potential of limiting the increase in energy consumption over the next 20 years to only 10 or 15 percent more than current consumption; moreover, a healthy economy could be maintained, with more jobs available than if the emphasis were on increasing energy supplies instead of increasing energy efficiency. An increase in coal-fired and nuclear electricity generation would be necessary under this CEQ scenario, but not more than would be provided by plants already under construction or on order.

The conserver society has not become a big theme yet in White House rhetoric. But the President did speak of it in the talk he gave at the White House on 29 February to environmentalists attending the Second Environmental Decade celebration. Speth had arranged this affair partly in an effort to keep Carter on the right side of the environmental constituency that helped elect him in 1976.

How often, and with what emphasis, the President returns to the conserver society theme in this political season is uncertain. But given the theme's controversial implications and the President's cautious political style, it may not become a major part of his 1980 campaign.

Nonetheless, Speth and CEQ are fitting together the diverse elements of a plan for the conserver society. These elements include: strengthening, not weakening, the fabric of environmental regulation, a fabric which Speth believes may be more vulnerable than many people imagine; looking to the protection of the country's prime farm land, scenic rural landscapes, and environmentally sensitive coastal resources, such as barrier islands; slowing down growth in energy consumption through conservation and accelerating development of renewable energy sources; leading a worldwide effort to protect the global commons from threats such as an excessive buildup of carbon dioxide in the atmosphere, the destruction of tropical rain forests, and desertification; and, by relying increasingly on energy conservation and renewable resources at home, enhancing U.S. leadership abroad in efforts to help the world's poor, share fossil fuel resources more equitably, and reduce the risks of nuclear weapons proliferation.

But Speth thinks the conserver society may be impossible to achieve unless the influence of corporations is checked through reform of political campaign financing. He has called, too, for reform of the way companies are governed. "The legal institutions for corporate governance—the stockholders and the directors—function too often as little more than rubber stamps for management decisions," he said recently. "Those that are affected most by the corporations' actions—labor, consumers, the community at large—have the least to say in its decisions. As a solution to these ills, I think the time has come for a healthy dose of democracy in corporate decision-making."

He would have the stockholders themselves elect a number of "public directors" to serve on the corporate boards, and would have the companies issue periodic "social reports," as is now required in West Germany and some other European countries.

Jimmy Carter seems especially unlikely this year to beard the lions of industry by pushing for reform of corporate governance. Moreover, if the recent past is any guide, he will downplay environmental regulation, too. But, should he ever give the sign, Speth and company are ready to help him spell out an ambitious agenda for the conserver society.

—LUTHER J. CARTER

Bern Dibner: Science Bibliophile

Library founded by inventor-entrepreneur is a unique repository of the seeds of modern science

Bern Dibner, head of the Burndy Corporation and owner of the world's largest collection of books devoted to the history of science, is a modest and delightful human being who probably comes as close as anyone does these days to being a Renaissance man. This is no accident, because for almost the past half-century Dibner has been influenced by that model of the successful marriage of science and humanism, Leonardo da Vinci.

Dibner has long been known to historians of science and antiquarian book dealers around the world. At present, visitors to the Smithsonian Institution are learning a little about his collection, because the Museum of History and Technology is staging a small but striking exhibit of books from among the 11,000 that Dibner donated to the institution in 1974. The occasion is the 25th anniversary of the first publication of *Heralds of Science*, a catalog compiled by Dibner of 200 seminal contributions to science since the invention of the printing press in 1455.

The exhibition contains such gems as the first edition of Copernicus's *De Revolutionibus Orbium Coelestium*, published in Nuremberg in 1543; Galileo's *Sidereus Nuncius Magna* (Venice, 1610), Newton's *Principia Mathematica* (London, 1687), Darwin's *Origin of Species*, and a 1482 edition of Euclid's book on geometry, the world's oldest science textbook.

These are only the tip of the iceberg of the vast Dibner collection, which, until the "mitosis" involving the Smithsonian, contained more than 40,000 volumes. But the Burndy library in Norwalk, Connecticut, is still a growing concern, still actively headed by its 82-year-old founder.

The Dibner collection is regarded as the most extensive one in the world exclusively devoted to science texts and by far the greatest accumulated by a single individual. "We can match book for book" the items contained in other large repositories such as those at Cambridge University, the Bodleian Library at Oxford, Harvard, and Yale, says Dibner. Although many private collections are difficult for the scholar to gain access to, the Burndy library sends materials to scholars on request. In 1959 it donated a sizable collection of Vinciana to Brandeis University—a collection second only to that amassed by Elmer Belt, an 87-year-old Los Angeles urologist, who has turned over his Leonardo materials to the University of California at Los Angeles.

Dibner, who emigrated to New York with his family from the Ukraine in 1904, began his career at General Electric, with a degree in electrical engineering obtained in 1921 from the New York

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Polytechnic Institute. The first major project of his career was work on electrification in Cuba. In 1924, Dibner's invention of an electrical connecting device led to the founding of his own company, which evolved into a concern comprising 27 manufacturing plants throughout the world.

In the late 1920's the seed was planted for what became his avocation when Dibner read a book called *Men and Machines* by Stuart Chase. The book contained an inventory of all the modern machines invented by or foreshadowed by Leonardo. Dibner thought Chase was giving Leonardo too much credit so he decided to find out the truth for himself. In 1936, when some other businessmen were engaged in throwing themselves out of windows, Dibner took his wife and son on an "industrial sabbatical" to Europe. He spent more than a year on the track of Leonardo, haunting the great libraries and universities of Europe. He found that Chase was right. His pursuit of Leonardo opened the door to all the riches of the Renaissance and to a consuming interest in the impact of technology on human society. As Dibner expressed it, the artifacts from the Renaissance "could prompt any industrialist to relate the excitement of electrical expansion in the late 1930's with the golden days of the Italian republics."

Dibner was ahead of his time. The Burndy library was chartered in 1941, 5 years before the first history of science course in America was established, at Harvard University. World War II was a time when many priceless old books were destroyed—Dibner writes that one bombing raid on Charing Cross in London resulted in the loss of over 4 million rare books—but it also supplied rare book-collecting opportunities for Dibner, who as an Air Force colonel found plenty of opportunity to prowl London's antiquarian book shops, ingratiating himself with sellers by handing out his cigarette rations. It was then, for example, that he picked up a 61-page original manuscript by Isaac Newton.

Dibner won't say how much he paid for things, partly because he doesn't remember and partly because he doesn't think the prices are important. But certainly he got into the science book-collecting game when such items were not very highly valued. "Most collectors are literary collectors," he says. Of old books, those dealing with science were least in demand. They had never been printed in large numbers and "were rarely prepared for publication with an eye to beauty of format and were therefore not collected or preserved for their appearance." This despite the fact that some have strikingly beautiful illustrations, such as the *Herbal* prepared by Leonard Fuchs, which now resides at the Smithsonian.

Prices are now jumping, however. For example, Dibner acquired a copy of William Harvey's book *De Motu Cordis* (on the circulation of blood) at a Paris auction in 1950 for $3600. Last spring a copy from the same edition (Frankfurt, 1628), from which there are about 25 copies extant, sold in London for $193,000—the highest price yet for any science book. Still, prices for such books are not nearly as inflated as prices for stamps. A copy of Newton's *Principia*, of which there are 150 copies, is valued at no more than $20,000.

The rarest of science books are those called incunabula, which means books printed before 1501. Some 6 million volumes in 40,000 titles and editions came forth from the first printing presses, but according to an inventory compiled in 1938, only 1044 titles were of scientific and medical interest. Of these, the Burndy library had 320, all of which are now at the Smithsonian.

Dibner believes that the invention of printing had an even more revolutionary impact on science than on other areas of knowledge. The only way knowledge could be disseminated prior to the development of movable type was by the services of copyists. But in the arcane world of science only the scientist could spot copying errors, so if a scientist wanted to spread his work he virtually had to be he own copyist.

In the seminal days of modern science, the mechanics of dissemination and accrual of knowledge stand out in sharp relief. One can see, for example, how printing fostered the birth of the modern electrical age. It started in Bologna ("the Cambridge, Mass., of Italy in the 1760's" according to Dibner), where the obstetrician Luigi Galvani in his free time was doing experiments at the hospital with dead frogs' legs. He discovered that electrical stimulation caused the legs to twitch and concluded that all living tissue had an innate quality, which he labeled "animal electricity." In 1791 he wrote a book on his experiments, *De Viribus Electricitatis*, of which 12 copies were printed ("he couldn't think of any more people who would be interested in this strange experiment"). One copy was sent to a physics professor at the University of Pavia, Alessandro Volta. Volta, following up on the experiments, concluded—correctly—that two dissimilar metals in contact with the frog nerve were necessary to make it twitch and that the nerve was only acting as a sensitive detector of the phenomenon. This was the discovery of electromagnetism and led to Volta's invention of the voltaic cell. Man had found how to create electric current.

The step this represents is striking when one visits the mezzanine of the

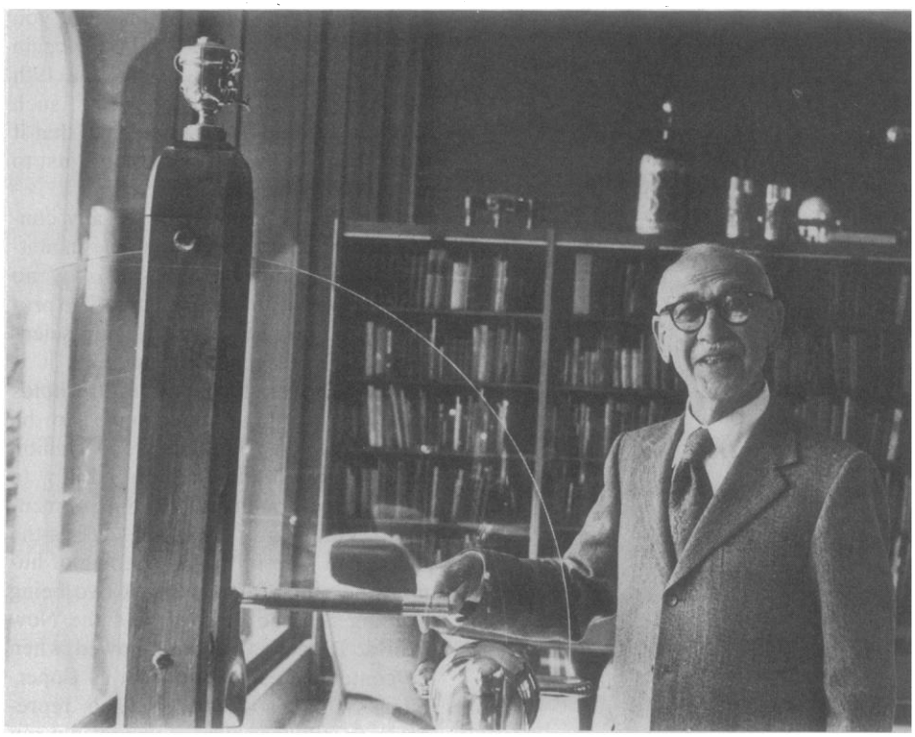

Photo by Constance Holden

Bern Dibner at the handle of an electrostatic generator.

Burndy library, which is all devoted to electricity and electromagnetism. People had been playing with electricity long before Volta, but the only kind they had to work with was static electricity. At the Burndy library a number of electrostatic generators are featured, including a little cupid-adorned device made in Venice in 1740, the "oldest electrical device in the western hemisphere." These generators

From Dibner collection at the Smithsonian—Leonard Fuchs, who, in his celebrated Herbal, *introduced many New World plants and emphasized the medicinal value of others. The American* fuchsias *were named for him. [Photo courtesy of National Museum of History and Technology]*

all have large glass disks that are rotated against a set of nails, which pull off the charge generated. The only practical use of this type of electricity, says Dibner, was the lightning rod developed by Benjamin Franklin.

Dibner feels a very personal connection with his collections. He like the "dirty" books—ones that have cut pages and that contain marginalia by readers, such as Michael Farady's *Experimental Researches in Electricity*, which is crammed with lecture notes added by his successor at the Royal Institution, John Tyndall. Although Leonardo towers above everyone else in Dibner's affections, he also has a special fondness for Franklin and for Samuel F. B. Morse, "the American Leonardo," who was a portrait painter as well as inventor of the telegraph. Of scientists with great moral and philosophical dimension, Einstein seems to be the end of the line. But you never know: Leonardo did not begin to get proper recognition until the 19th century, although he was "of such enormous vision and competence that it would take more than one lifetime just to understand what he did."

Although Dibner cannot see any contemporary scientists comparable in stature to the giants of yore, he is by no means bored with the present. "The proportion of original minds among scientists has never been as great as it is today." Dibner thinks the future holds great things. "Man was confined to the surface of the earth for 500 million years—in my lifetime he learned how to control and command the third dimension." He regards the moon walk as the third giant step in the broadening of humankind's horizons, the first two being printing and the discovery of the New World. Dibner is genuinely awed when he contemplates a book such as Copernicus's *De Revolutionibus*. This represents an advance whose impact did not begin to be felt until 60 years after it was printed. "Who was reading this book and what did they think the first 60 years?" asks Dibner. "Nobody today thinks the sun revolves around the earth but there was a time when only one person in the whole world knew the truth and that was Copernicus."

Dibner's imaginative connection with the past is evidenced by the reverence with which he shows the visitor a 14th-century bronze bell that used to hang in a Florentine monastery. Now it is in the Burndy library, mounted on a stand with low-friction bearings designed by Leonardo. It awes him to think that clangs of this very bell reverberated in the ears of so many creative geniuses of the past, such as Cellini, Michelangelo, Leonardo, and Columbus.

It was painful for Dibner to part with the treasures he has parceled out to other institutions, but these acts are in keeping with his sense of his part in the greater scheme of things, as exemplified in the Talmudic parable of the carob tree: "As my fathers planted for me before I was born, so do I plant for those who will come after me."—CONSTANCE HOLDEN

NRC Skirts Safety Issues in Export Approval

The Nuclear Regulatory Commission (NRC) recently approved the export of a controversial nuclear reactor to the Philippines, deciding as a matter of policy not to consider the detailed safety issues raised by several environmental groups.

The decision clears away the biggest obstacle to continued construction of the Westinghouse reactor near Manila, which environmentalists oppose because of the reactor's proximity to earthquake zones and a long-dormant volcano (*Science*, 31 August 1979). Several groups, including the Union of Concerned Scientists, the Natural Resources Defense Council, and the Center for Law and Social Policy, had petitioned the NRC to conduct a detailed review of the reactor's safety, encompassing design, siting, training of operators, and risks to U.S. servicemen stationed at nearby Navy and Air Force bases on Philippine territory.

A majority of three commissioners (out of five) decided that such a comprehensive review would be operationally awkward, too time-consuming, and too controversial. Commissioner Peter Bradford dissented, calling it "unsound law and bad policy" not to consider more carefully the reactor's impact on the military bases. "I do not mean by the dissent to say that . . . the plant will be unsafe," Bradford says. "The point is that the commission has declined to consider that question." The chairman of the commission, John Ahearne, abstained out of objection to the way the policy issue was taken up, but suggested he too favors a more detailed review.

The environmentalists have filed a lawsuit challenging the NRC's decision, but the chances of victory are seen as slight. The groups must prove that the commission violated federal laws, including the National Environmental Policy Act, the Nuclear Non-Proliferation Act, and the Atomic Energy Act, by electing not to conduct a comprehensive safety review. Most observers agree that the laws are ambiguous in this circumstance.

Renewed construction must also be approved by Philippine President Fer-

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