

CHEMICAL HERITAGE FOUNDATION

HOYT C. HOTTEL

Transcript of Interviews
Conducted by

James J. Bohning

at the

Massachusetts Institute of Technology

on

18 November and 2 December 1985

(With Subsequent Corrections and Additions)

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Oral History Program
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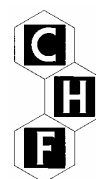
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Chemical Heritage Foundation
Oral History Program
315 Chestnut Street
Philadelphia, Pennsylvania 19106



HOYT CLARKE HOTTEL

1903 Born in Salem, Indiana, 15 January

Education

1922 A.B., chemistry, Indiana University

1924 S.M., chemical engineering, Massachusetts Institute of Technology

Professional Experience

Massachusetts Institute of Technology

1924-1925 Assistant Director, School of Chemical Engineering Practice,
Buffalo Station

1926-1927 Research Associate

1927 Research Associate in Applied Chemistry

1928 Research Associate in Fuel and Gas Engineering

1928-1931 Assistant Professor of Fuel and Gas Engineering

1931-1932 Associate Professor of Fuel and Gas Engineering

1932-1934 Acting Director, Fuels Research Laboratory

1932-1936 Assistant Director, Division of Industrial Cooperation and Research

1932-1941 Associate Professor of Fuel Engineering

1934-1968 Director, Fuels Research Laboratory

1938-1964 Chairman, Solar Energy Research Committee

1938-1944 Gas Turbine Committee

1941-1965 Professor of Fuel Engineering

1945-1950 Project Meteor Steering Committee

1965-1968 Carbon P. Dubbs Professor of Chemical Engineering

1968- Professor Emeritus

National Research Council

1931-1935 Committee on Heat Transmission, National Research Council

1956-1967 Chairman, National Academy of Sciences—National Research Council
Committee on Fire Research

1971-1973 NRC-NAE Panel on Coal Gasification Technology

1975-1978 Ad Hoc Panel on Advanced Power Cycle

1976-1980 Committee on Chemistry of Coal Utilization, National Research Council

1980-1982 Committee on Assessment of Industrial Energy Conservation Program

1985-1988 Panel for Fire Research

1942-1945	Section Chief on Fire Warfare, National Defense Research Committee
1942-1946	Gas Turbine Subcommittee, National Advisory Committee for Aeronautics
1946-1956	Chairman, Thermal Panel, Armed Forces Special Weapons Project
1952-1973	Chairman, American Flame Research Committee of the International Flame Foundation
1954-1964	Vice-President, Combustion Institute
	National Bureau of Standards
1965-1969	Advisory Panel, Research Division
1976-1980	Ad Hoc Evaluation Panel for Energy Conservation Program
1974	Review Committee, National Academy of Engineering Task Force on Energy
1974-1975 Brazil	National Academy of Sciences Advisory Group on Arid Zone Problems in Brazil
1987	Workshop Conference on Analytical Methods of Fire Safety for Buildings

Awards

1946	United States Medal for Merit
1946	King's Medal for Service in the Cause of Freedom, Great Britain
1947	William H. Walker Award, American Institute of Chemical Engineers
1960	Sir Alfred Egerton Gold Medal, The Combustion Institute
1960	Melchett Medal, Institute of Fuel, Great Britain
1963	National Academy of Sciences
1966	Max Jakob Award, American Institute of Chemical Engineers and American Society of Mechanical Engineering
1967	Founders Award, American Institute of Chemical Engineers
1972	Fellow, American Institute of Chemical Engineers
1974	National Academy of Engineering
1975	Farrington Daniels Award, International Solar Energy Society
1975	Esso Energy Award, Royal Society (London), shared with Dr. H. Tabor

ABSTRACT

Hoyt C. Hottel begins the first interview with a description of his childhood and education in Indiana, Missouri, and later Illinois, where his father was a salesman in the rubber industry. He praises his early schooling and various teachers and subjects at Hyde Park High School. Hottel discusses his entry into Indiana University's chemistry program at age 15 and courses and professors there, before turning to graduate work in chemical engineering at MIT with Walter Whitman; and relationships with Tom Sherwood, Warren K. Lewis, and Robert T. Haslam. His experiences at MIT's chemical engineering practice school—including work at a Bethlehem Steel plant, Pennobscot Chemical Fire Company, Revere Sugar Company and Merrimack Chemical Company—led to work as assistant director at the steel plant and influenced later research directions. Hottel next describes his interest in radiation from gases in relation to industrial furnace design; his decision to pursue doctoral research on flame propagation in hydrogen oxygen mixtures; the reasons he postponed writing his dissertation; and subsequent appointments as fuel and gas engineering assistant professor, Fuels Research Laboratory acting director, and division of industrial cooperation assistant director. As a central part of this interview, Hottel details his experiences while advising U.S. armed forces and national committees during WWII, including work on flamethrowers, incendiary bombs, smoke obscuration, napalm, and fire warfare. He closes the first interview with a discussion of his post-war career at MIT, work on turbine combustion and peacetime fire research at the Bureau of Standards.

Hottel opens the second interview with a review of his early experiences as a graduate student and young professor at MIT; he comments on early research, interdepartmental relations, the development of the fuel and gas engineering program, consulting work for private industry, and supervision of graduate students and their research. He briefly discusses his research involving rocket combustion, gas turbines, and Project Meteor, before describing the details of MIT's solar energy research and opinions on solar energy in general. He touches on involvement with the International Flame Foundation before closing the interview with discussion of post-retirement activities, including teaching combustion and radiative transfer courses and co-authoring a book on new energy technology.

INTERVIEWER

James J. Bohning is Professor of Chemistry Emeritus at Wilkes University, where he was a faculty member from 1959 to 1990. He served there as chemistry department chair from 1970 to 1986 and environmental science department chair from 1987 to 1990. He was chair of the American Chemical Society's Division of the History of Chemistry in 1986, received the Division's outstanding paper award in 1989, and presented more than twenty-five papers before the Division at national meetings of the Society. He has been on the advisory committee of the Society's National Historic Chemical Landmarks committee since its inception in 1992. He developed the oral history program of the Chemical Heritage Foundation beginning in 1985, and was the Foundation's Director of Oral History from 1990 to 1995. He currently writes for the American Chemical Society News Service.

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- 16 Early Career at MIT
Appointment as assistant professor in fuel and gas engineering at MIT. Acting director, Fuels Research Laboratory. Assistant director, division of industrial cooperation.
- 18 World War II
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- 35 Post-War Career at MIT
Work on gas turbine combustion. Involvement in establishing Fire Center at the Bureau of Standards.
- 42 Further Details of Experiences at MIT
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- 53 Further Details of Wartime Experiences
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- 58 Further details of Career at MIT
Solar energy research as chairman of solar energy committee. Construction of solar houses. Funding of solar energy project. Opinions on the viability of solar energy. Involvement in the International Flame Foundation.

66 Post-retirement Work

Half-time courses in combustion and radiative transfer at MIT. Book on new energy technology with Jack Howard. Review of MIT colleagues.

NOTES

1. Frederick H. Getman, *Outlines of Theoretical Chemistry* (New York: John Wiley & Sons, 1913).
2. Forris Jewett Moore, *A History of Chemistry* (New York: McGraw-Hill Book Company, 1918).
3. A. Schack, "Über die Strahlung der Feuergase und ihre praktische Berechnung," *Zeitschrift für Technische Physik*, 5 (1933): 267-278.
4. Jaques Cattell, ed., *American Men of Science*, 8th ed. (Lancaster, PA: The Science Press, 1949): 2482.
5. Hoyt C. Hottel, "Heat Transmission by Radiation from Non-Luminous Gases," *Industrial and Engineering Chemistry*, 19 (1927): 888-894;
Hoyt C. Hottel, "Heat Transmission by Radiation from Non-Luminous Gases," *Transactions of the American Institute of Chemical Engineers*, 19 (1927): 173-205.
6. Robert T. Haslam and Robert P. Russell, *Fuels and Their Combustion* (New York: McGraw-Hill Book Company, 1927).
7. Walter J. Wohlenberg and Donald G. Morrow, "Radiation in the Pulverized-Fuel Furnace," *Transactions of the American Society of Mechanical Engineers*, 47 (1925): 127-176;
Walter J. Wohlenberg and E. L. Lindseth, "The Influence of Radiation in Coal-Fired Furnaces on Boiler-Surface Requirements, and a Simplified Method for its Calculation," *Transactions of the American Society of Mechanical Engineers*, 48 (1926): 894-937.
8. R. T. Haslam and H. C. Hottel, "Combustion and Heat Transfer," *Transactions of the American Society of Mechanical Engineers*, 50 (1928): 9-22.
9. N. Artsay, "Analysis of Heat Absorption in Boilers and Superheaters," *Transactions of the American Society of Mechanical Engineers*, 51 (1929): 247-258.
10. Hoyt C. Hottel, "Stimulation of Fire Research in the United States after 1940 (A Historical Account)," *Combustion Science and Technology*, 39 (1984): 1-10.
11. William H. Walker, Warren K. Lewis, and William H. McAdams, *Principles of Chemical Engineering* (New York: McGraw-Hill Book Company, 1923);

- William H. Walker, Warren K. Lewis, William H. McAdams, and Edwin R. Gilliland, *Principles of Chemical Engineering*, 3rd Edition (New York: McGraw-Hill Book Company, 1937).
12. Henry M. Nelly, Jr. and Hoyt C. Hottel, "Combined Regenerator and Catalyst Chamber." U. S. Patent 2,230,467, issued 4 February 1941 (application filed 27 January 1938).
 13. C. M. Tu, H. Davis, and H. C. Hottel, "Combustion Rate of Carbon; Combustion of Spheres in Flowing Gas Streams," *Industrial and Engineering Chemistry*, 26 (1934): 749-757.
 14. C. M. Tu, H. Davis, and H. C. Hottel, "Combustion Rate of Carbon," *International Communications in Heat and Mass Transfer*, 11 (1984): 749-759.
 15. H. C. Hottel and W. R. Hawthorne, "Diffusion in Laminar Flame Jets," *Third Symposium on Combustion* (Baltimore: William & Wilkins Company, 1949): 254-266.
 16. W. R. Hawthorne, D. C. Weddell, and Hoyt Hottel, "Mixing and Combustion in Turbulent Gas Jets," *Third Symposium on Combustion* (Baltimore: William & Wilkins Company, 1953): 266-288.
 17. H. C. Hottel, "Burning in Laminar and Turbulent Fuel Jets," *Fourth Symposium on Combustion* (Baltimore: William & Wilkins Company, 1953): 97-113.
 18. H. C. Hottel, G. C. Williams, and H. C. Simpson, "Combustion of Droplets of Heavy Liquid Fuels," *Fifth Symposium on Combustion* (New York: Reinhold, 1955): 101-130.
 19. H. C. Hottel and J. E. Eberhardt, "Heat Transmission in Steel Reheating Furnaces," *Transactions of the American Society of Mechanical Engineers*, PRO 58 (1936): 185-193.
 20. H. C. Hottel and R. B. Egbert, "The Radiation of Furnace Gases," *Transactions of the American Society of Mechanical Engineers*, 63 (1941): 297-307.
 21. H. C. Hottel, "Solar Energy," *Chemical Engineering Progress*, 71 (1975): 54-65;
H. C. Hottel, "Cloudy Forecast," *Skeptic Magazine*, (March-April 1977): 47-68.
 22. H. C. Hottel, "The Reach of Economic and Technological Assessments of Solar Energy," *Proceedings of the First International Conference on Energy and Community Development of July 11, 1978* (Athens, Greece, May 1980).
 23. H. C. Hottel, F. W. Meyer, and I. M. Stewart, "Temperature in Industrial Furnaces; Interpretation and Use to Measure Radiant Heat Flux," *Industrial and Engineering Chemistry*, 28 (1936): 708-710.

24. Hoyt C. Hottel and Jack B. Howard, *New Energy Technology—Some Facts and Assessments* (Cambridge, MA: MIT Press, 1971).
25. Hoyt C. Hottel and Jack B. Howard, "An Agenda for Energy," *Technology Review*, (January 1972): 38-48.
26. H. C. Hottel and A. F. Sarofim, *Radiative Transfer* (New York: McGraw-Hill, 1967).
27. Warren K. Lewis, Arthur H. Redasch, and H. Clay Lewes, *Industrial Stoecheometry: Chemical Calculations of Manufacturing Processes*, 2nd ed. (New York: McGraw-Hill, 1954).
28. H. C. Hottel, "The Relative Thermal Value of Tomorrow's Fuels," *Industrial - Engineering Chemistry Fundamentals*, 22 (1983): 272-277.

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