
Center for the History of Electrical Engineering

Newsletter No. 28 Winter 1991

One of the most precious assets of the IEEE is the collective memories and understanding of its key members. Such memories are valuable for an organization to understand and celebrate its past, inspire members and students, and inform historians, journalists, and the general public about the nature of the profession.

In 1991 the Center for the History of Electrical Engineering began an oral history program to record professional quality historical interviews with the top echelon of electrical, electronics, and computer engineers, with particular attention to those engineers who have made great contributions to IEEE or its predecessor societies. The project is being paid for by the IEEE Life Member Fund, and the Life Member Fund Committee is assisting in the selection of candidates for interviews.

The process involves background research, a taped interview of six to ten hours, transcription, several rounds of editing, indexing, abstracting, and the writing of a biographical article. The articles, which are based on the interview, the subject's personal and published papers, and other primary and secondary sources, will appear in IEEE publications, such as Proceedings of the IEEE and Annals of the History of Computing. Because of the extent of the process, only three or four engineers will be interviewed each year.

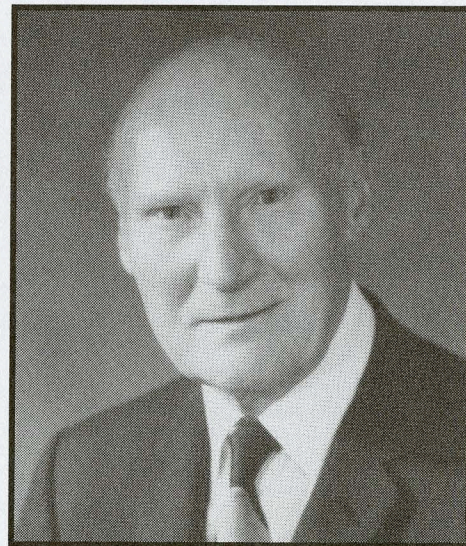
To date Ernst Weber, Edwin Harder, and Harold Wheeler have been interviewed. Weber, who earned both a Ph.D. and a Sc.D. in his native Vienna before immigrating to this country, worked in industry and academia—where he worked unceasingly to raise the level of engineering education—and served as IRE President and the first IEEE President. Wheeler is known for both inventions (such as automatic gain control) and conceptual



Harold Wheeler at his amateur radio station 3QK in December 1920.

THE IEEE ORAL-HISTORY PROJECT

contributions (such as the incremental-inductance rule) in radio- and TV-engineering and in antenna design. Harder has made important contributions to power engineering and the use of analog computers for this purpose. The fourth interview of this project, with Gordon Teal, will soon be conducted. ■



Ernst Weber

STAFF NOTES

An Exhibit on the Technology of Weather Forecasting

The IEEE Life Member Fund Committee has generously agreed to provide funding in 1992 to the Center for the History of Electrical Engineering for the preparation of an exhibit on the technology of weather forecasting. Frederik Nebeker, the Center's Research Historian, whose dissertation was a study of computing technology in meteorology, will be in charge of the exhibit. The first stage, the preparation of the material, will be completed by the end of 1992; the production of the exhibit will be done in the following year.

The general public often confuses engineers with scientists, or believes that engineering is merely applied science. This view does not recognize the independent life of engineering, and it ignores the great impact that technological advances have had on science. This exhibit shows how electrical technology drove the development of the science of meteorology and improved the practice of weather forecasting.

It was the telegraph—and the fact that in the north temperate zone weather generally moves from west to east—that made possible, in the latter half of the

19th century, fairly reliable one-day forecasts. In the early decades of this century, radio greatly increased the amount of data that reached meteorologists rapidly enough for use in forecasting, both by linking ships to shore and by permitting remote measurement of upper-air conditions. Even before the end of World War II radar was being used for forecasting, and radar meteorology has since grown to one of the largest and most useful of the branches of the science. Since the launching of TIROS I in 1960, a wide range of electronic instruments placed in satellites have greatly improved data gathering. And the forecasting activity itself has gradually come to be done more and more by electronic computer. These advances in the techniques of data gathering and data processing have led to a better understanding of atmospheric processes, and the science and the technology of weather prediction have then been combined to produce better forecasts.

The exhibit will aim to show how meteorology, throughout its development over the past one hundred and fifty years, has been dependent upon electrical and electronics engineering. ■

The Center's curator, Andrew Goldstein recently delivered a paper at the Telluride Ideas Festival, held September 6-8 1991. The paper treated the centennial of the Ames Power Plant, the site of the world's earliest industrial use of AC power. Mr. Goldstein, one of six historical speakers at the festival, discussed the reactions of the mining community and the electrical engineering community to the use of AC power in the Gold King Mine, where the power generated at Ames was transmitted. Mr. Goldstein pointed out that learned journals of the two communities indicate that they did not share the same interests or a common knowledge base. He emphasized the role of L.L. Nunn, the entrepreneur who brought AC power to Telluride, as a bridge between these isolated groups.

The Ames power plant was designated an electrical engineering milestone by the IEEE Board of Directors in July 1988. Charles Wright, a member of the IEEE History Committee who was active in preparing the documentation for the milestone award, also delivered a paper at the festival (see related article on page 3).

The Ideas Festival, organized to consider ways to meet Telluride's upcoming energy needs, commenced with a celebration of the historic site at Ames, which is near Telluride, and then continued with a conference entitled "Toward a Sustainable Energy Future" and a workshop where participants discussed local and regional choices for energy. Mr. Goldstein's paper provided an historical illustration of the energy problems of a different age that were solved by broad knowledge, flexible thinking, and courageous investment. ■

Center Director William Aspray has recently published an essay entitled "Oswald Veblen and the Origins of Mathematical Logic at Princeton", which appears in *Perspectives on the History of Mathematical Logic*, (Birkhäuser Boston, 1991), edited by Thomas Drucker. It traces the growth of Princeton's mathematical logic research program from its relative obscurity at the start of the 20th century to its golden age in the 1930s, when, led by luminaries such as Kurt Gödel and Alonzo Church, it enjoyed international fame. Aspray highlights the intellectual and institutional role of Oswald Veblen, a contributor to the now-defunct school of American Postulate Theory, to the development of the program in mathematical logic at Princeton—both at the university and at the Institute for Advanced Study. ■

Rutgers University, through its Work Study program, has provided the Center with the service of Cynthia Yaudes, a graduate student of history studying early 20th century US cultural history. Ms. Yaudes, a holder of a bachelors degree in history from Bucknell University, is editing oral history transcripts for the Radiation Laboratory Oral History Project and the IEEE Oral History Project. ■

Center Receives Sloan Foundation Grant

We are pleased to announce that the Alfred P. Sloan Foundation has generously provided a grant to Center Director William Aspray and Professor Martin Campbell-Kelly of the University of Warwick in England to write a book on the history of computers. The book is intended for a mass market and will cover all aspects of computing from the mid-nineteenth century through the introduction of the microcomputer. The manuscript is likely to be completed in 1993 and published by Basic Books as part of their Sloan Foundation Technology Series. More details will be provided at the time the book is published. ■

Telluride, Colorado: The Way it Began

by Charles R. Wright,
IEEE History Committee

When visiting Telluride, Colorado, and beginning the research on the Telluride Power Company, it was not uncommon to read or hear that the Ames Hydroelectric Generating Plant was the first in the world to generate alternating current power. With only a little research, it was soon learned that the Ames plant was far from being the first plant to generate alternating current—even in the United States, let alone what was being developed in Germany. Edward Dean Adams, in his report "Niagara Power", states that by the end of 1890 Westinghouse alone had 323 generating plants of which practically all were alternating current. All of these were used for lighting systems. A few Thomson-Houston lighting systems were also AC.

Because of the success of the Ames plant, which began operating in June 1891, and the multiple use of AC power for purposes other than lighting, the IEEE Board of Directors designated 1991 as the Transnational Centennial for the Use of AC Power.

During the construction of the Ames plant, work was progressing in Germany on an AC experimental system. William Cawthorne Unwin in his paper "On the Development and Transmission of Power from Central Stations", delivered at the Society of Arts in 1893, gives the following information on the German installation: "The object of the experiment was to find a solution of the problem of transmitting power by alternating currents. With the three-phase system, motors which are self-starting, without commutators, and very simple in construction can be used. In August 1891 alternating current was used in the Lauffen-Frankfort experiment. The Lauffen water powered generator supplied 100 hp which was transmitted a distance of 108 miles to Frankfort. The three-phase, transmission voltages ranged from 16,000 to 30,000 volts. This was obtained by using a step-up transformer at Lauffen and a step-down transformer at Frankfort. The use voltage at Frank-

fort was 75 volts, which supplied power for incandescent lamps and one 100 hp motor. The system operated at 10 Hertz and could provide a maximum of 180 hp."

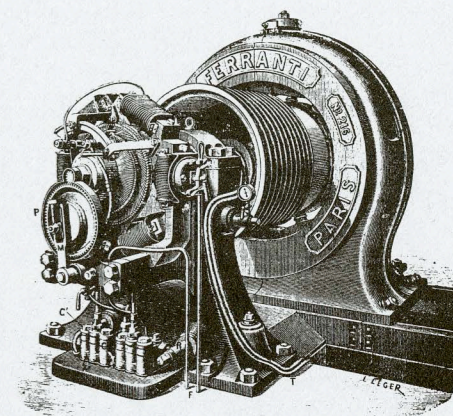
Previous to the operation of the Ames and Lauffen generating plants, it was thought that AC could be used only for lighting systems. The successful operation of the two above systems established alternating current as the standard for the growth of the electric utility industry in the world.

So, what is all this talk about the Telluride Power Company? The unique thing about the building and operating of the Ames plant is that the entire project was conceived for the purpose of using all generated power for industrial use. There was a 100 horse-power generator on one end of the 2.6 mile transmission line and a 100 hp motor on the other end at the Gold King Mine. The system operated at 3000 volts and 133 Hertz, single phase. The system operated so successfully that within one year a second generator was installed. This one was 600 hp. Some transformers were being used and power was provided for commercial, residential, and lighting systems. ■

IEEE/SHOT Prize Awarded

At the annual meeting of the Society for the History of Technology in October 1991, Michael Ben-Chaim was awarded the 1991 IEEE Life Member Prize in Electrical History for his article, "Social Mobility and Scientific Change: Stephen Gray's Contribution to Electrical Research" (*British Journal of Science* 22 (1990): 3-24.) Mr. Ben-Chaim's paper describes the development of the important concept of electrical conductivity.

The IEEE Life Members' Prize in Electrical History is sponsored by the IEEE Life Members Fund, awarded by the Society for the History of Technology, and administered by the Center. The prize is awarded annually for the best paper on the history of electrical technology published during the preceding year. ■



A French Dynamo circa 1891

The Newsletter reports on the activities of the Center and on new resources and projects in electrical history. It is published three times each year by the Center for the History of Electrical Engineering.

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The Newsletter is made possible by a grant
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The Center is working hard to preserve the history of electrical engineering and spread the word widely to Electrical Engineers, students, and the general public. We can not do it alone. Only 40% of our operating budget comes from the I.E.E.E. General Fund. The rest comes from Rutgers, project grants, contributions from companies, foundations, and individuals like you.

We need and appreciate your help to continue our work developing archives, exhibits, oral histories, popular articles, conferences, Milestones, teaching, and research. You can help. One important way is to become a Friend. You can become a Regular Friend for an annual donation of \$35 to \$99, a Sustaining Friend for \$100 to \$999, or a Patron for \$1000 to \$2499. All Friends contributions are tax deductible; the Friends Fund is part of the IEEE Foundation, a non-profit 501(c)(3) organization operating in the State of New York.

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Our Partnership Program enables individuals and organizations to become major, long term partners in our operation through financial investments of amounts ranging from \$2500 to \$100,000 and more. These investments generally become part of the Center's endowment, but investments may also be made for operating costs, projects, or other special purposes. For a brochure on the Partnership Program, or for further information, please contact the Center's Director, William Aspray, or complete the form below. ■

About Our Partners

We are pleased to welcome the Electro-Mechanics Company as an Associate Partner. Electro-Mechanics, based in Austin, Texas, manufactures antennas and accessories for electromagnetic compability testing. Since its founding in 1953, the Electro-Mechanics Company, and its subsidiary, Professional Testing EMI, have worked on equipment to defeat electromagnetic interference, a knotty problem that causes disruption in electronic communication systems.

A full list of our Partners is found on the back cover of the newsletter. ■

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PUBLICATIONS

Books

Gordon Bussey, Wireless—the Crucial Decade: History of the British Wireless Industry 1924-34. London: Peter Peregrinus, 1990, ix + 125 pp. \$58.00.

Most of the literature on the technical history of radio deals with the period before 1924, so Gordon Bussey's account of the decade beginning with that year is particularly welcome. This was an important decade, both in technology (from crystal set to superheterodyne receivers with radio tubes) and in broadcasting (from a few transmitters to "a continuous band of stations 9 kc/s apart").

Bussey gives attention to the technology of receivers and transmitters, the market for receivers, and government involvement in broadcasting. The emphasis is on events in England, but there is frequent reference, and an entire chapter, on events in other countries, particularly the United States. This book is a synthesis of a great deal of material, much of it drawn from *Wireless World*. It presents and interprets a good deal of quantitative evidence, in many cases by means of graphs and charts. There are also dozens of interesting illustrations—most of them advertisements—reproduced from *Wireless World*. There is a chapter on home construction and radio kits.

Gordon Bussey, Historical Adviser to Philips Electronics, is the author of numerous publications on the early history of radio including Vintage Crystal Sets 1922-1927 (1976) and The Story of Pye Wireless (1979). ■

Robert J. Chapuis and Amos E. Joel, Jr. Electronics, Computers, and Telephone Switching. A Book of Technological History. New York and Oxford: North Holland, 1990., xvi 426 pp. \$90.00.

In 1982 Robert Chapuis published an important book on 100 Years of Telephone Switching, covering the period 1878-1978. This book is an equally important sequel, covering the modern era of telephone switching technology through 1990, world-wide. The authors' technical command and sensitivity to economic and institutional issues shows through clearly on every page. Because switching technology is so closely intertwined with semiconductors, computers, and optical fiber transmission, the histories of these subjects are told in passing and related to the history of switching. The book covers all major developments in mainstream switching. Tangentially related subjects such as PBXes, cellular mobile radio services, and packet switching are not generally included. ■

Books Available

A catalogue of books on physics, mathematics and engineering has been released by a bookseller in Easthampton, Massachusetts. The catalogues lists several hundred books on pre-1955 computer development, early radio and television, atomic energy and military science, optics, cybernetics, and meteorology, giving a description of the contents, the book's condition, and the price.

The catalogue is available by contacting Kenneth Schoen and John Walsh, One Cottage St., Easthampton MA 01027, telephone (413) 527-4780, fax (413) 529-9748, internet: kenneth.schoen@bookseller@english.umass.edu ■

Newsletter Published

The Historical Electronics Museum in Baltimore, Maryland has recently begun to publish a newsletter called "Reflections". The newsletter features historical articles written by staff and guest contributors as well as notices on museum activities. The editorial staff accepts for publication contributions of experiences, information, or anecdotes. These may be sent to the Historical Electronics Museum, attn: Betsy Chalfant, P.O. Box 1693, Baltimore, MD 21203.

The Historical Electronics Museum was incorporated in 1980 and opened its doors to the public in 1983. They have acquired equipment and other artifacts from the U.S. government, the surplus market, donations and purchases from Westinghouse employees and other collectors, and other museums. Their collection of radar equipment is particularly strong, featuring a newly acquired SCR-270. This model, developed in 1936 at Fort Monmouth, New Jersey, successfully detected aircraft prior to the Japanese attack on Pearl Harbor on December 7, 1941. The museum also holds the historical collection of the IEEE Microwave Theory and Techniques Society.

The museum is open to the public each weekday from 9 am to 3 pm, with the exception of holidays. In addition, it is open on the first Saturday of each month from 10 am to 2 pm. It is located at 920 Elkridge Landing Road in Linthicum, Maryland. For further information, contact The Historical Electronics Museum, P.O. Box 1693, MS 4610, Baltimore, MD 21203, telephone (301) 765-2345. ■

Fellowship in Computer History Offered

The Charles Babbage Institute is accepting applications for the Adelle and Erwin Tomash Graduate Fellowship to be awarded for the 1992-93 academic year to a graduate student whose dissertation will address some aspect of the history of computers and information processing. Topics may be chosen from the technical history of hardware or software, economic or business aspects of the information processing industry, or other topics in the social, institutional or legal history of computing. Theses that consider technical issues in their socio-economic context are especially encouraged. The number of awards is dependant upon funding.

There are no restrictions on the venue of the fellowship. It may be held at the home academic institution, the Babbage Institute, or any other location where there are appropriate research facilities. The stipend will be \$10,000 plus an amount up to \$2,000 for tuition, fees, travel to the Babbage Institute and relevant archives, and other approved research expenses. Priority will be given to students who have completed all requirements for the doctoral degree except the research and writing of the dissertation, though less advanced and incoming graduate students are also eligible to apply. Fellows may reapply for up to two one-year continuations of the Fellowship.

Applicants should send biographical data and a research plan. The plan should contain a statement and justification of the research problem, a discussion of procedure for research and writing, information on availability of research materials, and evidence of faculty support for the project. Applicants should arrange for three letters of reference, certified transcripts of college credits, and GRE scores to be sent directly to the Institute. There is no special application form.

Complete application materials should be received by January 15, 1992 by the Charles Babbage Institute, University of Minnesota, 103 Walter Library, 117 Pleasant Street S.E., Minneapolis, MN 55455, telephone (612) 624-5050. ■

Annual Meeting of the Society for the History of Technology

This year the Society for the History of Technology (SHOT) held its annual meeting together with the History of Science Society. The joint meeting, held in Madison Wisconsin, lasted from 30 October through 3 November. Many of the talks dealt with the history of electrotechnology.

Because 1991 is the bicentennial of Michael Faraday's birth, one session was devoted to Faraday: Brian Bowers described a tour of Europe the young Faraday took with his mentor Humphry Davy; Ryan Tweney and David Gooding gave papers on Faraday's method; John Bryant told of his re-creation of some of Faraday's experiments; and Geoffrey Cantor described public images of Faraday.

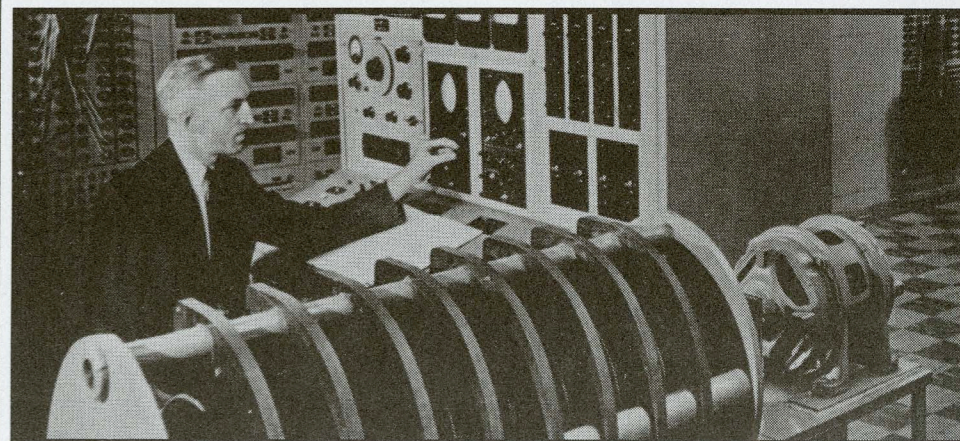
There was a session entitled 'National Telephone Systems in Comparative Perspective': Andrew Butrica discussed the French telephone system in the period 1877 to 1892; Kenneth Lipartito talked about automatic switching in the American telephone industry in the period 1891 to 1938; Frank Thomas read a paper about the German telephone system in the 1930s; and Patrice Carre, of the Centre Nationale d'Etudes des Télécommunications in Paris, provided a commentary.

A session on communications technology comprised talks by Edward Widmer on a technological history of rock and roll, by Robert McChesney on the debate over the social uses of radio in the period 1928 to

1933, and by Robert Silverman on the history of speaking machines, as well as a commentary by Pamela Laird.

Among the many other papers dealing with electrical engineering were the following: Amy Sue Bix's on the postwar debate over engineering education and sponsored research; Paul Ceruzzi's on how the design of the digital computer emerged; Debra Rosenthal's on the impact of the telegraph on women and writing; Bryan Pfaffenberger's on "the social construction of early personal computers"; Bernard Carlson's on Bell, Edison, Gray, and the telephone; Larry Lagerstrom's on the development of international electromagnetic units and standards; Bayla Singer's on the electric car; and Peter Kushkowsky's on images from the electric utility industry (notably Reddy Kilowatt).

In addition, there were meetings of SHOT special interest groups concerned with computers (Information, Computers & Society SIG—Judy O'Neill, Chair), communications (Mercurians SIG—Pamela Laird, Chair), and electrical technology (Jovians SIG—Bernard Carlson, Chair). Other SHOT special interest groups likely to be of interest to the readers of this newsletter are the Albatrosses SIG (aviation and space technology) and the Military History SIG. At the SHOT Awards Banquet the Electrical History Prize was awarded to Michael Ben-Chaim. (See the article on page 3) ■



Edwin Harder standing at the ANACOM III, a specialized computer used for studying electrical transient phenomena in power systems by Asea Brown Boveri Power Systems at East Pittsburgh.

Burroughs Records Donated

Unisys Corporation has donated a large collection of records relating to the Burroughs Corporation to the Charles Babbage Institute at the University of Minnesota. It includes over 500 cubic feet of historically valuable records, correspondence, photographs, films, video tapes, speeches, sound recordings, technical material, and product literature covering over 100 years of the company's history from 1883 to its merger with the Sperry Corporation. The donation will give historians of business and computing access to one of the most important sources on the accounting machine and electronic computer industries.

While the bulk of the collection reflects Burroughs' history during the past fifty years, it also includes early financial data, correspondence, and technical literature. There are several letters of company founder William S. Burroughs. Of interest to artifact collectors is the vast array of reports and pamphlets detailing the components of different calculators and listing machines. Also, the collection holds extant records of some early acquisitions of adding machine companies, such as Moon-Hopkins, Pike, and Universal.

Most of the collection is of more recent vintage, including computer product literature, records from various departments and individuals, advertising, press releases, documents from annual meetings, patent files, publications, and audio-visual materials. Of particular interest are the photographs and films; there are prints and negatives of a wide range of computer products and company events, as well as films produced as early as the 1940s. A

sample of subjects include a Burroughs' launch computer from the 1960s, a prototype mail sorting machine, electronic computers, a sensimatic accounting machine demonstration, the B 5000 computer, and Burroughs' military products from the late 1950s.

The records will be maintained and housed at the Charles Babbage Institute (CBI), a research center for the history of information processing located at the University of Minnesota. For more information, contact Bruce H. Bruemmer, archivist, CBI, 103 Walter Library, University of Minnesota, Minneapolis, MN 55455, telephone (612) 624-5050. ■

Conference Planned

An international conference on the theme 'Technological change' will be held at the University of Oxford from 8 to 11 September 1993. Papers will cover all periods from antiquity to the present, and the emphasis will be on problems of broad interest, in particular on methodology and the interdisciplinary and comparative perspectives that are increasingly of concern to historians of technology. The conference will take place in Rhodes House, and accommodations will be provided in Wadham College. For further details, write to Professor Robert Fox, Modern History Faculty, Broad Street, Oxford OX1 3BD, England.

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