IEEE History Center

ISSUE 64, March 2004

STATIC FROM THE DIRECTOR

You will notice a new look for the newsletter beginning with this issue. This is the annual issue where we thank you, our loyal supporters [see page 8]. You once again came through last year, a year in which the U.S. and global economies only just began to recover in our sector, and so we find ourselves once again deeply grateful to you. As you will see from articles throughout this issue, our programs such as Milestones [page 3] and the IEEE Virtual Museum [page 16] continued to blossom in 2003. Another way we try to show our gratitude is by sending you an interesting and attractive newsletter to help you keep abreast of our activities. In that light, I am happy to report that the prospects for 2004 look just as exciting, and here are just a few examples:

Marconi receiving an honorary degree from Columbia University

First, the IEEE Virtual Museum shows no sign of letting up. The analysis of a recently conducted Web survey should give us even a better idea of the nature of our visitors, what they want, and how to reach them. This is a program that particularly relies on the support of our individual donors. We appreciate what you have done to help build this award-winning site.

Next, IEEE Sections and other organizational units continue to increase their interest in the IEEE Milestones Program. Besides the three nominations recently approved, four more are under consideration by the IEEE History Committee, and countless proposals are in the pipeline from every Region and in every imaginable technical area.

One of those recently approved Milestones—the Fleming Valve—will be dedicated in conjunction with our conference on the history of electronics [see page 2]. The overwhelming response to our call for papers shows the important and unique role that the IEEE History Center plays in bringing together engineers, social scientists, hobbyists, and others to explore issues in the history of IEEE technologies.

Finally, 2004 presents opportunities for the History Center to shine in another arena in which we uniquely serve the cause of researching, preserving, and promoting electrical, electronic and computer history—our ability to partner with more narrowly focused organizations. Regular followers of our programs will remember when we aided the National Academy of Engineering in their millennial project to recognize the greatest engineering achievements of the 20th century. The resulting Website garnered a great deal of attention for engineering and for the IEEE History Center. Now, that project has resulted in a beautiful coffee-table book that should reach even more people [see page 7].

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THE STATE UNIVERSITY OF NEW JERSEY RUTGERS

CENTER ACTIVITIES

The newsletter reports on the activities of the Center and on new resources and projects in electrical and computer history. It is published three times each year by the IEEE History Center.

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Static from the Director *(continued from page 1)*

This year will be the 100th anniversary of Eta Kappa Nu, and the 30th anniversary of the Marconi Fellows Foundation at Columbia University.

We will be working with each of these organizations to help them commemorate their milestone, with Eta Kappa Nu under a grant from the IEEE Foundation, and with the Marconi Foundation with a grant from itself. These partnerships enable us to leverage our expertise with the resources of other institutions to further public awareness of, and appreciation for, the role of the engineer. At the same time it will help those institutions build their constituencies, and help the History Center enhance our own resources, such as our important oral history collection.

So, once again, thank you for your continuing support and be sure to continue to follow our activities through the newsletter and on our Website.

IEEE History of Electronics Conference at Bletchley Park

As reported more fully in the last newsletter, the IEEE History Center and the IEEE History Committee are organizing a conference on the history of electronics to be held this summer in Bletchley Park, England from Monday 28 June through Wednesday 30 June. The conference will be held in the Victorian mansion that was the center of British codebreaking efforts during World War II. Also on the park-like grounds are buildings from that time containing historical exhibits including a reconstructed Colossus computer.

The IEEE conference on the history of electronics is part of the celebration of the centennial of John Ambrose Fleming's diode electron tube, the first of the radio tubes. Following the IEEE conference there will be a conference on Fleming at University College, London and the annual history conference of the British Institute of Electrical Engineers, both held in London. Information is available at **www.ieee.org/organizations/history_center/Che2004/index.html.**

Mystery Photograph Challenge #14

The IEEE History Center maintains a photographic archive of more than 3,700 images. From time to time images are donated without any identification. Can you help identify this photograph? We are interested in any details such as type of equipment, approximate dates, manufacturer, how and where used, and anything else of historical interest you would like to tell us.

The IEEE History Center has a webpage that features the mystery photograph challenge. You may email us your answer at **history@ieee.org**, or you can fill out an on-line form.
www.ieee.org/organizations/history_center/mystery_photo.html

Dolgeville Mills

Located a short distance to the north of Little Falls, NY, the Dolgeville Mills complex is a fascinating piece of 19th-century industrial history and, in particular, of electrical engineering history. In 1879, the owner of the mill, Alfred Dolge, installed a 600hp water turbine to power the machinery in his felt works. In 1881, he had the Edison Electric Light Company install a dynamo to provide electric lighting in the plant. This makes the Dolgeville Mills hydroelectric installation one of the earliest hydroelectric plants. The electric light represented an advance because it allowed the factory to run 24 hours a day, as well as being safer around flammable cloth than oil or gas lights. A Westinghouse alternating current generator was installed in 1908, and it is still in service and generating power as part of Niagara Mohawk's grid.

The factory itself, a handsome limestone building, was erected in 1886, and has been converted to shops. For more information, see the website at: **www.dolgevillemill.com**

Dolgeville Mills Switchboard, circa 1910, copyright Dolgeville Mills

Dolgeville Mills Alternator, copyright Dolgeville Mills

Surf City

March is Women's History Month; learn more about some fascinating engineers at the following sites:

National Women's Hall of Fame - The web site provides short biographies of women in all walks of life, from (a few) engineers to entertainment. One biography worth noting is that of Beatrice Hicks, who earned degrees in chemical engineering, electrical engineering and physics. She was the first woman engineer employed by Western Electric Company. We hope that they add more engineers! **www.greatwomen.org**

Center for Women and Information Technology, located at the University of Maryland, Baltimore County (UMBC) has a mission to encourage more women and girls to study computer science and/or information systems and to pursue careers in IT. The web site provides resources for women and girls, including how to get started in the IT field, financial aid, and even career change information. **www.umbc.edu/cwit/index.html**

Introduce a Girl to Engineering Day is promoted by NATIONAL ENGINEERS WEEK on an annual basis. IEEE is the lead institution in 2004. The E-Week web site offers many resources, especially for girls who might be interested in engineering. Help educate the students about what engineers really do, and how they make a difference in society. **www.eweek.org**

Upcoming Milestones

At its November meeting, the IEEE Executive Committee approved three new milestones: The Decew Falls Hydroelectric project, the civilian experimental boiling water nuclear reactor (EBR-I), and the Fleming Diode. The Decew Falls milestone is sponsored by the IEEE Hamilton Section, the EBR-I milestone by the IEEE Eastern Idaho Section, and the Fleming Diode by the UKRI Section.

DECEW FALLS HYDRO-ELECTRIC PLANT

The Decew Falls Hydro-Electric Development was a pioneering project in the generation and transmission of electrical energy at higher voltages and at greater distances in Canada. On 25 August 1898 this station transmitted power at 22,500 Volts, 66 2/3 Hz, two-phase, a distance of 56 km to Hamilton, Ontario. Using the higher voltage permitted efficient transmission over that distance.

DeCew Falls No. 1 Plant, the first plant at DeCew Falls, is two miles from St. Catharines, and was built by the Cataract Power Company to supply power to Hamilton, a distance of 35 miles. It draws water from Lake Erie through the Welland Canal, with a storage reservoir in Lake Gibson. Seven steel penstocks are supported on the hillside by concrete piers. The direct-connected, turbo-generator units are mounted horizontally on a gravel foundation. The tail-water is carried downstream in Twelve Mile Creek to Lake Ontario at Port Dalhousie. The head is 260 feet. This plant began operation with two 1,500-hp units on 26 August 1898; two 3,000-hp units were added in 1900; the plant was completed in 1912 with a total output of 44,600 kVA at 66 2/3 cycles. It supplied power to Hamilton several years before Niagara power reached Toronto. In 1930 it was bought by Ontario Hydro and converted to 60 cycles. This is the oldest Niagara plant still operating.

The Milestone dedication ceremony has been scheduled for 2 May 2004

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Upcoming Milestones

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EXPERIMENTAL BREEDER REACTOR # 1
At this facility on 20 December 1951 electricity was first generated from the heat produced by a sustained nuclear reaction providing steam to a turbine generator. This event inaugurated the nuclear power industry in the United States. On 4 June 1953 EBR-I provided the first proof of "breeding" capability, producing one atom of nuclear fuel for each atom burned, and later produced electricity using a plutonium core reactor.

After World War II, the newly established Atomic Energy Commission (dissolved in 1974 and its responsibilities transferred to other agencies) assigned some of the nation's nuclear skills and resources to developing peaceful uses of the atom. The large bodies of uranium ore found in the 1950s were unknown then, and, since uranium was in very short supply, it was decided that the first power reactor would attempt to prove the theory of fuel breeding.

EBR-I construction began in late 1949 at the National Reactor Testing Station in Idaho, USA, now called the Idaho National Engineering and Environmental Laboratory. Early in 1951, a few months before the EBR-I building was completed, nine staff members from the Atomic Energy

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REFERENCE REQUESTS

Movie Studio Consults History Center

As one of its services, the IEEE History Center answers reference requests from scholars, researchers, government policy-makers, the news media, and the general public. An interesting reference request this year came from a movie studio preparing a feature film starring Russell Crowe ("A Beautiful Mind," "Master and Commander") and seeking information about the equipment and procedure used for connection and metering of electrical service in Newark NJ in the 1920s. The film, "Cinderella Man," is the story of a boxer, Jim Braddock whose career spanned the 1920-30s. In the film there is a period when Braddock cannot box because of an injury and struggles to support his family doing manual labor. In one scene (in winter) Mrs. Braddock watches helplessly as the utility serviceman disconnects their electrical service because the bill has not been paid for several months.
For past examples of electrical engineering in the movies, see page 5.

REMINISCENCES

The $27.00 Microwave Oven

Guest column contributed by Arnold M. Bucksbaum, SM

Looking over the advertisements, I see a microwave oven for sale for $27.00. This is almost unbelievable.

When I arrived at Amana engineering in July 1968, Amana was building 40 ovens a day and soon would be starting a new production line that had unlimited production capability. The magnetron for generating the microwave energy was costing more than 20% of the price of the oven and was not truly a mass-produced item. It used a very large coil of copper wire for the magnetic field. Again it was very expensive. Measuring energy leaking from the door seal was very crudely done. The instrument was really designed for measurement of energy from microwave antennas such as radar or communication antennas. The oven was made of steel with a painted outer cabinet and a stainless steel inner oven cavity into which the microwave energy would enter. There was no metal stirrer for moving the energy around the oven to improve the heating of food nor was there a turntable for rotating the food (these had not been thought of at the time).

There were many production line rejects. The reasons varied. We had ovens of several other manufacturers. Their door seals used a variety of different ways to reduce microwave door leakage. One used a metal braid gasket around the door. It would work for a while until it got dirty. Then, the energy would cause it to burn. The Amana system used a quarterwave choke. Theoretically, when properly positioned in the oven door, the choke was to present a zero impedance to the oven. Equivalently no energy could leak from the oven. But in the early days each oven was somewhat different and the leakage was not consistent from oven to oven. Practical dimensions were found and the result was a truly working choke tuned to the microwave oven frequency. This is similar to tuning in a radio station. When on-frequency, the station is very clearly received. With the microwave oven when the choke is tuned, energy leakage is suppressed.

My work on the door circuit took considerable time, testing, and experimental setups over the years. There is satisfaction when the job is done, when the design goes through production without problems, and when the public accepts the product as useful. The $27 microwave oven, who would have believed it a few years ago? It is very amazing that every oven uses the same door suppressing circuit.

Refrigerators

In the United States in the last decades of the 19th century it became increasingly common for a house to contain an icebox, which kept food cool using ice delivered by the iceman. The ice came from the town's ice plant, produced by a large mechanical refrigerator. Such machines, powered by steam engines, were not practical on a small scale. But in the first decades of the 20th century the development of reliable, small electric motors made a home refrigerator practical. Movies depict this change from the icebox to the refrigerator, as well as the later evolution of the home refrigerator.

The movie "Meet Me in St. Louis" (1944), which takes place in 1903 and 1904, shows an iceman making deliveries with his horse-drawn cart. In the movie "Two Bits" (1995), set in South Philadelphia in 1933, we are reminded of one of the disadvantages of iceboxes when a boy steps in the water that has overflowed from one. (Refrigerators can drip, too, of course, and this is commented on in "Strawberry and Chocolate" (1993), which takes place in 1979.) Even though refrigerators became common in the 1930s, many families were still using iceboxes in the 1950s, as we see in the Alfred Hitchcock classic "Rear Window" (1954).

One of the first home refrigerators to sell in large numbers was the Kelvinator, introduced in 1918. Much more successful was the General Electric Monitor Top (so-called because the top recalled the Civil-War ironclad gunship), which GE began mass-producing in 1926. Its distinctive appearance makes it easy to spot in old movies, such as the 1936 "My Man Godfrey", which shows a double-door Monitor Top in a rich man's apartment.

Refrigerators sometimes play unusual roles in movies. In the 1967 thriller "Wait Until Dark" a blind woman smashes all the lights in an apartment, but forgets about the refrigerator light; the killer props the refrigerator door open in order to use the light. In the Warren Beatty movie "Shampoo" (1975), a refrigerator opens and by its light reveals the identity of two people making love. A refrigerator serves as a portal for supernatural beings in "Ghostbusters" (1984), and in "Hannibal" (2001) Dr. Lecter closes a refrigerator door on Agent Starling's hair and then breaks the door handle off, so that she cannot pursue him.

A refrigerator can reveal something about a person's character. For example, in "Empire of the Sun" (1987) a child of a wealthy family leaves a refrigerator door open, letting it be closed by a servant, and in "Naked Gun" (1988) we see rotten food in Frank Drebbin's refrigerator. In a seedy apartment in the early Woody Allen movie "Take the Money and Run" (1969) a refrigerator serves as a closet. And an unwise use of the appliance is shown in "Beverly Hills Cop" (1984), where a man, in order to keep cool, sits in front of a refrigerator with the door open. As always, we would be grateful for reports from readers of other interesting cinematic depictions of refrigerators. You may contact us at **history@ieee.org**.

Upcoming Milestones

(continued from page 4)

Commission's Argonne National Laboratory arrived on the scene to install the reactor, which they had designed at their lab near Chicago. On 24 August, Walter Zinn and his Argonne staff brought EBR-I to criticality (a controlled, self- sustaining chain reaction) with a core about the size of a football. On 20 December 1951 at 1:50 p.m., the first usable amount of electricity ever generated from nuclear power began flowing from the turbine generator. Four light bulbs glowed brightly to inaugurate the birth of nuclear-generated power. The next day, the experiment was repeated, and sufficient electricity to power the EBR-I building was generated.

EBR-I's chief task was to determine whether scientists' theoretical calculations on fuel breeding would actually be achieved, that more nuclear fuel could be created in a reactor than was consumed during the operation. Early in 1953, laboratory analysis showed that EBR-I was creating one new atom of nuclear fuel for each atom it burned. (Source: Idaho National Engineering and Environmental Laboratory)

The milestone dedication ceremony has been scheduled for 4 June 2004.

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Upcoming Milestones

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FLEMING VALVE, 1904
Beginning in the 1880s Professor John Ambrose Fleming of University College London, investigated the Edison effect, electrical conduction within a glass bulb from an incandescent filament to a metal plate. In 1904 he constructed such a bulb and used it to rectify high frequency oscillations and thus detect wireless signals. The same year Fleming patented the device, later known as the 'Fleming valve.'

During the early 1900s, Professor Fleming studied wireless telegraphy detection. Having previously investigated the Edison effect that showed that an Edison lamp exhibited unilateral conduction, he discovered such lamps also rectified radio frequency oscillations.

This was the first successful rectification of radio waves, and essentially the birth of radio frequency "valve" (tube) technology. For a number of decades, vacuum devices emanating from this invention by Fleming proved to be the main component of a huge array of electronic devices. Not until the early 60s, with the mass production of semiconductor components, was the vacuum tube superseded. However, for many specialist applications in fields from high-fidelity audio to microwave generation, devices whose origins can be clearly traced to Fleming's experiments in 1904, are still vital.

The milestone dedication ceremony is expected to take place in June 2004.

For more information contact:

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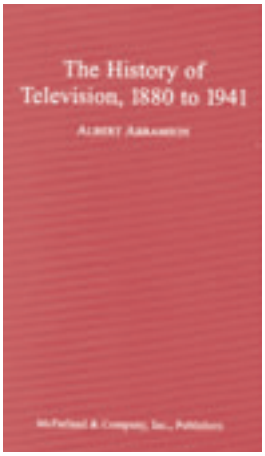
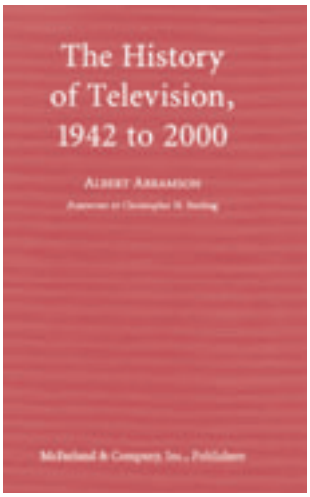


The History of Television, 1942-2000 is the long-awaited sequel to Abramson's previous book, *The History of Television, 1880-1941* (McFarland & Company, 1987). Because the first volume has been reprinted to correspond with the release of the second, and because the first volume predates the beginning of this newsletter series, this review will treat the two volumes together. As Abramson himself wrote in the introduction to the new volume, the two volumes were conceived of and researched as one work. Abramson died at age 81 in December 2003, just after the publication of this, his life's work.

Abramson, a retired CBS television engineer himself, is the author of two other works on television history, *Electronic Motion Pictures: A History of the Television Camera* (University of California Press, 1955), and *Zworykin: Pioneer of Television* (University of Illinois Press, 1995). In preparing the two volumes under review here, Abramson set out to do nothing less than to lay out the definitive technological history of television from its earliest origins to the modern day. He by and large succeeded. In the future, anyone with any interest in television history will start with these volumes.

Abramson gives only cursory attention to the content of television broadcasts and political environment in which it flourished, although he addresses these issues when it was relevant to his technical story. Cultural or political historians will want to turn here to understand the technical context and limitations of television as an evolving medium of mass communication. Abramson had a particular knack for explaining complex technology in a straightforward manner.

Both volumes are plainly produced. The second volume, with its larger size and two-column format, is easier on the eyes. Both volumes are also profusely illustrated (the second even more than the first), but the black-and-white photographs are often of poor quality.



Abramson acknowledged this in his introduction to the second volume, and explained that, owing to the constant business reorganization of the industry and the destruction of corporate archives (a problem for all historians of high technology!), in many cases better photographs were not available. He consciously decided that, for his type of history, poor photographs were better than none at all.

With or without the photographs, both volumes contain a wealth of data that will make them invaluable for years to come.

Both volumes are available from McFarland & Company, Inc., Box 611, Jefferson, NC, 28640 USA. 1st Volume: $55.00, ISBN 0-89950-284-9, 368pp., 50 photographs and illustrations, glossary, bibliography, index; 2nd Volume: $75.00, ISBN 0-7864-1220-8, 319pp., 364 photographs, notes, bibliography, index.

CRAGON, HARVEY G., *From Fish to Colossus: How the German Lorenz Cipher Was Broken at Bletchley Park*, Cragon Books, Dallas, TX, USA, 2003

The Lorenz cipher was the high level cipher used by the German army command for a higher volume of point-to-point communications than Enigma machines could handle. The Lorenz machines accommodated teleprinters; they also used an additive cipher which made their messages harder to break than Enigma's. To break the Lorenz ciphers, the British codebreakers required new and faster machines to handle the statistical analysis necessary to recover the wheel and pin settings. *From Fish to Colossus* describes the development of the many machines built to assist the codebreakers: "Heath Robinson," "Tunny," "Dragon" (so-named from the chomping sounds it made), "Proteus," "Aquarius," "Mrs. Miles," and "Colossus." Readers who are interested in engineering will find the many photographs and schematics fascinating, while readers who are curious about the mathematics which underly cryptology will find Cragon's explanations of key lengths, character distribution, superimposition in depth, and double delta wheel settings intriguing and understandable. The material is detailed; this is the nitty-gritty of the machinery and the intellectual quest which led to it.

Colonel Tiltman's breakthrough into the 30 August 1941 messages is given the space it deserves, as is the way the breakthrough allowed him to make certain assumptions about the Lorenz machine enciphering them, eventually allowing for the reverse-engineering of the "Tunny" machine, which was a functioning analog of the Lorenz machine, operational by April 1942.

From Fish to Colossus is excellent for the reader who wants to understand the details of the tasks which went on at Bletchley Park and Dollis Hill, and the tremendous intellectual achievement they represent.

Available from Cragon Books, 8600 Skyline Dr. #1102, Dallas, TX, paper, ISBN 0-9743045-0-6, xii + 146 pp., illus., refs., index.

MAGOUN ALEXANDER B., *David Sarnoff Research Center: RCA Labs to Sarnoff Corporation*, Arcadia Publishing, 2003

This publication is a delightful pictorial history of the heart of the Radio Corporation of America (RCA): its dedicated laboratories in Princeton, NJ. The book chronicles the construction and development of the labs from 1941 to 2002. It contains more than 200 vintage photographs of some of the exceptional engineers and their accomplishments including, for example, James Hillier, Harry Olson, Jan Rajchman and George Heilmeier. Each photograph is accompanied by a description of the individual or technology, short and concise. Magoun begins each of five chapters with introductory paragraphs describing the changing context for innovations covered in that time. The book also shows the social life of the lab, including company picnics, bowling leagues and canoeing, bringing a human side to research and development. The David Sarnoff Library maintains a collection of over 25,000 photographs, and Magoun has selected the very best to illustrate his book. Each is a complementary image of some of the innovations from the Labs, including color television, transistors, digital memory, LCDs, medical electronics and digital video. The author is the executive director of the David Sarnoff Library.

Available from Arcadia Publishing, **www.arcadiapublishing.com**, $19.99, ISBN: 0-7385-1331-0, 128 pp., illust.

National Academy of Engineering Publishes *A Century of Engineering* (with help from the IEEE History Center)

The National Academy of Engineering has just released *A Century of Engineering: Twenty Engineering Achievements That Transformed Our Lives*. The book reflects "…on the tremendous ingenuity and invention that marked the previous hundred years." Twelve of the 20 achievements are specifically electrical technologies, and the remaining eight fields draw heavily on electrical technologies. The IEEE History Center assisted the NAE by reviewing the chapters for historical accuracy, compiling timelines to accompany each chapter, and supplying some of the images used in the book.

Available from National Academies Press, 8700 Spectrum Drive, Landover, MD 20785, **www.nap.edu**, $45.00, hardcover, ISBN 0-309-8908-5, vii + 248 pp., illus., refs., index.

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GIVING SECURITY

Using "Paper Profits" to Preserve IEEE History

By Karen Galuchie, IEEE Development Office

After three long, hard years of decline, many investors are once again seeing their portfolios increase in value. In the United States, investors have the option to avoid capital gains tax and reduce their federal – and perhaps state – income taxes by using the "paper profits" of their appreciated marketable securities to support philanthropic organizations, such as the IEEE History Center. Quite often, investors find that by donating appreciated marketable securities they are able to give more than they ever thought possible.

Here is how it works. By donating appreciated marketable securities that you have held for at least one year, you avoid the capital gains taxes on the "paper profits" and are entitled to a charitable deduction for the full fair value of the asset. You may use this deduction up to 30% of your adjusted gross income in the year of the gift. You are allowed to carryover any unused deduction to help reduce taxes in up to five future tax years.

For example, Dr. Smith purchased 20 shares of XYZ stock in 1988 for $500, this stock is now worth $2,000. Instead of making his annual gift to the IEEE History Center with cash, Dr. Smith decides to donate these 20 shares of stock. The IEEE History Center receives a gift of $2,000 – the fair market value of the stock. Dr. Smith avoids paying $225 capital gains taxes (15% capital gains tax on the $1,500 gain) and since he is in the 33% bracket he saves $660 on his taxes. Thus the net cost to Dr. Smith for this $2,000 charitable contribution is only $1,115.

When thinking about using a marketable security to support philanthropic activities, such as the IEEE History Center, there are two general rules of caution. If the security has decreased in value, it is normally better from a tax perspective to sell the stock, take the capital loss on your tax return, and make a gift with the cash proceeds. Also, appreciated securities that you held for less than one year do not offer the best tax advantages for charitable gift purposes, as the charitable deduction must be based upon your cost basis, not the fair market value.

If you are considering supporting the IEEE History Center with a gift of marketable securities, please check with your financial advisor to determine the best tax advantages for you. To hold a confidential discussion of giving opportunities to the IEEE History Center or request the instructions for transferring marketable securities to the IEEE Foundation, please contact the IEEE Development Office by telephone at +1 732.562.3915 or by electronic mail at k.galuchie@ieee.org. Remember marketable securities include not only stocks and bonds, but shares in mutual funds as well.

"I Speak the Phrase Electric"

As part of the IEEE History Center's work in examining technology and its influence on all fields of human activity, the History Center newsletter from time to time examines the influence of electrical engineering on language, and not solely upon English. We want to document EE's effect on as many languages as we can, and we invite readers to send us their favorite examples. Here are some of ours:

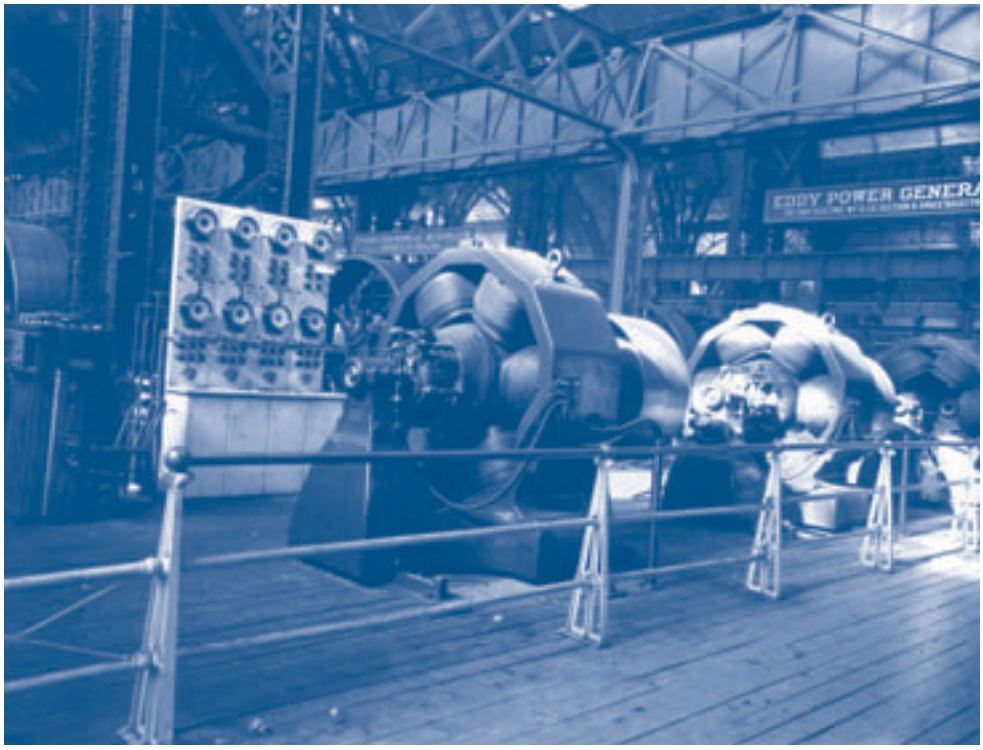
An early example of an electrical term used metaphorically is 'dynamo'. The word itself, a shortening of 'dynamo-electric machine', dates from about 1882 (and the longer form seems to have been coined, in its German form, by Werner Siemens in 1867). Just a decade later, in 1892, the English author George Meredith used 'dynamo' metaphorically, writing of a character's "whirring dynamo of a brain". In 1904 the Irish critic Edward Dowden–extending the metaphor to the output of the machine–wrote of a "stream of moral electricity worked from a dynamo of the will". In 1918 John Galsworthy's Man of Property contained the pleasant image of "the gentle beating of the dynamos of memory". (Word lovers, we might add, are grateful to 'dynamo' for giving us one of the best palindromes: "So many dynamos!")

To be 'on the same wavelength' (être sur la même longueur d'onde) is another early metaphor. It shares space in the vernacular with 'to be on the same page'; it will be interesting to see whether languages retain both electronic and paper 'media' metaphors.

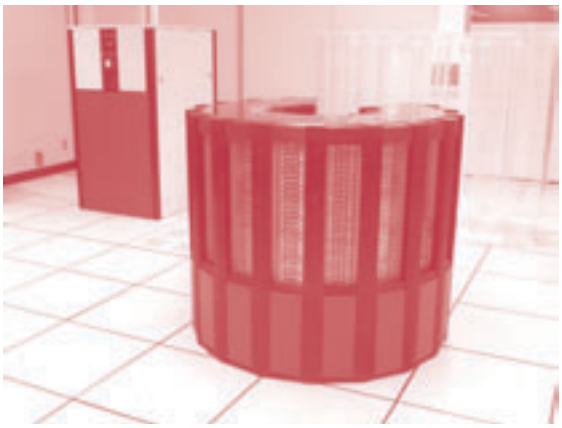
'Hard-wired' has entered popular speech in ways which often make one wonder if the speakers truly understand what it means. To describe certain behaviors as having been hard-wired into the human brain by millennia of evolution is a little hard to picture, given the tremendous adaptability and flexibility of that organ. 'Hard-wired' to describe the brain crosses language barriers: in German we find "…sind solche Dinge im Kopf fest verdrahtet?"

The Free On-Line Dictionary of Computing defines 'hard-wired' as an aspect of an electronic circuit which is determined by the wiring of the hardware, as opposed to being programmable in software or controlled by a switch, or – by extension – anything that is not modifiable, especially in the sense of customisable to one's particular needs or tastes.

'Hard-wired management,' and 'hard-wired learning' (there are books on how to do both) imply – probably unintentionally – inflexibility and inability to respond to changing business situations. Perhaps this explains partially the spate of recent bankruptcies. Spiritual psychologists tell us "we are hard-wired for the infinite." (Er, would that be coaxial, or twisted pair?). A journal article touts a newly appoited school district assistant superintendent of technology as being "hard-wired for educational excellence." (Could be a problem if he likes to go swimming.) Hard-wired has become a clothing brand name, the title of at least two pop songs, and an album. However, it looks as if the expression "hard-wired" is not so hard after all, and use has softened its meaning greatly. People use it when they really just mean "predisposed to."



So many dynamos. *Courtesy of Smithsonian Institution*



Over the last few months some great things have been happening at the IEEE Virtual Museum—a new exhibit opened and we received some very high-profile recognition.

Launched in December 2003, the VM's newest exhibit, *World War II: How War Impacted Technology; How Technology Impacted War*, takes a look back at a tumultuous time in history. After presenting a brief primer on the causes of the war, the exhibit explores the history of some of the technologies and developments that transformed the way war is fought, such as aircraft carriers, tanks, aerial bombing, and the atomic bomb. *World War II* also examines the "battlefield" of the laboratory, where engineers and scientists on both sides scrambled to develop technologies that not only affected the war, but laid the groundwork for many later developments, including space exploration, computing, and radar. In addition to charting the technological growth spurred on by the war, *World War II* also examines the home front activities of the Allies and the Axis as well as the role women played in the war effort. As with previous VM exhibits, *World War II* features biographies of those directly involved in the story as well as a look at historical milestones in the development and/or application of technology. The exhibit can be found at (**www.ieee.org/museum**).

With the addition of World War II, the VM now contains six full exhibits, comprising more than 300 pages of original content. As the museum becomes increasingly comprehensive, those in the media are taking note. In late 2003 the VM received word that *PC Magazine*, which had named it a Site of the Week earlier in the year, chose the VM as one of its Top 101 Most Incredibly Useful Sites of 2003. Then, in late January, the site was chosen as a Cool Site of the Day by radio personality and *USA Today* columnist Kim Komando. In her commentary Komando described the VM as "shockingly good" and added, "a virtual museum created by the IEEE doesn't sound very interesting. Surprisingly, it is." Reviews like these are especially gratifying as they affirm that the VM is fulfilling a vital part of its mission—disseminating the history of electrical engineering and technology to a mass audience and raising the profile of the IEEE among non-members. IEEE members know how vital technology is to our social and cultural fabric. With the growth and increased exposure of the VM, others are beginning to recognize it too.

In 2004, the VM faces the challenge of adding new content and reaching a broader audience within the confines of limited resources. As you are aware, the IEEE Virtual Museum—like the rest of the History Center's programs—relies heavily on the generosity of its friends and supporters. As we build a bigger and better museum, the continued support of our friends and supporters is vital to our development.

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