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CHARLES FRANKLIN KETTERING

1876—1958

A Biographical Memoir by
ZAY JEFFRIES

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Biographical Memoir

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August 29, 1876–November 25, 1958

BY ZAY JEFFRIES

CHARLES FRANKLIN KETTERING was elected to membership in the National Academy of Sciences in 1928. He died November 25, 1958. The impact of his contributions and personality was so great that he became a sort of "institution." The "Kettering Institution" will live, even though often anonymously, as long as civilization endures. This brief memoir can at best cover but a few small segments of his productive career, but at least it will serve to show that Kettering was one prophet who is honored not only in his own country but also by his contemporaries and associates.

Kettering was born August 29, 1876, on a farm in Ashland County, Ohio, a few miles from Loudonville. He was the son of Jacob and Martha (Hunter) Kettering. After graduating from Loudonville High School, he taught in the Bunker Hill, Ohio, grade school. He then attended Wooster College for one summer but decided that an engineering course at Ohio State University would suit him better than the pursuit of the classical languages. Because of eye trouble, however, he was forced to postpone his engineering education. Instead, for two years he taught in a grade school at Miffin, Ohio, after which his eyes had sufficiently recovered to warrant enrollment in the University. He was not able to finish his sophomore year, again because of eye trouble, so he worked for about two years for the Star Telephone Company, where he did everything in the construction and maintenance of small city and country telephone facilities including the adaptation and installation of a central battery system.

He then returned to the University, from which he graduated at the age of twenty-eight with degrees in mechanical and electrical engineering.

Soon after graduation he worked for the National Cash Register Company at Dayton, Ohio. Here his inventive genius was evidenced by his development of, among other things, an electric drive for cash registers. During his five years with this company Kettering made four major and many minor contributions, acquired competence in the disciplines essential for technologic progress, and enjoyed close association with several men of fertile mind.

Among these was Edward A. Deeds, a young executive who had engaged Kettering's services during his senior year at the University, and who was to play an important part in Kettering's career. Another was Earl Howard, at one time Deeds's secretary but later with Cadillac in Detroit. Also, W. A. Chryst, top assistant to Kettering, became a key figure in Kettering's ventures.

Howard reported to Kettering that the Cadillac engineers were far from satisfied with the best that was then available in automobile engine ignition. Nothing more than this information was needed by Kettering to arouse his interest. He began working nights and week ends on an improved ignition system. Deeds and Chryst joined him in this effort. The first work was done at Kettering's home, but when more space was required Deeds provided it in his barn. The development seemed so promising that in 1909 Kettering resigned from the National Cash Register Company and devoted all of his time to the work of the Dayton Engineering Laboratories Company, or "Delco" as their new venture was called. A much improved ignition system was developed and was soon adopted by Cadillac, and thus Delco was successfully launched. Although at that time Deeds remained with National Cash Register, he also maintained his association with Kettering.

Next came the historical development of the electric starting, ignition, and lighting system. After many disappointments and some misfortunes, this system was so much in demand that the laboratories

for a time became factories. Even though as much of the manufacturing was farmed out as was possible, the assembly operations called for more and more space.

As soon as Kettering could resume his laboratory work, he developed a small internal combustion engine and the necessary auxiliary equipment for a self-contained electrical system for use at locations not served by the utilities power lines. This unit became known as the "Delco Farm Light." By 1915 the business of Delco became so large that Deeds resigned from National Cash Register in order to devote more time to this new and exciting venture.

In 1916, seven years after Delco was started, Kettering and Deeds sold their interest to United Motors Company, which later became part of General Motors. Both men stayed on as operating heads of the Delco unit. This unit was assigned the problem of developing the ignition system for the Liberty aircraft engine of the First World War.

A separate organization, Dayton-Wright Aeroplane Company, was established and Kettering served as vice-president in charge of engineering. Among its other activities this organization was the major factor in the development for the United States government of "The Bug," a pilotless bomber, which was ready for production at the time the First World War armistice was signed in 1918. Another company, Dayton Metal Products, had a Research Division which Kettering headed, and this unit developed the guidance system for "The Bug."

Thus Kettering became busy as usual on a variety of new developments. While he was working on these, General Motors decided to establish a laboratory in Detroit and wanted Kettering to head it. He agreed to transfer his various interests to General Motors and head their laboratories, provided that he could make Dayton the headquarters for the new laboratories. This was agreed to. Soon the great team of Sloan and Kettering began to click, and Kettering was made vice-president and then director of General Motors. Eventually, too, Detroit became the research headquarters, but Kettering's

home remained in Dayton. In Detroit he lived at the Book-Cadillac Hotel.

From about 1920 on Kettering was the spearhead of technological progress at General Motors and was mainly responsible for the acquisition or creation of several new "businesses." Obviously, all of the developments of these large laboratories cannot be attributed to Kettering or any other one man. On the other hand, not many large organizations like General Motors Research Laboratories owe so much to the imagination, enthusiasm, and drive of one man as that organization owes to Kettering. In fact, his own associates characterized him as "a sort of spark-plug setting off one scientific explosion after another."

Some additional innovations springing from Kettering's imagination and drive or in which he made significant contributions are:

Tetraethyl lead or ethyl gasoline. In this development Thomas Midgley, Jr. and T. A. Boyd were closely associated with him.
The nontoxic refrigerant Freon
"Durex" bearings
Quick-drying lacquer finishes
Short-cycle malleable iron
Harmonic balancer
Four-wheel brakes
Crankcase ventilation
10 W and 20 W winter lubricating oils for automobile engines
Extraction of bromine from sea water
Engine oil coolers
Two-way shock absorbers
Static and dynamic balancing machines
Chromium plating improvements
Rubber bushings for spring shackles
Safety glass
Fixed-focus head lamps
Extreme high-pressure lubricants

Resonance-type intake and exhaust silencers
Double glass windows
Unit injector for Diesel engines
Variable speed transmissions
Permanent-mold centrifugally cast brake drums
Two-cycle Diesel engine. This development was an important factor in the displacement of steam by Diesel locomotives.
Combustion chamber development
D.C. amplifier
12 to 1 high-compression engine

Although space does not permit the inclusion of many interesting and important details of Kettering's technologic achievements, it is fortunate that most of the gaps can be filled in for interested readers by reference to a book, *Professional Amateur: The Biography of Charles Franklin Kettering,* by one of his lifelong associates, T. A. Boyd.

In recognition of his achievements Kettering received many honors. Among these were more than thirty honorary degrees from universities and colleges in various parts of the world, medals, decorations, honorary memberships, and appointments to high positions. He was a member of many technical and scientific societies and served as president of the Society of Automotive Engineers in 1918. He was chairman of the National Inventors' Council and also of the National Patent Planning Commission. He contributed generously and effectively to the security of the United States during both the First and Second World Wars.

Technology constituted the mainstream of Kettering's life but the stream had many and large branches. As an educator, what could have been a better beginning than teaching in grade schools? He became a trustee of Ohio State University, Antioch and Wooster colleges, and the University of Miami (Florida). He was a co-founder of Moraine Park School of Dayton, Ohio. But these are merely the manifestations of his interest in education. He instructed all who

came in contact with him. He became proficient in the art of communication. Different approaches were used as occasion demanded. He had a widespread reputation for his cursing. One did not get the impression, however, that he intended to be profane. It was one of his communication techniques which he could turn on and off at will.

Another of his communication techniques was his ability to deflate the sophisticated. He never seemed to exhaust his repertoire of tricks to achieve this objective. He could and often did stump his audiences or conferees with the question, "What makes grass green?" But he usually deflated for some purpose. For example, he said that often the restatement of a problem made the solution easier. Then he would illustrate by asking that a small *y* be written upside down. After his listeners had made some clumsy efforts, he would then say, "Now let's restate the problem. Write a small *h*." His deflation technique was not used to depress his listeners but to put them in the right frame of mind for an uplift. He came in contact with so many people in his lifetime and exerted such influence on them that it can truly be said that he was one of the great educators of his time.

Kettering was a practical scientist. To him the science disciplines were vital technologic tools. If delving deeply into the sciences was necessary for one of his projects, he did not hesitate to make profound studies of his own and to solicit help from others. He had the reputation in some quarters of being opposed to pure science, but he believed that science could be both pure and useful at the same time. While he was not enthusiastic about theoretical science, he was dedicated to experimental science. I recall meeting him by chance at breakfast in the Book-Cadillac Hotel long after he had achieved great fame. He asked me where he could procure some aluminum wire as fine as two and a half mils in diameter. I asked him if still finer wire would be preferred and he said it would. I then said I would send him a spool of one-mil wire. He beamed with the look and enthusiasm of a child who had just been given a coveted toy. Impressed by such enthusiasm, I asked him why he wanted the wire.

He said, "I am going to try experimentally to determine the inertia of the electron."

Kettering's standing in the scientific world is accurately reflected by the fact that in 1945 he served as president of the American Association for the Advancement of Science.

As a philosopher, Kettering held a unique place. Not since Franklin has America produced his equal as a down-to-earth philosopher. We have his own statement of one guiding principle of his life: "We are not at the end of our progress but at the beginning. We have but reached the shores of a great unexplored continent. We cannot turn back for there is no other way to go but forward. It is man's destiny to ponder on the riddle of existence and, as a by-product of his wonderment, to create a new life on this earth." He did not seem to worry much about metaphysical or abstract philosophy. Rather he tried to evolve, use, and teach a practical philosophy which could help individuals to more favorably orient their lives. One of the evidences of his stature in philosophy was his election in 1930 to membership in the American Philosophical Society, which was founded over two hundred years ago by Benjamin Franklin—a fitting Franklin-Kettering coupling.

Discussion of the branch streams of Kettering's life would be incomplete without mention of his standing as a speaker. Not many professionals have given more talks, addresses, lectures, and radio broadcasts. Furthermore, he was in such demand for talks that he had to decline many invitations. By this means, however, he communicated with tens of thousands of people. In fact, these talks were his most effective channel for the teaching of his philosophy and for imparting inspiration to others. T. A. Boyd has characterized his public speaking as follows: "Popular as a public speaker, Kettering made hundreds of addresses and radio speeches. These were full of wit and wisdom characteristic of him. He had a knack of putting things in direct and simple terms, of using imagery and apt analogy, and of injecting anecdotes and humor to give his talks vividness and vigor. Many of his sayings and epigrams have been widely quoted.

'The price of progress, is trouble,' he would say, 'and I don't think the price is too high.' "

In the area of philanthropy and public benefaction, he financed the Charles F. Kettering Foundation and helped in guiding its researches on photosynthesis and artificial fever therapy. The Sloan-Kettering Institute for cancer research received his active support as a director; hopefully, this activity will continue to benefit man throughout the foreseeable future. He assisted Ashland and Antioch colleges, the University of Cincinnati, Northwestern Technological Institute, Ohio State University, Washington University, and others. He financed fellowships in several colleges. In addition to these activities, much help that he gave in a quiet way to many people and many organizations may never be publicly reported. He gave to be helpful, not for public acclaim.

As a captain of industry, Kettering must be numbered among the great. He was as much at home with top industrialists as he was among scientists, engineers, and the common run of human beings. Early in life he was co-organizer of both the Dayton Metal Products Company and the Dayton-Wright Aeroplane Company. He was chairman of the board of Winters National Bank and Trust Company of Dayton and served as director of the National Cash Register Company, the Ethyl Corporation, the Mead Corporation, and the Moraine Development Company. His accomplishments for General Motors alone would have entitled him to a high position among industrialists, but even this plus the other activities mentioned does not adequately reflect his impact on the industrial world. Alfred P. Sloan, Jr., indicating an important facet of Kettering's industrialism, assures us that he was a "master salesman."

Eventually this technologic stream with all of its important branches joined to produce the entity which was Kettering the man. He was modest, kindly, and sometimes even humble. His faith that hard work and clear thinking could solve many a supposedly insoluble problem became so infectious that men and teams found

themselves working like beavers on problems Kettering thought had promise.

Kettering amassed a great fortune, which came, not as a prime objective of making money, but as a by-product of making great contributions. He had the genius to select important problems, the ability to solve them in a practical way, and the courage and passion to everlastingly stick with his important ventures till they found widespread use. It is not a stroke of luck that automobiles are year-round and twenty-four-hour-a-day vehicles and that they are driven by millions of women. Kettering's starting, ignition, and lighting system was responsible. His contributions to railroad locomotion, marine, aircraft, farm, construction, and other equipment were not regarded by him as significant until they had been put to appropriate use.

Kettering's associates, especially the ones who liked hard problems and hard work, revered him. They called him "Boss" or "Boss Ket." Many of his outside friends called him "Ket." Whether he was called "Boss," "Boss Ket," "Ket," Mr. or Dr. Kettering, one was always conscious that he possessed innate dignity.

Oliver Wendell Holmes wrote: "A man's mind stretched by a new idea can never go back to its original dimensions." This is one statement that Kettering never tried to prove by self-experimentation. He got new ideas so fast that his mind was stretched anew before it even had an opportunity to go back to its original dimensions. Not only did he continually stretch his own mind, but the induced stretching of the minds of others played an important part in his ultimate achievements.

Kettering was fond of practical jokes, but even in this activity there was often an important lesson for the victim. For example, if he had a luncheon guest's car repainted during the lunch hour, it was done mainly because the guest had told him at some former time that no one could develop a lacquer that would dry in so short a time.

One of Kettering's interests related to obsolescence. He did not believe in waste but neither did he believe that all machines and de-

vices had to be "worn out" before being replaced. He regarded obsolescence by improvements as a necessary means for rapid progress. He thought of this as similar to nature's means of progress by organic evolution. A suggested improvement was like a mutation. If it proved to be worthless, it was quickly discarded. If it proved to be more fit than the old, it would be used. If it proved to be sufficiently more fit than the old, it could not only live but could supersede the old; it could create a new species or a new model. Therefore, the faster the new developments could be made and the greater the degree of superiority, the more rapid would be the progress. He visualized this procedure as one which would enhance employment, create many new attractive positions, strengthen our institutions, and result in greater satisfaction in living.

In 1905 Kettering married Olive Williams; she died in 1946. After her death he said that she was the only possession of his that he had never tried to improve.

The attached selected bibliography will give a general idea of the subjects Kettering wrote and talked about. The variety and scope of the subjects reflect his great versatility.

Kettering has been widely acclaimed by his contemporaries. The remarks of two distinguished members of the National Academy of Sciences, now deceased, have typified this acclaim. Willis R. Whitney said: "We have never had another man like him in America. He is the most willing man to do things I have ever seen. Benjamin Franklin was a little like him. Both had horse sense and love of fun. If a fellow goes to school long enough, he gets frozen in his thinking. He is not free any more. But Ket has always been free." Robert A. Milliken said: "He is unique in that he combines in one individual the interest in pure science with the practical ability to apply knowledge in useful devices."

Kettering, indeed, was a very uncommon man. In discussing the inequality of man's talents, Frank Halliday Ferris wrote: "Yet when we look at life with eyes that are envy-free, we know that it is richer because of this inequality. Better that poetic ability be concentrated

in a Milton, musical ability in a Beethoven, the ability to paint in a Raphael, and the rest of us cultivate the art of appreciation, than that there be a dead level, a 'socialization' of artistic ability with resultant mediocrity. Better that Pasteur have five talents in science, Edison and Kettering in invention, and that we all benefit from their labors as we do."

Referring to "labors," it seems appropriate to close with a paraphrase of a well-known verse:

> Heights by Kett'ring reached and kept,
> Were not attained by sudden flight,
> But he, while his companions slept,
> Was toiling upward through the night.

KEY TO ABBREVIATIONS

Civ. Engng. = Civil Engineering
Industr. Engng. Chem. = Industrial and Engineering Chemistry
Mech. Engng. = Mechanical Engineering
Nat. Petrol. News = National Petroleum News
Phys. Rev. = Physical Review
S.A.E.J. = Journal of the Society of Automotive Engineers
Sat. Eve. Post = Saturday Evening Post
Sci. Amer. = Scientific American

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1,004,881	Cash Register	6-9-06	10-3-11
1,108,185	Store Service Credit System Apparatus	2-17-06	8-25-14
1,150,523	Engine Starting Device	6-15-11	8-17-15
1,171,055	Engine Starting, Lighting, Ignition System	4-17-11	2-8-16
1,255,177	Ignition System for Combustion Engines	7-29-14	2-5-18
1,404,152	Fuel Supply System	8-5-18	1-17-22
1,453,358	Joining Metals	12-15-20	5-1-23
1,463,958	Magneto Ignition System	3-25-20	8-7-23
1,479,432	Battery Charging System	2-11-18	1-1-24
1,501,561	Engine Construction	6-21-19	7-15-24
1,529,191	Magnetic Clutch	9-25-22	3-10-25
1,605,664	Motor Fuel (with T. Midgley, Jr.)	4-15-22	11-2-26
1,665,307	Cooling System for Internal Combustion Engines	4-2-23	4-10-28
1,707,732	Frame Construction for Automobile Chassis (with C. R. Short)	4-15-22	4-2-29
1,795,865	Hydraulic Slack Adjuster	5-21-27	3-10-31
1,886,339	Refrigerating Apparatus	12-31-28	11-1-32
2,007,608	Two-Cycle Engine	5-27-31	7-9-35
2,080,487	Synchronous Control of Clutch Servos	5-28-31	5-18-37
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