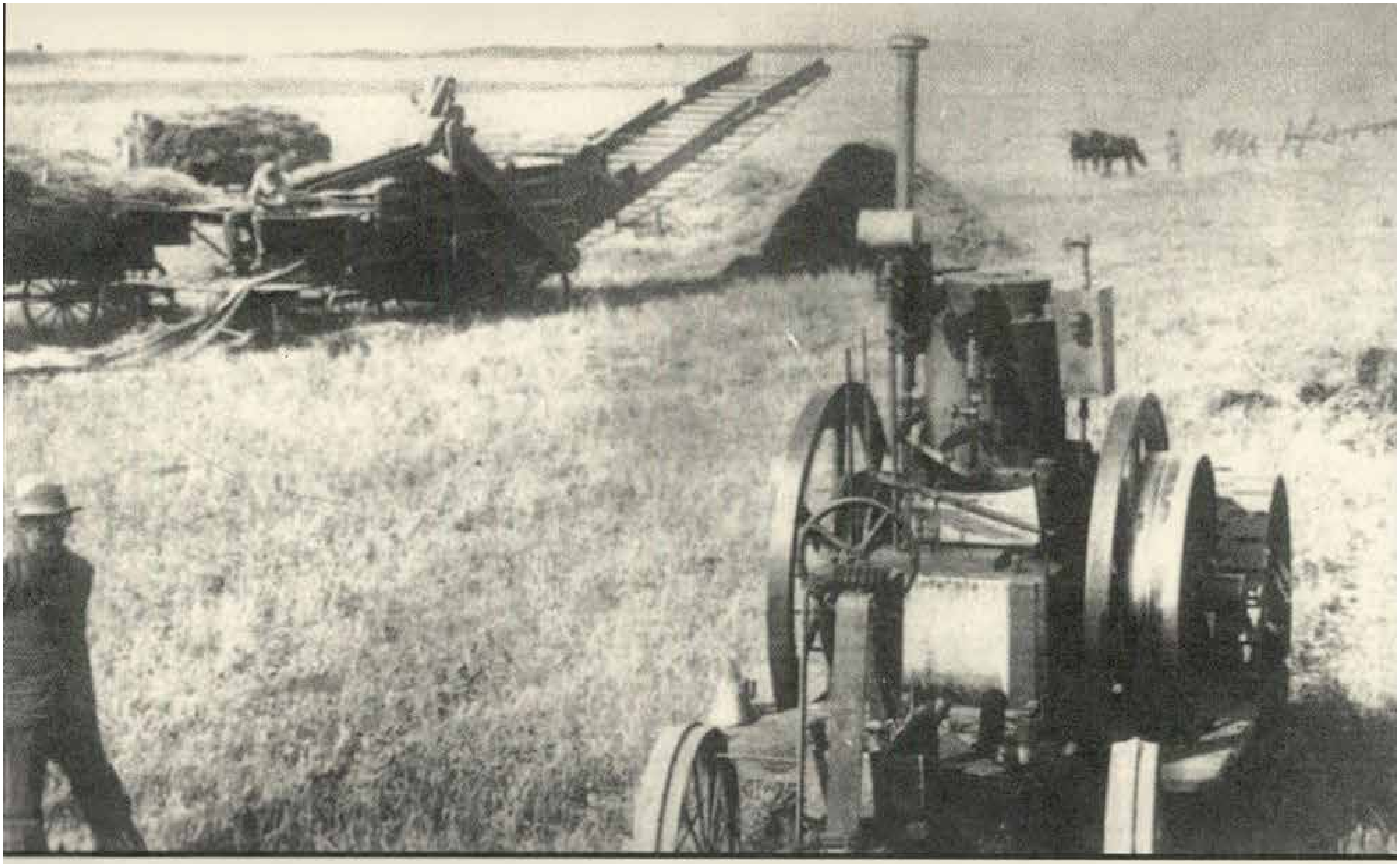
Froelich Tractor in Iowa and South Dakota, 1892 (Photo 1)



The Froelich Tractor in the field—South Dakota, 1892 (Froelich Foundation)

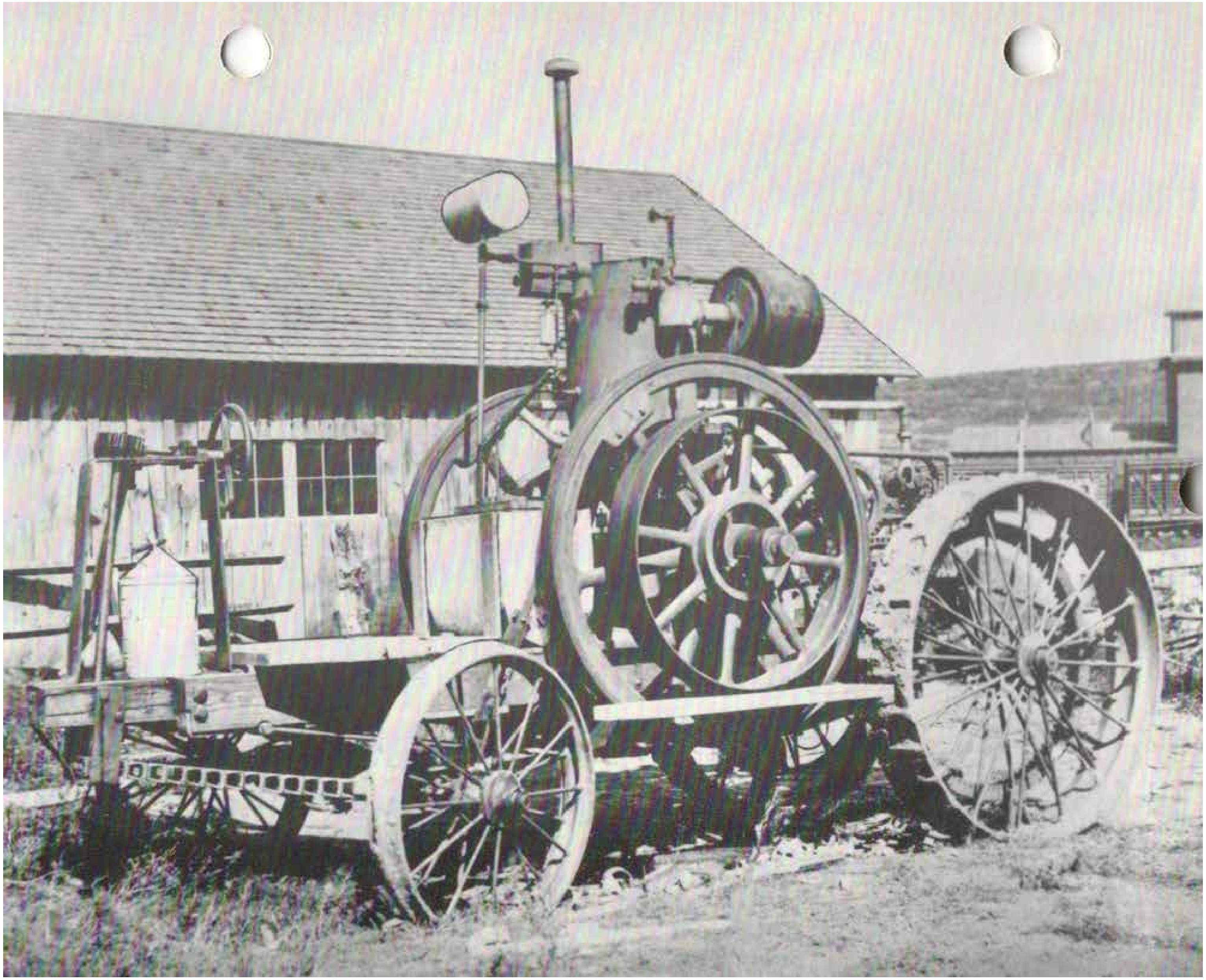
"Froelich Tractor Photos, Langford, South Dakota, and Froelich, Iowa," 1892. Courtesy of Froelich Foundation and Museum

Froelich Tractor in Iowa and South Dakota, 1892 (Photo 2)

John Froelich threshing near Langford, South Dakota in 1892 using his gasoline tractor. (Froelich Foundation)

“Froelich Tractor Photos, Langford, South Dakota, and Froelich, Iowa,” 1892. Courtesy of Froelich Foundation and Museum

Froelich Tractor in Iowa and South Dakota, 1892 (Photo 3)



“Froelich Tractor Photos, Langford, South Dakota, and Froelich, Iowa,” 1892. Courtesy of Froelich Foundation and Museum

Froelich Tractor in Iowa and South Dakota, 1892 (Photo 4)

“Froelich Tractor Photos, Langford, South Dakota, and Froelich, Iowa,” 1892. Courtesy of Froelich Foundation and Museum

Biography of John Froelich from Iowa Inventors Hall of Fame Pamphlet, 1994

JOHN FROELICH

■ Invented gasoline-powered tractor

1849 ■ 1933

INDUCTED 1991

John Froelich helped pave the way for modern farming. In 1892, this native of rural Clayton County, Iowa, produced the first mechanically successful gasoline tractor that propelled itself backward and forward.

He grew up in Froelich, Iowa, which was named for his father, Henry Froelich. John operated an elevator and tinkered with machines to improve their efficiency. One such innovation was mounting a gasoline engine on a well-drilling outfit — an idea that led him to mounting an internal combustion engine on a tractor. A few weeks later, the tractor — the forerunner of today's John Deere tractor — was shipped to Langford, South Dakota, where it threshed some 72,000 bushels over a period of 52 days.

In 1892, this Iowa native produced the first mechanically successful gasolinetractor that propelled itself backward and forward.

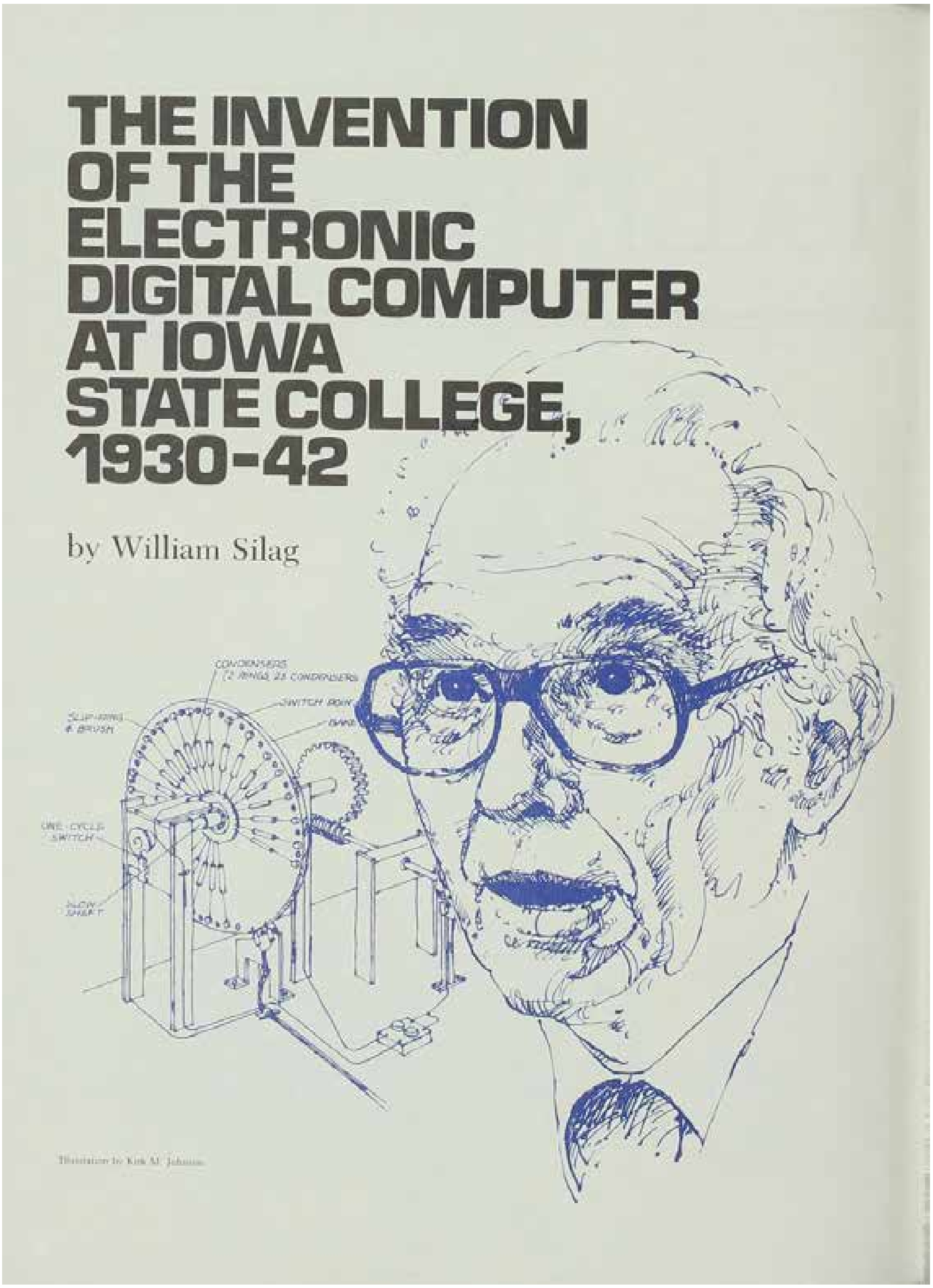
The new gasoline engine tractor was considered cheaper, safer, and easier to care for than a steam-engine tractor. Banking on these advantages, Froelich, with other investors, founded the Waterloo Gasoline Traction Engine Company in 1893. Eventually, this company would become what is today the John Deere Tractor Works.

Froelich received two patents for mechanisms relating to internal combustion engines before moving to Minnesota, where he was granted twelve more patents between 1906 and 1925. Most of these patents related to tractors and internal combustion engines.

His innovations helped to make Waterloo a center of internal combustion engine production in the United States in the early years of this century. ■

Courtesy of State Historical Society of Iowa, 1994

“The Invention of the Electronic Digital Computer” from *The Palimpsest*, September/October 1984 (Pg.1)



THE INVENTION OF THE ELECTRONIC DIGITAL COMPUTER AT IOWA STATE COLLEGE, 1930-42

by William Silag

Illustration by Kirk M. Johnson

Courtesy of State Historical Society of Iowa, Silag, William, “The Invention of the Electronic Digital Computer,” *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

“The Invention of the Electronic Digital Computer” from *The Palimpsest*, September/October 1984 (Pg.2)

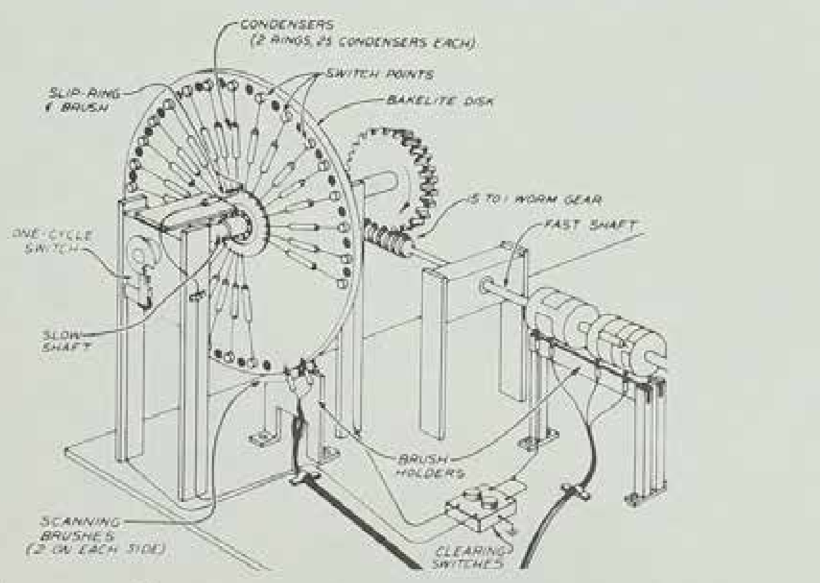
requiring high precision, and most people would not need to use it."

The Prototype, 1939

Progress on the computing machine had thus far been achieved at Atanasoff's desk in Iowa State College's Physics Building rather than in a laboratory or workshop. "All of my work on the capacitor memory and the add-subtract mechanism was entirely theoretical; no experiments were used in deriving the circuits or in checking them." By the end of 1938, however, he was eager to begin building a prototype. "Since the trip to Illinois, I had used more than a year working mostly on jogging and logic circuits for adding and subtracting. I now felt much more confident that the project would be a success and I knew that I could not go on alone." Early in 1939 Atanasoff applied for financial support for the project in the form of a grant from Robert Buchanan, dean of the graduate school at Iowa State College. The requested money, which was to be used for materials and shop work as well as for an assistant's salary, totaled $650. Buchanan approved the request later that spring, and Atanasoff hired Clifford E. Berry, a young graduate student in engineering from Ames. Berry began work with Atanasoff at the start of fall semester 1939.

The two men got along well together from the beginning. "Berry was one of the best things that could have happened to the project," said Atanasoff. "After he had worked for a short time, I knew that he had [not only] the requisite mechanical and electronic skills, but also that he had vision and inventive skills as well."

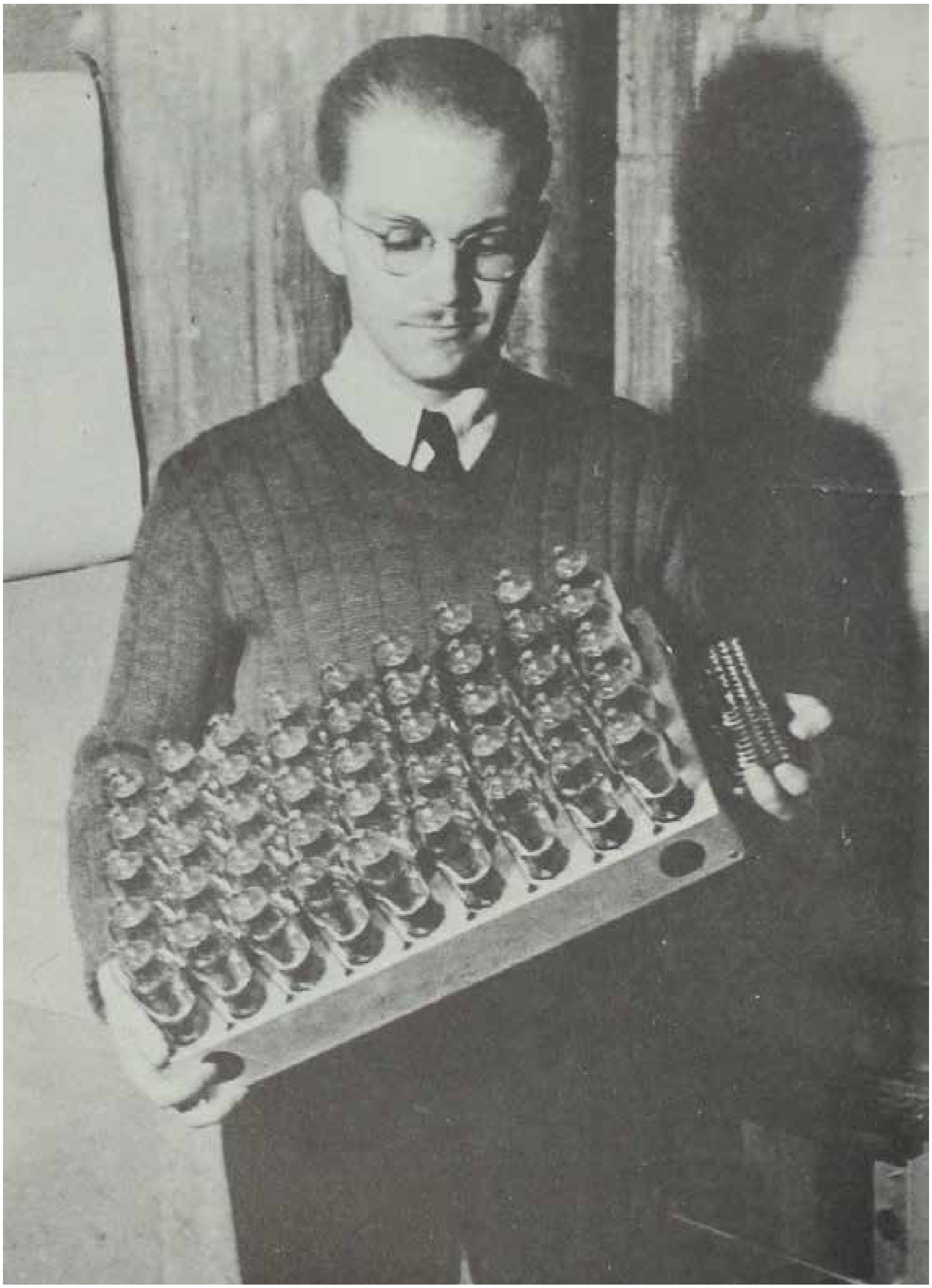
Clifford Edward Berry was just beginning his graduate career when he went to work for Atanasoff. He had read through Atanasoff's plans for the computing machine during the



The prototype of the ABC. (courtesy the Department of Special Collections, ISU library)

Courtesy of State Historical Society of Iowa, Silag, William, “The Invention of the Electronic Digital Computer,” *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

"The Invention of the Electronic Digital Computer" from *The Palimpsest*, September/October 1984 (Pg.3)



Courtesy of State Historical Society of Iowa, Silag, William, "The Invention of the Electronic Digital Computer," *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

“The Invention of the Electronic Digital Computer” from *The Palimpsest*, September/October 1984 (Pg.4)

summer of 1939, and had a good grasp of Atanasoff's goals when he joined the project in September.

Atanasoff had meticulously worked out designs for some parts of the proposed computer, but he had only rough ideas of the remainder of the machine. There was also the complicated business of perfecting the sequence of mathematical steps the computer would use for solving systems of equations, which was, after all, the machine's principal objective. Atanasoff had been thinking about these steps in the preceding months of planning: "I had begun to consider other problems of mathematics and physics to which the new method [of calculation] could be applied. To this end, I suggested to Clifford that we momentarily forget the 'solution of systems' and build a computer. We of course realized that such a computer should and must be a simple gadget. We did not dare to build everything into our plans. Our skill as inventors depended on how well we chose between these factors, the indispensable and the impossible."

In a few weeks a prototype computer began to take shape in their basement workshop in the Physics Building. It was the size of a breadboard, with electrical components mounted on one surface, and could be moved easily around the workshop. "This prototype was designed to work out all of the aspects which worried us about this kind of a computation," Atanasoff explained. It included the key components of a complete calculating machine in scaled-down form and without many of the accessories needed for practical operation, but it allowed the inventors to see where their ideas were leading them. "Almost as soon as the prototype was completed, it began to work very well. The assembly procedure for the logic circuits which Berry had devised made them perfect." The

Left: Clifford E. Berry holding vacuum tubes that were part of the ABC's memory bank, c. 1941 (courtesy the Des Moines Register*)*

first demonstrations of the prototype were conducted in October 1939. "Our visitors who understood what was going on were surprised to find so much structure giving additions and subtractions that were correct."

Atanasoff admitted that the prototype was a very crude device. "It could just add and subtract the binary equivalents of decimal numbers having up to eight places. Nevertheless, Clifford Berry and I regarded this machine as a great success. It settled many doubts about how an electronic computer should be built. . . . [W]e both knew we could build a machine that could do almost anything in the way of computation." A demonstration of the prototype for college officials in December 1939 resulted in a grant of $810 from the Iowa State College Research Council to build a full-scale machine capable of solving systems of equations. Construction of the larger machine, later named the "Atanasoff Berry Computer" [ABC], began immediately after the winter holidays.

The Atanasoff Berry Computer, 1940-1942

"In order to get started fast, I decided to take a chance and estimate the size of the machine. I knew a few dimensions of the various parts that were to go into it [and] without very much figuring, I made an estimate of the size of the total machine and arrived at roughly the size of an office desk." Soon after Christmas, Atanasoff ordered some angle iron for a frame and asked Clifford Berry to start putting it together. "I think I was lucky," he once said, referring to his quick estimates of the size of the frame. "As we progressed we did not often have to redo portions once they were built."

Atanasoff's pioneering vacuum-tube circuitry proved trustworthy in the tests he and Berry conducted with one of the machine's add-subtract mechanisms in January 1940.

Courtesy of State Historical Society of Iowa, Silag, William, “The Invention of the Electronic Digital Computer,” *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

"The Invention of the Electronic Digital Computer" from *The Palimpsest*, September/October 1984 (Pg.5)

Subsequent work on the ABC proceeded with only a few minor difficulties during 1940 and 1941. In May 1942 Atanasoff and Berry completed construction of the machine and began demonstrations and troubleshooting. They had spent about $5,000 on the project, with Berry's salary accounting for much of the money spent. The mathematical processes and most of the engineering features of the Atanasoff Berry Computer seemed faultless: "during the construction of the computer, we had tested and corrected each subsystem, and so the shake-down did not require much time except for one flaw." The flaw had to do with the reliability of the ABC's electric-spark method of punching holes in binary cards. "We had tested the base-two card system rather carefully, but the number of tests was not sufficient to find an error which occurred once in 10,000 or 100,000 times. This meant that when we tested the complete machine, in the spring of 1942, we discovered that the card system was rather good, but not good enough." Determined to establish an error-free computing operation,

Analog computer: A computer that operates by converting numbers into measurable physical quantities, such as the lengths of rod, rotations, or voltages. [A conventional watch offers an example of analog measurement. Time is measured by the relative positions of the hands on the face of the watch. For example, 1:17 is represented by the hour hand between the 1 and 2, and the minute hand between the 3 and 4.]

Binary: A number system using two digits, usually 1 and 0. It is the most common system used in computers. The value of a number is determined by the relative position of 1's and 0's. For example:

decimal number	*binary equivalent*
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
6	00000110
7	00000111
8	00001000
9	00001001
10	00001010

Binary system of counting: Blocks of 1, 2, and powers of 2 ($2 \times 2 = 4$, $2 \times 2 \times 2 = 8$, $2 \times 2 \times 2 \times 2 = 16$, etc.) are used to build numbers that we associate with the decimal number system. A binary number is built from the right column to the left: a 0 in a column indicates that no block of that number is needed, while a 1 in a column indicates that a block of that power of 2 is needed to build the desired number. Thus, the number 3 is built from 1 1-block, and 1 2^1-block (or $1+2=3$). The number four is built from 0 1-block, 0 2^1-block, and 1 2^2-block (or $0+0+4=4$). The number seven is built from 1 1-block, 1 2^1-block, and 1 2^2-block (or $1+2+4=7$). The number ten is built from 0 1-block, 1 2^1-block, 0 2^2-block, and 1 2^3-block (or $0+2+0+8=10$). Large numbers can thus be simply represented for computers using only a system of 1's and 0's.

Bit: A single binary digit, a 1 or 0. A bit is one-eighth of a byte.

Byte: A cluster of eight binary digits. A byte is composed of eight bits.

Capacitor: A device for storing an electrical charge, also called a condenser.

Decimal: The number system using ten digits, 0 through 9. It is the most common system used by people for counting.

Digital computer: A computer that operates with numbers expressed in digits, whether in a decimal, binary, or other number system. [A digital watch indicates time directly in numbers, such as 1:17.]

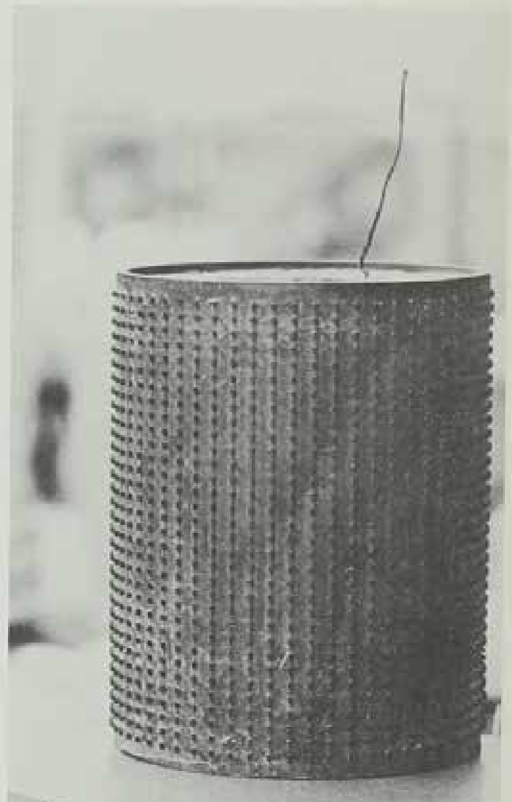
Courtesy of State Historical Society of Iowa, Silag, William, "The Invention of the Electronic Digital Computer," *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

"The Invention of the Electronic Digital Computer" from *The Palimpsest*, September/October 1984 (Pg.6)

neither had any inclination to return to work in Ames. Back at Iowa State College, where the ABC had been stored, the machine was finally dismantled.

Meanwhile, the computer industry had begun to develop and in the mid-1950s patent controversies arose that caused corporate lawyers to begin tracing the ancestry of the electronic digital computer. Several lawyers, working independently, and on different cases, "discovered" Atanasoff, Berry, and the ABC. The first discovery was made by an IBM lawyer in 1954 but Atanasoff did not become a major center of attention in the patent controversies until the mid-1960s, when lawyers for the Honeywell Corporation began building a case that challenged the legitimacy of a patent by which the Sperry Rand Company (manufacturer of the UNIVAC computer) was collecting royalties from its competition, including Honeywell.

The case went to trial in Minneapolis, home of the Honeywell Corporation, in the late 1960s and a decision invalidating the Sperry Rand Company patent was made by Federal



All that remains at Iowa State University of the Atanasoff Berry Computer. (courtesy the Department of Special Collections, ISU library)

An end view of one of the ABC's memory drums. (courtesy the Department of Special Collections, ISU library)

Judge Earl Larson in 1973. Judge Larson's decision named John Vincent Atanasoff as the originator of several of the major engineering concepts on which the rise of the electronic computer, and the computer industry, had taken place in the late 1940s and 1950s. While the court did not grant Atanasoff or anybody else either monetary reward or reassignment of patent rights, the court destroyed all other claims pertaining to the invention of the electronic digital computer, including those advanced by Sperry Rand.

Atanasoff is happy enough with the court's decision. "What each man accomplishes

Courtesy of State Historical Society of Iowa, Silag, William, "The Invention of the Electronic Digital Computer," *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

"The Invention of the Electronic Digital Computer" from *The Palimpsest*, September/October 1984 (Pg.7)

John Vincent Atanasoff in his Maryland workshop, c. 1967. (courtesy the Department of Special Collections, ISU library)

depends on his brains and energy," Atanasoff remarked in an interview a few years ago, "but also on the surroundings in which he works. In this, timing is important." And about the timing of the ABC, he said simply, "I am very grateful that fate should have placed me at the beginning of this great adventure." □

Note on Sources

This essay is based on a larger study of John Vincent Atanasoff and the Atanasoff Berry Computer now in preparation by the author. Primary sources include interviews with John Vincent Atanasoff; the scientific papers, speeches, and correspondence of John Vincent Atanasoff and Clifford Berry, pretrial testimony, recorded on videotape, by John Vincent Atanasoff in connection with United States District Court, Fourth Division, HONEYWELL, INC. V. SPERRY RAND, ET AL., No. 4-67 Civ. 138, decided October 19, 1973; Federal Judge Earl Larson, "Findings of Fact, Conclusions of Law and Order for Judgment," *U.S. Patent Quarterly* 180 (March 1974), 673-773; excerpts from John Vincent Atanasoff, "The Advent of Electronic Digital Computing," forthcoming in the *Annals of the History of Computing*; Arthur W. Burks and Alice R. Burks, "The ENIAC: First General Purpose Electronic Computer," *Annals of the History of Computing* 3 (October 1981), 310-399; and "From One John Vincent Atanasoff," a documentary film produced at Iowa State University under the direction of Steven Knudsen and released in 1983.

Among the secondary sources consulted were: Christopher Evans, *The Making of the Micro* (London, 1981); Kathryn Fishman, *The Computer Establishment* (New York, 1981); Herman H. Goldstine, *The Computer From Pascal to von Neumann* (Princeton, 1972); Dirk Hanson, *The New Alchemists: Silicon Valley and the Microelectronics Revolution* (Boston, 1982); and David Gardner's historical articles published in *Datamation*.

The author wishes to thank John Vincent Atanasoff and Alice Atanasoff for their generosity in responding to inquiries and supplying documentary material. The author is also grateful for assistance and encouragement provided by Steven J. Fuller and Loren N. Horton of the Office of the State Historical Society, by Steven Knudsen, David L. Lendt, Robert Lindemeyer, Richard Lowitt, Michael Mendelson, Robert Ottoson, and Jane Smiley, all of Iowa State University, and by the staff of the Special Collections Department at the Iowa State University library in Ames, particularly Becky Owings.

"The Invention of the Electronic Digital Computer" from *The Palimpsest*, September/October 1984 (Pg.8)

Courtesy of State Historical Society of Iowa, Silag, William, "The Invention of the Electronic Digital Computer," *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

"The Invention of the Electronic Digital Computer" from *The Palimpsest*, September/October 1984 (Pg.9)

The Atanasoff Berry Computer

The Atanasoff Berry Computer embodied four complementary ideas: digital electronic logic circuits, binary enumeration, serial calculation, and regenerative memory. Atanasoff's memory component included a pair of electrical recording devices he called "abaci" elements, one called a keyboard abacus and the other a counter abacus (see illustration of the ABC on page 177). The ABC computed by adding a number on the keyboard abacus to a number on the counter abacus. "The numbers on the two abaci thus play different roles," Atanasoff wrote in 1940. "One is left unchanged, the other is enhanced or diminished by the first in the course of the operation." Atanasoff and Berry planned their machine to operate on thirty abaci of each type (2 × 30), each containing fifty (50) binary digits, for a total of three thousand bits of memory (2 × 30 × 50 = 3000).

For abacus elements Atanasoff used small tubular paper condensers, fifty per element. The condenser elements occupied radial positions at six-degree intervals within a hollow cylinder of bakelite measuring eleven inches long by eight inches in diameter. Each cylinder held thirty-two fifty-condenser abacus elements (two of the thirty-two were idle by design), arranged in rings along the inner wall of the bakelite cylinder. The condensers' inner terminals connected to a common lead; their outer terminals connected to contacts poking out through the wall of the cylinder. As the cylinder rotated on its horizontal axis, once per second, these contacts were read and recharged by brushes extending from the circuits of the add-subtract mechanism.

At the heart of the logic circuitry, a set of thirty add-subtract mechanisms did the actual computing. The add-subtract mechanism governing the coaction of the two abaci embodied the most significant electrical circuit developed by Atanasoff and Berry. Each add-subtract mechanism consisted of seven twin triode vacuum tubes interconnected to perform binary addition. Berry developed circuits in which the grids of the input tubes floated on small capacitors charged by momentary contact with a storage capacitor. Each add-subtract mechanism had three inputs, two for the digits being added and one to handle the carry-over from the previous place, and two outputs, one for the result in that place and one for the carry-over to the next place. The thirty computing units were identical in structure and rested on individual chassis piled in a five-by-six array within the larger angle-iron frame. The machine looked like a big office desk covered with wires and electrical hardware.

The add-subtract mechanism arranged the abacus elements in a specific correspondence, added or subtracted one from the other, and took care of carry-over or borrowing as necessay in the mathematical procedure. Able to recharge its data source continually, an add-subtract mechanism conducted its routine serial operations at a fixed pace, one operation per second as the cylinder completed its electrically-powered rotation.

The logic circuits could calculate binary numbers serially with impressive speed. Addition and subtraction could be accomplished in a single operation, while multiplication and division, which were carried out by successive

Courtesy of State Historical Society of Iowa, Silag, William, "The Invention of the Electronic Digital Computer," *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

“The Invention of the Electronic Digital Computer” from *The Palimpsest*, September/October 1984 (Pg.10)

additions or subtractions, took a series of operations. Base-two calculation demanded only about a third the number of separate operations as base-ten calculation would have demanded on the same machinery. The prototype of 1939 suggested the potential of the circuitry by calculating pi (the ratio of the circumference of a circle to its diameter) to a thousand decimal places with ease, but it was the full-scale ABC that demonstrated the superiority of electrical calculation over mechanical calculation. For example, where MIT's differential analyzer took at least a few hours to set up and arrive at a solution for a variable in two complex equations, the ABC did the same work in no more than ninety seconds.

The ABC provided the results of intermediate steps in a mathematical operation on cards, issued by an auxiliary punching device receiving electrical signals from the add-subtract mechanism. The machine's operator could reinsert these cards later if they were needed in the operation. The ABC reported all such intermediate results in binary code (since the add-subtract mechanism did its work in base-two numbers, translation to base-ten in the midst of the mathematical operation made little sense). Moreover, the punched cards themselves (like the abaci elements) permitted the expression of thirty fifty-place base-two numbers, nearly triple the capacity of the same equipment using base-ten numbers. Atanasoff's desire to maximize the quantitative potential of the ABC thus reinforced his decision to adopt binary notation for the actual task of electronic calculation.

For loading information into the computer, Atanasoff and Berry devised a system of cards that could be read by passing an electrical charge through punched holes. Clifford Berry engineered the card-handling apparatus, which featured a novel method of initially punching cards by burning holes in them electrically. He geared this apparatus to the abaci shaft, thereby synchronizing the movement of the cards with the calculating operation. When a negatively charged contact touched a reading brush, an arc five thousand volts strong burned a hole through the card and then extinguished itself within a quarter of a second. All of this action took place as the card-handling mechanism whisked the cards along its steel rollers at the rate of one per second.

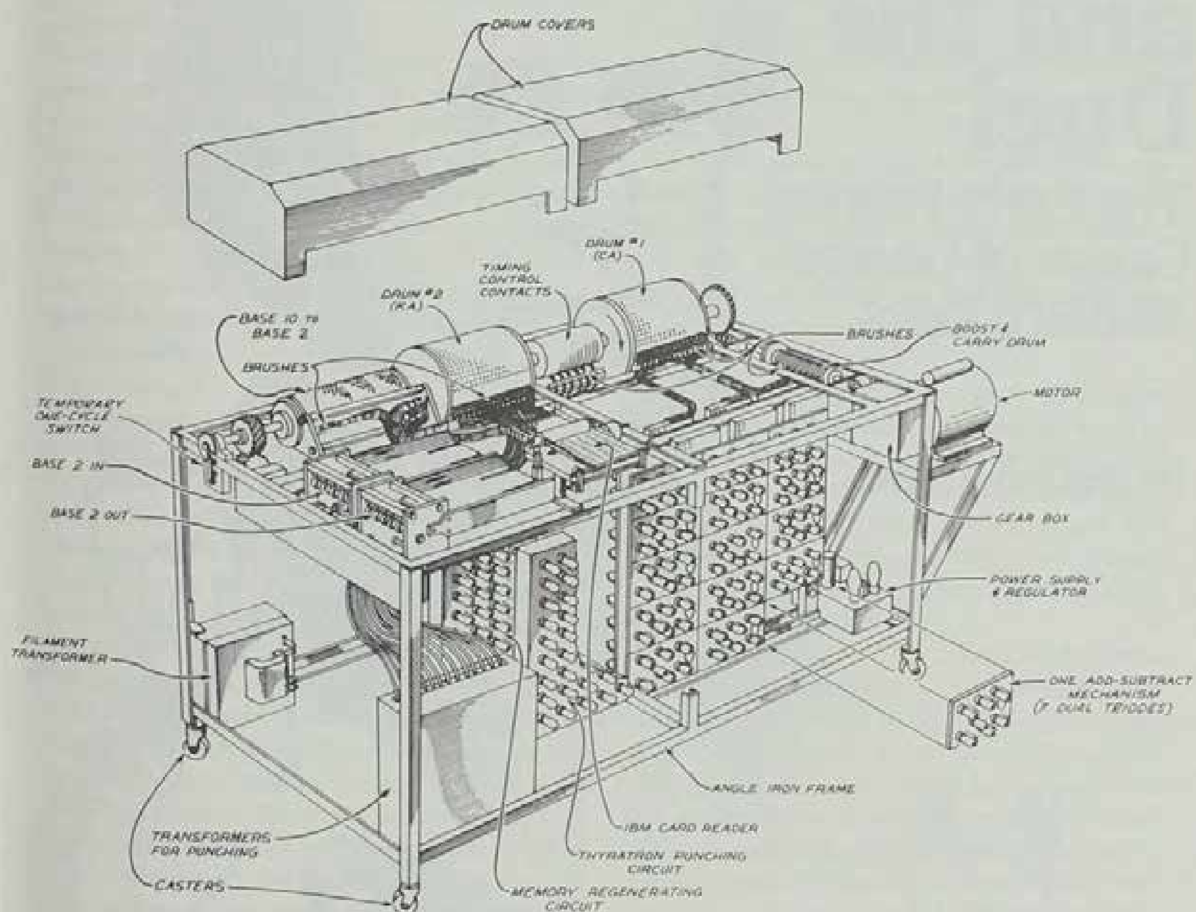
Subsequent readings of the data thus recorded on cards repeated several steps of the punching procedure. Cards to be read passed between electrodes — the same ones used for punching — which tested in proper sequence each possible hole position on a card. The electrode's card-reading voltage was low enough not to puncture the card but high enough to force a current through any point already broken down, and ranged from one-fourth to one-third of the card-punching voltage. When a hole on a card passed between the electrodes, a negative impulse—representing a number value of "one" — entered the input section of the add-subtract mechanism. Card positions bearing no hole were read as the number value "zero."

In order to make the results of the binary calculation readable to the person operating the ABC, an auxiliary device changed base-two numbers to base-ten by means of a conversion drum. Atanasoff estimated that five fifteen-place binary numbers could be transferred simultaneously in a total time of fifteen seconds, with faster rates of conversion possible for smaller numbers.

From the operator's point of view, the ABC was a streamlined affair. Manual controls included power switches and a keyboard, switches for starting card punching and reading operations, and switches to route numbers to a specific abacus. A flexible arrangement of plugs and jacks permitted special set-ups. Once a computing procedure was programmed, the operator fed in data cards and the results were reported on the ABC's output dials.

Courtesy of State Historical Society of Iowa, Silag, William, “The Invention of the Electronic Digital Computer,” *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

“The Invention of the Electronic Digital Computer” from *The Palimpsest*, September/October 1984 (Pg.11)



The Atanasoff Berry Computer. (courtesy the Department of Special Collections, ISU library)

Courtesy of State Historical Society of Iowa, Silag, William, “The Invention of the Electronic Digital Computer,” *The Palimpsest*, Vol. 65, No. 5, pp. 159-177, September/October 1984

Biography of Clair Cameron Patterson, 1998 (Pg.1)

NATIONAL ACADEMY OF SCIENCES

CLAIR CAMERON PATTERSON

1922—1995

A Biographical Memoir by
GEORGE R. TILTON

Biographical Memoir

Tilton, George R., "Claire Cameron Patterson: 1922-1995," 1998. Courtesy of National Academy of Sciences

Biography of Clair Cameron Patterson, 1998 (Pg.2)

Courtesy of the Division of Geological and Planetary Science, California Institute of Technology

Tilton, George R., “Claire Cameron Patterson: 1922-1995,” 1998. Courtesy of National Academy of Sciences

Biography of Clair Cameron Patterson, 1998 (Pg.3)

CLAIR CAMERON PATTERSON

June 2, 1922 – December 5, 1995

BY GEORGE R. TILTON

CLAIR PATTERSON WAS an energetic, innovative, determined scientist whose pioneering work stretched across an unusual number of sub-disciplines, including archeology, meteorology, oceanography, and environmental science—besides chemistry and geology. He is best known for his determination of the age of the Earth. That was possible only after he had spent some five years establishing methods for the separation and isotopic analysis of lead at microgram and sub-microgram levels. His techniques opened a new field in lead isotope geochemistry for terrestrial as well as for planetary studies. Whereas terrestrial lead isotope data had been based entirely on galena ore samples, isotopes could finally be measured on ordinary igneous rocks and sediments, greatly expanding the utility of the technique.

While subsequently applying the methodology to ocean sediments, he came to the conclusion that the input of lead into the oceans was much greater than the removal of lead to sediments, because human activities were polluting the environment with unprecedented, possibly dangerous, levels of lead. Then followed years of study and debate involving him and other investigators and politicians over control of lead in the environment. In the end, his basic views

Tilton, George R., "Claire Cameron Patterson: 1922-1995," 1998. Courtesy of National Academy of Sciences

Biography of Clair Cameron Patterson, 1998 (Pg.4)

prevailed, resulting in drastic reductions in the amount of lead entering the environment. Thus, in addition to measuring the age of the Earth and significantly expanding the field of lead isotope geochemistry, Patterson applied his scientific expertise to create a healthier environment for society.

Clair Patterson (known as "Pat" to friends) was born and grew up in Mitchellville, Iowa, near Des Moines. His father, whom he describes as "a contentious intellectual Scot," was a postal worker. His mother was interested in education and served on the school board. A chemistry set, which she gave him at an early age, seems to have started a lifelong attraction to chemistry . He attended a small high school with fewer than 100 students, and later graduated from Grinnell College with an A. B. degree in chemistry. There he met his wife-to-be Lorna McCleary. They moved to the University of Iowa for graduate work, where Pat did an M. A. thesis in molecular spectroscopy.

After graduation in 1944 both Pat and Laurie were sent to Chicago to work on the Manhattan (atomic bomb) Project at the University of Chicago at the invitation of Professor George Glockler, for whom Pat had done his M. A. research. After several months there, he decided to enlist in the army, but the draft board rejected him because of his high security rating and sent him back to the University of Chicago. There it was decided that both Pat and Laurie would go to Oak Ridge, Tennessee, to continue work on the Manhattan Project. At Oak Ridge, Patterson worked in the ^{235}U electromagnetic separation plant and became acquainted with mass spectrometers.

After the war it was natural for him to return to the University of Chicago to continue his education. Laurie obtained a position as research infrared spectroscopist at the Illinois Institute of Technology to support him and their family while he pursued his Ph.D. degree.

Tilton, George R., "Claire Cameron Patterson: 1922-1995," 1998. Courtesy of National Academy of Sciences

Biography of Clair Cameron Patterson, 1998 (Pg.5)

In those days a large number of scientists had left various wartime activities and had assembled at the University of Chicago. In geochemistry those scientists included Harold Urey, Willard Libby, Harrison Brown, and Anthony Turkevich. Mark Inghram, a mass spectrometer expert in the physics department, also played a critical role in new isotope work that would create new dimensions in geochemistry. The university had created a truly exciting intellectual environment, which probably few, possibly none, of the graduate students recognized at the time.

Harrison Brown had become interested in meteorites, and started a program to measure trace element abundances by the new analytical techniques that were developed during the war years. The meteorite data would serve to define elemental abundances in the solar system, which, among other applications, could be used to develop models for the formation of the elements.

The first project with Edward Goldberg, measuring gallium in iron meteorites by neutron activation, was already well along when Patterson and I came on board. The plan was for Patterson to measure the isotopic composition and concentration of small quantities of lead by developing new mass spectrometric techniques, while I was to measure uranium by alpha counting. (I finally also ended up using the mass spectrometer with isotope dilution instead of alpha counting.) In part, our projects would attempt to verify several trace element abundances then prevalent in the meteorite literature which appeared (and turned out to be) erroneous, but Harrison also had the idea that lead isotope data from iron meteorites might reveal the isotopic composition of lead when the solar system first formed. He reasoned that the uranium concentrations in iron meteorites would probably be negligible compared to lead concentrations, so that the initial lead isotope ratios would be preserved. That was the goal when Patterson began his

Tilton, George R., “Claire Cameron Patterson: 1922-1995,” 1998. Courtesy of National Academy of Sciences

Biography of Clair Cameron Patterson, 1998 (Pg.6)

dissertation project, however attaining it was to take considerably longer than we imagined at the time.

Patterson started lead measurements in 1948 in a very dusty laboratory in Kent Hall, one of the oldest buildings on campus. In retrospect it was an extremely unfavorable environment for lead work. None of the modern techniques, such as laminar flow filtered air, sub-boiling distillation of liquid reagents, and Teflon containers were available in those days. In spite of those handicaps, Patterson was able to attain processing blanks of circa 0.1 microgram, a very impressive achievement at the time, but now approximately equal to the total amount of sample lead commonly used for isotope analyses.

His dissertation in 1951 did not report lead analyses from meteorites; instead it gave lead isotopic compositions for minerals separated from a billion-year-old Precambrian granite. On a visit to the U.S. Geological Survey in Washington D.C., Brown had met Esper S. Larsen, Jr., who was working on a method for dating zircon in granitic rocks by an alpha-lead method. Alpha counting was used as a measure of the uranium and thorium content; lead, which was assumed to be entirely radiogenic (produced by the decay of uranium and thorium), was determined by emission spectroscopy. Despite several obvious disadvantages, the method seemed to give reasonable dates on many rocks. Brown saw that the work of Patterson and me would eliminate those problems, so we arranged to study one of Larsen's rocks. We finally obtained lead and uranium data on all of the major, and several of the accessory, minerals from the rock. Particularly important was the highly radiogenic lead found in zircon, which showed that a common accessory mineral in granites could be used for measuring accurate ages. As it happened, the zircon yielded nearly concordant uranium-lead ages, although that did not turn out later to be true

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for all zircons. In any case, that promising start opened up a new field of dating for geologists, and has led to hundreds of age determinations on zircon.

In parallel with the lead work, Patterson participated in an experiment to determine the branching ratio for the decay of ^{40}K to ^{40}Ar and ^{40}Ca. Although the decay constant for beta decay to ^{40}Ca was well established, there was much uncertainty in the constant for decay to ^{40}Ar by K electron capture. This led Mark Inghram and Harrison Brown to plan a cooperative study to measure the branching ratio by determining the radiogenic ^{40}Ar and ^{40}Ca in a 100-million-year-old KCl crystal (sylvite). The Inghram group would measure ^{40}Ar while Patterson and Brown would measure ^{40}Ca. They reported a value that came within circa 4% of the finally accepted value.

After graduation, Patterson stayed on with Brown at Chicago in a postdoctoral role to continue the quest toward their still unmet meteorite age goal. He obtained much cleaner laboratory facilities in the new Institute for Nuclear Studies building, where he worked on improvement of analytical techniques. However, after a year this was interrupted when Brown accepted a faculty appointment at the California Institute of Technology. Patterson accompanied him there and built facilities that set new standards for low-level lead work. By 1953 he was finally able to carry out the definitive study, using the troilite (sulfide) phase of the Canyon Diablo iron meteorite to measure the isotopic composition of primordial lead, from which he determined an age for the Earth. The chemical separation was done at CalTech, and the mass spectrometer measurements were still made at the University of Chicago in Mark Inghram's laboratory. Harrison Brown's suspicion was finally confirmed! The answer turned out to be 4.5 billion years, later refined to 4.55 billion years. The new age was substantially older than the commonly

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quoted age of 3.3 billion years, which was based on tenuous modeling of terrestrial lead evolution from galena deposits.

Patterson's reactions on being the first person to know the age of the Earth are interesting and worthy of note. He wrote,[1]

> True scientific discovery renders the brain incapable at such moments of shouting vigorously to the world "Look at what I've done! Now I will reap the benefits of recognition and wealth." Instead such discovery instinctively forces the brain to thunder "*We* did it" in a voice no one else can hear, within its sacred, but lonely, chapel of scientific thought.

There "we" refers to what Patterson calls "the generations-old community of scientific minds." From my observations, he lived that ethic. To him it must have been an exercise in improving the state of the "community of scientific minds." His attitude recalls the remark of Newton: "If I have seen farther than others, it is because I have stood on the shoulders of giants."

The age that Patterson derived has stood the test of time, and is still the quoted value forty-four years later. In the meantime, there have been small changes in the accepted values for the uranium decay constants, improvements in chemical and mass spectrometric techniques, and a better understanding of the physical processes taking place in the early solar system and Earth formation, but these have not substantially changed the age Patterson first gave to us. Some textbooks have given diagrams showing that the logarithm of the supposed age of the Earth plotted against the year in which the ages appeared approximated a straight line, but Patterson's work has finally capped that trend.

Patterson next focused on dating meteorites directly instead of inferring their ages from the Canyon Diablo troilite initial lead ratios. He did this by measuring lead isotope ratios in two stone meteorites with spherical chondrules (chondrites) and a second stone without chondrules (achon-

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drite). A colleague, Leon Silver, had recommended the achondrite because of its freshness and evolved petrologic appearance. Coupled with the iron meteorite troilite lead, the complete data yielded a $^{207}Pb/^{206}Pb$ age of 4.55 ± 0.07 billion years. The achondrite data were especially important because the Pb ratios in the two chondrites were close to those of modern terrestrial lead, raising questions about possible Earth contamination, but the exceptionally high uranium/lead and thorium/lead ratios in the Nuevo Laredo achondrite produced lead with isotope ratios that were unlike any isotopic compositions that have ever been found in terrestrial rocks. They also fit the 4.55 Ga age, which removed any doubts about major errors in the date.

The meteorite work led indirectly to his second major scientific accomplishment. The new ability to isolate microgram quantities of lead from ordinary rocks and determine its isotopic composition had opened for the first time the path for measuring lead isotopes in common geological samples, such as granites, basalts, and sediments. That led him to start lead isotope tracer studies as a tool for unraveling the geochemical evolution of the Earth. As part of that project he set out to obtain better data for the isotopic composition of "modern terrestrial lead" by measuring the isotopic composition of lead in ocean sediments. By 1962 Tsaihwa J. Chow and Patterson reported the first results in an encyclopedic publication that initiated Patterson's concern with anthropogenic lead pollution, which was to occupy much of his attention for the remainder of his scientific career.

The isotope data revealed interesting patterns for Atlantic and Pacific Ocean leads that could be related to the differences in the ages and compositions of the landmasses draining into those oceans. However, in studying the balance between input and removal of lead in the oceans, the

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authors calculated that the amount of anthropogenic lead presently dispersed into the environment each year was circa eighty times the rate of deposit into ocean sediments. Thus, the geochemical cycle for lead appeared to be badly out of balance. The authors noted that their calculations were provisional; the analytical data were scarce or of poor precision in many cases, however this was the seminal study that started Patterson's investigations into the lead pollution problem.

The limitations in the analytical data on which many of the conclusions in the 1962 paper were based led Patterson to start new investigations to attack the problem. In 1963 he published a report with Mitsunobu Tatsumoto showing that deep ocean water contained 3 to 10 times less lead than surface water, the reverse of the trend for most elements (e.g., barium). This provided new evidence for disturbance in the balance of the natural geochemical cycle for lead by anthropogenic lead input.

In the 1965 paper entitled "Contaminated and Natural Lead Environments of Man,"[2] Patterson made his first attempt to dispel the then prevailing view that industrial lead had increased environmental lead levels by no more than a factor of approximately two over natural levels. He maintained that the belief arose from the poor quality of lead analyses in prehistoric comparison samples in which much of the lead reported was actually due to underestimation of blank contamination. He compiled the amounts of industrial lead entering the environment from gasoline, solder, paint, and pesticides and showed that they involved very substantial quantities of lead compared to the expected natural flux. He estimated the lead concentration in blood for many Americans to be over 100 times that of the natural level, and within about a factor of two of the accepted limit for symptoms of lead poisoning to occur.

R. A. Kehoe, a recognized expert on industrial toxicol-

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ogy[3] accused him of being more of a zealot than a scientist in the warnings he had raised.[4] Another leading toxicologist had just returned from a World Health Organization conference where fifteen nations had agreed that environmental lead contributions to the body burden had not changed in any significant way, either in blood or urinary lead contents, over the last two decades. He called Patterson's conclusions "rabble rousing."[5]

Patterson's reactions are recorded in a letter to editor Katharine Boucot accompanying the revised manuscript:

> The enclosed manuscript does not constitute basic research and it lies within a field that is outside of my interests. This is not a welcome activity to a physical scientist whose interests are inclined to basic research. My efforts have been directed to this matter for the greater part of a year with reluctance and to the detriment of research in geochemistry. In the end they have been greeted with derisive and scornful insults from toxicologists, sanitary engineers and public health officials because their traditional views are challenged. It is a relief to know that this phase of the work is ended and the time will soon come when my participation in this trying situation will stop.[6]

Patterson's participation did not stop; instead on October 27, 1965, he wrote to California Governor Pat Brown restating the points from his 1965 review and emphasizing the dangerously high levels of lead in aerosols, particularly in the Los Angeles area. In it he claimed that the California Department of Public Health was not doing all it should to protect the population from the dangers of lead poisoning. His first request drew a polite rejection. A second letter on March 24, 1966, had better success, perhaps because of a letter from a high state official.[7] On July 6, 1966, Governor Brown signed a bill directing the State Department of Public Health to hold hearings and to establish air quality standards for California by February 1, 1967. Although that

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deadline was not met, Patterson clearly played a role in advancing concern over California air control standards.

He had simultaneously started parallel actions at the national level as well. On October 7, 1965, he sent a communication similar to the Brown letter to Senator Muskie, chairman of the Subcommittee on Air and Water Pollution. In it he offered to appear before the committee. He was subsequently invited to a hearing held on June 15, 1966, in Washington. There Patterson emphasized that most officials failed to understand the difference between "natural" and "normal" lead body burdens, the former based on incorrect data from pre-industrial humans, the latter on averages in modern populations. In support of that assertion he cited his newer work in Greenland showing the large increases in lead in snow starting with the industrial revolution. He furthermore believed it was wrong for public health agencies to work so closely with lead industries, whom he considered often biased in matters concerning public health.

His views drew support from some of the public (e.g., Ralph Nader), but were once again strongly opposed by others, notably by R. A. Kehoe, the highly regarded authority on industrial poisoning. A battle line was drawn that was to last about two decades.

By 1970 Patterson and his colleagues had completed studies of snow strata from Greenland and Antarctica that showed clearly the increase in atmospheric lead beginning with the industrial revolution in both regions. Modern Greenland snow contained over 100 times the amount of lead in pre-industrial snow, with most of the increase occurring over the last 100 years. The effect was about ten times smaller in Antarctic snow, but it was clearly observable. Later work with improved blanks reduced that figure to two.

In 1971 the National Research Council released a report entitled "Airborne Lead in Perspective" to guide the Envi-

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ronmental Protection Agency's policies on lead pollution. The panel was widely accused of not being forceful enough in interpreting its data and being too heavily weighted toward industrial scientists.[8] Patterson's work was largely ignored, however by December 1973 the EPA did announce a program to reduce lead in gasoline by 60-65% in phased steps. Thus was the beginning of the removal of lead from gasoline.

Meanwhile Patterson continued to work on the lead problem from another perspective by measuring lead, barium, and calcium concentrations in bones from 1600-year-old Peruvian skeletons.[9] The results indicated a 700- to 1200-fold increase in concentrations of lead in modern man, with no change in barium, a good staind-in for lead, and calcium. In a letter Patterson once said, "I have a passionate interest in this paper."[10]

In the late 1970s Patterson turned his attention to lead in food. In 1979 he wrote to the commissioner of food and drugs at the Environmental Protection Agency asserting that "your headquarters laboratory cannot correctly analyze for lead in tuna fish muscle."[11] He maintained that the laboratory blanks were too high to permit accurate analyses for lead concentrations below 1 ppm. When asked if he could cite other laboratories that agreed with his results, Patterson responded that scientific matters are not decided by majority vote.[12] That contact finally led to his participation in a symposium on analytical methods of analyzing for lead in food at the sub-1 ppm level, held October 10, 1981, in Washington. It was attended by both EPA and Bureau of Foods representatives. Patterson made three recommendations for improvements that seem to have been taken seriously.[13] These were (1) to use Bureau of Standards mass spectrometers to permit mass spectrometric lead analyses; (2) to equip EPA field laboratories better; and (3) to pro-

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mote more contacts between EPA and academic laboratories. A few months later Patterson wrote that he believed the analytical work being done at the headquarters EPA laboratory met his standards.[14]

In 1980 Dorothy M. Settle and Patterson[15] published a warning on the amount of lead entering the food chain due to lead solder used in sealing cans. Although the National Marine Services laboratories had reported only twice as much lead in canned albacore muscle as in fresh tuna (700 versus 400 nanograms per gram), the authors found 0.3 nanogram per gram of lead in fresh and 1400 nanograms/gram in canned muscle. Barium varied by only a factor of two in the samples. A sample of fresh muscle prepared at CalTech and analyzed at the fisheries laboratory gave 20 nanograms per gram for lead, still much higher than the CalTech value. By 1993 lead solder was removed from all food containers in the United States. Patterson's influence is again clearly evident.

Although he was excluded from the earlier 1971 National Research Council panel that produced the report on airborne lead, in 1978 Patterson was appointed to a new twelve-member NRC panel to evaluate the state of knowledge about environmental issues related to lead poisoning. The panel report[16] is noted for containing majority and minority evaluations. The majority report cites the need to reduce lead hazards for urban children; notes that the margin between toxic and typical levels for lead in adults needs better definition; and concedes that typical atmospheric lead concentrations are 10 to 100 times the natural backgrounds for average populations and 1,000 to 10,000 times greater for urban populations. The report asks for further research on these subjects, as well as on relationships between lead ingestion and intellectual ability. The need for improved analytical work was emphasized.

In his lengthy 78-page minority report Patterson argued

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that the majority report was not forceful enough. Basically he said that the dangers of the prevalent practices were already clearly enough defined and that efforts should start immediately to drastically reduce or completely remove industrial lead from the everyday environment. That included gasoline, food containers, foils, paint, and glazes. He also cited water distribution systems. He urged "investigations into biochemical perturbations within cells caused by lead exposures ranging down from typical to 1/1000 of typical." He had long criticized assigning a sharp limit for lead in air or blood to denote a dividing line between poisonous and non-poisonous levels.

The above items give some, but by no means a complete, indication of the efforts Patterson devoted toward reducing the environmental lead burden. Many others joined the campaign with the passage of time, but he was clearly a principal player, and could be said to have initiated some of the changes that have occurred. Around 1973 lead began to be reduced in gasoline; it was removed completely in 1987. Lead solder has been removed from U. S. food containers a well as from paints and water lines. By 1991 scientists could report that the lead content of Greenland snow had fallen by a factor of 7.5 since 1971.[17]

Patterson will be remembered for having first discovered the differences between "natural" and "common" or "typical" lead abundances in the human population, and for arguing that point until it was universally accepted. That in turn has stimulated considerable medical research to study the effects of lead at below the toxic poisoning level on the human learning ability.[18]

Beginning in the early 1980s, Patterson's interests began to turn toward what I call the third stage of his intellectual career. It involved an introspective, philosophical evaluation of the place of man (H. s. sapiens, as he often stated it) in society. He distinguished between what he termed the

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engineering versus the scientific modes of thinking. His thoughts are best spelled out in the two articles in the 1994 special issue of *Geochimica et Cosmochimica Acta* in his honor. He sees the scientific mind as the inquiring mind that seeks to uncover the world's secrets, while the engineering mind seeks to control the natural world. This undoubtedly grew out of his experience as a scientist in discovering the age of the Earth, while the engineering mind would be equated with the technology that utilized the large amounts of lead that had polluted the environment. Thus he says,[19] "Most persons cannot see the ills of a culture constructed by 10,000 years of perverted utilitarian rationalizations because they perceive only its material technological forms through the eyes of a diseased *Homo sapiens sapiens* mind." At the end he was working on a book to express his ideas on those and other matters, such as population control. We will never know what it might have contained, but we can guess that it would have been a stimulating, unique, and undoubtedly controversial treatment.

As a person, Patterson was modest about his own accomplishments and generous in acknowledging the contributions of colleagues, especially those of his co-workers. He opened his laboratory to scientists from around the world and trained them in the techniques he had developed. He was self-assured in science and not one to follow the beaten path. Although he was very sensitive to the negative criticisms his work generated, he pursued his beliefs vigorously with what some would (and some did) call a fanatical drive. Perhaps any lesser degree of motivation would have led him to give up the struggle without seeing it through to the finish. He cared deeply about the welfare of society and applied his scientific knowledge toward seeking and making a better future for all. His final efforts on the book he hoped to write were directed toward that goal. His unique

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personality has been eloquently portrayed in the Saul Bellow novel *The Dean's December*, in which Patterson is the model for Sam Beech.[20] He was truly a one-of-a-kind person.

Patterson's many accomplishments were recognized in 1995 by the award of the Tyler Prize for Environmental Achievement, a most fitting reward for his prolonged efforts on behalf of the environment, the Goldschmidt Medal of the Geochemical Society in 1980, and the J. Lawrence Smith Medal of the National Academy of Sciences in 1973. He was elected to the National Academy of Sciences in 1987, and received honorary doctorates from Grinnell College in 1973 and the University of Paris in 1975, as well as the Professional Achievement Award from the University of Chicago in 1983. An asteroid (2511) and a peak in the Queen Maude Mountains, Antarctica, are named for him.

He is survived by his wife Lorna Jean McCleary Patterson, who resides at The Sea Ranch, California, and children Cameroon Clair Patterson, Claire Mai Keister, Charles Warner Patterson, and Susan McCleary Patterson.

I THANK PROFESSOR Leon Silver and Dr. Peter Neuschul, California Institute of Technology, and Lorna Patterson for discussions and critical reviews of the manuscript. I am especially indebted to Dr. Neuschul and to the archives collection of the California Institute of Technology for providing many valuable information sources.

NOTES

1. Historical changes in integrity and worth of scientific knowledge. *Geochim. Cosmochim. Acta* 58(1994):3141.
2. Contaminated and natural environments of man. *Arch. Environ. Health* 11(1965):344-60.
3. As an employee of the Ethyl Corporation Kehoe discovered that deaths among workers manufacturing lead tetraethyl in the early 1920s were due to absorption of lead through the skin and

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NATIONAL ACADEMY OF SCIENCES

JOHN ROBINSON PIERCE
1910–2002

A Biographical Memoir by

EDWARD E. DAVID, JR., MAX V. MATHEWS,
AND A. MICHAEL NOLL

Any opinions expressed in this memoir are those of the authors and do not necessarily reflect the views of the National Academy of Sciences.

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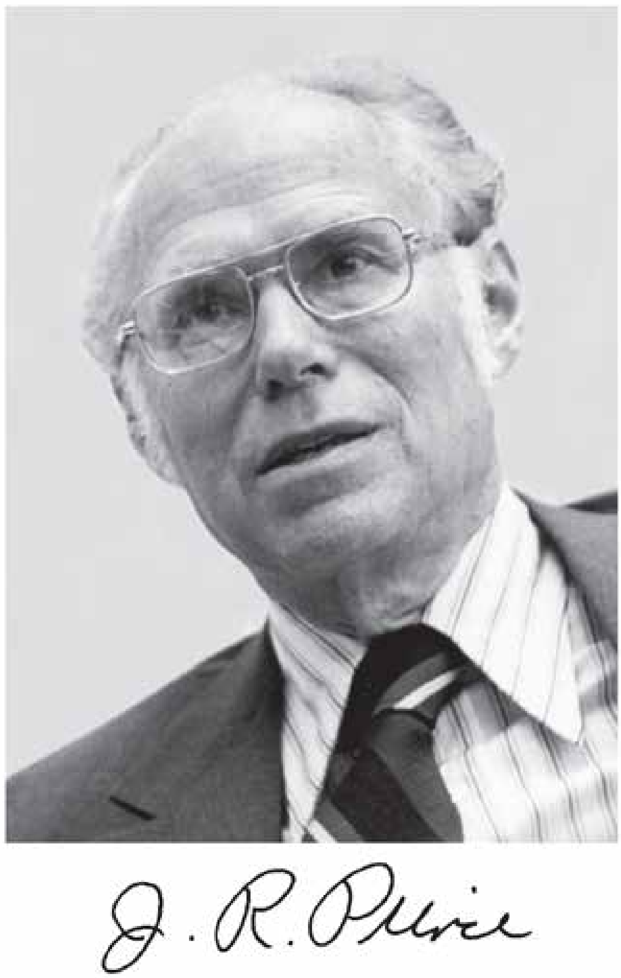

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Biography of John Robinson Pierce, 2004 (Pg.3)

JOHN ROBINSON PIERCE

March 27, 1910–April 2, 2002

BY EDWARD E. DAVID, JR., MAX V. MATHEWS, AND
A. MICHAEL NOLL

JOHN ROBINSON PIERCE is most renowned for being the father of communications satellites, namely, *Echo* and *Telstar*. He was also an active stimulator of innovative research in his division at Bell Labs from the mid-1950s to 1971. He was able to challenge and inspire many of the brightest researchers in communication science and technology, leading to a host of discoveries and innovations that created today's digital era. All who knew him were affected by his wit and quick, intelligent grasp of science and technology. He was a gifted author, not only of books that explained communication science and technology to nontechnicians but also of science fiction. His many keen comments are treasured memories of him that continue to inspire his many friends and colleagues. This wit led him to coin the term "transistor" for the device that his colleagues at Bell Labs had invented. We have all benefited from his innovativeness, intelligence, energy, and enthusiasm for communication science and technology.

John Robinson Pierce was born on March 27, 1910, in Des Moines, Iowa, an only child of John Starr Pierce and Harriet Ann Pierce. Although neither parent had gone beyond high school, they recognized their son's talents and

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worked to put him through the California Institute of Technology, where he earned his doctor of philosophy degree. Pierce spent most of his childhood in St. Paul, Minnesota. The family then moved in 1927 to Long Beach, California, where his parents worked in real estate sales, earning the money to pay for his education. They later moved to Pasadena so John could live at home to save money while attending Caltech and studying electrical engineering and physics.

During John's childhood, his father was frequently away from home for weeks at a time as a salesman. His mother had to cope with the mechanical problems of managing a household, which exposed John to all sorts of mechanical interests. "My mother encouraged me in all sorts of technical play," John said at one time, adding, "I was really my mother's child." Then, "As an only child with a certain amount of timidity, I led a somewhat sheltered life. I should have been learning more from other people and less from books." He clearly outgrew any timidity, eventually constructing and flying gliders until one of his acquaintances fell from such a machine and was killed. After that he ceased flying these homemade flyers. He quit because at the funeral of the friend, he thought about how many such funerals he had attended involving the glider community.

Reading excited him, at first science fiction and subsequently murder mysteries. The science fiction stories he wrote helped finance his education, and he would later state, "I wished that I could be a writer, but I thought it would be more practical to be an engineer." Even after he became one of the great research engineers at Bell Labs, he continued to enjoy writing, not only technical memoranda and books about communication but also science fiction under the pseudonym J. J. Coupling. He would later say, "I enjoy writing. . . . I also enjoy being known as the author." Clearly, writing was great fun for John. When he received

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the Marconi Award in 1979, he used the money to finance the writing of a book, *The Science of Musical Sound*.

Pierce was married three times. His first marriage, to Martha Peacock, the mother of his two children, John Jeremy Pierce and Elizabeth Anne Pierce, ended in a divorce in 1964 after 26 years. His second marriage, in 1964, was to Ellen Richter McKown, who died in 1986. Brenda Katharine Woodard, whom he married in 1987, survives him.

Upon graduation from the California Institute of Technology with a Ph.D. magna cum laude in 1936, John went to work at Bell Labs in its facility on West Street in New York City, where he performed research on vacuum tubes, particularly electron multiplier tubes and the reflex Klystron tube that was used in X-band radars during the Second World War. While at Bell Labs, John shared an apartment in New York City with Chuck Elmendorf (Charles Halsey Elmendorf III, later a vice-president of AT&T). They became fast friends over the next decades at Bell Labs and interchanged information and experiences.

In 1944 Pierce visited England, where he met Rudy Kompfner, inventor of the traveling-wave tube (TWT). Kompfner moved to Bell Labs in 1951, and they continued to perfect TWTs. While Kompfner saw the TWT chiefly as a low-noise amplifier, Pierce saw its application as a broadband amplifier. The Bell Labs' research organization and John moved from West Street to Murray Hill, New Jersey, in 1949, and John's work on TWTs continued until 1959.

As early as 1954 John had studied the practicality of using communications satellites to relay signals back and forth from Earth. In the summer of 1958 Pierce and Kompfner attended a summer study in Woods Hole, Massachusetts, sponsored by the Air Force. There they promoted the idea of a balloon satellite for communications, work that John would later say "had the most impact of anything I have

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ever done." A signal was to be sent to the satellite and bounced back to Earth. But Mervin Kelly, then president of Bell Labs, was not enthusiastic and refused to pursue it. His reasons involved the hostility of the U.S. Department of Justice and its aversion to the Bell System's "monopoly." Kelly retired in 1959, and his successor as president of Bell Labs, James Fisk, thought it was proper to proceed with the idea; *Echo* thus became reality. The *Echo* passive satellite was launched on August 12, 1960, and a message recorded by President Eisenhower was bounced off it. Pierce then went on to promote the idea for an active communications satellite, *Telstar*, which was to use transistors and a traveling-wave tube. However, the government then decreed that the Bell System, which was a regulated monopoly, should not work in satellite communications, just as Kelly had feared. (Kelly also foresaw the Justice Department's antitrust suit against the Bell System.) So *Telstar* was not deployed as a communications business. John would later state, "I took that hard . . . [but] I liked Bell Labs better than I liked satellites."

John, Claude E. Shannon, and Bernard M. Oliver described the idea of digital encoding of speech and other communication signals under the term "pulse code modulation" (PCM) and in 1948 published a paper entitled "The Philosophy of PCM" describing this technique in the *Proceedings of the Institute of Radio Engineers*. This paper and the ideas that led to and followed from it were the beginnings of today's digital era.

In 1952 John was made director of electronics research at Bell Labs, reporting to Harald Friis. John greatly admired Friis, who was very much his mentor at Bell Labs. Upon Friis's retirement, William O. Baker, then vice-president of research at Bell Labs, promoted John to executive director. Friis had formed a microwave laboratory in Holmdel, New Jersey, where the Bell System's highly successful long-distance

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microwave telephone transmission technology was developed. The microwave towers spaced about 30 miles apart throughout the entire country are still a visible reminder of this system. Kompfner took over the management of this laboratory, working under John.

John had a considerable affection for Bell Labs and a strong appreciation of the skills and talents represented there. The environment and mission of Bell Labs, which was to improve the performance of telecommunications across the world, profoundly influenced him. John always believed that any subject, no matter how complex, could be made understandable, and the creation of this clarity often required his skills and his ability to avoid becoming trapped in trivialities.

John spent over three decades of his professional life at Bell Labs. As executive director of communications research he reported directly to William O. Baker, the vice-president of research. John and Bill were a tremendous team, working together in a unique intellectual environment in which John could flourish, free from the bureaucratic intricacies that seem to grip so many organizations. Baker felt that Pierce's biggest contribution to Bell labs was "his ability to inspire and lead people." John retired from Bell Labs in 1971.

After retiring from Bell Labs, John joined the engineering faculty of Caltech, living in Pasadena in a stunning Japanese-style home with naturalistic pool and small waterfall. The layout was very graceful with *shoji* screens and sliding panels, but it lacked a private guestroom. John cured this deficiency by excavating a room under the house with his own hands. Nevertheless, after decades at Bell Labs, he found it hard to adapt to university life—raising research money and doing formal teaching, but he much enjoyed interacting with individual Caltech students.

He became emeritus at Caltech in 1980 and accepted the part-time post of chief technologist at the Jet Propulsion

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Laboratory from 1980 to 1983, but his real interest in this last phase of his life turned to the technology of electronic and computer music. In 1983 he moved to Stanford as visiting professor of music associated with the Stanford Center for Computer Research in Music and Acoustics, CCRMA (pronounced "karma"). In 1987 Max Mathews joined him at CCRMA. They spent a wonderful decade working together until John's failing eyesight made computers inaccessible for him. In 2000 Parkinson's disease forced him to move to an assisted living facility.

John had a long-time interest in music. He studied the piano while a student at Caltech and later installed a pipe organ in his home near Bell Labs. John, Claude Shannon, and Shannon's wife, Betty, who was a pianist, carried out several ingenious experiments to estimate the information content of music. The results were interesting but not successful, and the essence of music continues to this day to elude quantification as information.

John and Mathews attended a piano concert in 1957, which included pieces by Schoenberg and Schnabel. They both felt that the Schoenberg was great and the Schnabel was horrible. During the concert, John said to Mathews, "Max, with the right program your equipment should be able to synthesize better music than this. Take some time and write a music program." This sojourn into computer music was possible because to facilitate research on speech coding, Mathews with Ed David and H. S. McDonald had recently developed equipment to put digitized sound into a computer and to recover processed sound from a stream of numbers generated by the computer. John's support and inspiration led Mathews to write a series of programs, "Music 1" through "Music 5," which started and set the course of present-day synthesized music. John, frustrated by his limitations as a pianist, took up the computer with great

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zest and composed about a dozen early pieces and exercises for the computer—more original compositions than anyone else.

AT&T administrators, when it came to their attention, were not enthusiastic about the public success of music programs. They asked for an explanation as to the appropriateness of the work in a telephone company laboratory. With the strong support of both John and Bill Baker, Mathews was able to show them how music synthesis grew directly out of vital speech compression research and how music synthesis techniques fed back useful technology to speech synthesis. Without the support and encouragement from John and Bill Baker, computer music would not have begun when, where, and how it did. Similar comments can be made about radio astronomy and the measurement of the 3° Kelvin background noise that supports the big bang theory of the beginning of the Universe. The measurement required Harold Friis's very-low-noise horn antenna at Holmdel, New Jersey.

During his decade at Stanford, John's interests focused on the perception of music. He created a new course in musical psychoacoustics He also invented a new musical scale based on a new chord, the 3:5:7 chord, which has many properties similar to the conventional major triad, the 4:5:6 chord. The 3:5:7 chord leads to a different harmony since its scale does not contain octave intervals (2:1).

In addition to his scientific contributions to music, Pierce was the most important patron of computer music. He attracted support for this field during its adolescence from 1970 through 1985. Without the funds he secured, computer music certainly would have progressed much more slowly and might not have survived.

John was a very social person. He was also very practical and efficient. He loved to write. Some of his books served

Biography of John Robinson Pierce, 2004 (Pg.10)

multiple purposes. *Man's World of Sound*, written with David, is a good example. He and David had recently been given the task of managing speech research at Bell Labs, a domain new to both men. On a trip to attend a seminar on the subject in New York City they discussed their concerns. John said, "Ed, what do you know about speech and hearing?" David answered, "Very little." Pierce replied, "Then let's write a book about that." Ed concurred with enthusiasm. After the meeting, John called his editor; they went downtown and signed a book contract. The result was not only a fine book but a lifelong friendship.

Another example of an authorship, which served multiple purposes, was the rewrite of *Signals* with Noll. The original book, still useful for teaching, was out of print and needed revision. John also was glad to have a reason to work with Noll, a long-time friend whose work on computer graphics and arts John particularly admired. After agreeing to the collaboration, John, as he always did, crashed ahead as if to win a race with Noll to see who could write the quicker.

John was like an electron, a package of energy that seemed everywhere, yet was indefinable. His fast mind was quick to grasp concepts, and his energy was inexhaustible. He ran up and down stairs, always in a hurry. His speech seemed unable to catch up with the thoughts in his mind. He was very impatient, and would have little time for those who dallied or delayed the forward progress of science and technology. John always seemed restless, and this could make him seem forbidding in his dealings with people.

John certainly had strong views and a gift for summarizing these views in one-line statements. During a conference on the use of computers, including people from his division, much to John's disapproval, John dismissed the project saying, "What is not worth doing is not worth doing well." Another famous John one-liner was his dismissal of research into

David, Edward E. et al., "John Robinson Pierce: 1910-2002," 2004. Courtesy of National Academy of Sciences

Biography of John Robinson Pierce, 2004 (Pg.11)

artificial intelligence, saying, “Artificial intelligence is mostly real stupidity.”

John was always very modest. He had little patience with Washington and its bureaucracies, and never created a lucrative consulting business around himself. Asked why he did not do so, he responded, “I didn’t promote myself.”

JOHN R. PIERCE IN HIS OWN WORDS

On technical journals

I will say this of our multitude of technical journals, they beat the hell out of ideas mathematically and erect an awful lot of mathematics about things. And whether they really find out anything, I don’t know. I will say that one of my criteria in life is that things have to be good enough. But after they’re good enough, they get a little boring.[1]

On music

I like striking and effective music. I think that one of the troubles with avant-garde is that they don’t know what else to do to be different.[1]

Electronically produced sounds should not be part of electronics; they should be a part of the evolution of musical sound, from drum, lyre, and Stradivarius to some of today’s entirely new sounds.[5]

On information theory

Make no mistake. Information theory is not nonsense just because so much nonsense has been written about it.[4]

On communications satellites

Communications satellites were more important than I could have realized.[1]

Biography of John Robinson Pierce, 2004 (Pg.12)

On Bell Labs and administration in general

Doing things right is awfully important. But that wasn't my part of Bell Laboratories. My part was finding either new ways to do or rather drastically different ways of doing them.[1]

[I]n the university, no one can tell a professor what to do, on the one hand. But in any deep sense, nobody cares what he's doing, either. . . . But in the Bell Laboratories . . . research department . . . people cared about everything.[1]

[T]he Bell Labs, where I worked for 35 years, was the best industrial research laboratory in the world, and perhaps the best laboratory in the world.[2]

When I was Executive Director, the person who appeared at my door or who called me had precedence over anything else.[1]

On his life and creativity

I've really had a lot of good fortune in my life. But you'll never have good fortune unless you believe you're fortunate.

I've never been a good experimenter. I did a lot of tinkering.[1]

I've described myself as a low-grade theoretician.[1]

Night thoughts or dreams seldom solve problems correctly or definitively, however great the inspiration may seem at the time.[2]

My view of getting something new done was always that you started small with somebody who had done something real. With good luck, that would grow.[3]

Some problems are so difficult that they can't be solved in a hundred years, unless someone thinks about them for five minutes.

Biography of John Robinson Pierce, 2004 (Pg.13)

On universities

It takes a great deal of a lot of things to operate successfully on a university campus. If you really want to be successful, you have to set up a stream of graduate students and government support.[1]

On the application of science

Valid science is never old or out of date. It is only speculation about science, the "application" of science to philosophy, and false analogies between science and other matters that become old almost as soon as they are new.[6]

Surely, it is wonderful if a new idea contributes to the solution of a broad range of problems. But, first of all, to be worthy to notice a new idea must have some solid and clearly demonstrated value, however narrow that value may be.[7]

On knowledge and the future

Knowledge is hard learned. But, without knowledge, we can do no more than fantasize, which is childishly easy. The knowledge that can take us beyond fantasy requires an exercise of the mind, an exercise that can be as invigorating as exercise of the body.[4]

Whatever we may say of the future, it is open to us. That is, if we are knowledgeable enough to act, and if we leave ourselves free to act.[4]

I do feel sure that the future will be different, and I hope that it will be better. All of my experience tells me that the way to make it so is to work hard on present problems, with an eye always open for the unexpected.[6]

John Pierce was an extraordinary person with many skills and an awesome intellect. He contributed to the productivity of the many people, institutions, and corporations that came into contact with him. Above all, John Pierce was a person of strict integrity. He knew the difference between specula-

Biography of John Robinson Pierce, 2004 (Pg.14)

tion, wishful thinking, and factual evidence. Pretense was not his way. This attitude permeated his life, his contributions to science and engineering, and his personal relations. We will not often see his kind again.

HONORARY DOCTORATES

1961	D.Eng., Newark College of Engineering
	D.Sc., Northwestern University
1963	D.Sc., Yale University
	D.Sc., Polytechnic Institute of Brooklyn
1964	E.D., Carnegie Institute of Technology
1965	D.Sc., Columbia University
1970	D.Sc., University of Nevada
1974	LL.D., University of Pennsylvania
	D.Eng., University of Bologna (Italy)
1978	D.Sc., University of Southern California

HONORS

1955	Elected to membership in the National Academy of Sciences
1960	Stuart Ballantine Medal (Franklin Institute)
1962	Elected to membership in the American Academy of Arts and Sciences
1963	National Medal of Science
	Edison Medal (IEEE)
1965	Elected to membership in the National Academy of Engineering
1974	John Scott Award (Franklin Institute)
	Marconi Fellowship Award
1977	Founder's Award (National Academy of Engineering)
1985	Japan Prize
1987	Arthur C. Clarke Award
1995	Charles Stark Draper Prize
2003	National Inventors Hall of Fame (posthumous)

NASA Astronaut Peggy Whitson Interview, September 1, 2017 (Pg.1)

Space Station

Sept. 1, 2017

NASA Astronaut Peggy Whitson Shares Thoughts on Extended Mission, Returning to Earth

Record-breaking astronaut Peggy Whitson is set to leave the International Space Station – her home of the past nine months – on Saturday, Sept. 2, and return to Earth. Impacts from Hurricane Harvey at NASA's Johnson Space Center in Houston caused her final in-flight news conference to be canceled, however, she was able to participate via email in the following interview with the Associated Press's Marcia Dunn, acting as a press pool representative.

Astronaut Peggy Whitson pauses during a busy day on orbit to look out the seven-windowed cupola at the Earth 250 miles below.

Whitson and her Expedition 52 crewmates Jack Fischer of NASA and Fyodor Yurchikhin of the Russian space agency Roscosmos are scheduled to land in Kazakhstan at 9:22 pm EDT on Saturday. NASA Television and the agency's website will provide complete coverage of their departure and landing.

Garcia, Mark, "NASA Astronaut Peggy Whitson Shares Thoughts on Extended Mission, Returning to Earth," 1 September 2017. **Courtesy of NASA**

NASA Astronaut Peggy Whitson Interview, September 1, 2017 (Pg.2)

What are your thoughts as you get ready to close out your 9 1/2 - month mission at the International Space Station? Has the flight hurried by or seemed to have dragged? Are you thrilled to finally be headed back to Earth, or feeling sad that you're leaving your orbital home?

Actually, most of the flight has gone by very quickly. In fact, I would say that it didn't feel any longer than my previous two flights of 6 months in duration. I would say the slowest time has been the last week or so. I think it has to do with switching in your mind where you want/need to be. Once the switch is thrown to go home, time seems to move a lot slower.

Peggy Whitson, Expedition 50 flight engineer, poses with the NASA Village banner in the U.S. Destiny laboratory module.

You will be arriving back to a hurricane-flooded Houston. How has the catastrophe there affected your mindset in the past week? Has it made you more anxious about returning home? How did you and your family home fare?

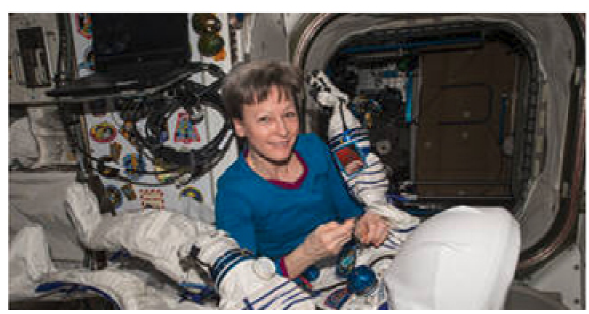
Our home is fine, but so many friends and co-workers have been impacted. For example, in order to keep mission control running, the team (three shifts of a skeleton support crew) were sleeping on cots in the backup mission control rooms. Their sacrifices for the station and keeping things running up here are amazing. And then there were so many others who "called in" to support various meetings and decisions that had to be made to keep the program running, all the while worrying about the sheetrock that needed to be torn out of their flooded house. All this was done because of the caliber of folks we are lucky enough to have working at NASA. Any trepidations I might have about returning in the aftermath of a hurricane are entirely eclipsed by the all those folks keeping our mission going and physically putting themselves out there to help folks who were less fortunate than us.

Astronaut Peggy Whitson checks out a tiny robotic experiment floating inside the Japanese Kibo laboratory module/

Besides family and friends, what have you missed most about Earth? What do you want to eat and do first thing back?

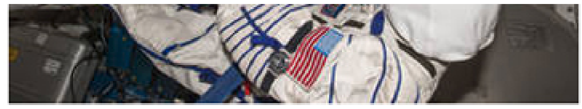
Flush toilets. Trust me, you don't want to know the details.

Pizza has been on my mind for a month or two, since Jack [Fischer] told the ground we weren't a pizza delivery place when he was joking with them.



Garcia, Mark, "NASA Astronaut Peggy Whitson Shares Thoughts on Extended Mission, Returning to Earth," 1 September 2017. **Courtesy of NASA**

NASA Astronaut Peggy Whitson Interview, September 1, 2017 (Pg.3)



Astronaut Peggy Whitson readies the Sokol launch and entry suit she will wear when she returns to Earth inside the Soyuz MS-04 vehicle.

What will you miss most about space?

Things I will miss:

I know that I will hugely miss the freedom of floating and moving with the lightest of touch, especially those first few days after my return when gravity will especially SUCK.

I will miss seeing the enchantingly peaceful limb of our Earth from this vantage point. Until the end of my days, my eyes will search the horizon to see that curve.

I will miss seeing and working within this awe-inspiring creation that we, as a people, have constructed here in space, travelling at 17,500 mph. I still can't believe the incredible level of detail that was required to imagine this place, let alone to build it!

I will miss being the hands of so many investigators, exploring new avenues in research that can't be accomplished on Earth.

I will also miss the ability to "go for a walk" in a spaceship built for one.

And mostly, I will miss that incredible sense of satisfaction, gratitude and pride that comes from working with the NASA team from on orbit.

You broke quite a few records on this mission and set a new standard for astronauts everywhere. What are your thoughts about being a space superwoman and breaking so many records?

I have noted in more than a few interviews that I am not overly comfortable with the praise about the records. I honestly do think that it is critical that we are continuously breaking records, because that represents us moving forward in exploration. I feel lucky to have been in a position to take advantage of the opportunities that I have had, and yet I do acknowledge that my dedication and work ethic helped put me in those positions. Recognizing all that, it is still difficult for me to come to grips with the fact that I have the potential to be a role model. I am working on paying forward some of the advice and mentoring that I received on my journey, in hopes that one day those young people will do the same, and look back on a life in which they leapt at the opportunities and broke their own records.

Looking back on this particular flight, what were your fondest and most challenging moments?

I have been blessed with some really special crewmates. Being able to be a really integral member of the team, no matter what role I was in, was truly special. Some folks describe our common existence up here as like being in a family. While family describes some of the everyday part of living and working together up here, it doesn't sufficiently encompass the reliance on our combined skills on complex, technical and even dangerous work. It's family, but so much more.

One of our more challenging events was an SCU (umbilical for the space suit) started leaking just before the start of an EVA [extra-vehicular activity, or spacewalk]. There were a number of little failures leading up to this point, so I was pretty sure that we were not going to be able to go out the door. The ground team and Thomas Pesquet, who was serving as the suit IV [intra-vehicular officer], however, went through some heroic efforts and in the end made it happen. Just another typical NASA day of making hard things look very easy.

Garcia, Mark, "NASA Astronaut Peggy Whitson Shares Thoughts on Extended Mission, Returning to Earth," 1 September 2017. **Courtesy of NASA**

NASA Astronaut Peggy Whitson Interview, September 1, 2017 (Pg.4)

How did this mission differ from your previous two flights, given its extra length? Do you feel you're returning as strong as ever? How much longer could you envision yourself staying up there, if you had to? An entire year? Longer?

Yes, I do think I could have flown in space longer. The resistive exercise device is much better than the previous versions, and does a fantastic job of keeping us fit from a bone and muscle perspective.

Is this your last spaceflight, in all likelihood? What's next for you? Do you envision staying at NASA? What's your hope for the future of spaceflight?

I am not sure what the future holds for me personally, but I envision myself continuing to work on spaceflight programs. My desire to contribute to the spaceflight team as we move forward in our exploration of space has only increased over the years.

Last Updated: Sept. 1, 2017
Editor: Mark Garcia

Garcia, Mark, "NASA Astronaut Peggy Whitson Shares Thoughts on Extended Mission, Returning to Earth," 1 September 2017. **Courtesy of NASA**

NASA Astronaut Peggy Whitson Returns from the International Space Station with Record-Breaking Accomplishments, September 4, 2017 (Pg.1)

Sept. 4, 2017
RELEASE 17-076

President Trump Welcomes Home Record-breaking NASA Astronaut Peggy Whitson

NASA astronaut Peggy Whitson talks on the phone with President Donald Trump as she flew on a NASA plane to Johnson Space Center's Ellington Field in Houston Sunday, Sept. 3, 2017. Whitson, NASA's Jack Fischer, and Commander Fyodor Yurchikhin of Roscosmos, landed back on Earth at 9:22 p.m. EDT Sept. 2 in Kazakhstan following their long-duration mission aboard the International Space Station. During the phone call, President Trump congratulated Whitson for her record breaking mission and Fischer for his accomplishments on his first spaceflight. During this mission, Whitson became the U.S. astronaut who has spent the most cumulative time in space with a total of 665 days during three long-duration missions.
Credits: NASA/D. Huot
Download high-resolution image here.

Beutel, Allard, "President Trump Welcomes Home Record-breaking NASA Astronaut Peggy Whitson," 4 September 2017. **Courtesy of NASA**

NASA Astronaut Peggy Whitson Returns from the International Space Station with Record-Breaking Accomplishments, September 4, 2017 (Pg.2)

NASA astronauts Peggy Whitson and Jack Fischer received a special welcome as they were flying home to Houston Sunday evening. President Donald Trump spoke by phone with Whitson and Fischer on a NASA plane following Whitson's record-breaking mission to the International Space Station.

Whitson, Fischer, and Commander Fyodor Yurchikhin of Roscosmos, landed back on Earth Saturday in Kazakhstan. She and Fischer flew to NASA Johnson Space Center's Ellington Field Sunday.

"I want to congratulate Peggy and Jack for their incredible accomplishments. They make us all very proud," said President Trump. "Exploration has always been at the core of who we are as Americans, and their brave contributions to human spaceflight have continued that great tradition."

NASA astronaut Jack Fischer talks on the phone with President Donald Trump as Fischer flew on a NASA plane to Johnson Space Center's Ellington Field in Houston Sunday, Sept. 3, 2017. Fischer, NASA's Peggy Whitson, and Commander Fyodor Yurchikhin of Roscosmos, landed back on Earth at 9:22 p.m. EDT Sept. 2 in Kazakhstan following their long-duration mission aboard the International Space Station. During the phone call, President Trump congratulated Fischer on his accomplishments on his first spaceflight, and Whitson for her record breaking mission.
Credits: NASA/Dan Huot
Download high-resolution image here.

Whitson's records are:

- She is the U.S. astronaut who has spent the most cumulative time in space with a total of 665 days during three long-duration missions.
- She is the only female astronaut to command the station twice. During her second mission, she became the first woman to command the space station. During this mission, she became the first woman to command the space station twice -- she was station commander from April 9 through June 1.
- She is the female astronaut who has spent the longest time in orbit during a single spaceflight -- 288 days.
- She holds multiple spacewalking records: completing the most total spacewalks – 10; and most total spacewalking time -- 60 hours, 21 minutes -- for a woman; and having the third most spacewalking time for any spacefarer (a cosmonaut is first and former NASA Astronaut Michael Lopez-Alegria is second).

"Peggy is an inspiration to us all," said President Trump, "especially to young women interested in or currently pursuing careers in science, technology, engineering and math."

This was the president's second call with the two astronauts. On April 24, when Whitson officially set the U.S. record for most cumulative days in space, Whitson and Fischer received a celebratory phone call from President Trump, First Daughter Ivanka Trump, and fellow astronaut Kate Rubins from the Oval Office.

"I appreciate President Trump reaching out personally to congratulate Peggy for her record breaking mission and Jack for his accomplishments on his first spaceflight," said acting Administrator Robert Lightfoot. "The president has had the opportunity to hear from Peggy and Jack first-hand how the work aboard the International Space Station is directly pushing the boundaries of human knowledge, and advancing American leadership in the boundless frontier of space. I want to add my thanks to the teams on the ground across the globe, especially in Houston, who are dealing with the aftermath of a Harvey, yet still maintained the focus to get Peggy and Jack home safely. It is an amazing team."

Beutel, Allard, "President Trump Welcomes Home Record-breaking NASA Astronaut Peggy Whitson," 4 September 2017. **Courtesy of NASA**

Letter from Annie Wittenmyer to the Soldiers' Aid Societies of Iowa Ladies, 1861 (Pg.1)

First to respond to the need
of Civil War wounded, creator of
the diet-kitchen for army hospitals,
and founder of soldiers' orphans' homes was

ANNIE WITTENMYER,

Iowa's Civil War Heroine

by RON FISHER

Courtesy of State Historical Society of Iowa, pp. 113-114, 1861

Letter from Annie Wittenmyer to the Soldiers' Aid Societies of Iowa Ladies, 1861 (Pg.2)

WEEKLY GATE CITY.
KEOKUK: 1861
MONDAY MORNING, NOV. 25.

Report of Mrs. Wittenmyer, to the Soldiers' Aid Societies of Iowa Ladies.

Having been delegated by the Keokuk Aid Society to visit the hospitals of the West, for the purpose of ascertaining their arrangements, and the wants of the sick and wounded among our volunteers, I am instructed to lay before you a brief report of their condition, and to furnish you with a list of articles needed to promote the comfort and secure the convalesence of the sick soldiers, from our State, who are now in hospital.

That there has been great distress among our troops on account of sickness, and that a lack of hospital stores and comforts has aggravated their sufferings, I may not conceal.

That there should be a lack of such hospital furniture and stores as the Government proposes to supply, may be a matter of surprise to some, but when we take into consideration that the Government, at the commencement of this war, was almost in a state of disorganization, and that within the compass of a few months, a vast military campaign has been set on foot, involving millions of dollars, and the health and comfort of hundreds of thousands of men, and that the Government has had to contend with an injured credit and hordes of dishonest army contractors, there is little cause to wonder that her supplies are not more bountiful.

But some of our soldiers have still more serious difficulties to contend with,—their surgeons have not made the necessary requisitions, are lacking in moral character, addicted to intemperate habits, or are overbearing to their men and exhibit but little concern for their health, comfort, or cleanliness.

We may not be able to remedy all of the evils connected with the hospital arrangements of our brave Iowa volunteers; but we have done, and are still doing a great deal to ameliorate their condition, and we hope that very soon, aided by the societies throughout the State who are cooperating with us, we will be able to render their condition very comfortable.

I am requested by our soldiers to express to you, ladies, their deep and heartfelt gratitude for the substantial testimony you have given them, in the way of comforts and delicacies, of your interest in their welfare and your high appreciation of their services; and I have been assured that the consciousness that hundreds of ladies in their own State were thinking of them, and laboring for their comfort, has cheered many a sick soldier, through dark hours of pain, suffering and neglect.

The ladies of our State have done nobly—let us continue our efforts—much still is to be done.

We hope to be able to place in each Regiment, at least two good and efficient female nurses, who will labor for the comfort of our sick, and have charge and take care of our hospital stores. We are fully convinced of the importance of this measure and have secured the services of some of our best ladies for this work. Some of them are already in the field, others will soon follow. Most of the nurses heretofore have been taken from the ranks and are distressingly awkward and rough in their approaches to the men, and know little or nothing about taking care of the sick. A woman of intelligence and character could do more to inspire confidence and render the sick comfortable than a half dozen such men, for women are peculiarly adapted to the kind and delicate offices of a sick room.

Women, weak and dependent as they are, are the most efficient agents for doing good, either as *nurses* or *visitors* among our hospitals. They are received with a degree of confidence and cordiality that no man, however great his military or medical reputation, can command, and with womanly *hearts* and womanly *tact*, they can lay hold of influences that men cannot reach.

Several instances of this kind have recently transpired under the supervision of our society, demonstrating this fact beyond controversy, and proving to us the importance of having female delegates frequently in the field. And the importance of such a measure is still more apparent when we reflect that, the medical and nursing departments of our army are fraught with a *ten-fold interest*, as regards *the saving of valuable life*, above any other department.

Another very serious difficulty that our sick soldiers have to contend with, and one which they feel as bitterly as another is, the impracticable plans of the Sanitary Commission. St. Louis has been made by them the great rendezvous of the sick of the Western division of the army, and it is their plan to draw away the sick from their regiments for a distance of from 100 to 200 miles, and concentrate them at that place. Very extensive preparations have been made there for their accommodation, and, already, there are nearly three thousand sick soldiers in St. Louis.

While we can but speak in terms of praise of the Sanitary Commission, as regards the St. Louis hospitals, the impracticability of their plans will appear, when we take into consideration the fact that, most of our troops are at remote distances from that post, and any attempt to transport *very sick men* to that point would be hazardous to human life—if not very sick, it would be a needless expense and trouble. Besides, our sick soldiers are decidedly opposed to being separated from their regiments and companions, (who are ready to stand by them to the death,) and placed in a promiscuous crowd of strangers in a General Hospital.

The consequence is, that while large sums of money are being expended in St. Louis for hospital purposes, the regiment hospitals are grossly neglected, and our sick are left to choose between staying with their regiments, and suffering the privations and dangers consequent upon a lack of suitable hospital *stores* and *nurses*, and of going to St. Louis at the hazard of their lives. They mostly choose to stay with the regiments and suffer; and the depths of anguish and dispair which have wrung with agony many a noble spirit, God alone can fathom.

Many of our Surgeons are noble men, who will do their duty in the camp or in the field, and are doing all they can for the comfort of their men; but there are others who will best secure the interest of themselves and their men by *resigning their positions immediately*.

It is painful for me to speak of these things and I do it only from a sense of duty, and for the purpose of showing how many difficulties our sick soldiers have to contend with, and the importance of laboring for the regiment hospitals.

As far as my observation extended our troops are well clothed and well fed, and but for the disabilities under which they labor with regard to hospital supplies, *&c., &c.*, the comfort of the men would be tolerably well secured. But the miasmatic districts in which some of our regiments have been quartered, has been very fatal to their health.

This is especially true of the Iowa 2d, 3d and 7th.

The Second, which has suffered more severely on account of sickness than any other, has been brought up from Bird's Point to St. Louis to recruit, and the health of the regiment is improving slowly. There are at this time about 200 out on furlough, 300 to be prescribed for daily, in camp, and 80 in the General Hospital. Some of the sickest of the men were left behind, in Cairo.

Nov 25, 1861 -1

Letter from Annie Wittenmyer to the Soldiers' Aid Societies of Iowa Ladies, 1861 (Pg.3)

The Third, which has been in Quincy for the last six weeks recruiting, has been ordered to St. Louis and is now considered fit for duty.

The Seventh Regiment had two hundred on their sick-list before the battle of Belmont; as they suffered severely in that conflict their number has been greatly increased.

The health of our other regiments is comparatively good—being more recently called into the field and at a more favorable season of the year, they are not likely to suffer so severely.

The articles needed for hospital use are—

Bed-shirts and drawers, made of Canton flannel, bed-sacks, pillow-sacks and cases, size for cot, sheets and comfortables, size for cots, yarn socks, slippers, or cloth shoes, towels, lint bandages, and old linen or cotton clothes, wines, jellies, dried or canned fruits, farina, corn starch, &c.

Any one, or all of these articles will be most acceptable, and if forwarded here, will be taken immediately on to where they are most needed. We are in correspondence with the various regiments and hospitals, and we will frequently visit our hospitals and we pledge ourselves that, whatever stores are sent to us will be taken to where they are most needed, and used for the comfort of our sick soldiers.

We make no appeal to your patriotism or generosity, for we are persuaded that you will heartily co-operate with us in our effort to make them comfortable.

Banded together as we are for a high and noble purpose, let us, true to our country and humanity, and trusting in God, go forward in the prosecution of the work before us with zeal and courage, and may civil and religious liberty crown our efforts.

Published by order of the Keokuk Ladies Aid Society.

ANNIE WITTENMYER,
Corresponding Secretary.

Keokuk, Nov. 14th, 1861.

THE KEOKUK DAILY GATE CITY

MONDAY, MARCH 4, 1935

Mrs. Annie Wittenmyer.

—THE CIVIL WAR

4. Aid from Home.

While the men of Iowa were in the Union army fighting to hold the nation together, the women at home were bravely serving their country too. Every heroic deed in battle was matched by a courageous act far from the scene of bloodshed. For every shattered body at the front there was a broken heart in some home. The men who enlisted risked their lives but the women they left behind endured unusual hardships. Many worked in the fields, some went to nurse the wounded soldiers, and every one tried to help win the war.

At first the ladies expressed their patriotism with flags which were presented to the companies on the eve of their departure or while in training camp. An emergency, however, soon tested the valor of Iowa women. The men in the first regiment of volunteers had no uniforms for campaign service. None could be obtained from the United States government. Finally, Governor Kirkwood sent a man to Chicago to buy cloth. All he could get was "some very poor, thin, sleazy gray satinett, half cotton and half wool, only fit for summer wear."

Loyal women in the home towns of the First Iowa companies gladly undertook to make this cloth into uniforms. Under the direction of local tailors they went to work. At Dubuque nearly 250 cut and basted, trimmed and stitched for nine days. There was much puzzling over the strange-shaped pieces that went into the men's clothing.

Amid smiles and frowns and the din of female voices the garments were fashioned with little regard for sizes. It was said that some of the soldiers had to climb on a chair to reach the pockets in their trousers. The coat collars were either just a little above the small of the wearer's back or several inches over his head. Nor could the women resist a few adornments. One company wore blouses with green collars and another was distinguished by trimmings of red flannel. Nevertheless the soldiers were glad to get their uniforms, and they appreciated the prayers and hopes that had been sewed into them.

No sooner had the first regiments gone south than the people at home began to plan ways of making army life as comfortable as possible. In each community supplies of food and clothing were gathered and sent to friends and relatives in camp. Soldiers' aid societies were organized for this purpose. In August, 1861, the Keokuk aid society sent Mrs. Annie Wittenmyer to visit the Iowa regiments and see what the soldiers needed. Women all over the state were invited to work through the Keokuk society.

Meanwhile, Governor Kirkwood asked Rev. A. J. Kynett of Lyons to unify all the relief work in Iowa. He formed the Army Sanitary Commission to encourage aid for the soldiers and to save the expense and losses of goods sent privately. This organization worked with the United States Sanitary Commission to improve the health of the army. The Keokuk aid society had the same object, but was interested mainly in the welfare of Iowa soldiers. In November, 1863, these two associations were united to form the Iowa Sanitary Commission. No doubt hundreds of lives were saved and much suffering relieved by the generous help of the people at home.

More soldiers were killed or disabled by sickness from exposure, bad food, and epidemics than by gun fire in battle. The medical service of the army was not able to treat such cases properly, and

Courtesy of State Historical Society of Iowa, pp. 113-114, 1861

Letter from Annie Wittenmyer to Governor Samuel Kirkwood, 1863

...could be found.

THE GATE CITY.

KEOKUK:

TUESDAY, JUNE 8. 1863

REPORT OF MRS. WITTENMYER TO GOVERNOR KIRKWOOD.

HON. SAM. J. KIRKWOOD, GOVERNOR OF IOWA.

Dear Sir.—I have visited, during the last three months, most of the Iowa Regiments in the field, and it gives me great pleasure to report that with but few exceptions I have found their camps and hospitals in as good condition as circumstances would admit.

Some of our Regiments occupy positions of honor and great responsibility, and most of our officers and troops are spoken of in terms of praise and commendation by the Commanding Generals of the Western Department.

The health of our army is greatly improved, owing mainly to the distribution of large supplies of vegetables and anti-scorbutics, but we have now about thirty thousand troops in a section of our country made desolate by the ravages of war—the sickly season of summer is approaching, and unless a generous supply of vegetable food is contributed by the loyal people at home, scurvy, debility and great mortality must result. I therefore call your special attention to the sanitary organizations of the State, and urge upon you the importance of securing unanimous and concentrated efforts.

I am receiving large contributions from all parts of the State, but, up to this time, the supply has not been equal to the demand. This will be a matter of surprise to those who have carefully calculated the amount necessary to supply so large an army, but persons unacquainted with the Commissary Department, are liable to reach false conclusions. It is found, upon calculation, to require 500 bushels of potatoes to supply one pound to each man in the field, from this State, and 812 bushels of dried apples to supply one fourth of a pound to each man, and other things in like proportion. But the character of the work now before us, which has assumed such immense magnitude, is one that ought to command the aid and sympathy of every generous loyal person in the State.

I have received, during the last three months, from the soldiers' aid society of the State 1153 packages, (barrels and boxes,) of goods and vegetables, and $425 58 in money. A full exhibit of the receipts and disbursements will appear in my annual report. I have, during the time, received from the U. S. Government ten bales of cotton for comfortables, which has been manufactured by the aid societies in the West with great acceptability, and are now being distributed for use in the general and post hospitals. I have just received and caused to be sold another lot, (14 bales,) of cotton, given me by the U. S. Government for sanitary purposes, on which I have realized $2,000-18, which is now on deposit, and which, according to the instructions from the Government, I will apply to the purchase of such supplies as are most needed by the army.

The Government is offering me safe and prompt transportation for sanitary supplies, and every facility for carrying out the generous intentions of our people.

Owing to recent orders, no more goods can be sent at the cost of the Government to particular individuals or regiments, but all supplies must go into a common fund for general distribution.

The transactions briefly mentioned in this report, together with my hospital labors, an immense correspondence, and over three thousand miles travel, have so completely occupied my time, that I have not been able to devote as much attention to organizing societies in the State, as I had hoped, but I can safely report a large increase in the number of societies, and greater enthusiasm in regard to the sanitary affairs throughout the State, than ever has existed heretofore. Hoping that I have done some good, and that my labors may meet your approbation,

I am very respectfully
Your obedient servant,
ANNIE WITTENMYER,
State San. Ag't.

EXECUTIVE OFFICE, IOWA,
Iowa City, May 18, 1863.

To the People of Iowa:

The foregoing report of Mrs. Wittenmyer, State Sanitary Agent, shows fully that the efforts to supply our noble men who are periling their lives in defence of our common liberties, with those things needed—and not furnished by our Government—to preserve them in health, or restore them when sick or wounded, are not on such a scale as to meet the pressing demand. Our people do not yet appreciate the magnitude of this work.—Mrs. Wittenmyer gives some figures, which show at a glance that no limited or fitful supply will answer the purpose, nothing short of a full strong, constant stream. Should all our troops be supplied to-day, to-morrow quickly comes with its wants equally urgent—so that,

Courtesy of State Historical Society of Iowa, Kirkwood, Samuel, pp. 115-116, 1863

American Red Cross Letter to Herbert Hoover, March 4, 1918

NATIONAL OFFICERS
WOODROW WILSON, PRESIDENT
ROBERT W. DE FOREST, VICE-PRESIDENT
JOHN SKELTON WILLIAMS, TREASURER
JOHN W. DAVIS, COUNSELOR
STOCKTON AXSON, SECRETARY

WILLIAM HOWARD TAFT, CHAIRMAN CENTRAL COMMITTEE
ELIOT WADSWORTH, VICE-CHAIRMAN
HARVEY D. GIBSON, GENERAL MANAGER

THE AMERICAN RED CROSS
NATIONAL HEADQUARTERS
WASHINGTON, D. C

RED CROSS WAR COUNCIL
BY APPOINTMENT OF THE PRESIDENT OF THE UNITED STATES

HENRY P. DAVISON, CHAIRMAN
CHARLES D. NORTON
GRAYSON M. P. MURPHY
JOHN D. RYAN
CORNELIUS N. BLISS, JR.

EX OFFICIO
WILLIAM HOWARD TAFT
ELIOT WADSWORTH

March 4, 1918

My dear Mr. Hoover:

In response to your request on behalf of the Commission for Relief in Belgium, the Red Cross will be glad to undertake the collection of used and surplus clothing and other articles for the use of the Commission in its relief work in occupied territories in France and Belgium.

We have set aside the week of March 18th to March 25th for a special campaign for this purpose. We feel certain that the people of the United States will respond generously, and that we will be able to collect for the Commission such quantities of clothing and other articles as it requires to satisfactorily carry on its work of relief. We will send out your appeal to all our Chapters through our Divisional organization. Where your local committees still exist, we trust that this work may be done by such committees in co-operation with our local Chapters in order that the Chapters may feel that they too have a part in this great work.

Cordially yours,

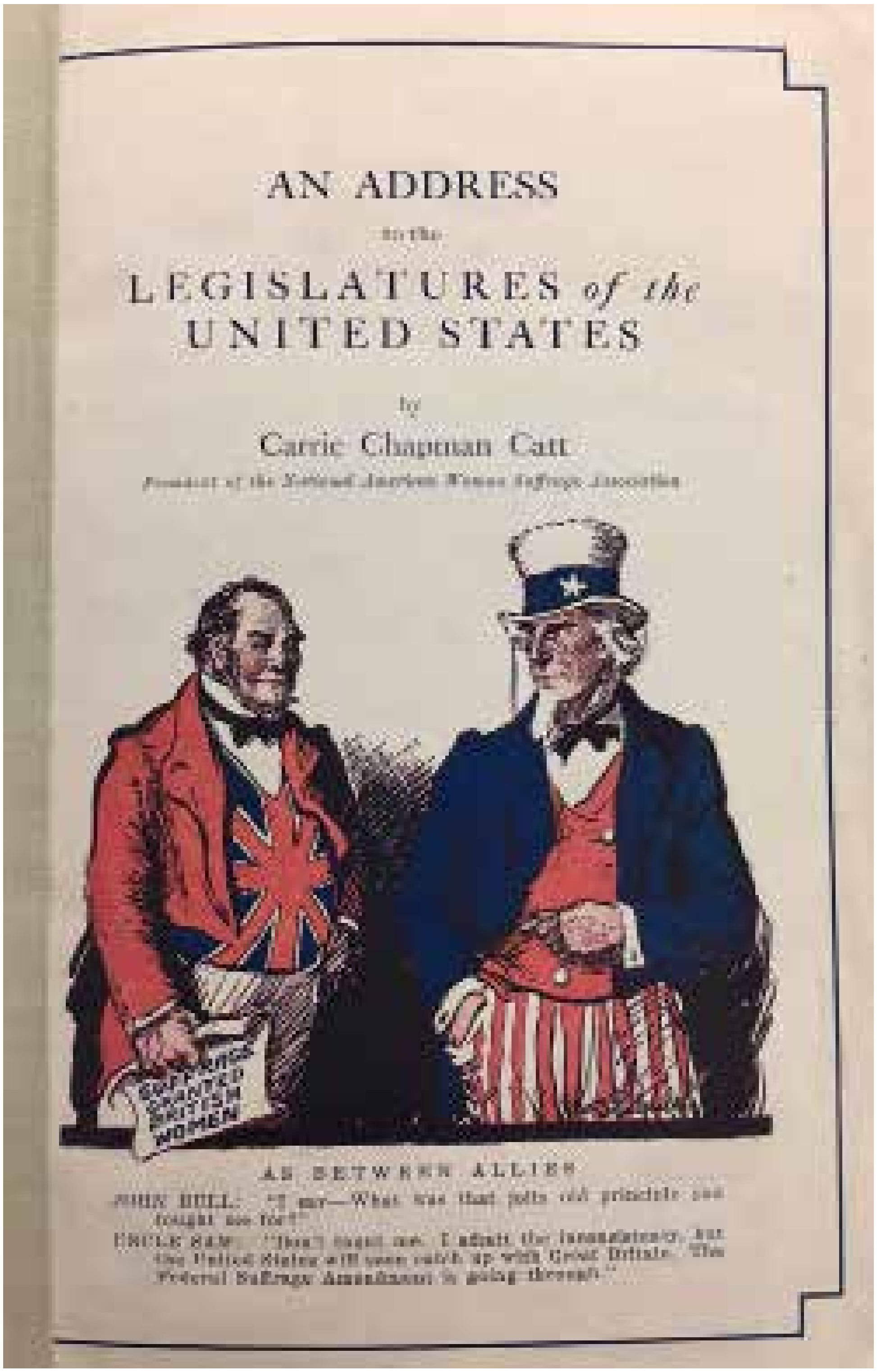
H. P. Davison

Chairman, Red Cross War Council.

Mr. Herbert Hoover, Chairman,
Commission for Relief of Belgium,
Washington, D.C.

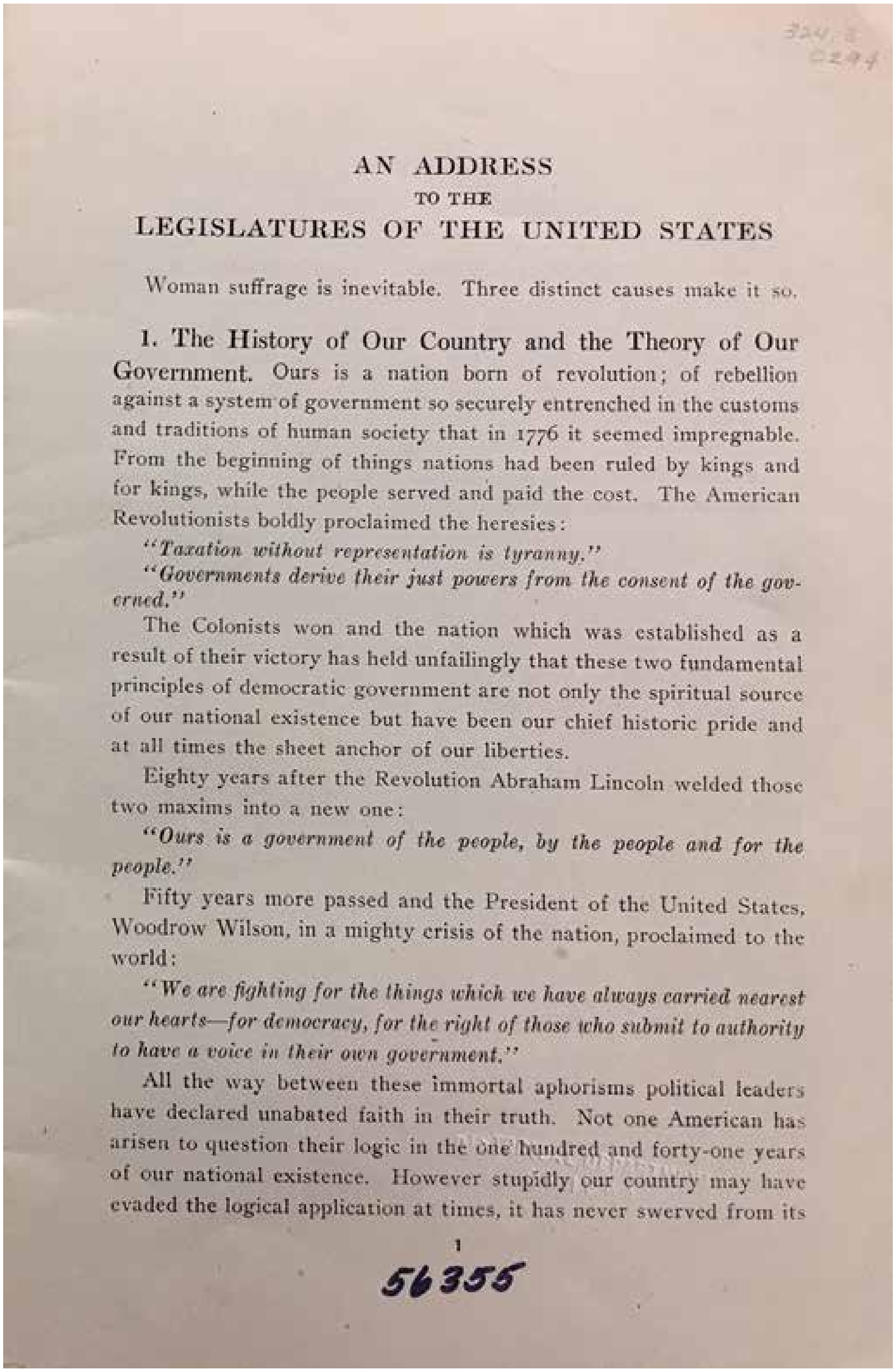
Davison, Henry P., "American Red Cross Letter to Mr. Hoover," 4 March 1918. **Courtesy of National Archives**

Address from Carrie Chapman Catt to U.S. Legislatures about Women's Suffrage Movement, 1919 (Pg.1)



Courtesy of State Historical Society of Iowa, Catt, Carrie Chapman, "An Address to the Legislatures of the United States of America," pp. 1-9, 1919

Address from Carrie Chapman Catt to U.S. Legislatures about Women's Suffrage Movement, 1919 (Pg.2)



AN ADDRESS
TO THE
LEGISLATURES OF THE UNITED STATES

Woman suffrage is inevitable. Three distinct causes make it so.

1. The History of Our Country and the Theory of Our Government. Ours is a nation born of revolution; of rebellion against a system of government so securely entrenched in the customs and traditions of human society that in 1776 it seemed impregnable. From the beginning of things nations had been ruled by kings and for kings, while the people served and paid the cost. The American Revolutionists boldly proclaimed the heresies:

"Taxation without representation is tyranny."

"Governments derive their just powers from the consent of the governed."

The Colonists won and the nation which was established as a result of their victory has held unfailingly that these two fundamental principles of democratic government are not only the spiritual source of our national existence but have been our chief historic pride and at all times the sheet anchor of our liberties.

Eighty years after the Revolution Abraham Lincoln welded those two maxims into a new one:

"Ours is a government of the people, by the people and for the people."

Fifty years more passed and the President of the United States, Woodrow Wilson, in a mighty crisis of the nation, proclaimed to the world:

"We are fighting for the things which we have always carried nearest our hearts—for democracy, for the right of those who submit to authority to have a voice in their own government."

All the way between these immortal aphorisms political leaders have declared unabated faith in their truth. Not one American has arisen to question their logic in the one hundred and forty-one years of our national existence. However stupidly our country may have evaded the logical application at times, it has never swerved from its

Courtesy of State Historical Society of Iowa, Catt, Carrie Chapman, "An Address to the Legislatures of the United States of America," pp. 1-9, 1919

Address from Carrie Chapman Catt to U.S. Legislatures about Women's Suffrage Movement, 1919 (Pg.3)

devotion to the theory of democracy as expressed by those two axioms.

Not only has it unceasingly upheld the THEORY but it has carried these theories into PRACTICE whenever *men* made application.

Certain denominations of Protestans, Catholics, Jews, non-land holders, workingmen, Negroes, Indians, were at one time disfranchised in all, or in part, of our country. Class by class they have been admitted to the electorate. Political motives may have played their part in some instances but the only reason given by historians for their enfranchisement is the force of the logic of these maxims of the Declaration.

Meantime the United States opened wide its gates to men of all the nations of earth. By the combination of naturalization granted the foreigner after a five-years' residence by our national government and the uniform provision of the State constitutions which extend the vote to *male citizens*, it has been the custom in our country for three generations that any male immigrant, accepted by the national government as a citizen, automatically became a voter in any State in which he chose to reside, subject only to the minor qualifications prescribed by the State. Justifiable exceptions to the general principle might have been entered. Men just emerging from slavery, untrained to think or act for themselves and in most cases wholly illiterate, were not asked to qualify for voting citizenship. Not even as a measure of national caution has the vote ever been withheld from immigrants until they have learned our language, earned a certificate of fitness from our schools or given definite evidence of loyalty to our country. When such questions have been raised, political leaders have replied: "What! Tax men and in return give them no vote; compel men to obey the authority of a government to which they may not give consent! Never. That is un-American." So, it happens that men of all nations and all races, except the Mongolian, may secure citizenship and automatically become voters in any State in the Union, and even the Mongolian born in this country is a citizen and has the vote.

With such a history behind it, how can our nation escape the logic it has never failed to follow, when its last unenfranchised class calls for the vote? Behold our Uncle Sam floating the banner with

Courtesy of State Historical Society of Iowa, Catt, Carrie Chapman, "An Address to the Legislatures of the United States of America," pp. 1-9, 1919

Address from Carrie Chapman Catt to U.S. Legislatures about Women's Suffrage Movement, 1919 (Pg.4)

one hand, "Taxation without representation is tyranny," and with the other seizing the billions of dollars paid in taxes by women to whom he refuses "representation." Behold him again, welcoming the boys of twenty-one and the newly-made immigrant citizen to "a voice in their own government" while he denies that fundamental right of democracy to thousands of women public school teachers from whom many of these men learned all they know of citizenship and patriotism, to women college presidents, to women who preach in our pulpits, interpret law in our courts, preside over our hospitals, write books and magazines and serve in every uplifting moral and social enterprise.

Is there a single man who can justify such inequality of treatment, such outrageous discriminations?

Woman suffrage became an assured fact when the Declaration of Independence was written. It matters not at all whether Thomas Jefferson and his compatriots thought of women when they wrote that immortal document. They conceived and voiced a principle greater than any man. "A Power not of themselves which makes for righteousness" gave them the vision and they proclaimed truisms as immutable as the multiplication table, as changeless as time. The Hon. Champ Clark announced that he had been a woman suffragist ever since he "got the hang of the Declaration of Independence." So it must be with every other American. The amazing thing is that it has required so long a time for a people, most of whom know how to read, "to get the hang of it." Indeed, so inevitable does our history make woman suffrage that any citizen, political party, or Legislature that now blocks its coming by so much as a single day, contributes to the indefensible inconsistency which threatens to make our nation a jest among the onward-moving peoples of the world.

2. The Suffrage for Women Already Established in the United States Makes Woman Suffrage for the Nation Inevitable. When Elihu Root, as President of the American Society of International Law, at the eleventh annual meeting in Washington, April 26, 1917, said, "The world cannot be half democratic and half autocratic. It must be all democratic or all Prussian. There can be no compromise," he voiced a general truth. Precisely the same intuition has

Address from Carrie Chapman Catt to U.S. Legislatures about Women's Suffrage Movement, 1919 (Pg.5)

already taught the blindest and most hostile foe of woman suffrage that our nation cannot long continue a condition under which government in half its territory rests upon the consent of half the people and in the other half upon the consent of all the people; a condition which grants representation to the taxed in half its territory and denies it in the other half; a condition which permits women in some States to share in the election of the President, Senators and Representatives and denies them that privilege in others. It is too obvious to require demonstration that woman suffrage, now covering more than half our territory, will eventually be ordained in all the nation. No one will deny it; the only question left is when and how will it be completely established.

3. The Leadership of the United States in World Democracy Compels the Enfranchisement of Its Own Women. The maxims of the Declaration were once called "fundamental principles of government." They are now called "American principles" or even "Americanisms." They have become the slogans of every movement toward political liberty the world around; of every effort to widen the suffrage for men or women in any land. Not a people, race or class striving for freedom is there anywhere in the world that has not made our axioms the chief weapon of the struggle. More, all men and women the world around, with far-sighted vision into the verities of things, know that the world tragedy of our day was not waged over the assassination of an Archduke, nor commercial competition, nor national ambitions, nor the freedom of the seas—but was a death grapple between the forces which deny and those which uphold the truths of the Declaration of Independence.

Our "Americanisms" became the issue of the great war!

Every day the conviction grew stronger that a world humanity would emerge from the war, demanding political liberty and accepting nothing less.

That prediction has proved true and in the new struggle emanating from the war, there is little doubt that men and women will demand and attain political liberty together. Yesterday men and women were fighting the world's battle for Democracy together—

Courtesy of State Historical Society of Iowa, Catt, Carrie Chapman, "An Address to the Legislatures of the United States of America," pp. 1-9, 1919

Address from Carrie Chapman Catt to U.S. Legislatures about Women's Suffrage Movement, 1919 (Pg.6)

men in the army of the trenches, women in the supporting army behind the trenches. They paid the frightful cost of war and bore its sad and sickening sorrows together. Tomorrow they will share its rewards together in democracies which make no discrimination on account of sex.

The war brought new times. In the words of Premier Lloyd George: "There are times in history when the world spins along its destined course so leisurely that for centuries it seems to be at a standstill. Then come awful times when it rushes along at so giddy a pace that the track of centuries is covered in a single year. These are the times in which we now live."

It is true; democracy, votes for men and votes for women, making slow but certain progress in 1914, have suddenly become established facts in many lands in 1917. Already our one-time Mother Country has become the standard bearer of *our* Americanisms, the principles she once denied, and—cynical fact—Great Britain, not the United States, is now leading the world on to the coming democracy.

As an earnest of its sincerity in the battle for democracy, the government of Great Britain not only pledged votes to its disfranchised men and to its women, but the measure passed the House of Commons June, 1917, by a vote of 7 to 1, the House of Lords in January, 1918 and became a national law on February 6th, 1918 by the signature of the King. In consequence of this law the women of England, Scotland, Ireland, Wales and all the smaller British Islands participated in the parliamentary elections in December 1918.

Canada, too, has enfranchised its women from the Atlantic to the Pacific. The great Island Colonies of Great Britain (New Zealand and Australia) and Finland, Norway, Denmark, Iceland have long had woman suffrage. Sweden and Holland have now extended the vote to women, while France and Italy pledge votes to their women. The governments in process of formation amid the wreckage of the former empires of Russia, Germany and Austria, are promising equal suffrage for women.

No slogan of democracy is more worthy of immortality than that of the women of the New Russia, "Without the participation of women, suffrage is not universal."

Courtesy of State Historical Society of Iowa, Catt, Carrie Chapman, "An Address to the Legislatures of the United States of America," pp. 1-9, 1919

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Any man who has red, American blood in his veins, any man who has gloried in our history and felt the thrill of patriotic pride in the belief that our land was the leader of world democracy, will share the humiliation that our country has so long delayed action upon this question. Other countries have beaten us in what we have been taught was our especial world mission.

The Logic of the Situation Calls for Immediate Action

Is it not clear that American history makes woman suffrage inevitable? That full suffrage in fifteen States makes its coming in all forty-eight States inevitable? That the spread of democracy over the world, including votes for the women of many countries, in each case based upon the principles our Republic gave to the world, compels action by our nation? Is it not clear that the world expects such action and fails to understand its delay?

In the face of these facts we ask you, Legislators of the United States, is not the immediate enfranchisement of the women of our nation the duty of the hour?

Why hesitate? Not an inch of solid ground is left for the feet of the opponent. The world's war has killed, buried and pronounced the obsequies upon the hard-worked "war argument." Mr. Asquith, erstwhile champion anti-suffragist of the world, has said so and the British Parliament has confirmed it by its enfranchisement of British women. The million and fifteen thousand women of New York; the two hundred and two thousand women of Michigan, the sixty-five thousand women of Oklahoma, the thirty-eight thousand women of Maine, the fifty thousand women of South Dakota, who signed a declaration that they wanted the vote, plus the heavy vote of women in every State and country where women have the franchise, have finally and completely disposed of the familiar "they don't want it" argument. Thousands of women annually emerging from the schools and colleges have closed the debate upon the one-time serious "they don't know enough" argument. The statistics of police courts and prisons have laid the ghost of the "too bad to vote" argument. The woman who demanded the book and verse in the Bible which gave men the vote, declaring that the next verse gave it to women, brought the

Courtesy of State Historical Society of Iowa, Catt, Carrie Chapman, "An Address to the Legislatures of the United States of America," pp. 1-9, 1919

Address from Carrie Chapman Catt to U.S. Legislatures about Women's Suffrage Movement, 1919 (Pg.8)

"Bible argument" to a sudden end. The testimony of thousands of reputable citizens of our own suffrage States and of all other suffrage lands that woman suffrage has brought no harm and much positive good, and the absence of reputable citizens who deny these facts, has closed the "women only double the vote" argument. The increasing number of women wage-earners, many supporting families and some supporting husbands, has thrown out the "women are represented" argument. One by one these pet misgivings have been relegated to the scrap heap of all rejected, cast-off prejudices. Not an argument is left. The case against woman suffrage, carefully prepared by the combined wit, skill and wisdom of opponents, including some men of high repute, during sixty years, has been closed. The jury of the New York electorate in 1917, the jury of the electorate in Michigan, South Dakota and Oklahoma in 1918 heard it all, weighed the evidence and pronounced it "incompetent, irrelevant and immaterial."

Historians tell us that the battle of Gettysburg brought our Civil War to an end, although the fighting went on a year longer because the people who directed it did not see that the end had come. Had their sight been clearer, a year's casualties of human life, desolated homes, high taxes and bitterness of spirit might have been avoided. The battle of New York was the Gettysburg of the woman suffrage movement. There are those too blind to see that the end has come, and others, unrelenting and unreasoning, who stubbornly deny that the end has come although they know it. These can compel the women of the nation to keep a standing suffrage army, to finance it, to fight on until these blind and stubborn ones are gathered to their fathers and men with clearer vision come to take their places, but the casualties will be sex antagonism, party antagonism, bitterness, resentment, contempt, hate and the things which grow out of a rankling grievance autocratically denied redress. These things are not mentioned in the spirit of threat but merely to voice well known principles of historical psychology.

Benjamin Franklin once said "The cost of war is not paid at the time, the bills come afterwards." So too the nation, refusing justice when justice is due, finds the costs accumulating and the bills presented at unexpected and embarrassing times. Think it over.

Courtesy of State Historical Society of Iowa, Catt, Carrie Chapman, "An Address to the Legislatures of the United States of America," pp. 1-9, 1919

Address from Carrie Chapman Catt to U.S. Legislatures about Women's Suffrage Movement, 1919 (Pg.9)

Two Ways

Women may be enfranchised in two ways.

1. *By amendment of the National Constitution.* This process demands that the amendment shall pass both Houses of Congress by a two-thirds vote and shall then be ratified by the Legislature of three-fourths of the States. . . .

2. *By amendment of State Constitutions.* This method sends the question from each Legislature by referendum to all male voters of the State.

Three Reasons for the Federal Method

There are three reasons for choosing the Federal Method and three for rejecting the State Method. The Federal Method is best.

1. *Because it is the quickest process and the place of our Nation in the procession of democracy demands immediate action.*

In 1869 Wyoming led the way by extending full suffrage to women and 1919 will round out half a century of the most self-sacrificing struggle any class ever made for the vote. It is enough. The British women's suffrage army will be mustered out at the end of their half century of similar endeavor. Surely men of the land of George Washington will not require a longer time than those of the land of George the Third to discover that taxation without representation is tyranny no matter whether it be men or women who are taxed! We may justly expect American men to be as willing to grant to the women of the United States as generous consideration as those of Great Britain have done.

2. *Every other country dignifies woman suffrage as a national question.* Even Canada and Australia, composed of self-governing states like our own, so regard it. Were the precedent not established our own national government has taken a step which makes the treatment of woman suffrage as a national question imperative. For the first time in our history Congress has imposed a direct tax upon women and has thus deliberately violated the most fundamental and sacred principle of our government, since it offers no compensating

Courtesy of State Historical Society of Iowa, Catt, Carrie Chapman, "An Address to the Legislatures of the United States of America," pp. 1-9, 1919

Address from Carrie Chapman Catt to U.S. Legislatures about Women's Suffrage Movement, 1919 (Pg.10)

"representation" for the tax it imposes. Unless reparation is made it becomes the same kind of tyrant as was George the Third. When the exemption for unmarried persons under the Income Tax was reduced to $1,000, the Congress laid the tax upon thousands of wage-earning women—teachers, doctors, lawyers, bookkeepers, secretaries and the proprietors of many businesses. Such women are earning their incomes under hard conditions of economic inequalities largely due to their disfranchisement. Many of these, while fighting their own economic battle, have been contributors to the campaign for suffrage that they might bring easier conditions for all women. Now those contributions will be deflected from suffrage treasuries into government funds through taxation.

Women have realized the dire need of huge government resources at this time and have made no protest against the tax, but it must be understood, and understood clearly, that the protest is there just the same and that disfranchised women income taxpayers with few exceptions harbor a genuine grievance against the government of the United States. The national government is guilty of the violation of the American principle that the tax and the vote are inseparable; it alone can make amends. Two ways are open; exempt the women from the Income Tax or grant them the vote—there can be no compromise. To shift responsibility from Congress and the Legislatures to the voters is to invite the scorn of every human being who has learned to reason. A Congress which creates the law and has the power to violate a world-acknowledged axiom of just government can also command the law and the power to make reparation to those it has wronged by the violation.

3. *If the entire forty-eight States should severally enfranchise women their political status would still be inferior to that of men* since no provision for national protection in their right to vote would exist. The women of California or New York are not wholly enfranchised for the national government has not denied the States the right to deprive them of the vote. This protection can come only by Federal action. Therefore, since women will eventually be forced to demand Congressional action in order to equalize the rights of men and women, why not take such action now and thus shorten and ease the process?

Courtesy of State Historical Society of Iowa, Catt, Carrie Chapman, "An Address to the Legislatures of the United States of America," pp. 1-9, 1919

First Lady Lou Henry Hoover Comments on her Husband's Career and Public Service, 1932 (Pg.1)

were called "gilt edged securities" and most of these remained intact)

However, as he looked the mines over early in that autumn, he was not disheartened. If this war is shortlived, he reasoned, a year or two's work and rehabilitation will put most (not all) of his enterprises back where they were before.

If the war is long drawn out, there is no one who knows better, or who has a wider entree throughout the world into the personnel connected with, the mining and metallurgy of raw materials needed for ammunition, than he did. A bigger fortune opens here than the one otherwise lost.

At that time he was about to wind up the organization giving relief to Americans "stranded" in Europe at the outbreak of the war. And here again was evidenced his tendency always first to look out for the person suffering! The thing that first concerned him, right on the spot when the war broke, and knowing well a number of people high in the affairs of each of the belligerent countries,- the thing that first concerned him, the first day, was not how most quickly to get to safety himself with his family, nor how he could be of spectacular assistance to one of the fighting powers, thus getting "honorable mention",- and a "button",- but unspectacularly he sat in his office, first giving what assistance he could to the stranded friends coming in and begging a loan of five dollars,- of five hundred dollars. And then taking them on wholesale and directing a great organization that cared for (over a hundred thousand - I forget how many)

The rest of the war story you know. When the people of Belgium and Northern France were abandoned between the millstones of Germany and France and England, he became the only discernible factor to prevent the deaths of thousands,- or millions,- of innocent people by starvation, with all the attendant horrors of illness, family tragedies, wholesale rebellion against the occupying soldiery and the consequent rioting and slaughter. Once, not emotionally but with the cold analysis of the engineer, he took down his own family problem and examined it. It took no magic or research or intuition to see that if the war lasted long the fortune he had accumulated would be entirely gone. It was more evident that no one, with his mining and metallurgical knowledge or his genius for organization, had come forward on the side of the Allies for what might be called the supplies-for-ammunition department, and a fortune awaited him there to be measured only by his own conscience. But there was no question as to what he would do. It was only that he would not do it blindly. He thought it out first, And he did ask me if I approved,- but it was only a formal question. He knew the answer. (But I often wonder what he would have done if I had said I thought the adequate care of his wife and children were his first duty!)

For more than two and a half years he worked as few men have ever worked before, he suffered great physical hardships frequently, he was often in the war zone and subject to the dangers of bombardment and other war activities, and absolutely his only interest was the sustenance of the largest number of little human lives he knew of exposed to the more than imminent possibility of the greatest individual and family suffering ever threatened in

Hoover, Lou H., "Mrs. Hoover comments on her husband's career and public service during the campaign of 1932," pp. 4-8, 1932. Courtesy of National Archives

First Lady Lou Henry Hoover Comments on her Husband's Career and Public Service, 1932 (Pg.2)

the world. They were a people that he had not known intimately before, either as a nation or as having intimate friends amongst them. He had no special, preconceived, admiration for them as a people. Their country was not one from which he would ever want an opportunity, peace come, professionally or for recouping his fortunes. He had always been singularly averse to consorting with people merely socially prominent (while, if he found them interesting, he did not mind if they were Earls or paupers), and so he had never been interested in possible forays into the fringes of society around the higher nobility and royalties. The fact that he might get royal recognition for his efforts meant just absolutely nothing to him. The only motive for all that boundless effort and sacrifice was his understanding of the plight of those hundreds of thousands of isolated families of little people who had absolutely no way of fending for themselves. (And yet they say he does not think of the little man!)

When we came into the war, the same was true. Primarily he wanted to win the war,- because only by the preservation of democracy could all the little men have their rights,- so his first thought was for victory. His recent experience determined that he should do his part in the domain of food,- a peculiarly strange field, to those who knew him well, for one who was also singularly fitted for the manufacture of ammunition and the providing of its constituent elements! And secondarily, next after, and very close after, the necessity of profiding sufficient food for our own soldiers and our Allies, did he consider the effect the conservation would have upon the poorer class of our own people. His sedond thought was always practically for their adequate food supply, and (spiritually) that their courage, spiritual participation in, and understanding of the situation should be maintained. That little man!

When the war was over, I feel free to say, his thought, his effort, what persuasive powers he had, were spent, more than those of any other man around those conference tables in Paris, on the ultimate effect their deliberations and decisions would have upon the great masses of population in the various countries. Even President Wilson thought and spoke more of the inherent rights of nations, than of peoples.

Of course during all those months of the Armistice, when he spent so much time and energy on the tangled peace matters, he was also working eight and ten hours every day taking care of the poor little men (and women and children) who were all but forgotten by nearly everyone else. The statesmen seemed to think that while they continued for months their bickerings in Paris their various units of population back home would live on air and keep warm by patriotism, with all the machinery of commerce lying in ruins about them, and no one to build it up. He literally fed millions of the little people over there (this time of course arranging theoretical ways for their paying for it), by shipping the food into their countries, reconstructing their transportation and communications, and helping in the thousand ways you can read about in the A.R.A.

And following the Armistice, when peace had come, and when his own affairs had reached a condition demanding his attention, President Wilson asked if he would remain in Europe after the rest of our delegations left, to help the adjustment of new conditions. He stayed at great sacrifice to himself and us, merely to assure

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the continuance of food and other supplies to the millions of those unknown "little men", and to help them get adjusted to their new economic conditions. (That he had no ulterior desires from the countries concerned, governments or rulers or leading citizens, is evidenced from the facts that he has refused all decorations and orders offered him - the one French one being a surprise - and that assiduously he has not cultivated any of the representatives here from the countries indebted to him, nor their visiting leading citizens, that he has never revisited any of those countries, nor made any effort to keep any "strings" out for future use. He has gone out of his way, at some effort, to keep from being in any position where anyone would have to acknowledge his benefactions. And always remember, of course, he nor any of us have ever received a penny in recompense, or even in remuneration for expenses incurred, for all those years of work during the war and after. (Except his two or three "dollar-a-year's",- and I never heard of his getting them! Or saw them!)

Those years of his life,- and ours,- he gave up to the cause of the little man, millions of him. And not only those years, but most of the kind of happiness, of pleasure, that had been his before. A certain definite, and very original, kind of joy of life was stamped out of him by those war years. Can you remember that as a fun-making, fun-enjoying person he completely changed? Not that he became altogether solemn and serious, not that a quaint whimsicality does not persist and is highly entertaining,- but the old sparkling spontaneity is now only occasionally glimpsed far below the surface.

Since the war, the cause of the little men has been almost as dominant in his life as during that period. During the first few years thereafter, he had to devote considerable time to the marshalling of the forces contributing to our own living. Enterprises had to be revamped or closed out. Others strengthened and built up. Certain investments had to be sold to the best advantage possible and the proceeds put into something more promising or more constructive. It took much time and more thought. But not by any means all at his command. He did many considerable bits of work for the man with fewer opportunities or privileges than himself. The ones that come to my mind first are the Unemployment and Labor Conferences of which he was Chairman in 1920. They got our people back to work after the war more quickly than did any other country, and started new thought in regard to the handling of labor problems in a nation, which if kept up would have tremendously minimized, and very likely prevented, the great unemployment of the present.

Of course, be sure not to quote this.

However, both Harding and Coolidge and their Labor Secretary were inclined to let anything ride that was not going very badly, and besides, none of them had ever handled labor to any considerable extent, so they did not provide for unemployment ahead. Labor in their administrations was little concern of the Secretary of Commerce,- although indirectly he had a little to deal with it, and he did not hesitate to give his opinion regarding the handling of its problems. But he had many ideas for vital improvements in labor matters to begin after his inauguration. However the troubles came so much sooner than even he suspected, that he had not time to begin in that Department in his own administration at the point where he left off in 1920, before the cataclysm was upon us. But if you study back through these past three years, you will see that he has bent every possible effort to caring for the working man and his family. And usually this has had to do with helping keep Industry open. It is

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better that Industry keeps jobs for men, than that the Federal (or any other) government provides him and his family with food and warmth and hospitalization for nothing.

And the "little man" other than the "working man"? The so-called "white collar man", and many others? I suppose by that term "little man" we mean one who is not out-standing, not individually indispensible to his calling, be it mine or factory or office or farm. One who works inconspicuously and more or less adequately in his post for a wage or salary or income sufficient to support his family,- to give them food, clothing, housing, education, hospitalization, amusement and all kindred necessities or small luxurities. But one who can not accomplish all that and afford much leisure time himself, nor provide all the luxuries he would wish for his family, nor all the necessities when illness or misfortune arrive. Nor is he assured of the permanence of even what he has, even if he is ready to work valiantly, at our present stage of economic development. And that is one of the things Daddy has had his eye on helping accomplish,- the assurance of work for the industrious.

But look back through the past three years, and recognize that with factory laborer, farmer, office clerk and others, it is the "small man" that the President has been ceaselessly working for.

His political opponents try to make party or individual capital out of the fact that the dollars are actually loaned to the bank, the railway, the farming co-operative, the big industry. But these must in turn distribute it to the "little man". (And not only must they distribute it to him in wages and salaries or sales, but the actual ownership of most of them is very largely in the hands of "little men" now,- in the shape of stocks and bonds. For more little men than big ones go down in these days when a big enterprise fails. And with the banks, the depositors lose as well.)

I started this letter when I was incensed at much reading one morning of Democratic and "Progressive" effusions about the President's having no thought for the little man, but bending all his energies toward saving the bloated plutocrat. The absolute injustice and downright lying of these statements infuriated me,- and there rushed through my mind a whirl-wind mind-movie of how all that he has been doing so endlessly and so courageously has been for the small individual, the millions of them.

I had to write to you about it! And I thought I was going into a lengthy exposition of all he has accomplished, with these able and tireless men about him, and has tried to accomplish, (remembering always the many of his efforts that have been frustrated through purely political motives in opposition,) for the farmer, the workingman, the clerk, the salesman, the home owner, the bank depositor, the small stock and bond holder since being in the White House,- for the purpose of having the picture in logical sequence on paper for my own satisfaction. I began with a paragraph or two about the

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evidences of his earlier life tending to show the same inclinations,- and all my time has been absorbed before I reached the subject of my discourse!

Now things are piling upon me. I will not have time to finish this for days. But you can doubtless finish it in your own minds yourselves. If you can not, if there are steps in his progress, his accomplishment, that you have not happened to see, whose significance you have not happened to grasp, think them out for yourself and make his case clear for "the little man," in each instance, in your own mind.

Finished in haste.
Certainly to be read at leisure!

Most love

Hoover, Lou H., "Mrs. Hoover comments on her husband's career and public service during the campaign of 1932," pp. 4-8, 1932. **Courtesy of National Archives**