronic integration.

The AT&T Corporate Archive

Robert G. Lewis

When Henry B. Thayer, President of the American Telephone and Telegraph Company, appointed William Chauncey Langdon to establish a historical archive for the company in October 1922, AT&T was well on its way to becoming the world's largest corporation. Bell himself, however, was never seriously involved in the commercial applications of the telephone, which began under the direction of his father-in-law, Gardiner G. Hubbard. By 1880, the Bell patents were under the control of the American Bell Telephone Company, the parent company of the fledgling Bell System. In 1900 its assets were transferred to the American Telephone and Telegraph Company, initially founded as a subsidiary of American Bell in 1885 for the purpose of conducting the company's nascent long-distance business.

Under the leadership of Theodore N. Vail, President of AT&T from 1907 to 1919, the Bell System embarked upon a period of profound change in its managerial and financial structure. From 1900 until divestiture in January 1984, AT&T was the corporate head of the Bell System which attained its mature organizational form with the founding of the Bell Telephone Laboratories in 1925. In addition to AT&T as corporate manager, this functional form was composed of the Long Lines Department, the local telephone operating companies, Western Electric Co., and Bell Labs.

Center for the History of Electrical Engineering

John J. Carty established the Bell System Historical Museum around 1913.

The specific circumstances under which the science of telephony and the Bell System developed induced an early appreciation for telephone history on the part of its managers. Langdon's work as the head of the American Telephone Historical Collection did not begin *de novo*. The extensive patent litigation which characterized the early years of the company (especially the 1878-1894 period) led to the collection and preservation of numerous historical documents. Particularly notable was the work of T.D. Lockwood who began, in the company's Patent Department, in 1883 to compile and document the history of the central telephone exchange. Lockwood also collected many personal histories of telephone pioneers and published articles on the history of telephony.

President Vail took a keen interest in telephone history and many of his Annual Reports incorporated historical accounts of the development of telephony as context for discussion of emerging trends. It was his conviction that "no thorough understanding of anything can be had without a knowledge of its origin, its roots." During Vail's tenure, first state, and then federal regulation became significant factors in the business, adding further impetus to the collection and preservation of historical material, much as the legal requirements for patent litigation had in the past.

As early as 1913, Vail's chief engineer, J.J. Carty, established the Bell System Historical Museum, an extensive collection of telephone artifacts. From 1922 until the mid-1930s, the historical collections of AT&T were given a firm institutional foundation by the indefatigable work of Langdon, who became a recognized authority on the history of telephony and the telephone business. The commitment to preserve the company's history was reinforced by Thayer's successor, Walter E. Gifford, in 1925 when he issued to Langdon an "authorization to receive historical material for the American Telephone Historical Collection" from all Bell System departments. The historical archive, begun with such foresight early in the company history, has enjoyed continual (if uneven) support ever since. Relied upon heavily from 1930 to 1980 to meet legal and regulatory information needs, the collection was reorganized in the 1950s to become part of a company reference center.

Recently-retired AT&T chairman Charles L. Brown reemphasized the importance of the company's history, recognizing in 1982 that many aspects of the AT&T case would be diagnosed and judged by historians. His initiative led to the establishment of the current AT&T corporate archive and history program with particular emphasis on the need to document the historic divestiture agreement and breakup of the functional form of the Bell System that had remained essentially unchanged for nearly 100 years.

AT&T's archive holdings comprise a unique corporate resource which, because of AT&T's size and historic role in the development of telecommunications, represent a source for understanding several areas of modern American business history. Its collections shed light on the origins and development of a number of fields, including: the history of electromechanical and electric telephone technology; the history of sound film technology; radio and television; the evolution of managerial organization and technique; the growth of regulation and government-business relations; the history of corporate public relations; and the early development of corporate accounting practices.

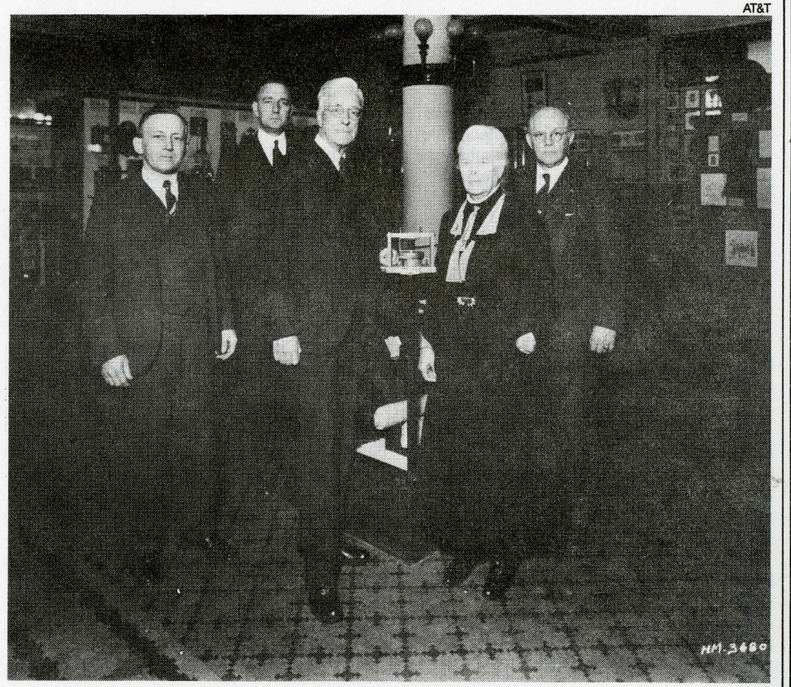
The core historical collection of the AT&T archive is especially strong in the history of telephony and the telephone business from its inception in 1876 to 1935. Materials pertinent to the telephone operating companies, Western Electric, Bell Laboratories, as well as AT&T are contained within these holdings. The archive collections also include material of more recent vintage but these records may be less complete and less well indexed. The repository contains the private papers of many telephone pioneers; early telephone directories; annual reports of Bell licensees (19th century); 3,500 company publications; more than 1,500 linear feet of business correspondence, conference and committee reports and other business records; 500 volumes of letterpress books of the company's presidents and general managers (1878-ca. 1910); 95,000 photographs and slides; 2,000 audio and video tapes; scrapbooks; memoirs of telephone pioneers; awards, certificates, and medals received by company personnel; and a collection of 15,000 telephone artifacts. In addition to the AT&T corporate archive collections, AT&T Bell Laboratories maintains an extensive archive, principally of technical and scientific papers, including Western Electric historical records, documenting the path of the company's research and development efforts.

(continued on next page)

In 1982 the company also took steps to reformulate and implement its corporate policy with respect to the archive and its use. Important objectives of the policy are to stimulate awareness of the archive and make the materials more available for corporate and approved scholarly reference. These objectives have led to a program of broader acquisition, accessioning and cataloguing; the establishment of adequate storage and reading room facilities; and direct participation in research and publications projects. The Johns Hopkins/AT&T Series in Telephone History and the AT&T Fellowship in Telephone History are two important facets of the program which also includes staff research projects, responses to public requests for historical information about the company and other direct support for scholarly projects.

Robert G. Lewis is Division Manager, Public Relations, Historical Archive & Publications, AT&T. For further information on the AT&T collections, contact Robert W. Garnet, Historian, or Ralph E. Swinburne, Archivist, AT&T Corporate Archive, 195 Broadway, Room 01-1507, New York, NY 10007 (212-720-4608 or 4612). An article on the AT&T Bell Laboratories archives appeared in Newsletter *No. 4, Fall 1983, page 6. For more information on the Bell Labs materials, contact Marcy G. Goldstein, Archivist, AT&T Bell Laboratories, 5 Reinman Road, Warren, NJ 07060 (201-582-6643).*

AT&T



William Langdon (far right) was appointed to establish a historical archive for AT&T in 1922. He is pictured here with (left to right) W.C.F. Farnell, G.F. Fowler, and Mr. and Mrs. Thomas A. Watson, in the Bell System Historical Museum, 1933.

The Newsletter of the IEEE Center for the History of Electrical Engineering is sent three times a year free of charge to engineers, historians, and others with an interest in the history of electrical science and technology. If you wish to be certain of receiving later issues, please take the time to fill out the form below and stamp and mail it to the Center (if you have not yet done so).

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EXHIBITIONS AND MUSEUMS

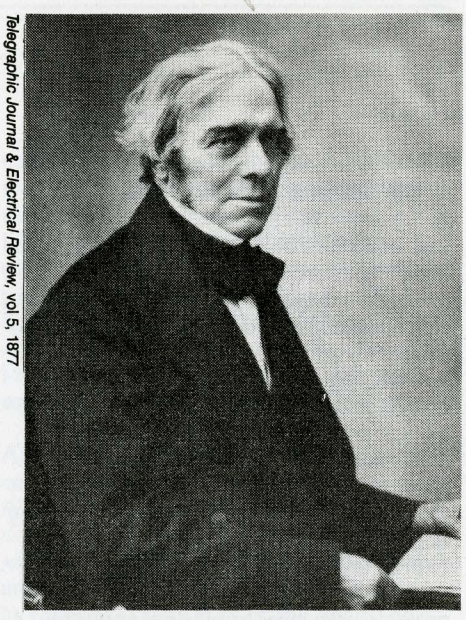
Galileo Ferraris's Workshop

An exhibit of models from Galileo Ferraris's workshop was mounted at the Politecnico di Torino, Italy, for the international conference on the "Evolution and Modern Aspects of Induction Machines" (see page 3). Ferraris, professor of applied physics at the University of Torino, started the Scuola de Elettrotechnica at the Regio Museo Industriale Italiano (Industrial Museum, Turin, now the Politecnico di Torino) in 1889 and taught there until his death in 1897. Ferraris gained international renown for experiments he conducted at the Museo in 1885, in which he produced a rotating magnetic field with two out-of-phase alternating currents. A copper cylinder turned with the rotating field, thus demonstrating a workable induction motor. His 1888 paper on these experiments marks the first publication of the principle of the induction motor.

For use in his teaching, and in his scientific research, Ferraris collected models of dynamos, motors, transformers, and other electrical equipment, in addition to some full-sized apparatus. After Ferraris's death, however, these items suffered an uncertain fate, until Prof. Carlo Chiodi of the Politecnico began to collect what remained. Twenty-two of these artifacts were selected for the exhibit at Torino.

The items, which range from a model of Pacinotti's 1860 dynamo-motor to a Tesla transformer from around 1900, are complemented by replicas of models of Ferraris's first rotating field motors, the originals of which were destroyed in fires. Oral tradition has it that the replicas were made after the turn of the century by the craftsman who made Ferraris's original models. Other items of interest are an early single-phase induction motor designed by Charles E.L. Brown, the Gaulard and Gibbs "secondary generator" that Ferraris used for his 1884 experiments on transformer efficiency, and the Ganz Company transformer that Ferraris used for his historic experiments in 1885 on the rotating field.

The collection is now kept in the Istituto Elettrotecnico Nazionale Galileo Ferraris in Torino. A 48-page, full-color catalogue of the models and apparatus included in the exhibit is available from the Dipartimento di Elettrotecnica, Politecnico di Torino, C.so Duca degli Abruzzi, 24, 10129 Torino, Italy.



Telegraphic Journal & Electrical Review, vol 5, 1877

Michael Faraday

The main permanent exhibit at the Royal Institution in London is devoted to Michael Faraday. In 1831, Faraday discovered the phenomenon of electromagnetic induction – the ability to generate electricity with magnets – in experiments conducted in his laboratory at the Royal Institution. A re-creation of this lab, displaying much of Faraday's original equipment, is the centerpiece of the exhibit at the Royal Institution. Photographs, paintings, material from the Faraday archives, and apparatus provide insight into Faraday's life and work.

The Royal Institution of Great Britain is located at 21 Albemarle Street, London W1X 4BS.

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