

# Center for the History of Electrical Engineering

Newsletter No. 34 Fall 1993

## Sparks Of Genius

Every three years the IEEE holds a Sections Congress, where representatives from the nearly 300 IEEE Sections from around the world meet to discuss members' concerns. At Sections Congress '93, held this past summer in San Juan, Puerto Rico, delegates drew up a prioritized list of 33 recommended actions. The second of these recommendations was to enhance the self- and public image of the engineer, in part by educating the public about the importance of the accomplishments of electrical engineering.

The Center's most recent product will help to achieve this goal. *Sparks of Genius: Portraits of Electrical Engineering Excellence* by Frederik Nebeker, with contributions by William Aspray, Andrew Goldstein, and David Morton, published by IEEE Press in October, contains eight biographical studies of living electrical engineers. Each study, based upon an extensive oral-history interview, as well as published materials and personal papers, illustrates what makes engineering exciting by presenting technical landmarks, and the individuals behind them, in their scientific, commercial and political contexts. The book is a product of the IEEE Oral History Program, funded by the Life Member Committee.

It is generally acknowledged that electrical, electronic, and computer technologies have profoundly changed society in the 20th century, but few people have much understanding of the processes responsible.

Indeed, many people, if asked to name outstanding electrical engineers, can hardly do more than list a few inventors, such as Morse, Bell, and Edison, from the earliest days of electrical engineering.

It is characteristic of our culture that literary, artistic, or scientific work bears the name of the writer, artist, or scientist, while engineering work is usually anonymous. There are no doubt many reasons for this—most people have little understanding of technology; the collaborative nature of modern engineering means that achievements are seldom attributed to individuals; engineering is often regarded as routine problem-solving (and even the obviously innovative engineering is often thought of as merely applying the discoveries of scientists); and the list goes on.

Although the view of engineering as routine is well entrenched, it is, as any engineer knows, a misperception. Engineering draws on a large body of knowledge, some of it embodied in scientific laws. But these laws seldom determine, in any large measure, the solutions an engineer conceives. The individual engineer—his or her knowledge, experience, talents, insight, and inspiration—matters in the way each task is accomplished. This much is true of all engineers. Beyond this, there are many especially creative engineers who put their individual stamp on engineering in a larger way by helping to determine the direction of technological advance. They may do this by augmenting the stock of available technological means or by recognizing that exist-

ing means can be applied in a new way or by directing the work of a large number of engineers.

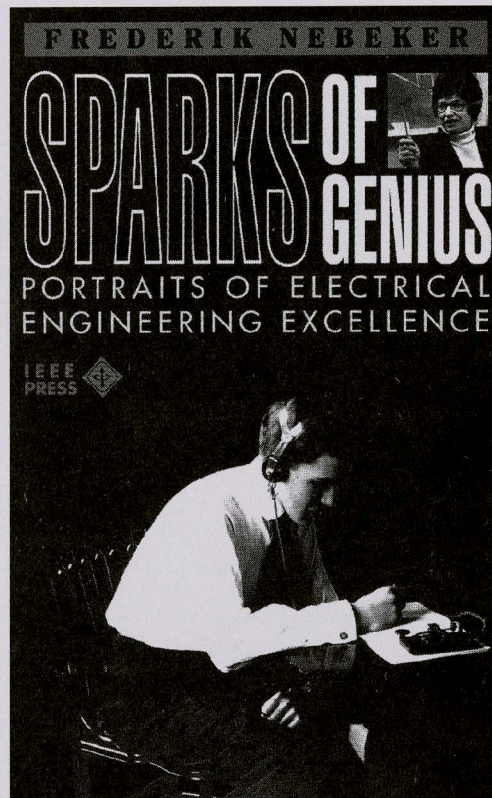
It is the purpose of *Sparks of Genius* to direct light upon the individual engineer. This is important for understanding how, in general, technological advance comes about and how, more particularly, certain technologies of the late 20th century have

received their present form. What's more, the story of the individual engineer is very often—as illustrated in these eight cases—a fascinating one, being a part of the momentous political, military, and scientific developments of our tumultuous century. The eight cases selected for this volume offer a sampling of distinguished electrical engineers from a wide range of technical areas.

**Ernst Weber**, born in Vienna in 1901, earned doctorates in both physics and electrical engineering and worked as an engineer for Siemens-Schuckert before moving to

the United States in 1930. For the next 39 years he served Polytechnic Institute of Brooklyn (later Polytechnic University) as researcher in microwave techniques, teacher, and administrator. He was President of Polytechnic from 1957 to 1969, and in 1963 he became the first president of the newly formed Institute of Electrical and Electronics Engineers.

Another European immigrant engineer is **Herman Schwan**, who was born in Aachen, Germany in 1915. Hardships and hindrances associated with the Nazi regime delayed his education and led him



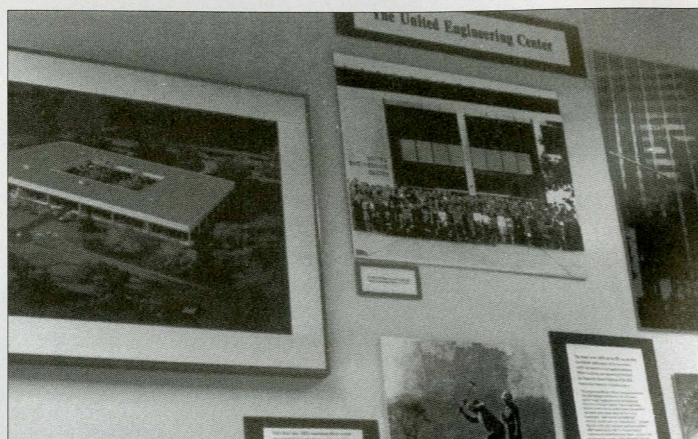


## STAFF NOTES

## Center Exhibit on IEEE Facilities Opened

Andrew Goldstein, the Center's curator, prepared an exhibit on the history of the IEEE's facilities that displayed in the IEEE Service Center in Piscataway during the month of August. The exhibit, entitled "A Place Where They Can Go" traced the history of the office space that the IEEE and its predecessor societies, the AIEE and the IRE, have occupied since the AIEE was founded in 1884. (The title refers to a quotation from AIEE President Charles Scott, who used the phrase in 1902 to argue why engineers would benefit if the AIEE, then without headquarters, took up permanent office space.) The exhibit was divided into five sections, focusing on: the AIEE and its space in the Engineering Societies Building (maintained between 1907 and 1961); the IRE and its offices in the Brokaw mansion (1946-1964); the merger of the two societies and the IEEE's occupancy of the United Engineering Center (1961-present); the IEEE's expansion and the need for the service center in Piscataway (1975-present);

and, lastly, the IEEE's presence around the world, featuring the offices of the various departments, sections and society chapters that the IEEE maintains across the globe. Arguing that the activities of the IEEE are reflected in the facilities it maintains, the exhibit illustrated the ways in which the IEEE has transformed itself to stay responsive to the needs of the engineers it serves. The exhibit, which consisted of over 40 photographs and artifacts as well as approximately 2000 words of text, will be reinstalled in the conference area at the IEEE Service Center once construction there is completed. Plans are also being made to prepare an exhibit catalogue, which will be distributed through the Center. ■



Images from the facilities exhibit: Piscataway and the United Engineering Center

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.

Mailing address:  
Rutgers University  
39 Union Street  
New Brunswick NJ 08903  
Telephone: (908) 932-1066  
Fax: (908) 932-1193  
internet: ieee@zodiac.rutgers.edu

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Maria Palombini, Work-study Student

With the beginning of the 1993-94 academic year, the Center is again fortunate to have the services of four Rutgers graduate students of history to assist the staff with project research and preparation. The four bring a wealth of experience and knowledge to the Center.

**Jill Cooper** begins her second year at the Center. She received a B.S. degree in biology from Bucknell University in 1990. She has written on the training of European and American telegraph operators and is currently concluding her coursework in the history of technology and American history.

**Barbara Cutter** received a B.A. degree in Russian Regional Studies at Columbia University. She is currently planning a dissertation on 19th century American murder narratives, gender, and the culture of violence.

**David Hyde** graduated from Reed College with a degree in American History. This year he is beginning a dissertation at Rutgers entitled "Bourgeois Self-Representation and the American Theatre, 1880-1920."

**Dina Moakley** received a B.A. degree in history from Middlebury College in

Vermont. She is currently in her second year of coursework focusing on American history and the history of technology. Before enrolling at Rutgers, she worked at the Museum of Science in Boston. ■

Center Hires  
Project Archivist

In September the Center gained a new staff member, John S. Riddle, who is working on a half-time basis at the Center while he is pursuing his Master of Library of Science Degree at Rutgers University. Mr. Riddle will be carrying out the archival component of the Power and Control Project.

In order to know and preserve the history of electrical technology, one has to preserve the documents of the participants. The archival component of the project aims at locating important documents produced by individuals and companies worldwide. The Center also gives guidance about what to save and how to save it. In addition, we are locating company histories, which often exist only as in-house publications. Mr. Riddle will write, and the Center will publish, one guide to company records and another to company histories. ■

## Jack Avins Project

Andrew Goldstein has begun a research project on the life and work of Jack Avins, an RCA engineer who was pivotal in the introduction of integrated circuits into television receiver design. Avins received an A.B. degree in mathematics and physics from Columbia University in 1932 and an M.S. in Electrical Engineering from the Polytechnic Institute of Brooklyn in 1949. From 1946 until his retirement in 1976, Avins was on the staff of the chief engineer of the RCA Consumer Electronics Division and managed an engineering group developing integrated circuits for television receivers. He earned more than 50 patents for his work on television receivers, AM stereo sound and other technologies. He was elected a Fellow of the IEEE and given the IEEE Consumer Electronics Outstanding Achievement Award in 1977. In his last years, Avins focused close attention on the growth of the electronics industry in Japan. The Center's research will consider Avins' technical contributions in the context of RCA's entire R&D program and how his engineering experience might have influenced his outspoken positions on international trade. The study is being supported mainly by a grant from the Avins family. ■

## 1993 Life Member Prize

At the 1993 meeting of the Society for the History of Technology, held in Washington DC, William M. McBride was awarded the 1993 IEEE Life Member Prize in Electrical History for his article, "Strategic Determinism in Technology Selection: The Electric Battleship and U.S. Naval-Industrial Relations" (*Technology and Culture* 33, 2 (April 1992), 248-277.) Dr. McBride's paper examines the history of the turboelectric drive in military seacraft as an example of the compromises resulting from military strategic doctrine, the level of autonomy engineering specialists were allowed with regard to military decisions, and the influence of political-industrial alliances.

The IEEE Life Member Prize in Electrical History is sponsored by the IEEE Life Member 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. ■

## STAFF NOTES

## Summary of Center Activities

## Center Projects

- **Power and Control**  
*A comprehensive history of electrical engineering with related efforts in archives and oral history*
- **Engineers as Executives**  
*A collection of interviews with the leaders of major technological firms in the US, Japan and Germany, focusing on the significance of an engineering background for business executives*
- **Sparks of Genius**  
*Biographical studies of eight stand-out engineers who opened doors in electrotechnology's most exciting areas*
- **Tracking Radar History**  
*Twenty papers on radar history and historiography from leading historians and radar engineers*
- **Ernst Weber Biography**  
*A history of EE, told from the personal perspective of one of the field's greats*
- **Multi-Institutional Archival Research**  
*A study conducted with the American Institute of Physics on the archival issues associated with big-science projects*
- **Radio History**  
*A look at how engineers, working as experts for government policy makers, shaped the growth of this fundamental medium*
- **Jack Avins**  
*Biographical research on the RCA engineer who brought integrated circuits to television receivers*
- **John Pierce**  
*Biographical study of a key figure in Bell Lab's vacuum tube heyday*

## Programs

- **Newsletter**
- **Milestones**  
*Designation of important sites in EE history*
- **Workshop in the History of Science, Technology, and Medicine**  
*An informal forum for researchers to present their work in front of the local scholarly community*
- **Fellowship in Electrical History**  
*With support from the IEEE Life Member Fund, the Center annually awards a fellowship for graduate or post-graduate study of electrical history*
- **Summer Internship**  
*With the support of the IEEE Life Member Fund, the Center hosts one student, frequently from outside the US, for a summer internship*
- **Electrical History Prize**  
*An annual prize supported by the IEEE Life Member Fund to the best scholarly paper on the history of EE*
- **Exhibits**  
*Images and information about select themes in EE history*
- **Archives of the IEEE**  
*Records of the AIEE, IRE, and IEEE, plus photographs of people and things associated with electrotechnology*
- **Oral History**  
*Tape recordings of the recollections of noteworthy engineers and managers*

## On-Going Activities

- **Teaching**  
*Graduate and undergraduate courses at Rutgers University for the History and Engineering departments*
- **Lectures at Professional Meetings**  
*Sessions and papers at major IEEE conferences, as well as those of other organizations*
- **Reference Service**  
*Center staff answers questions about the history of electrotechnology*

## APS Library

In September Frederik Nebeker spent a day at the American Philosophical Society (APS) in Philadelphia serving on a library advisory committee. The APS Library, with extensive holdings of printed materials (books, journals, and pamphlets) and a large collection of manuscripts, is one of the country's richest sources for the history of science and technology. The library advisory committees review the existing book and manuscript collections, consider which areas to expand or reduce, and help define collection development policies. ■

International Congress  
of History of Science

The Nineteenth International Congress of History of Science—the Congress takes place every four years—was held in Zaragoza, Spain from 22 to 29 August 1993. William Aspray was co-organizer with Javier Echeverria of Symposium 5 on "The impact of the computer on the sciences", and Frederik Nebeker presented a paper on quantification in radio engineering in Symposium 43 on "Science and technology in telecommunications". ■

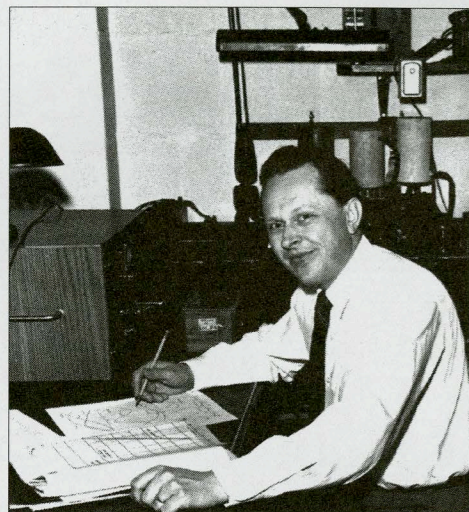


# Sparks of Genius

*continued from page 1*

to a position at the Institute for the Physical Foundations of Medicine at the University of Frankfurt, which was one of the very first institutions devoted to research in what today is called biophysics and biomedical engineering. Shortly after the war he emigrated to the United States, where his research, teaching, and professional activities helped establish the discipline of biomedical engineering.

During the war Schwan became involved with the new technology of radar, while the same happened in the United States to **Charles Townes**. Born in South Carolina in 1915, Townes earned a physics Ph.D. before beginning work at Bell Telephone Laboratories in 1939.



Herman Schwan

In early 1941 he was asked to help design, build, and test radar bombing systems. This work led to his development of the new field of microwave spectroscopy and later to the invention of the maser and laser. These devices opened the new realm of quantum electronics, which has already resulted in hundreds of important practical applications.

Another Bell Labs scientist who had a profound influence on the development of electronics was **Gordon Teal**. Teal, who was born in Texas in 1907 and trained as a chemist, worked at Bell Labs and later at Texas Instruments. He played a crucial role in the emergence of solid-state electronics by recognizing the value of fabricating components from single crystals, and he was the first to develop techniques for producing transistors of monocrystalline germanium and silicon. The story of his career shows how materials science

became an important part of the electronics industry.

The main source of the electronics industry was, of course, the radio industry. The career of **Harold Wheeler** shows well the transition from radio engineering to the wide-ranging electronics engineering of today. Born in South Dakota in 1903, Wheeler made numerous contributions—theoretical, instrumental, and practical—to the development of radio, television, and radar. His most famous invention is a circuit that achieves automatic volume control (now called automatic gain control) that became, and remains today, a standard feature of AM radios. During and after the Second World War the design of antennas and transmission lines became specialties of his.

Transmission lines were also a concern of **Edwin Harder** who was born in Buffalo, New York in 1905 and worked his entire career at Westinghouse Electric Company. There his calculational approach to power engineering led to many patents and practical devices. Just after World War II he directed the design, development, and application of a general-purpose analog computer, the Anacom, which remained in service until 1991.

While the power engineer Edwin Harder came to be involved in analog computing, the biomedical engineer **Thelma Estrin** came to be involved in digital computing. Estrin, who was born in New York City in 1924, entered engineering because of the urgent need for workers in the defense industries during World War II. She went on to earn a Ph.D. in electrical engineering and became a pioneer in two respects: in the application of computers to biomedical research and health-care delivery, and in providing a role model for young women

considering a career in engineering.

The computer has become a universal tool, now vital to many branches of engineering. Another engineer whose career illustrates this is **Amos Joel**, born in Philadelphia in 1918. His fascination with telephone switching began in his youth and is just as strong today. During the 64 years in between, most of it spent at Bell Telephone Laboratories, he made countless contributions to that field. He played a central role in the introduction, in the decades since World War II, of electronics and computing technology into telephone switching.

These eight engineers were certainly direction-setting. They augmented the stock of available technological means in, for example, Teal's single-crystal transistors, Harder's analog computers, or Townes's maser. They adapted and extended existing means to open new areas of engineering, as Joel's introduction of electronics into switching systems, Schwan's development of electrical instrumentation to understand biology, and Estrin's use of computers in biomedical research and health-care delivery all illustrate. And they directed the work of other engineers, as Weber at Polytechnic's Microwave Research Institute and Wheeler at Hazeltine Corporation and Wheeler Laboratories show.

The stories of these engineers cast light on the emergence of new branches of electrical engineering—microwave engineering, television, analog computing, solid-state electronics, quantum electronics, and biomedical engineering—as well as the continued advance of older branches—radio engineering, power engineering, and telephone switching. Their stories show connections of electrical engineering with other disciplines: mathematics (Harder), physics (Weber, Wheeler, Townes, Schwan), chemistry (Teal), and biology (Schwan, Estrin). Their stories show the impact of the Second World War on the engineers of their generation and the way in which resourceful people managed to profit from vicissitude. Most importantly, their stories show that in engineering, as in science and the arts, individuals do matter. ■

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## FRIENDS

The Center continues to work hard to preserve the history of electrical engineering and spread the word widely to electrical engineers, students, and the general public. Only about half of our funding comes from the IEEE General Fund. The rest comes from Rutgers, project grants, and 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.

We have two programs by which companies, foundations, and individuals can help

to support the Center's activities: through an annual gift to the Friends Program or a lifetime gift to the Partnership Program. Whether you give to the Friends Program or the Partnership Program, your gift is tax-deductible and its use is overseen by the Friends Committee, a group of distinguished electrical engineers appointed by the IEEE Foundation. Partnership donations not earmarked for a specific project are treated like endowment funds, as a means to provide continuing support to the Center. Partnership contributions may be fulfilled over several years. Some Friends contributions are used for current projects, while others are treated like

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## BIBLIOGRAPHY

The Newsletter's "Bibliography" section was prepared with the assistance of Prof. Thomas J. Higgins of the University of Wisconsin-Madison.

## Books

AT&T Archives. *Events in Telecommunications History*. Warren, NJ: AT&T, 1992.

Barnum, Frank O. "His Master's Voice" in *America: Ninety Years of Communications Pioneering and Progress: Victor Talking Radio Company, Radio Corporation of America, General Electric Company*. Camden, NJ: General Electric Company, 1991.

Baughman, James L. *The Republic of Mass Culture: Journalism, Filmmaking, and Broadcasting in America since 1941*. Baltimore, MD: Johns Hopkins University Press, 1992.

Bennett-Levy, Michael. *Historic Televisions and Video Recorders [of Great Britain]*. Musselburgh, England: MBL Publications, 1993.

Bougnoux, Daniel. *La communication par la bande: Introduction aux sciences de l'information et de la communication*. Paris: Éditions de la Découverte, 1991.

Bradley, Keith. *Phone Wars: The Story of Mercury Communications*. London: Century Business, 1992.

Cantor, Geoffrey, David Gooding, and Frank A. J.L. James. *Faraday*. Woodbury, NY: American Institute of Physics, 1991.

Charon, J. P., and J. P. Simon. *Histoire D'Enfance: Les Reseaux Cables Audiovisuels en France, 1984-1986*. Paris: La Documentation Française, 1989.

Eber, D. H. *Genius at Work: Images of Alexander Graham Bell*. Post Mills, VT: Nimbus (Chelesea Green), 1991.

Elliot, David, Jane Roberts, and Trevor Houghton. *Privatising Electricity: The*

*Politics of Power*. London: Belhaven Press, 1991.

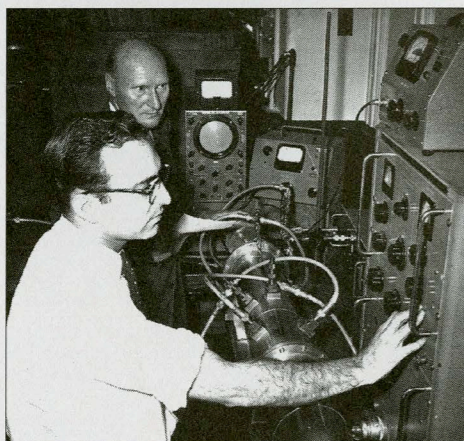
Flichy, Patrice. *Une histoire de la communication moderne: Espace public et vie privée*. Paris: Éditions de la Découverte, 1991.

Friedricks, William B. *Henry E. Huntington and the Creation of Southern California*. Columbus, OH: Ohio State University Press, 1992.

Hawes, Robert. *Radio Art*. Westport, CT: Greenwood Press, 1991.

Heims, Steven J. *The Cybernetics Group*. Cambridge, MA: MIT Press, 1991.

Henry, Joseph. *The Papers of Joseph Henry: Volume 6, January 1844-December 1846, The Princeton Years*, Editor Marc Rothenberg. Washington, DC: Smithsonian Institution Press, 1992.



Ernst Weber (above)

Hijiya, James A. *Lee De Forest and the Fatherhood of Radio*. Bethlehem, PA: Lehigh University Press, 1992.

Howse, Derek. *Radar at Sea: The Royal Navy in World War 2*. Hurdsmills Basinstoke, Hampshire: MacMillan, 1993.

Insull, Samuel. *The Memoirs of Samuel Insull: An Autobiography*, ed. Larry Plachno. Polo, IL: Transportation Trails, 1992.

Keiter, Les, and Dennis Christanson. *Fifty Years Behind the Microphone: The Les Keiter Story*. Honolulu: University of Hawaii Press, 1991.

Kraeuter, David. *Radio and Television Pioneers: A Patent Bibliography*. Metuchen, NJ: Scarecrow Press, 1992.

McChesney, Robert W. *Telecommunications, Mass Media, and Democracy: The Battle for Control of U.S. Broadcasting, 1928-1935*. New York: Oxford University Press, 1993.

Noam, Eli. *Telecommunications in Europe*. New York: Oxford University Press, 1992.

Oslin, George P. *The Story of Telecommunications*. Macon, GA: Mercer University Press, 1992.

Rens, Jean-Guy. *L'Empire Invisible: Histoire des Télécommunications au Canada, De 1956 à Nos Jours*. Québec: Québec University Press, 1993.

Robertson, Peter. *Beyond Southern Skies: Radio Astronomy and the Parkes Telescope*. New York: Cambridge University Press, 1993.

Surtees, Lawrence. *Pa Bell: A. Jean de Grandpre and the Meteoric Rise of Bell Canada Enterprises*. Toronto: Random House, 1992.

Toole, Mary Alexander. *Ada, the Enchantress of Numbers: A Selection from the Letters of Lord Byron's Daughter and Her Description of the First Computer*. Mill Valley, CA: Strawberry Press, 1992.

Verschuur, Gerrit L. *Hidden Attraction: The Mystery and History of Magnetism*. New York: Oxford University Press, 1993.

Walker, Andrew. *A Skyful of Freedom: 60 Years of the BBC World Service*. London: Broadside Books, 1992.

Weber, Robert J., and David N. Perkins, eds. *Inventive Minds: Creativity in*

*Technology*, New York: Oxford University Press, 1992.

Williams, J. E. D. *From Sails to Satellites: The Origin and Development of Navigational Sciences*. New York: Oxford University Press, 1992.

Young, Peter. *Person to Person: The International Impact of the Telephone*. Cambridge: Granta Editions, 1991.

## Articles

Abramson, Albert. "Pioneers of Television-Philo Taylor Farnsworth." *SMPTE Journal* 101, no. 11 (November 1992): 770-784.

Archibald, Thomas. "Riemann and the Theory of Electrical Phenomena: Nobili's Rings." *Centaurus* 34, no. 3 (1991): 247-271.

Aspray, William. "Edwin L. Harder and the Anacom: Analog Computing at Westinghouse." *IEEE Annals of the History of Computing* 15, no. 2 (1993): 35-52.

"Baird: First With Colour." *Electronics World and Wireless World* 97, no. 1665 (July 1991): 616-617.

Bennett, Stuart. "The Development of Process Control Instruments, 1900-1940." *Trans. of the Newcomen Soc.* 64 (1992): 133-164.

Bissell, Christopher. "Six Decades in Control: An Interview with Winfried Oppelt." *IEE Review* 38 (January 1992): 17-21.

Brittain, James E. "George C. Southworth." *Proceedings of the IEEE* 81, no. 7 (July 1993): 1086.

Brittain, James E. "The Introduction of the Loading Coil: George A. Campbell and Michael I. Pupin." *The Engineer in America: A Historical Anthology from 'Technology and Culture'*, 261-282. Editor Terry S. Reynolds. Chicago: University of Chicago Press, 1991.

Buckland, Michael K. "Emanuel Goldberg, Electronic Document Retrieval, and Vannevar Bush's Memex." *Journal of the American Society for Information Science* 43, no. 4 (May 1992): 284-294.

Campbell, A. T. "History of the IEEE/AESS Gyro and Accelerometer Panel." *IEEE Aerospace and Electronic Systems Magazine* 8, no. 4 (April 1993): 53.

Campbell-Kelly, Martin. "The Airy Tape: An Early Chapter in the History of Debugging." *IEEE Annals of the History of Computing* 14, no. 4 (1992): 16-26.

Canuel, Alain. "Les Télécommunications à Montréal Entre 1846 et 1946." *Scientia Canadensis* 16, no. 1 (1992): 5-24.

Carlson, W. Bernard. "Academic Entrepreneurship and Engineering Education: Dugald C. Jackson and the MIT-GE Cooperative Engineering Course, 1907-1932." *The Engineer in America: A Historical Anthology from 'Technology and Culture'*, 367-398. Editor Terry S. Reynolds. Chicago: University of Chicago Press, 1991.

Carlson, W. Bernard, and Michael E. Gorman. "A Cognitive Framework to Understand Technological Creativity: Bell, Edison, and the Telephone." *Inventive Minds: Creativity in Technology*, 48-79. eds. Robert J. Weber, and David N. Perkins. New York: Oxford University Press, 1992.

Checkland, Olive. "Richard Henry Brunton and the Japan Lights, 1868-1876." *Trans. of the Newcomen Soc.* 64 (1992): 217-228.

Churchhouse, R. F. "The M209 Cipher Machine." *IEE Review* 39, no. 4 (July 1993): 173-175.

Cooke, R. "25 Years of Computers in Control." *Measurement + Control* 25, no. 6 (July 1992): 173-182.

Coopersmith, Jonathan. "Soviet Electrification: The Roads not Taken." *IEEE Technology and Society Magazine* 12,

no. 2 (June 1993): 13-20.

Crawford, Elspeth. "Michael Faraday's Thought: Discovery or Revelation." *Correspondence, Invariance and Heuristics: Essays in Honour of Heinz Post*, 105-124. eds. Steven French, and Harmke Kamminga. Dordrecht, Netherlands: Kluwer Academic Publishers, 1993.

Croarken, Mary. "The Emergence of Computing Science Research and Teaching at Cambridge, 1936-1949." *IEEE Annals of the History of Computing* 14, no. 4 (1992): 10-15.

Davis, Jack. "Theatrophone." *The Old Timer's Bulletin* 33, no. 3 (August 1992): 10-11.

Douglas, Susan J. "Audio Outlaws: Radio and Phonograph Enthusiasts." *Possible Dreams: Enthusiasm for Technology in America*, 45-59. ed. John L. Wright. Dearborn, MI: Henry Ford Museum & Greenfield Village, 1992.

Dvorak, John C. "The Tenth Anniversary of the IBM PC." *PC Magazine* 13 (July 1991): 83.

"The First Two Decades [of EPRI]." *EPRI Journal* 18, no. 1 (January 1993): 4-26.

Foreman-Peck, James. "The Development and Diffusion of Telephone Technology in Britain, 1900-1940." *Trans. of the Newcomen Soc.* 64 (1992): 165-180.

Fox, Robert, and Anna Guagnini. "Life in the Slow Lane: Research and Electrical Engineering in Britain, France, and Italy, Ca. 1900." *Technological Development and Science in the Industrial Age: New Perspectives on the Science-Technology Relationship*, 133-153. eds. Peter Kroes, and Martijn Bakker. Dordrecht, Netherlands: Kluwer Academic Publishers, 1992.

Friedel, Robert. "Perspiration in Perspective: Changing Perspectives of Genius and Expertise in American Invention." *Inventive Minds: Creativity in Technology*, 11-26. eds. Robert J. Weber,

## BIBLIOGRAPHY



## BIBLIOGRAPHY

and David N. Perkins. New York: Oxford University Press, 1992.

Giget, Marc. "The Conjunction of Political, Institutional, and Industrial Issues in the Choice of Experimental Communication Satellites in Europe, Compared to the USA and Japan." *History and Technology* 9, no. 1 (1992): 63-82.

Hunkin, Tim. "Just Give Me the Fax." *New Scientist* 137, no. 1860 (13 February 1993): 33-37.

Ioffe, Khatskel A. "Popov: Russia's Marconi?" *Electronics World + Wireless World* 1993, no. 1676 (July 1992): 561-565.

Jeffrey, Kirk. "The Invention and Reinvention of Cardiac Pacing." *Cardiology Clinics* 10, no. 4 (1992): 561-571.

Kent, David. "Measurement and Control, 1950s-1990s: A View from the Inside." *Measurement + Control* 25, no. 7 (September 1992): 213-222.

Kline, Ronald R. "Harold Black and the Negative-Feedback Amplifier." *IEEE Control Systems* 13, no. 4 (August 1993): 82-85.

Kryzhanovsky, Leonid. "The Invention of the Resistor." *Centaurus* 32, no. 4 (1989): 336-339.

### Edouard Branly

A collection of articles exploring the theme "Edouard Branly et la TSF: tradition ou innovation" has been published in the January issue of the French journal *Revue d'histoire des sciences*. The issue (volume 46, no. 1) contains works on Branly, his role in inventing the Branly tube, the reception of the TSF in Germany and Italy and related topics. For more information, contact the University of France Press in Vendome.

Kuhfeld, Albert W. "A Heart-to-Chart Conversation [Recording Physiological Phenomena]." *IEEE Engineering in Medicine and Biology* 12, no. 3 (September 1993): 109-110.

Midbon, Mark. "Peace, Love, and the Rise of IBM." *Computers & Society* 23, no. 1-2 (July 1993): 3-10.

Morgan, Robert B. "History of Electricity: The Individuals, Inventions & Companies that Made a Difference." *EC&M [Electrical Construction and Maintenance]* 90, no. 5 (May 1991): 59-82.

Morus, Iwan Rhys. "Marketing the Machine: The Construction of

Electrotherapeutics as Viable Medicine in Early Victorian England." *Medical History* 36 (1992): 34-52.

Nicholl, Matthew. "Good Vibrations [Electrical Synthetic Music]." *American Heritage of Invention & Technology* 8, no. 4 (March 1993): 26-31.

Schatzberg, Eric. "The Mechanization of Urban Transit in the United States: Electricity and its Competitors." *Technological Competitiveness: Contemporary and Historical Perspectives on the Electrical, Electronics, and Computer Industries*, 225-242. Editor William Aspray. New York: IEEE Press, 1993.

Schwan, H. P. "Early Organizations of Biomedical Engineering in the U.S." *IEEE Engineering in Medicine and Biology* 12, no. 3 (September 1993): 25-33.

Small, James S. "General-Purpose Electronic Analog Computing: 1945-1965." *IEEE Annals of the History of Computing* 15, no. 2 (1993): 8-18.

Spiller, E. "Early History of X-ray Lithography at IBM." *IBM Journal of Research and Development* 37, no. 3 (May 1993): 291-298.

### Friends:

L P Cornell Jr  
Almer Crawford  
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I Hayashi  
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G M Howard

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Aaron J. Ihde  
Giichi Ikeda  
Institute Of Electrical Engineers  
Lawrence J. Israel  
R M Johnson  
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Wen L Liu  
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### Friends:

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Sommerman  
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Walter Turner  
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Arthur Van Gelder

V C Vanderbilt Jr  
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William W Ward  
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David R Wood  
Harris O. Wood  
Leonard W. Woodall  
W P Worley  
Mitsuyoshi Yamamoto  
William J Young  
E J Ziha Jr

### Other Contributors:

Mohamed B E Abdelrazik  
Djuniarjo Abdulgani  
Pier A Abetti  
Nagraj G Acharya  
Takehiko Adachi  
Jerry L Adams  
R M Adams  
John D Adcock  
Gina M Addeo  
David F Adelman  
Andreas N Adraktas  
Ashok K Agrawal  
Daniel M Agun  
B T Ahlport  
A A Ahmed  
Ahmed M Ahmed  
J B Aidala  
Valerio Aisa  
Stuart Aizlewood  
Shigeru Akamatsu  
Masami Akamine  
Yasuhiro Akita  
Tatsuo Akiyama  
Dina N Al Nakib  
Abdulaziz S Al-Yousefi  
Lorandi M Alberto  
J A Caceres Alderete  
Paul Alesu  
Charles C Alexander  
Mark Alexander  
Paduvail M Alexander  
Florante M Alfaro  
Horacio Alfaro Jr  
Sven F Alfas  
Paul N Alioti  
Ahmad Y Alkhiary  
Jonathan Allen  
R W Allington  
Seymour Altmark  
Hiroshi Amino

Joseph R Amsden  
Alejandro E Ancajima  
Brent Anderson  
C E Anderson  
David L Anderson  
Dennis L Anderson  
Gary A Anderson  
Henry N Anderson  
K R Anderson  
R L Anderson  
R V Anderson  
Paul S Anderssen  
James T Andrews  
Thomas L Andrews Jr  
Philippe A Angelle  
A Angeloglu  
Chris K Angelos  
David A Angst  
Souguil J M Ann  
York D Anthony  
Lawrence Antlick  
Henry J Antosz  
Takafumi Aoki  
Nagatoshi Aou  
Tomos L Ap Rhys  
Peter L Apolito  
Tatsumi Arakawa  
Mituhiko Araki  
G S Aristogenis  
E Arjeski  
Marvin P Arluk  
Fritz Arndt  
W F Arndt  
E F Arnold  
Jack H Arnold  
F C Arnoult  
Walter Arnstein  
Juan Peire Arroba  
A Arunkumar  
Yoshimi Asada

Katsushi Asahina  
Paul O Asenuga  
Edward E Ashley  
Abdulraof A Ashmawi  
Ali G Asiri  
Dariush N Astarai  
Edwin A Atencio

Kent Bagwell  
D Bahadoor  
Nancyjane Bailey  
Robert R Bailey  
William F Bailey  
Paul A Bainbridge  
William H Baker

Steven Baraniuk  
W J Barclay  
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James L Barnes  
Wayne E Barr  
Juan C Barragan  
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Frederick R Bartram  
H L Bassett  
Richard T Bassett  
Ross K Bassett  
Satyendra N Basu  
J K Bates Jr  
Aris Battain  
L Diane Batten  
F H Battle  
Tibor T Bauerhuber  
Carleton A Bayless  
C L Beaty Jr  
Harry L Beck  
George E Becker  
Robert A Becker  
Laurel Beecher  
Willy M Beeck  
John M Beezley  
Anwar A Beg  
J W Belanger Jr  
Delamar T Bell Jr  
Joe E Bell  
Charles H Beller Jr  
L M Belleville  
Luis G Benavides S  
Nigel A Benfield  
Lim Kee Beng  
Eric E Bennett  
Tanj Bennett  
William R Bennett  
Robert F Benningfield Jr  
Albert Berg  
Robert O Berge

Michael Bergman  
Ira W Berk  
Eric C Berkobin  
Gabriel O Bernal  
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Andrew E Bernstein  
Lawrence Bernstein  
N M Bernstein  
Donald W Berrian  
Frederick C Berry  
Thomas R Bertolino  
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Pamela M Betts  
Martin F Beusekamp  
Walter X Bezerra  
Narayan V Bhagavatula  
Bashir Muhammad Bhatti  
R C Bickel  
Miles H Bickelhaupt  
William B Bigler II  
C M Billmyer  
Khalid A Binali  
Greg Birch  
Peter G Bischoff  
Daniel R Bishop  
Rebecca J Bishop  
Amy E Bissmeyer  
Karl M Bizjak  
Maurice W Bizzarri  
J L Blackburn  
Jerry M Blackmon  
Marybelle C Blakeslee  
A L Blanchard  
Thomas P Blinn  
E Bloch  
Robert D Blumofe  
Martin G Blundell  
Andre M Boek



Amos Joel

Robert G Atkinson Jr  
Joseph Awe  
Tamerat Awetu  
Jose M Lizaso Azcarate  
Francisco J Azcondo  
Joseph G Azrak  
W C Bachtel  
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Ranjit K Balaram  
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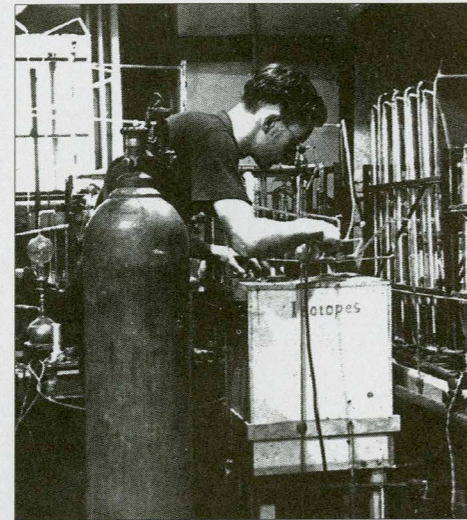
**Other Contributors**

*cont.*  
 Clarence H Boeshart  
 Robert A Bogan  
 Thomas Boinay  
 R Bolgiano Jr  
 M Pilar Bombin-Ballano  
 James J Bonang  
 J M Bond  
 Federico Bonzanigo  
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 The Nan Chang  
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Yat Sun Chiu  
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 David E Christie  
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 Robert J Clare IV  
 Ian Clark  
 Richard C Clarke  
 Jose Clavijo  
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 Garrett W Coble  
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 Joseph A Coleman  
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 Sidney R Collis  
 Ian Colquhoun  
 Roy E Combs  
 James H Compton  
 Francis S Conboy  
 V Cones  
 John B Conklin  
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 Louis H Cook Jr  
 Louis W Cook  
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 R D Cooley  
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 C I Cutler  
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 Galal M R El-Mahdy  
 James C Elder  
 Charles A Eldering  
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David M Elliott  
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 F R Fluhr  
 Charles W Flynn  
 John J Foley  
 Saroya I Follender  
 A Fong  
 Ming-Tay Foo  
 James R Ford  
 Wayne E Fordyce  
 Reginald Forster  
 David A Forsyth  
 M G Foster  
 David R Fournier

**Other Contributors**

*cont.*  
 H K Foute  
 Edward J Fowlkes  
 M E Fox  
 Paul J Fox  
 Konrad Frank  
 G R Fraser  
 B Freeman  
 Nelson M Freire  
 Robert French  
 Jurg Freudiger  
 Rowland Friebeley  
 E M Friedl  
 Timothy P Froehling  
 Charles L Frush  
 Bernhard A Fruth  
 Max J Fuchs  
 Gerald Estrin  
 Toshio Fujii  
 Norio Fujimaki  
 Masayuki Fujino  
 M Fujita  
 Tadashi Fukao  
 Masao Fukata  
 Yukio Fukayama  
 Shigeru Fukuda  
 Charles E Fuller  
 John W Fullwood  
 Raymond Fung  
 Daniel A Green  
 J P Green  
 Paul A Green  
 S Greenwald  
 E C Gregory  
 Ray E Greig  
 Walter E Gretschmann  
 Gordon P Gretton-  
 Watson  
 Richard Griffiths  
 Tiberiu M Grigorescu  
 Francis J Grill  
 R A Grimes  
 K Kennard Gross  
 Todd Gross  
 P C Grossman  
 Horst E Gruening  
 J J Guarrera  
 Scott A Gudgel  
 Myron E Gudz  
 Charles S Guenzer  
 Michael A Guida  
 John N Gundersen  
 Desh B Gupta  
 Rohini Gupta  
 Samir K Gupta  
 Sant D Gupta  
 Julio Gutierrez-Rios  
 R A Gutschow  
 Michael F Guyote  
 Wm S Haddock Jr  
 Hugh J Hagel  
 Howard H Haglund  
 Carl A Hagson  
 Raziel Haimi-Cohen  
 G A Hajek  
 R N Hall  
 Robert B Hall  
 Nagaharu Hamada  
 Ohsai Hamada  
 Irvin L Hoehner  
 Rudiger Hofert  
 Carvel D Hoffman  
 W A Hoffman  
 Woodward C Hoffman  
 Michael H Hoffmann  
 Thomas C Holbrook  
 W L Holcomb  
 C H Holley  
 Wilbert J Holmer

**Other Contributors**

*cont.*  
 Arthur Goldsmith  
 S Goldstein  
 Keith W Golke  
 Daniel J Gomez  
 Gerhard Gonter  
 Miguel A Gonzalez  
 Munoz  
 Guillermo Gonzalez  
 Sergio Gonzalez  
 Cuevas Gonzalo Dr  
 J Goodlet  
 Charles D Goodman  
 David J Goodman  
 James F Goodrich  
 Kenneth R Goodwin Jr  
 K Gopalan  
 Gerald W Gordon  
 E Gorin  
 Michael J Gorman  
 Mitsuhiko Goto  
 Cornelis A Goud  
 John C Graham  
 Donald A Grandis  
 David N Grant  
 Homer H Grant Jr  
 Robert D Grant  
 Willard S Grant  
 Frank D Gray  
 James P Gray  
 Daniel A Green  
 J P Green  
 Paul A Green  
 S Greenwald  
 E C Gregory  
 Ray E Greig  
 Walter E Gretschmann  
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 Watson  
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 Thomas C Holbrook  
 W L Holcomb  
 C H Holley  
 Wilbert J Holmer

**Other Contributors**

*cont.*  
 David E Hanson  
 Mark D Hanson  
 Chang Chung Hao  
 Kazuaki Harada  
 Milton W Harden  
 C W Hargens 3rd  
 C C Hargis  
 Steven B Hargus  
 William R Harmon  
 Edgar D Harras  
 Paul S Harrington  
 James G Harris  
 Robert G Harshman  
 Daniel J Hart  
 Gerald Hartill  
 Alex J Harui  
 Alan L Harvey  
 R B Harvey  
 Takeyoshi Hashimoto  
 Abe H Hassan  
 Joseph E Hrason  
 Hiroshi Hatafuku  
 Mitsutoshi Hatori  
 J Haworth  
 Masao Hayakawa  
 P C Hayden  
 D M Hayter  
 Bruce L Hebbard  
 Harold R Heckendorn  
 Leo J Hefferman  
 Odell C Hegna  
 Frederick V Hei Kamp  
 L H Heiden  
 Charles L Heimbach  
 Tjeero M Hein Dijkstra  
 Steven J Heinrich  
 Mark W Heising  
 Leslie J Hellenack  
 Duane Helmer  
 Johan H Hendriks  
 F L Hermach  
 Simon Herman  
 Rafael Hernandez  
 Eberhard Herter  
 H M Hess  
 Dor H Hesselgrave  
 Daryl T Hester  
 Karan L Heureux  
 Bernd Heuser  
 H R Higgins  
 T J Higgins  
 James M Higgins-Thomas  
 E A Hilberg Jr  
 D L Hill  
 Michael A Hillmeyer  
 Jorge Him  
 Frank Himmer  
 J R Hines  
 Daniel W Hinz  
 Yukio Hiramatsu  
 Nobu Hirano  
 Takashi Hirayama  
 Richard F Hirsh  
 T W Hissey Jr  
 Masao Hiyanne  
 Mark Ho  
 Alan E Hochhalter  
 Irvin L Hoehner  
 Rudiger Hofert  
 Carvel D Hoffman  
 W A Hoffman  
 Woodward C Hoffman  
 Michael H Hoffmann  
 Thomas C Holbrook  
 W L Holcomb  
 C H Holley  
 Wilbert J Holmer

**Other Contributors**

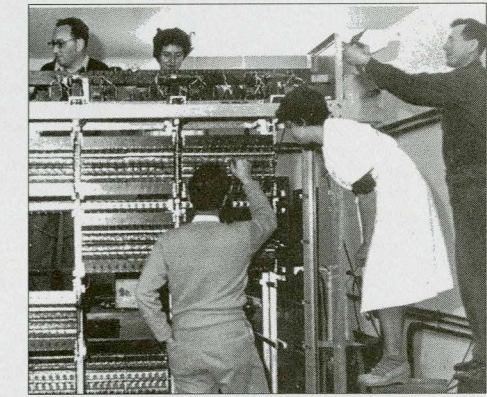
*cont.*  
 R G Holt  
 Masashi Honda  
 William K Honea  
 Werner E Honisch  
 William Hoppa  
 Semmatsu Horii  
 Steven C Horii  
 Gary W Horn  
 Chris K Horne  
 Svante P Horneman  
 William A Hornfeck  
 Eiki Hotta  
 Chih-Jen Hou  
 R D Hough  
 Michael M How  
 L L Howard  
 Walker G Howard  
 Henry H Howell Jr  
 Philip L Hower  
 Stephen B Howlett  
 Ralph E Hoy  
 Joseph E Hrason  
 Wei Fang Hsia  
 Ching C Hsieh  
 Ming-Cheng Hsieh  
 Cheng H Huang  
 Chien-T Huang  
 Ming-Chih Huang  
 Shih Chi Huang  
 Charles F Huber  
 William A Huber  
 Robert H Huck  
 C R Hudetz  
 Donald G Hughes  
 Paul J Humphreys  
 Lo Wai Hung

**Other Contributors**

*cont.*  
 J J Ingram  
 Maxwell Ingram  
 Kazumi Inoue  
 Nobuo Inoue  
 Takahiro Inoue  
 Yuji Inoue  
 Hirosei Inuzuka  
 Nicolae M Iosif  
 Giuseppe Ippolito  
 Ken Ishihara  
 Naka Ishii  
 Rokuya Ishii  
 Shozo Ishii  
 Yasuo Ishii  
 Koji Ishikawa  
 Masayuki Ishikawa  
 Katsuhiko Ishimura  
 Takayama Ishioka  
 Mohamadd H  
 Iskandarani  
 Abu A Shaheedul Islam  
 Mitsuo Ito  
 Tadahiko Itoh  
 Yoshio Itoh  
 Masayoshi Iwahara  
 Kenichi Iwai  
 Takano Iwakane  
 Koshiro Iwaya  
 Guillermo R Izquierdo  
 Takehiro Izumi  
 James M Jack  
 Daniel W Jackson  
 David R Jackson  
 Alan Jacobs  
 George Jacobs  
 Steve Jacobson

**Other Contributors**

*cont.*  
 Min Jiang  
 Nicolas Jodal  
 A E Joel Jr  
 Rune Johannessen  
 Johnny K John  
 Charles M Johnson  
 Clark E Johnson Jr  
 Howie Johnson  
 John P Johnson  
 Kenneth W Johnson  
 M C Johnson  
 Orisa D Johnson Jr  
 Steven D Johnson  
 D L Johnston  
 Paul S Johrde  
 Steven A Jonason  
 C K Jones  
 Eric D Jones  
 G W Jones  
 Gwynne H Jones  
 John W Jones  
 Steven M Jones  
 Thomas M Jones  
 Peter Jongsen  
 Robin E Jowett  
 J W Joyner  
 Reginald Jue  
 Kevin W Juhl  
 Mohamed Juman  
 Arthur Jurszewicz  
 M J Kabrisky  
 J Kacerek  
 E Kadak  
 John W Kaefer  
 Fred R Kaepfel  
 Keith K Kagamida  
 Kiyohiko Kajihara  
 G C Kalandar  
 E Y Kameda  
 Kohji Kamejima  
 Michitaka Kameyama  
 Yoshio Kami  
 Tomonori Kamikawa  
 Mokhtar Kamli  
 Yasushi Kanai  
 Luiz S Kanda  
 Matthew C Kane  
 Thomas J Kane  
 Yutaka Kaneda  
 Seiichi Kanema  
 Karn Kanjanarat  
 Thomas A Kanneman  
 Hiroshi Kano  
 Sadahiko Kano  
 M N Kaplan  
 Martin N Kaplan  
 D J Karbo  
 Peter Kartaschoff  
 Naoki Kasahara  
 Hiroyuki Kasai  
 Hideaki Kashihara  
 Toshinobu Kashiwabara  
 Shigeru Katagiri  
 Ken Katano  
 Husam R Katkhoda  
 Takayoshi Katori  
 Arthur J Katz  
 Fred L Kaufmann  
 G L Kaufman  
 Antulio H Jarquin  
 Phairoj Jatanachai  
 Ronald Javitch  
 Walter M. Jeffers  
 William W Jeffers  
 Glen A Jenkins  
 S C Jenkins  
 Woon D Jeong  
 Mark A Jerve  
 M M Jesurun



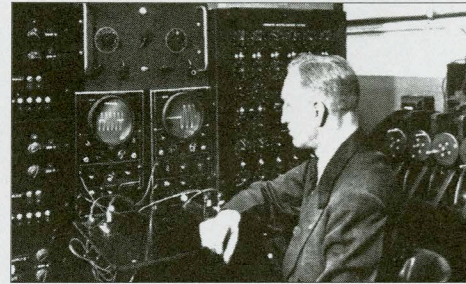
Thelma Estrin (2nd from right)



## Other Contributors

J W Kearney  
C E Keener  
G R Keesecker  
William R Keesling  
G P Kefalas  
Cotton R Keith  
F C Keller  
H F Kelley  
Robert Kelley  
Thomas G Kelley  
W R Kelley  
Alex C Kelly  
William J Kelly Jr  
Klaus W Kelting  
Stanley F Kemp  
P G Kendall  
Thomas A Kennedy  
John M Kennedy-Reyes  
Robert G Kennington  
Avi W Kerem  
Esa J Kerttula  
Hui C Keung  
Hayat M Khan  
Keniti Kido  
Kenneth A Kiefer  
Thomas F Kiefer  
James Kilazoglou  
Lark K Kim  
Michael J Kim  
Pong Kim-Ming  
Rinjiro Kimura  
Richard C King  
Eugene L Kingsbury  
Peter Kirchofer  
Dieter Kirchner  
H J Kirshner  
Kunihiro Kishaba  
Tomio Kishimoto  
Yasuchika Kishimoto  
Tamas A Kiss  
John G Kissane  
Kazuhiro Kitagawa  
Joao P Kitajima  
Tokuhiko Kitami  
William Kitchen  
Yukio Kito  
Richard W Kitterman  
Raymond A Kjar  
Robert B Kjelgaard  
Rolf D Klein  
W J Klein  
W T Klein  
Donald R Klinger  
E A Klingshirn  
Marian J Kloza  
Ronald O Knecht  
Charles P Kneeter  
Joseph G Kneuer  
Shawn D Knight  
Bernard Knorr  
David I Knox  
Kaname Kobayashi  
Misao Kobayashi  
Susumu Kobayashi  
Magnus Koch  
Kathleen C Kocher  
Jimmy Koe  
Keiichi Koga  
Ryuji Koga  
Kenji Kohiyama  
Douglas Y Koide  
Naokazu Koizumi  
H G Kolsky  
Koichiro Kominami  
Samuel K Kong  
Joe D Koon

Mark Kopecki  
Steven S Kornak  
Donald M Koshi  
Pete F Kosir  
Walter F Kosonocky  
Yasuharu Kosuge  
Nobuo Kotera  
Chester C Kowalik Jr  
Martin J Kral  
C K Kramar  
Jan Kraski  
Wolfgang Kraus  
A Krausz  
Seymour Krevsky  
H C Kriegel  
Thorsten Krohn



Edwin Harder

Yahachi Kuboyama  
Burton M Kuck  
Victor Kuczynski  
William M Kuker  
Per A Kullstam  
Hiromitsu Kumamoto  
K B Kumar  
W H Kummer  
Toshiro Kunihiro  
Michael E Kunsman  
Frederic Kunzi  
E F Kups  
Genzaburo Kuraishi  
Yoji Kuroda  
Noriyoshi Kuroyanagi  
Iwan H Kusumadaja  
Sadao H Kuwamoto  
Linda S Kuzniar  
Poon K Kwok  
Tse Yin Kwok  
William M Kwok Kee  
R L Kyhl  
Michael Kyriazanos  
John W La Londe  
Anita J La Salle  
Timo I Laakso  
R P Andre Lacroix  
Nelson Laffey  
David T Lafleme  
Wai S Lai  
John F Laidig  
Jefferson P Lamb  
A Lamberson  
Elias Landau  
Leslie C Lander  
R A Landrum  
George L Lang  
P Lang  
Gholamreza Langari  
Frederick L Langhoff Jr  
Berthold Lankl  
Suzanne N Lansford  
Ryuji Koga  
Kenji Kohiyama  
Douglas Y Koide  
Naokazu Koizumi  
H G Kolsky  
Koichiro Kominami  
Samuel K Kong  
Joe D Koon

J E Lauterbach  
J I Laveson  
Anthony J Laviano  
Piero Lavopa  
Dennis A Laws  
Leo Lawshine  
G L Le Baron  
Khai M Le  
Nan H Le  
Herbert A Leach  
Jeffrey S Leane  
Jack Lebid  
Louis C Lechenger  
Bong Yong Lee  
Frank P Lee Jr  
Fu-Hsieng A Lee

Edward W Liu  
Xia Liu  
Constantin D Livescu  
David J Livigni  
Pedro J Lizcano  
M O Loftness  
B F Lohr  
Claude J Loos  
Abelardo Lopez-Lagunas  
H W Lord  
Lars Lord  
Stephen M Lott  
F A Lotte Jr  
Hoivan J Louis  
Kon Lovett  
R A Lovin  
Karl G Lovstrand  
John Lowe  
Lester H Lowe Jr  
John L Lowrance  
Weijian Lu  
Stephen J Lucci  
Larrondo H Luciano  
James R Lucid  
Ronald A Luhks  
Andrew Luk  
Lloyd M Luke  
Torbjorn Lundahl  
Giuseppe Luoni  
Joachim H Lutz  
Bob Lyness  
Hing C Ma  
Olabisi A Mabogunje  
Steven Machanic  
Walkowiak Maciej  
Ronald H MacPherson  
Thomas F Madigan  
Edgardo J Maffia  
Gregory A Magin  
Michael L Maglothin  
Alexander S Magyar  
Peter P Magyar  
Austin J Maher  
William E Maier Jr  
Rahul Majumdar  
Junichi Makino  
Paolo L G Malapelle  
T D Malarkey  
A Malcolm  
Roger J Malik  
Lawrence J Mclean  
Simon D McMahon  
Keith A McMillan  
Robert J McMillen  
Michael W McNeil  
Dennis E McNulty  
James G Meade  
John J Meader  
Kevin A Meagher  
Philip L Medley  
H L Medlin  
John Mekota  
Thomas Melchiorre  
Leslie M Melenchuk  
Robert J Melford  
Carl W Melone  
John F Melrose  
Irving M Meltzer  
Gustavo Mendez  
Moises Mendez  
Pedro G Mendoza  
Peter F Mengel  
Nanda K Menon  
J K Menoudakos  
Audley A Merchant  
James G Merrett  
V Bruce Merritt  
M F Messa  
Stephen Messinger

Leon Masliah  
Francis L Mason  
Rob Mason  
Philippe Massonet  
Brian L Mast  
Joel W Masters  
Hiroshi Masuyama  
Alfredo P Mateos-Papis  
Clyde E Mathews  
Daniel Mathews  
Rafael A Mattienzo  
Kazuyuki Matsui  
Keiju Matsui  
Sumitaka Matsumoto  
Hiroshi Matsuo  
Kouki Matsuse  
Noriyuki Matsushima  
George L Matthaei  
Hubert Matthey  
Thomas A Mattioli  
Hitoshi Matznaga  
Robert D Maurer  
Steven E Mavis  
Richard L Maxey  
Robert M May  
Christian Mayer  
C L Mayeshiba  
Bruno R Maza  
Douglas R Mc Callum  
Lawrence P Mc Cormick  
Gordon P Mc Couch  
Bruce Mc Donald  
Vincent T Mc Donough  
W H Mc Kee  
J L Mc Kelvie  
Alexander A Mc Kenzie  
Gerald J Mc Niff  
Thomas H Mc Rorie  
J O McCaldin  
Edward L McCall  
Charles E McCallar Jr  
R O McCary  
Brian T McClelland  
Terence R McComb  
William G McCoy  
James G McGraw  
Gregory J McIsaac  
Lee G McNight  
Ian W McLarty  
Hugh J McLaughlin  
Lawrence J Mclean  
Simon D McMahon  
Keith A McMillan  
Robert J McMillen  
Michael W McNeil  
Dennis E McNulty  
James G Meade  
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Moises Mendez  
Pedro G Mendoza  
Peter F Mengel  
Nanda K Menon  
J K Menoudakos  
Audley A Merchant  
James G Merrett  
V Bruce Merritt  
M F Messa  
Stephen Messinger

Denis Mestdagh  
Andrew C Metaxas  
S Metzger  
D R Meyer  
G E Meyer  
Hans R Meyer  
J A Meyer  
Robert H Meyer  
Robert H Meyer  
R D Middlebrook  
David Middleton  
Jose M Miguel  
John Mihalko  
Tetsuya Miki  
J E Mikkali  
Daniel D Milano  
Donald S Miles  
R L Miles  
Joseph R Mileta  
Lamine Mili  
Michael D Mille  
C M Miller  
Damon A Miller  
David L Miller  
Ethan L Miller  
G L Miller  
Ian T Miller  
J W Miller  
James W Miller  
N D Miller  
Richard J Miller  
Scott D Miller  
Joseph A Minahan  
Leo Nagamatsu  
Shoji Nagasaki  
Mak Chai Ming  
Robert D Misner  
Jaime Misraji  
Thomas H Mc Rorie  
Mahendra R Mistry  
David B Mitchell  
Dimitris K Mitrakos  
Kuniaki Miura  
Masayasu Miyake  
Shoichi Miyashiro  
Masachika Miyata  
Shigehiro Miyatake  
Toshio Mizuno  
Chris I Mobbs  
Brian D Moe  
James M Moe Jr  
Bagyo Y Moeliodihardjo  
Jerry D Moench  
Stu-Chuen Mok  
Nina H Moldt  
Bernard E Mollet  
Timothy J Moloney  
G R Moltrup  
Mark W Monaghan  
George L Monkovic  
Jose M Monroig  
Leone C Monticone  
Masahide Monura  
James C Moore  
R A Moore  
Juan C Mora  
Maurizio Morabito  
John P Moraitis  
Michael J Moran  
Elmer Nelson  
Boris D Nemsic  
A W Newman  
Charles L Newman  
C Z Neyor  
Akio Nezu  
Justin Ng  
Paulino Ng  
Wai-Tung Ng  
Neal Nguyen  
Quang M Nguyen

## Other Contributors

Ronald E Moulton  
John N Mourjopoulos  
Trevor Mudge  
Marino H Mueller  
Robert L Muglia  
Allan J Mui  
Takashi Mukai  
C Everett Mullin  
Sherman N Mullin  
Marco P Mundo  
Steven W Mundy  
Hiroshi Murata  
Robert S Murch  
J Muroga  
H Deon Murphy  
George B Murray III  
W E Murray  
M P Musick  
S S Mustafa  
C M Miller  
Nozomu Muto  
Frederick Mutto  
Jon H Myer  
A F Myers  
Arthur R Myers  
Richard Myers  
Leonard T Mygatt III  
Frank M Myint  
Akira Nabae  
Eric Nabel  
Carlos A Nacazona  
Leo Nagamatsu  
Shoji Nagasaki  
Mak Chai Ming  
Robert D Misner  
Jaime Misraji  
Thomas H Mc Rorie  
Mahendra R Mistry  
David B Mitchell  
Dimitris K Mitrakos  
Kuniaki Miura  
Masayasu Miyake  
Shoichi Miyashiro  
Masachika Miyata  
Shigehiro Miyatake  
Toshio Mizuno  
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R A Moore  
Juan C Mora  
Maurizio Morabito  
John P Moraitis  
Michael J Moran  
Elmer Nelson  
Boris D Nemsic  
A W Newman  
Charles L Newman  
C Z Neyor  
Akio Nezu  
Justin Ng  
Paulino Ng  
Wai-Tung Ng  
Neal Nguyen  
Quang M Nguyen

C Nichols  
Sam Nicolino Jr  
Ravi Nigam  
Ralph S Nightingale  
Nils A Nilsson  
Kiko Nishida  
Toshio Nishikawa  
Joe Nkrumah  
Eitaku Nobuyama  
Kenroku Nogi  
Albino Nogueiras  
J Noordanus  
Isami Norigoe  
Donald W Novotny  
Michael M Nowadly  
Anton S Noz  
Conrado N Nuesca  
Mitchell J Nusbam  
Joseph Nutaro  
Robert J O Malley Jr  
John T O'Donnell  
R E Oakes  
Norio Obata  
D K Obenland  
William C Oberkirk  
Shinichiro Oda  
Roy D Odhner  
E E Odohi  
Yoshiya Ogihara  
Myung Oh  
Hiroyoshi Ohara  
Yasutaka Ohashi  
Masanobu Ohhata  
Sumio Ohkawa  
E A Ohm  
Takanori Ohmaya  
Masamichi Ohmori  
Nobuo Ohmori  
Eiichi Ohno  
Shigeru Oho  
Masato H Ohsato  
Satoru Ohta  
Kouichi Ohtani  
Norihiro Ohwada  
Nobuhiro Ohya  
Kazuo Okada  
Keisuke Okada  
Hideyuki Okamoto  
Hideyuki Okamoto  
Mikio Okawa  
B Okazaki  
Herman C Okean  
Sevgin Oktay  
Katsuhiko Okubo  
Nile M Oldham  
Robert R Olds  
Mertanen Olli  
A G Olsen  
Mark D Olson  
Sang Pui On  
Daniel C Ongg  
Shoichi Ono  
Tohru Onuki  
Morry Oppenheim  
A F Orazio  
Joann J Ordille  
Dmitry Orlovsky  
Rose Ortwin  
R L Osborn  
Raymond C Osofsky  
Andrew Ostash  
Takeshi Ota  
Raul J Otero  
Tai-Ichi Otsuji  
Edward L Owen  
R H Owens Jr  
Masashi Ozawa  
Naoki Ozawa  
Larry D Paarmann

Ernest L Pacheco  
Noe Pacheco  
John R Padilla  
Charles E Pagano Jr  
Henry A Pahl  
Howard Palmer  
George Panagiotopoulos  
Gerard Pannell  
David K Pantalone  
H J Pantis  
Victor A Pantoni  
Petros N Papas  
Bruce J Pardus  
Hong S Park  
Hwasik Park  
Se-Hwa Park  
James H Parker  
Norman W Parker  
Susan J Parker  
Robert S Parnell  
Tai-Ming Parng  
Renzo F Parodi  
Pedro C Parra  
Phillip E Partin  
Shella Paskel  
G F Paskusz  
Gianfranco Passariello  
J J Patay  
Hasmukh S Patel  
K V Patel  
M R Patel  
Nupur H Patel  
Bernard J Patterson  
Robert J Patukonis  
David D Pau  
Robert W Paulsen  
H R Paulson  
J N Payne  
Charles Payret  
Cyrus L Peck  
Don E Peck  
J A Pecon Jr  
Sudhir P Pednekar  
Carlos Cordero Pedraza  
Luis D Pedro  
Nahum Peleg  
Erik M Pell  
William M Peloso  
C S Pendergraph III  
W W Pendleton  
Philip M Pennington  
William F Peoples  
Charles J Peplinski  
Salvador Perdomo  
Orlando Peretra  
David C Perez  
Jesus Perez  
Tomas Perez-Escolar  
L Perper  
Darrell E Perreault  
Victor T Perrote Jr  
Robert G Pessler  
Edward C Peter  
Harry E Peters  
Sandra Peters  
Ronald G Peterson  
Mircea E Petrini  
Richard L Petritz  
Sam Petrokofsky  
Peter J Phalen  
Edward V Phillips  
Richard H Phillips  
W F Phillips  
Lawrence E Philps  
T F Piatkowski  
Gerald Di Piazza  
W F Pickard  
Charles H Pickman  
George Pida

C B Pierce  
Salvador Pierpaolo  
Charl R Pieterse  
V J Pietkiewicz  
Manu R Pillai  
Law S Ping  
Anthony Pino  
Robert L Pique  
Jerry Place  
Jaime C Plana  
Joseph J Plante  
Stefan Platzeck  
C Poda  
H Andy Podgurski



Harold Wheeler

Hans D Polaschegg  
Edwin C Polke Jr  
Rene Pomey  
Joseph N Pomponio  
Carlos Ponce  
Charles W Pond  
Frank B Pope Jr  
Herbert Popper  
Stanley Poremba  
Thomas Porskievies  
David D Porter  
Patrick Rickard  
J D Riddle II  
Kathryn J Rinehart  
Barry N Ritter  
Domenico Rizzo  
Diana Robba  
Michael W Roberson  
John R Roberts  
Richard E Robinette  
A Robinson  
Charles J Robinson  
Don G Robinson  
George W Robinson  
James G. Robinson  
Kelly S Robinson  
Alexis Rochwerger  
Craig A Rockenbauch  
Carlos E Rodriguez  
Felix Rodriguez  
Juan V Rodriguez  
John S Roe  
Walter C Roehr Jr  
Klaus E Roeser  
Stacey A Rogers  
Sabino J Rojas  
Mark D Roos  
Gary T Rose  
R H Rose 2nd  
Ronald Rosen  
J M Rosenberg  
Edward Rosenstraus  
Gordon M Ross  
Virgil M Ross  
Richard M Rossetti

Randall C Reed  
George T Reich  
Konrad Reichert  
Donald P Reid  
J O Reid  
James M Reid  
Robert Reid  
Thomas S Reidy  
Richard Reno  
Frank Renovich Jr  
Marco Resendiz  
Eric Reuter  
Spiridon A Reveliotis  
Joost P Rey

R A Rothenberg  
I Rotkin  
Peter Roubitschek  
J C Rouse  
Aldo Roveri  
Thomas D Rovito  
William A Rowe  
J H Rowlett  
Rolf Roxin  
Tamal K Roy  
S Rubin  
John R Ruckstuhl  
Alan D Rudd  
Darcy E Ruff  
Henry Ruff  
Joseph R Ruggiero  
G H Ruggles Jr  
W I Rumer  
Lars M Runbeck  
W Rungseewijitprapa  
D W Rusnell  
F A Russell  
William G Ruthenberg  
V F Ryan Jr  
Eugene Rymaszewski  
C A Rypinski  
H Ryser  
Rodzaki M Saad  
Osamu Saburi  
J S Saby  
Sato Saga  
John N Sahalos  
S Saithanya  
Fuji Saito  
Osamu Saito  
Masaharu Sakagami  
Takao Sakai  
Yoshio Sakai  
Yo Sakaki  
Masayuki Sakamoto  
Hiroshi Sakemoto  
Peter F Salamon Jr  
Adolfo Zelada Salas  
Guillermo A Salgado  
Charles M. Salina  
John B Sallemi  
Richard H Sammons  
Gordon T Samuels  
Carlos E Sanchez  
Royden C Sanders Jr  
Alvaro A Sandovai  
Yaska Sankar  
Koichi Sano  
Michael A Santangelo  
Candido M Santos  
Claudio P Sartori  
Martin S Sas  
Hajime Sasaki  
Tsutomu Sasaki  
Takao Sasayama  
C Sashidhar  
Robert J Satnik  
Robert M Saunders  
Robert W Saunders  
Sheila L Saunders  
John B Savage  
Kunio Sawaya  
George T Scache  
D H Schaefer  
L P Schaefer  
Richard R Schaefer  
R H Schafer  
Lee M Schaff  
Robert E Schafrik  
Albert Schapiro  
Ward M Scharmer  
Gary W Scheer  
Russell R Scheer  
Mark S Scher

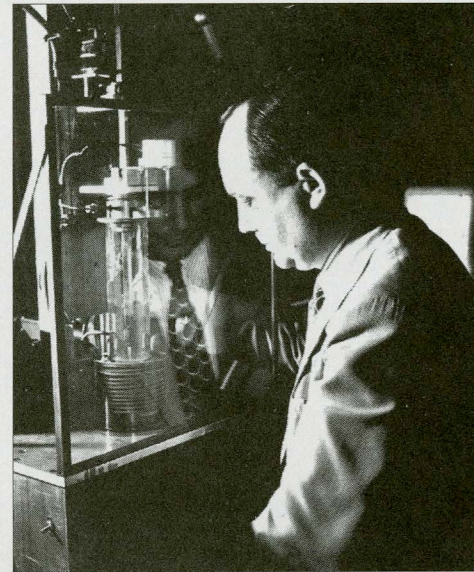


## Other Contributors

cont.

Kathren G Scherb  
Hans G Scherneck  
Rich F Schiferl  
Rodica Schileru-Key  
Kurt Schlacher  
Stanley A Schlitter  
Carl W Schmidt  
Kurt H Schmidt  
W M Schmidt  
J A Schmitendorf  
Richard Schmitz  
R E Schneider  
S Schneider  
Robert C Schober  
R L Schoenfeld  
Wayne S Schoepbach  
John H Schramm  
T W Schroeder  
Michael Schroth  
Mischa Schwartz  
Peter H Schwartz  
Richard F Schwartz  
A F Schwarz  
Marcos G Schwarz  
Roland Schwerdtfeger  
Frederick A Schwertz  
Frank J Scire  
Robert F Scott  
Robert C Seay  
Kiyoshi Segawa  
George B Seliga  
Faith Worzaia Sell  
Abraham Selman  
Antonio Seminara  
Jiro Senda  
Edwin Senior  
Mark J Serencha  
Rodolfo Serna-Guevara  
Djoni Setyadi  
Michael J Seymour  
Rudolph Seymour  
Abdullah M Shaalan  
R R Shade  
Mansoor Shafi  
D K Shah  
Dharmesh M Shah  
Narendra M Shah  
Anup Shahi  
Tony D Shan  
Mark A Shand  
John P Shanklin  
Edward A Sharpe  
Guy B Shaw  
Frank A Sheehan Jr  
J J Sheehan  
B Sheffield  
Jeffrey L Shepard  
W M Shepard  
John E Sherman  
Toshio Shibata  
Yasutsugu Shigeta  
J D Shimble  
Alexander K Shindle  
Kobayashi Shinichi  
Seiichi Shinno  
Hidetoshi Shinoda  
Hiroshi Shintani  
Hiromu Shioyama  
Paul P Shipley  
William K Shirado  
Katsuhiko Shirai  
Hiromitsu Shirakawa  
Fareed Ar Shirazi  
Lee A Shombert  
H D Shoulders  
Robert Show

Jeff Shupe  
Vincent Siclari  
Mohammad M Siddiqui  
Clifford M Siegel  
Phillip A Sierk  
Manuel Silva  
Michael D Silver  
James M Simmers  
Chuck Simmons  
Dan J Simon  
Randall L Simpson  
Kenneth H Sinclair  
A Singer



Gordon Teal

E Skeltved-Jensen  
Anthony Skjellum  
M Skoller  
Dennis P Slack  
Barry L Slattery  
Martha Sloan  
Otto Slooten  
Paula J Slowik  
B Thomas Smith  
David K Smith  
G B Smith  
Gail S Smith  
H Smith  
Hector M Smith  
Kelvin C Smith  
M G Smith  
N F Smith  
R J Smith  
Richard H Smith  
Robert W Smith  
Russell M Smith Jr  
Susan M Smith  
Will R Smith  
Elias Snitzer  
T Louis Snitzer  
Charles M Snow  
W F Snyder  
Lo Soi-Kwong  
John T Solar  
K Solomon  
Isao Someya  
Hideaki Sone  
Park Jin Soo  
Edmund L Soohoo  
Frederick G Suffield  
R W Sorensen  
Daniel G Soroka  
G B Soule  
T G Spargo  
Debra R Sparkman

Will Specks  
Homer Spence  
Karl Sperber  
Joseph S Sperrazza  
M Springel  
V Sreeram  
R P Srivastava  
Carl V Stacy  
Peter P Staev  
Forrest L Staffanson  
John C Stamatiou  
Alec G Stanculescu  
Marc Standaert

Wong Sui Wai  
Takashi Sukegawa  
Long X Sun  
Jon M Surprise  
Hironori Susaki  
Gary C Sutherland  
Michelle L Sutphin  
L E Sutton 3rd  
Sadao Suzuki  
Shiro Suzuki  
Yukinori Suzuki  
Bernard T Svihel  
John R Svirbely  
Mark S Swiecicki  
Theodore J Swift  
William M Swift  
Edward Syrett  
Satoshi Tada  
Victor Taft  
Katsubumi Tajima  
Atsushi Takada  
Hitoshi Takagi  
Chihiro Takahashi  
Hirokazu Takahashi  
Makoto Takahashi  
Norio Takato  
Tsuoyoshi Takebe  
Kazuro Takeda  
Yasuhide Takeda  
Ken Takeya  
Anna S F Tam  
T Tamir  
Atsumi Tanaka  
Ikuo Tanaka  
Masatomo Tanaka  
Shojiro Tanaka  
Shuzo Tanaka  
Toshiki P Tanaka  
Kenzaburo Tanemura  
Keiji Taniguchi  
Shigeru Tanimoto  
Glenn M Tanimura  
Ryoji Taniyama  
Manzer H Tariq  
Marshall J Tate  
Bruce C Taylor  
Frank F Taylor  
J M Taylor  
Richard R Taylor  
Warren F Taylor III  
Kenshi Tazaki  
Chang Jew Teck  
S Teichman  
Senait Telahun  
B H Temple  
Jim W Templeton  
R K Templeton  
Paolo Tenti  
Ronald G Tenty  
Yew T Teo  
C Tepper  
Shinichi Terashima  
Lewis M Terman  
Frederic T Terry  
Yoshimi Teshigawara  
Donald E Tesko  
David A Teviotdale  
C I Theodoulidis  
Boong-How Thiang  
William F Thiesse  
Norman T Thomas  
Don R Thompson  
R D Thompson  
Hernan Tienda  
Steven J Tilidetzke  
G S Timoshenko  
Edmund R Ting  
Ronald J Tippets  
Leung M To

Mauro G Togneri  
Robert T Tolle  
Ahmet Tolunay  
Alexander S Tom  
Masaaki Tomita  
Paul L Tomko  
Willis J Tompkins  
Munehiko Tonami  
Naoya Torii  
Mark Torre  
Tokujun Totani  
Anthony A Townsend  
Corey R Trapp  
Paul J Traut  
Robert Tremblay  
Robert I Trepp  
Howard H Trieu  
John A Trimmer  
Steven J Tripka  
Roberto Trozzo  
Francisco Trujillo  
Bruce L Trumbo  
Anhi Truong  
Henry J Trussell  
Yuh-Show Tsai  
Andrew K C Tsang  
A Tsoularis  
Eizo Tsuchihashi  
Siu F Tsui  
Mamoru Tsukamoto  
Tsuneo Tsukhara  
Eiichi Tsutsui  
Shengru Tu  
Robert B Tucker Jr  
Allen F Turner  
Norman B Tweed Jr  
H A Tynan  
K J Tyssen  
Clive C Tzuang  
Tatsuo Uchida  
Kazuhiro Ueda  
Fumio Ueno  
Michiyuki Uenohara  
Ross Ulan  
Masuo Umemoto  
Takaji Umeno  
R J Ungrodt  
L E Unnewehr  
Masami Uno  
F T Upham  
Kazuo Ushijima  
Kiminori Utsunomiya  
Otto K Uyehara  
David Vaccaro  
Harri J Vahatalo  
B U Vainik  
Antonio Valentini  
Edward J Van Beever  
J P Van Duyn  
William B Van Lennep  
Eric H Van Tongerlo  
H A Van Wassen  
Edgar W Van Winkle  
Miles E Vance  
Wouter F G Vander Elst  
Hubert J Vanooteghem  
Luis A Varady  
Anil K Varma  
F J Vaquero Esparza  
Dan I Vasilache  
Ken R Vassallo  
J R M Vaughan  
William K Vaughan  
Carlos E Velasquez  
Maribel Velez  
Aires M Veloso  
Johan Veltmeyer  
Crispin V Venal Jr  
N G Verschuren

Tino F Vescovi  
John E Vetack  
Esther Berger Vidal  
O A Villareal B  
J L Norman Violette  
Edward M Vipler  
Herbert Voelcker Jr  
Ian D W Vogt  
Francis Von Muller  
Oi Khiun Voon  
John F Voss  
David W Voth  
G Wade  
Richard K Wade  
Thomas O Wade  
D L Waidelich  
William L Wainscott  
Michael S Walker  
J D Wallace  
R M Walser  
Andrew C Walsh  
Ralph E Walter  
Richard P Waltermeyer  
Yik Chiu Wan  
Shinn S Wang  
E J Warchol  
Paul T Ward  
Ronald L Ward  
R B Ward-Cox  
S C Wardrip  
A C Warrick  
C A Washburn  
Neil H Wasserman  
Tomoyuki Watanabe  
H M Watson  
James G Watson  
Jay S Watson  
John A Watson  
Robert T Watson  
S R Watson Jr  
Edward A Weaver  
Michael J Webb  
Arthur F Webster  
D R Webster  
Stuart Wecker  
Gerald E Weed  
Charles W Weesner  
E Weiblen  
Herschel Weil  
Jay W Weinberger  
I Weiss  
Russell J Weiss  
Gerald A Welch  
Gary L Welharticky  
Robert A Welker  
David R Welland  
L Weller  
W B Wells  
Eric W Wendt  
Donald M Wenrich  
Duane J Wenzel  
Walter J Weppler  
Donn Werrbach  
Burnell G West  
Cecil D West  
Stephen R West  
Allen K Weston  
B H Weston  
R E Wetmore  
Terry E Weymouth  
Larry A Wharton  
Daniel E Whelan  
James R White

## Other Contributors

cont.

K E White  
Willis S White Jr  
Howard E Whitehead  
P R Whiteley  
John P Whitley  
John A Whitman  
D I Whitmoyer  
Cynthia K Whitney  
Jimmy W Wickiser  
E T Wiggins  
G L Wilcox  
Thomas G Wildman  
John F Wilhelm  
George O Wilkinson Sr  
Roger A C Williams  
R H Williamson  
Scott D Willingham

FM Willmoth  
Eric L Wilson  
F J Wilson  
Samuel C Wilson Jr  
T L Wilson  
F C Wimsatt  
Koon Chi Wing  
Robert Y Wing  
W Winglar  
Frank A Winiger  
Rudolf Winkelmann  
Ronald M Winn  
C N Winningstad  
Stefan L Wipf  
Adi Wiratama  
Gregory P Wirth  
Erling H Wold  
Barnet A Wolff  
Mathis Wolfgang  
L M Wolman

Peter M Wolter  
C S Wong  
G H Wong  
Wa Peng Wong  
Wilfred C Wong  
James Wood Jr  
Samuel A Wood  
Mark L Woodhouse  
A J Woodley  
Ronald D Woods  
Bernard T Wooters  
C N Works  
Frederick J Woyach  
Malcolm T Wright  
Long Wu  
Kongshi Xu  
Goro Yabe  
Koji Yada  
Takashi Yahagi  
Yoji Yamada

Cemal G Yamalioglu  
Jiro Yamasaki  
Kimio Yamashita  
Shigeru Yanagawa  
Andrew T Yanchak  
Frank S Yang  
Hung-Pin D Yang  
Ju-Yuan D Yang  
Nicholas W Yang  
Wei-Ting Yang  
H Yanofsky  
Kenichiro Yashiro  
Kuo S Yeh  
Winston Yen  
Swee-Ping Yeo  
O Ying-Lie  
Bunkichi Yoda  
Tomoo Yoda  
Mitsuo Yokoyama  
Ryuzo Yokoyama

Hyo Sub Yoon  
R A York  
Junichi Yoshida  
Minoru Yoshida  
Isami Yoshihara  
Naoo Yoshimura  
Mamiro Yoshizawa  
Toshiaki Yoshizumi  
H D Young  
Patrick S Young  
Cheng-Cheh Yu  
Liang C Yu  
Pao Ta Yu  
Priscilla I Yu  
Ho Yu-Tak  
Serdar Yurdakul  
L J Zahora  
Anthony Zaide  
Mehmet S Zaim  
Raymond A Zalewski

G Rivera Zambrano  
Miguel A Zarabozo  
Peter A Zarcades  
Robert R Zelandi  
Ilija Zeljkovic  
Lorenzo Zennaro  
Mike Zerkus  
C H Zierdt Jr  
E C Ruffian Zilbermann  
W O Zimmerman Jr  
Primo Zingaretti  
Jeffrey W Zink  
W A Znaniecki  
Michael Zofchak  
John A Zulaski  
F J Zupancic  
R Zweigler

Our sincere thanks to everyone who has contributed to the Center. This list of 1993 contributors is complete through Oct. 10, 1993

## New Film and Video Hardware Exhibit

"Creating a Collection: Film and Video Technology", a major exhibition surveying a century of moving image technology, has opened at the American Museum of the Moving Image. This exhibition includes nearly one thousand pieces of film and video equipment, constituting a comprehensive view of moving image hardware from *fin de siecle* peep shows to the home video revolution. The museum's technology collection, considered to be one of the largest and most comprehensive in the world in this subject area, features motion picture cameras and projectors, grip and studio equipment, editing equipment and laboratory apparatus. Also included in the exhibit are television cameras and receivers, video recorders, electronic testing and control equipment, and sound

recording equipment for film and video production. "Creating a Collection" includes studio, industrial and amateur equipment. The exhibition traces the development of the motion picture projector from the first crude gear boxes of the 1890s to the sophisticated behemoths used in the largest picture palaces. Bulky mechanical television sets of the 1920s are set against the space age Philco Predicta of 1959. With hundreds of examples, the evolution of microphones, light meters, and video recorders is similarly charted.

The American Museum of the Moving Image is located in New York City at the Astoria Studios, the largest, busiest and most significant motion picture facility between London and Hollywood. For

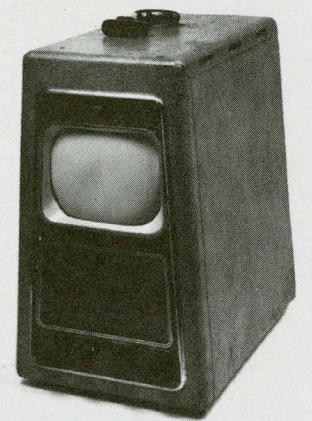
## Australian Electrotechnology

A collection of photographic images of electrical technology in Australia is being processed by the Australian Science Archives Project (ASAP), in cooperation with the Public Record Office of Victoria (PROV) and ScienceWorks museum. The three groups will survey, rehouse and prepare the 100,000-image collection of the State Electricity Commission of Victoria for eventual transfer to PROV's Laverton repository. Before the transfer is made, ScienceWorks will select approximately 5,000 images for their image database system, allowing users to preview the images on-screen before they request copies. ASAP will publish a brief guide to the collection. For more information, contact ASAP, Canberra Office, GPO Box 783, Canberra ACT 2601, tel. (06) 257 7985. ■

## EE History in South Africa

The South African Institute of Electrical Engineers (SAIEE) is contributing to the world-wide effort to promote the understanding of electrical engineering history through the support of a Historical Interest Group. Recent activities of the group include publication of historical articles in *Elektron*, the official journal of the SAIEE, tours of museums and industrial sites, and presentation of historical papers at SAIEE functions. The group is also storing electrical artifacts, including a Siemens punched paper tape recorder, a GEC table model radio (BC4652), and two Nevitron single phase mercury arc grid controlled rectifiers, in anticipation of securing the resources to open a museum of engineering. The group is willing to accept contributions of artifacts and books. For more information, contact the HIG of the SAIEE, Box 93541, Yeoville 2143, South Africa. ■

more information, contact the American Museum of the Moving Image, 35 Avenue at 36 Street, Astoria, NY 11106, tel. (718) 784-4520. ■



Airline Television circa 1950

## Domestic Electrical Technology Exhibit

Household appliances, some of the most visible of electrical technologies, is the subject of an exhibit running until January 2, 1994 at the Cooper-Hewitt National Museum of Design in New York City. The exhibit, entitled "Mechanical Brides: Women and Machines from Home to Office" focuses on three groups of appliances designed to reduce labor: cleaning and cooking equipment, telephones, and typewriters. Using advertisements to illustrate marketing strategies, the exhibit critically examines the impact so-called "labor-saving appliances" have had on women's lives, contrasting the promise of these devices with the frequently different reality. ■



## In Memoriam: Andrei Silard

The Center is saddened to report the death of one of its History Committee members, Dr. Andrei Silard, a faculty member in the department of electronics at the Polytechnic Institut in Bucharest, Romania. Dr. Silard was a Fellow of the IEEE for his contributions to silicon power and photonic devices. He had an undergraduate degree in history and a strong interest in the history of electrotechnology. He died earlier this year, after a long illness, at the age of 49. His place on the History Committee is being filled for the remainder of this year by Dr. Anna Guagnini of the University of Bologna, a professional historian engaged in writing about Marconi. ■

## History of Information Processing Fellowship

The Charles Babbage Institute is accepting applications for the Adelle and Erwin Tomash Graduate Fellowship to be awarded for the 1994-95 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 social, institutional or legal contexts of computing.

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

We are grateful to the organizations and individuals listed below who provide generous support to the center in the form of operating, endowment, and project funding. If you or your organization are interested in joining our Partnership Program, please contact the Director, Dr. William Aspray.

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We are also grateful to the thousands of individuals and institutions who make annual contributions to our Friends Fund.

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

There is no special application form. 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.

Complete application materials should be received by January 15, 1994 by the Charles Babbage Institute, University of Minnesota, 103 Walter Library, 117 Pleasant Street S.E., Minneapolis, MN 55455, tel. (612) 624-5050. ■

Center for the History of Electrical Engineering  
Institute of Electrical and Electronics Engineers  
445 Hoes Lane, P.O. Box 1331  
Piscataway, NJ 08855-1331

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