R. Kompfner

Rudolf Kompfner

1909-1977

By John R. Pierce

Rudolf Kompfner, known universally as Rudi, Professor Emeritus at Stanford University, Quondam Fellow of All Souls College, Oxford, was born in Vienna, Austria, on May 16, 1909; he died suddenly of a heart attack at the Stanford University Medical Center on December 3, 1977.

Rudi Kompfner is known especially for his invention of the traveling-wave tube and the backward-wave oscillator; for his work on satellite communication, in which the traveling-wave tube has played an important part; for work on light-wave communication and optical fibers; and for contributions to acoustic microscopy. He was a scientist, engineer, and inventor with a great enthusiasm in his life and work and a great talent for friendship and the inspiration of others.

The seemingly diverse elements in Dr. Kompfner's life were welded into an unforgettable personality through a constancy of interest expressed during a diversity of circumstances. The constancy of interest included his technical work; his family life; and his love of music, skiing, swimming, good company, and good food.

The diversity of circumstance was great. Immediately after World War I, when the Allies still blockaded Austria, Dr. Kompfner was sent to stay with a Swedish family in order to escape starvation, for which we should all be eternally grateful. With an enthusiasm for physics inspired partly by reading the works of Arago as a young man, he was not permitted to pursue this career.

Rather, he studied architecture at the Technische Hochschule in Vienna, becoming a Diplom-Ingenier in 1933. He then emigrated to the United Kingdom, where he was an architectural apprentice with P. D. Hepworth in London from 1934 to 1936. He was Director, Almond Franey and Sons, Ltd., Builders, London, in 1936-1941. During this period, he not only designed buildings that still stand, but he also studied electron tubes in the Library of the Patent Office in Chancery Lane. This led to the publication of several papers and to his patenting a novel television pickup tube.

Early in World War II, Dr. Kompfner was interned briefly on the Isle of Man as an enemy alien. This gave him an opportunity to think about physics and to study with interned German physicists. In the summer of 1941, he was given a job with the Admiralty, to work on microwave tubes at the Physics Department of Birmingham University under Professor M. L. Oliphant. The work there on high-power magnetrons for radar was a revelation to him. But the fruitful outcome was the invention of the traveling-wave tube, while trying to make a better klystrom amplifier for radar receivers. His fundamental idea-the continuous interaction of an electron stream and an electromagnetic wave of the same velocity traveling along a helix-was ingenious, and the realization worked!

In 1944 Dr. Kompfner was transferred, still as an employee of the Admiralty, to the Clarendon Laboratory at Oxford. There he was haunted with the idea of a voltage-tunable traveling-wave oscillator. His interest persisted through the period during which he studied for his Doctor of Philosophy degree in physics, which he obtained in 1951. He made some theoretical and experimental progress toward his end, partly in collaboration with F. N. H. Robinson of SERL (Services Electronics Research Laboratory) at Baldock.

In 1950 Dr. Kompfner left the Admiralty and became associated with the Atomic Energy Research Establishment, but he continued to work at the Clarendon Laboratory on microwave tubes. In 1951 he accepted employment at Bell Laboratories and arrived at Murray Hill, New Jersey, on December 27, 1951. There he found the facilities necessary to continue his work on tunable traveling-wave

oscillators, and in a short time he had demonstrated electronic tuning over an unprecedented range of 10,000 megahertz-a wave-length range from 6.00 to 7.50 millimeters.

His interest in microwave tubes extended over many years, and his contributions were various, including the use of coupled helices, novel means of focusing (slalum focusing), understanding of noise, and the effects of nonreciprocal loss. Eventually, he assumed greater responsibilities, becoming Director of Electronics Research in 1955, Director of Electronics and Radio Research in 1957 and Associate Executive Director, Research, Communication Sciences Division, in 1962.

In 1958, together with J. R. Pierce, Dr. Kompfner became interested in communication satellites. In 1959 they published a paper outlining the potentialities of such satellites. The Bell Laboratories work on the Echo satellite, which was launched on August 12, 1960, was carried out in Dr. Kompfner's department and under his direction. He was also deeply involved in the Telstar experiment-the launching by AT&T in 1962 of a satellite that carried live television across the Atlantic for the first time.

In the late fifties, Dr. Kompfner became enthusiastic about communication using light waves. His leadership played a large part in the exploration of various possibilities, which led ultimately to the first use of light-wave communication to carry commercial telephone traffic in Chicago in 1977.

In June 1973, Dr. Kompfner retired from Bell Laboratories. Thereafter he divided his time between Stanford University, where he became Professor of Applied Physics and, almost immediately, Emeritus Professor, in 1974, and Oxford, where he was Fellow of All Souls-the first engineer and architect since Christopher Wren, among classicists and humanists-and Professor of Engineering Science.

In this later period, Dr. Kompfner's chief interests were divided among work at Oxford on ingenious ideas concerning the use and interconnection of optical fibers and work at Stanford, chiefly in C. F. Quate's program on an acoustical microscope. He had had an enthusiasm for this field as early as 1966, when he talked of a

program with Quate, Joseph Pick, and Marvin Chodorow. He contributed a number of ideas in this area, including observation by means of harmonics and means for improving depth of focus.

Dr. Kompfner's work received widespread recognition. In 1955 the (British) Physical Society awarded him the Duddell Medal. Happily, this led to his delivering and writing a lecture, "Some Recollections of the Early History of the Traveling-Wave Tube." He later wrote a short book, *The Invention of the Traveling Wave Tube* (San Francisco Press, 1964).

Dr. Kompfner was awarded the National Medal of Science (1975), the David Sarnoff Award (1960), the Medal of Honor of the IEEE (1973), the Stuart Ballantine Medal of the Franklin Institute (1960), the John Scott Award (1974), and the Sylvanus Thompson Medal from the Routgen Society, Incorporated, with the British Institute of Radiology (1974). He was awarded an Honorary Doctorate of Science by Oxford University in 1969 and an Honorary Doctorate of Technical Science from the Technische Hochschule in Vienna in 1964 not as a former student of architecture, which would have been inadmissible, but allowable because he had never been a student of physics in that institution.

Dr. Kompfner was a member of a number of societies and institutions: The National Academy of Engineering, the National Academy of Sciences, the Physical Society (British), and a Fellow of the IEEE. He served these organizations and his country in a number of ways. In the National Academy of Engineering he served as a Member and Chairman of the Awards Committee, as a Member and a Vice-Chairman of the Aeronautics and Space Engineering Board (ASEB), and as a Member of the Selection Committee for the Zworykin Award. He also served the NAE Committee on Science and Public Policy, the Space Science Board, and the Academy Forum General Science Advisory Committee. He was a Member of the Trustees of the Associated Universities, Inc. He was made a Fellow of the American Association for the Advancement of Science (AAAS) in 1974.

His countries and many individuals owe Rudi Kompfner a great debt of friendship and inspiration. A good part of this writer's career was built on Rudi's invention of the traveling-wave tube.

Rudi's career exemplifies the benefits that this calling can bring to society. He, himself, summarized the personal rewards:

> The feeling one experiences when he obtains a new and important insight, when a crucial experiment *works,* when an idea begins to grow and bear fruit, these mental states are indescribably beautiful and exciting. No material rewards can produce effects even distantly approaching them. Yet another benefit is that an inventor can never be bored. There is no time when I cannot think of a variety of problems, all waiting to be speculated about, perhaps tackled, perhaps solved. All one has to do is to ask questions, why? how? and not be content with the easy, the superficial answer.