PROF. E. R. G. ECKERT

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ERNST R. G. ECKERT

ON THE OCCASION OF HIS SIXTIETH BIRTHDAY

ON 13 September 1964, a number of his students and colleagues, both past and present, gathered together in Minneapolis, Minnesota, to pay homage to Professor Ernst Rudolph Georg Eckert on the occasion of his sixtieth birthday. Many more from around the world, unable to be physically present in Minnesota, were present in spirit and added their best wishes for many happy returns of the day.

Professor Eckert was born in Prague, Czechoslovakia, where he spent his youth. There he attended the German Institute of Technology, obtaining his Diploma Ingenieur in 1927 and his Dr. Ing. in 1931. He remained at the Institute as an Assistant, engaging in the study of radiation heat transfer in furnaces, publishing his earliest papers at this time [*Hauptverein dtsch. Ingen. Mitt.* 483–486 (1931); *Arch. Wärmewirt*, **13**, 241 (1932)].

In 1935, Ernst Eckert made one of the most important moves in his life when he moved to Danzig where Ernst Schmidt was Professor and Director of the Engine Laboratory. Since Professor Schmidt had been active in research on thermal radiation, both from solids and gases, and Ernst Eckert had developed an interest in this field at Prague, it was natural that Ernst Eckert would obtain his habilitation in the field of thermal radiation (1938). During this period at Danzig, under the influence of the outstanding experimentalist Schmidt, Eckert published a series of research papers which are in use to this day; these covered directional emissivity measurements of metallic and non-metallic surfaces [*Forsch. Geb. Ingen.* **6**, 175 (1935)], directional reflectivity values of surfaces exposed to blackbody radiation [*Forsch. Geb. Ingen.* **7**, 265 (1936)], an optical projection method of determining radiation exchange factors [*Z. Ver. dtsch. Ing.* **79**, 1495 (1935)], among many others.

In the late 1930's he turned his attention from radiation in solids to radiation from gases and perhaps the results of these efforts represent his major contributions to the radiation field. He reported in 1937 (*V.D.I.-Forsch.* 387) the emissivity of carbon dioxide–nitrogen mixtures over a range of partial pressures and gas layer thicknesses demonstrating that Beer's law applies to carbon dioxide at moderate pressures. With E. Schmidt, he reported emissivity data for water vapor which explained the discrepancy existing at that time between the earlier results of E. Schmidt and those of Hottel and Mangelsdorf; the Schmidt–Eckert investigation [*Forsch. Geb. Ingen.* **8**, 87 (1937)] disclosed that Beer's law is not valid for water vapor and that the emissivity is sensitive to the partial pressure of the water vapor. The results of these early radiation studies of Eckert are published in *Technische Strahlungsaustauschrechnungen*, V.D.I.-Verlag, Berlin (1937).

In 1937 Professor Schmidt moved to Braunschweig and shortly thereafter in 1938 Ernst Eckert followed, taking up a position as docent at the Institute of Technology and simultaneously becoming a section chief at the newly established Aeronautical Research Establishment (LFA). In this period Dr. Eckert turned his attention from thermal radiation to forced convection over external surfaces and it is the concensus of many of his colleagues that his greatest contributions came in this field. In 1940 he and O. Drewitz (*Forsch. Geb. Ingen.* **11**, 116 (1940)] pointed out that for constant physical properties the heat-transfer coefficient for high speed flows is given by the same expression as for low speed flows if it is defined in terms of the difference between the actual wall temperature and the adiabatic wall temperature and that this conclusion applies to turbulent as well as laminar flows. He developed a cylindrical thermometer to measure the adiabatic wall temperature (*Z. Ver. dtsch. Ing.* **84**,

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813 (1940)] and with W. Weise presented recovery factor data for both laminar and turbulent flow along a cylinder [*Forsch. Geb. Ingen.* **13**, 246 (1942)]. Another major contribution during this period was the development of an approximate method for calculating heat transfer for flow over two dimensional bodies [*V.D.I.-Forsch.* 416 (1942)]. In recognition of his contributions to heat transfer in high velocity flows the dimensionless quantity giving a measure of the temperature increase due to adiabatic compression has been named the Eckert number.

In 1943 Eckert was offered and accepted a Professorship at the Institute of Thermodynamics at his old Alma Mater the German Institute of Technology at Prague, leaving his academic post at Braunschweig but retaining his position at the Aeronautical Research Institute. He continued in these positions until the end of the war in 1945.

On the conclusion of hostilities Professor Eckert accepted an offer to come to the United States and from 1945–49 he was a consultant to the Power Plant Laboratory at Wright–Patterson Air Force Base in Dayton, Ohio. Here he was involved in the design and construction of a Zehnder–Mach interferometer which was used by him and E. Soehngen for the study of free convection from horizontal tubes and vertical plates [U.S.A.F. Technical Report 5747, Wright–Patterson Air Force Base, Dayton, Ohio (1948)]. In 1949, Dr. Eckert moved to Cleveland as a consultant to the compressor and turbine division, Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics. In addition to his consulting commitments he continued research on free convection and on mixed free and forced convection.

In 1951 the opportunity to return to the academic life presented itself when he was offered, and accepted, his present position as Professor of Mechanical Engineering at the University of Minnesota. In 1955 he was also named Director of the Thermodynamics and Heat Transfer Division. During the past 13 years at Minnesota he has continued to do outstanding research over a wide variety of topics including convective heat transfer in both circular and non-circular passages, mass transfer cooling, thermal radiation, interferometric studies of free convection; more recently he has been interested in heat transfer at extremely high temperatures. As an indication of his productivity, Professor Eckert has now authored or co-authored over 200 technical papers.

Dr. Eckert's writings also include five books, two of them published in German. The English texts are: *Introduction to the Transfer of Heat and Mass* [McGraw-Hill (1950)], *Heat and Mass Transfer* [with R. M. DRAKE, McGraw-Hill (1959)], and his most recent book, *Introduction to Heat and Mass Transfer* [translated by J. F. GROSS, McGraw-Hill (1963)].

Professor Eckert's contributions to heat transfer go beyond his actual published research papers. As an outstanding lecturer and a skilled researcher he has had inestimable influence on his students and colleagues. Some 20 students have obtained the Ph.D. degree under his guidance and as a reflection of Professor Eckert's commitment to education, 18 of these now hold university positions. The other two hold responsible positions in the Aerospace industry.

In addition to his teaching and research duties at Minnesota, Professor Eckert has been active as a technical consultant to a number of industrial concerns and governmental committees. He is also a member of the Advisory Council of the Mechanical Engineering Department of Princeton University and a Visiting Professor at Purdue University.

It may be of special interest to note that he played a critical role in the founding of the *International Journal of Heat and Mass Transfer* and has been a co-Chairman of its Honorary Editorial Advisory Board since its inception.

In 1961, in recognition of his many achievements, Professor Eckert was selected to be the first recipient of the Max Jakob Medal and Award. The citation that accompanied the award reads as follows: "For his many and vital contributions to basic knowledge in heat transfer, made directly by his experimental and analytical investigations and also in recognition of his contributions as an outstanding teacher whose enthusiasm and understanding has contributed so widely to the advancement of this important field of engineering science."

To those who have been privileged to know

and work with Dr. Eckert, he has been an inspiration not only in technical matters but in personal relationships as well. He has been unselfish with the time he has spent with students and colleagues, and his quiet good humor and friendliness without pretension have made such associations with him richly rewarding experiences.

In addition to his technical and scientific accomplishments, Professor Eckert finds time to be a devoted family man. He and his wife, Josephine Binder Eckert, and their four children, Christa, Elke, Karin and Dieter, form a charming group with whom it is always a pleasure to associate.

We are sure that his many colleagues all over the world join us in wishing Professor Eckert the happiest of birthdays and many more years of successful accomplishments.

J. P. HARTNETT
T. F. IRVINE, JR.