

RESOLUTION ADOPTED ON THE DEATH OF

PROFESSOR JOSEPH H. KEENAN

We, the Faculty of the Department of Mechanical Engineering of the Massachusetts Institute of Technology, record with deep sorrow the death of our esteemed friend and colleague Joseph H. Keenan, Professor Emeritus of Mechanical Engineering and former Head of this Department.

Professor Keenan died July 17, 1977. Although stricken with lung cancer, he had steadfastly maintained an active life for the last three years.

Joseph Henry Keenan was born August 24, 1900, in Wilkes-Barre, Pennsylvania. He received the bachelor of science degree from MIT in naval architecture and marine engineering in 1922.

Until 1928 he was a turbine design engineer with the General Electric Company in Schenectady, New York, where he first became interested in the properties of steam. For six years, from 1928-1934, he was an assistant professor of mechanical engineering at Stevens Institute of Technology in Hoboken, New Jersey. In 1934 he came to MIT as an associate professor of mechanical engineering and became a full professor in 1939.

During the more than forty years he was associated with MIT, Professor Keenan made a host of friends among his colleagues and students. He is remembered by all for his personal qualities and for his dedication to the Department and to the Institute. The preeminence of the Department was a constant source of pride for him and he worked throughout his career to insure continued excellence. He had a deep and genuine concern for students, both for their professional development and their growth as educated persons in the broadest sense. No less was he concerned with the discovery and nurturing of promising young faculty members, by this means imprinting the Department with his lasting influence. Truly a master teacher with a highly individual style, he patiently led students, by means of leading questions, to individual discovery and insight.

Professor Keenan's works on thermodynamics are world-renowned and have directly and indirectly changed the face of thermodynamics teaching in engineering. His contributions to thermodynamics derived from an uncompromising search for understanding and the elimination of ambiguities overlooked or accepted by others. He developed a coherent and logical exposition of the fundamentals of thermodynamics so that the widest possible range of problems could be considered in a uniform and consistent manner. To the very

end he strove to improve the exposition and to make it more useful for practicing engineers. His famous textbook "Thermodynamics", published in 1941, remains a classic. It represents the distilled essence of thinking up to that time, and it is characterized by simplicity of approach, rigor in logical development and economy of effort. This book has had an authoritative and continuous influence on teachers of thermodynamics, in all branches of engineering, and throughout the world.

Through his writing and teaching, Professor Keenan brought to the engineering profession the fundamental work of J. Willard Gibbs in thermodynamics which, for the most part, had been overlooked by engineers and scientists for five decades. In the 1930's he adapted Gibbs' concept of thermodynamic availability to the steady-flow processes of engineering. The initial motivation for this development was the allocation of fuel costs in a process with many outputs. Availability soon became widely used in chemical engineering and power-plant engineering, particularly abroad. Recently, it has become an important tool in the shaping of a National energy policy.

In the late fifties and sixties, Professor Keenan contributed to a new interpretation of thermodynamics that is applicable to a much wider range of systems and physical

phenomena than any other interpretation presented in the past. This new interpretation applies to quantum systems and classical systems, relativistic mechanics and Newtonian mechanics, nuclear reactions and chemical reactions, fluids and solids, and to single molecules. It is presented in a book he co-authored, "Principles of General Thermodynamics", published in 1965. In this book, the conflict between the postulates of thermodynamics, including reversibility, and those of quantum mechanics are resolved, and many aspects of these two sciences are unified into a single conceptual entity.

The development of accurate tables of the properties of steam, so vital to the electric power industry, was a continuing preoccupation during Professor Keenan's entire career, the initial milestone being his appointment in 1929 as the United States representative to the International Committee on the Properties of Steam. His name is synonymous with the "Steam Tables", familiar to generations of students and practicing engineers: he was author or co-author of successively improved tables of steam properties published in 1930, 1936 and 1939, all of them authoritative. The Air Tables, and then the Gas Tables, which he also co-authored, provided for the emerging gas turbine industry what the Steam Tables had done for the steam power industry.

During his professional career, Professor Keenan conducted significant experimental research, most of which represented pioneering efforts. Among his works were the determination of steam-turbine nozzle performance, experiments on friction coefficients of air at supersonic speeds, experiments on injectors and on heat transfer at high speeds, the development of the free-piston compressor for gas turbine applications, the development of equipment for processing coffee and cocoa, and the development of dust separation equipment.

Professor Keenan headed the Department from 1958-1961, leading the Department through the post-Sputnik years, one of the most difficult periods of its recent history. The introspective studies under his leadership were important factors in the changes that have kept the Department in a preeminent position.

During his long career, Professor Keenan received many honors including Honorary Membership in the American Society of Mechanical Engineers, the Worcester Reed Warner Medal of the American Society of Mechanical Engineers for permanent contributions to the literature of engineering, a Fulbright Lectureship in 1951 at Cambridge University and at the Imperial College of Science and Technology in London, an Honorary Doctor of Laws degree from the University of

Glasgow, and Membership in the American Academy of Arts and Sciences and the National Academy of Engineering.

By this resolution we honor our dear friend and colleague Joseph H. Keenan, and we express our deep sense of loss. It is our wish that this resolution in his honor be conveyed to his family with profound feelings of sympathy.

9 September 1977