

THE BECKMAN CENTER FOR THE HISTORY OF CHEMISTRY

CARROLL A. HOCHWALT

Transcript of an Interview
Conducted by

Jeffrey L. Sturchio and Arnold Thackray

in

Clayton, Missouri

on

12 July 1985

CENTER FOR HISTORY OF CHEMISTRY

Oral History Program

RELEASE FORM

This document contains my understanding and agreement with the Center for History of Chemistry with respect to my participation in a tape-recorded interview conducted by Arnold Thackray and J. L. Sturchion 12 July 1985. I have read the transcript supplied by the Center and returned it with my corrections and emendations.

1. The tapes and corrected transcript (collectively called the "Work") will be maintained by the Center and made available in accordance with general policies for research and other scholarly purposes.
2. I hereby grant, assign, and transfer to the Center all right, title, and interest in the Work, including the literary rights and the copyright, except that I shall retain the right to copy, use and publish the Work in part or in full until my death.
3. The manuscript may be read and the tape(s) heard by scholars approved by the Center subject to the restrictions listed below. The scholar pledges not to quote from, cite, or reproduce by any means this material except with the written permission of the Center.
4. I wish to place the following conditions that I have checked below upon the use of this interview. I understand that the Center will enforce my wishes until the time of my death, when any restrictions will be removed.
 - a. No restrictions for access.
 - b. My permission required to quote, cite, or reproduce.
 - c. My permission required for access to the entire document and all tapes.

This constitutes our entire and complete understanding.

(Signature) David S. Hochstadt, Jr.

(Date) 11/9/87

ABSTRACT

Carroll A. Hochwalt begins with his early years in Dayton, Ohio, including his student days at the University of Dayton. This is followed by his work with Charles Kettering and Thomas Midgley Jr. at Dayton Metal Products, where Hochwalt was a significant contributor to the development of lead tetraethyl and other antiknock compounds. In the central portion of the interview Hochwalt focuses on the Hochwalt and Thomas Laboratories, its development into a large consulting research operation, the clients it served, and the products it developed. The interview concludes with Hochwalt's association with the Monsanto Company and his role in the company's research management.

INTERVIEWERS

Jeffrey L. Sturchio holds an A.B. in history from Princeton and a Ph.D. in the history and sociology of science from the University of Pennsylvania. He has had teaching appointments at the New Jersey Institute of Technology and Rutgers University, and a fellowship at the Smithsonian's National Museum of American History. He is Associate Director of the Beckman Center for the History of Chemistry.

Arnold Thackray majored in the physical sciences before turning to the history of science, receiving a Ph.D. from Cambridge University in 1966. He has held appointments at Oxford, Cambridge, Harvard, the Institute for Advanced Study, the Center for Advanced Study in the Behavioral Sciences, and the Hebrew University of Jerusalem. In 1983 he received the Dexter Award from the American Chemical Society for outstanding contributions to the history of chemistry. He is Director of the Beckman Center for the History of Chemistry.

CARROLL A. HOCHWALT

1900 Born in Dayton, Ohio, on 29 April
1987 Died in St. Louis, Missouri on 23 May

Education

1922 B.Ch.E., University of Dayton
1935 D.Sc., University of Dayton

Professional Experience

1918-1920 Laboratory Assistant, Dayton Metal Products Company
1920-1924 Research Chemist, General Motors Corporation
(Tetraethyl Lead Division)
1924-1925 Production Manager, Ethyl Gasoline Corporation
1926-1936 Vice President, Thomas and Hochwalt Laboratories
Monsanto Company
1936-1945 Associate Director, Central Research Department
1945-1948 Director, Central Research Department
1947-1964 Vice President of Research, Development, and
Engineering
1948-1950 Coordinator, Research Developments and Patents
1949-1950 President, Chemstrand Corporation
St. Louis Research Council
1964-1967 Director
1967-1971 Vice Chairman of the Board
1965-1966 President, St. Louis Regional Industrial Development
Corporation
1971-1973 Director, St. Louis Regional Commerce and Growth
Association

Honors

1956 Midwest Award, American Chemical Society, St.
Louis Section
1962 Honorary D.Sc. degree, Washington University
1963 Knight of Malta, Pope Paul VI
1964 Honorary D.Sc. degree, St. Louis University
1967 Distinguished Alumnus Award, University of Dayton
1969 Brotherhood Citation, National Conference of
Christians and Jews (St. Louis)
1970 Cardinal Gibbons Award, Catholic University of
America
1971 Society of Chemical Industry Medal, American Section

TABLE OF CONTENTS

- 1 Childhood and Early Education
German ancestry. Parents, and father's authorship of books on sporting dogs and historical fiction. Brothers. High school education at St. Mary's Institute. Decision to study chemical engineering.
- 4 Undergraduate Education
St. Mary's Institute (University of Dayton). Professor Wohlleben. Courses and textbooks. Summer work at Dayton Metal Products. Charles Kettering. Thomas Midgley, Jr. T. A. Boyd. Degree in chemical engineering. Ph.D. thesis.
- 6 Dayton Metal Products
Work on antiknock compounds. Lead tetraethyl. Cyclohexane pilot plant. Catalyst research. Octane number development. Kettering's leadership. Lead poisoning. Marriage. Early personal objectives. Charles A. Thomas. Use of bromides to remove engine lead residues.
- 12 Thomas and Hochwalt Laboratories
Formation. Development of fire extinguisher. Competitors. Contract with General Motors. Synthetic Rubber. Freon refrigerant. Ad in Fortune. Working relationship with Thomas. Crap game used to get payroll funds. Morton Salt. Lynn Watt. Origin of Monsanto connection as customers. Carbon remover for the Alemite Corporation. Synthetic detergents. Edgar Queeny. Purchase of Thomas and Hochwalt by Monsanto.
- 18 Early Work at Monsanto
Independence. Service on Executive Committee. Monsanto in the late 1930s. Development of synthetic detergents and fibers. Styrene pilot plant in Dayton. Acrylonitrile pilot plant in Dayton. The detergent "All" and Westinghouse.
- 22 Pre-Monsanto Days at Thomas and Hochwalt
Standard of New Jersey. General Motors. Santolube. Mead Paper Company. Ault and Wiborg Printing Company. National Distillers Company and quick-aged whiskey. Orange peel in laquers. Consulting fees. Laboratory fire. Staff recruitment.
- 27 Research at Monsanto
Moving Monsanto into petrochemicals, detergents, and fibers. Rubber Reserve. Styrene production in World War II. Development of Acrilan. Chemstrand. Comparisons between directing research at Thomas and Hochwalt and Monsanto.

- 33 **Comments and Personal Thoughts**
 Bikini atomic bomb test. Advice to those entering the
 chemical industry. Coming importance of biotechnology.
- 37 **Notes**
- 40 **Index**

8. Thomas Midgley, Jr., "Motor Fuel," U.S. Patent 1,491,998, issued 29 April 1924 (application filed 4 October 1918).
9. T. A. Boyd, "Pathfinding in Fuels and Engines," Society of Automotive Engineers Quarterly Transactions, 4 (1950): 182-195.
10. See Stuart W. Leslie, Boss Kettering (New York: Columbia University Press, 1983).
11. Thomas G. Midgley, "From the Periodic Table to Production," Industrial and Engineering Chemistry, 29 (1937): 241-255; Joseph C. Robert, Ethyl: A History of the Corporation and the People Who Made It (Charlottesville: University of Virginia, 1983): 93-113.
12. Thomas G. Midgley, Jr., Carroll A. Hochwalt, and Charles Allen Thomas, "Polymerization of Dienes," U.S. Patent 1,713,236, issued 14 May 1929 (application filed 25 August 1926); Midgley, Hochwalt, and Thomas, "Manufacture of Rubber," U.S. Patent 1,806,547, issued 19 May 1931 (application filed 22 December 1927).
13. "American Chemical Industries: Thomas and Hochwalt Laboratories, Inc.," Industrial and Engineering Chemistry, 14 (1936): 181; "Thomas and Hochwalt Laboratories, Research Division of Monsanto Chemical Company," Industrial and Engineering Chemistry, 10 (1938): 441-444; Thomas and Hochwalt Laboratories, Chemical Research (Dayton, Ohio: Thomas and Hochwalt, 1933).
14. Carroll A. Hochwalt and John B. Waliuszis, "Manufacture of Ammonium Bromide," U.S. Patent 1,872,292, issued 16 August 1932 (application filed 14 August 1931); Hochwalt and Waliuszis, "Preparation of Bromates," U.S. Patent 1,919,721, issued 25 July 1933 (application filed 19 March 1932).
15. Thomas and Hochwalt ran ads in Fortune XI (May 1935): 193; (June 1935): 33; and (July 1935): 135.
16. "Monsanto's Renaissance Man of Research," Monsanto World News, May 1985: 4-5.
17. Carroll A. Hochwalt, "Prepared Resin," U.S. Patent 2,035,233, issued 24 March 1936 (application filed 17 June 1930); Charles A. Thomas and Hochwalt, "Protective Coating," U.S. Patent 2,038,364, issued 5 May 1936 (application filed 24 July 1930); Waldo C. Ault and Hochwalt, "Manufacture of Motor Fuel," U.S. Patent 2,105,464, issued 18 January 1938 (application filed 29 June 1936).

18. Carroll A. Hochwalt, "Method and Means for Removing Carbon Deposits from Engine Cylinders," U.S. Patent 1,726,437, issued 27 August 1929 (application filed 18 September 1923); Thomas Midgley, Jr., and Hochwalt, "Method and Means for Removing Carbon Deposits from Cylinders," U.S. Patent 1,786,860, issued 30 December 1930 (application filed 2 February 1926); Charles A. Thomas and Hochwalt, "Composition for Removing Carbon Deposits," U.S. Patent 1,896,759, issued 7 February 1933 (application filed 30 October 1929); Thomas and Hochwalt, "Composition for Removing Carbon Deposits," U.S. Patent 1,949,588, issued 6 March 1934 (application filed 18 July 1930).
19. Charles A. Thomas and Carroll A. Hochwalt, "Prepared Resin," U.S. Patent 1,836,629, issued 15 December 1931 (application filed 21 July 1928).
20. Charles A. Thomas and Carroll A. Hochwalt, "Pigment From Ferrous Hydroxide and Other Metal Compounds and a Tannin-Containing Extract," U.S. Patent 2,050,000, issued 7 May 1935 (application filed 26 April 1930); Thomas and Hochwalt, "Pigment from Ferrous Hydroxide and Tannin-Bearing Chestnut Wood Extract," U.S. Patent 2,000,842, issued 7 May 1935 (application filed 31 January 1931).
21. Carroll A. Hochwalt, Charles A. Thomas, and Ernest C. Dybdal, "Hydrogenation of Freshly Distilled Spirits," Industrial and Engineering Chemistry, 27 (1935): 1404-1407.
22. Carroll A. Hochwalt and William H. Carmody, "Ageing of Whiskey," U.S. Patent 2,027,099, issued 7 January 1936 (application filed 30 August 1933); Hochwalt and Charles A. Thomas, "Method of Ageing Whiskey," U.S. Patent 2,027,100, issued 7 January 1936 (application filed 19 December 1933); Thomas and Hochwalt, "Method of Artificially Ageing Whiskey," U.S. Patent 2,027,129, issued 7 January 1936 (application filed 12 September 1934).
23. Carroll A. Hochwalt and Paul E. Marling, "Dehydration of Nitrocellulose and Production of Laquers Containing the Same," U.S. Patent 1,961,120, issued 29 May 1934 (application filed 19 August 1933).
24. Carroll A. Hochwalt and Paul E. Marling, "Effect of Dehydration of Nitrocellulose on Orange Peel of Sprayed Laquer Films," Industrial and Engineering Chemistry, 27 (1935): 190-192.
25. Dan J. Forrestal, Faith, Hope, and \$5000: The Story of Monsanto, the Trials and Triumphs of the First 75 Years (New York: Simon and Schuster, 1977): 121-134.

26. Carroll A. Hochwalt and Nicholas N. T. Samaras, "The Industrial Research Chemist'" Chemical and Engineering News, 28 (1950): 3296-3298; Hochwalt, "The Impact of Chemistry on the World of Science," The Scientific Monthly, July 1953: 48-53; Hochwalt, "The Philosophy of Research," Address delivered at the University of Dayton, 1956, in "The Industrial Philosopher, as Revealed in Selected Speeches and Papers by Carroll A. Hochwalt, Vice-President, Monsanto Chemical Company" (unpublished typescripts).
27. Manuel M. Baizer, "Coupling Cyclic Olefins by Electrolysis," U.S. Patent 3,193,475, issued 6 July 1965 (application filed 13 August 1962); Baizer, "Electrolytic Hydrodimerization of Two Different alpha,beta-Olefinic Compounds," U.S. Patent 3,193,476, issued 6 July 1965 (application filed 29 December 1961); plus U.S. Patents 3,193,477-483; 3,193,510; 3,198,746; 3,218,245; 3,193,480; and 3,218,246. See also J. H. Prescott, "Monsanto's Unique Process Brings Electrochemistry to Organics," Chemical Engineering, 72 (1965): 238-242; Manuel M. Baizer, "Discovery, Development, and Commercialization of the Electrochemical Adiponitrile Process," Chemistry and Industry, (7 July 1979): 435-439.
28. "Monsanto's Renaissance Man of Research," Monsanto World News, May 1985: 4-5.
29. Carroll A. Hochwalt, "Bikini Test 'Immeasurably Increased Knowledge of Bomb' Scientist Says," St. Louis Post-Dispatch, 8 July 1946: 1B; Hochwalt, "An Eye-Witness Account of the Bikini Test," and "Diary" (unpublished typescripts, copies available at the Beckman Center).

INDEX

A

Acrilan, 16, 19, 20, 29, 30, 34
Acrylonitrile, 16, 20, 28, 32
Adams, Roger, 26
Adipic acid, 16, 32
Agricultural chemicals, 16, 34
Agricultural products, 29
Akron, Ohio, 28
Aldehydes, 23
Alemite Corporation, 16
Alkylated compounds, 9
Alkylating agent, 6
"All" (detergent), 20, 21
Aluminum chloride, 22
American Viscose Corporation, 19
Ammonium bromide, 14
Andrews, James, 9
Anniston, Alabama, 29
Antiknock problem, 6, 8, 9
Antimony, 6
Ault and Wiborg Printing Company, 23
Automobile starter, 7
Automotive industry, 9

B

Baking powder, 17
Battelle Memorial Institute, 13, 15
Benzene, 6, 7, 25
Bikini test, 33
Biotechnology, 34
Boston, Massachusetts, 20
Bourbon whiskey, 24
Boyd, Thomas A., 5, 7, 9
Bromides, 12
Bromine, 12
Butadiene, 13, 16, 28

C

Calcium phosphate, 17
Carbon paper, 23
Carbon remover, 16
Carothers, Wallace H., 30
Catalysts, 7
Catalytic hydrogenation, 25
Chemical engineering, 2
Chemical engineers, 20
Chemstrand Corporation, 19, 29, 30
Chicago, University of, 27
Chillicothe, Ohio, 22
Chlorosulfonic acid, 16
Chrysler Corporation, 16
Cincinnati, Ohio, 23
Cincinnati, University of, 27

Cleveland, Ohio, 1
Clients, 12, 14, 15, 17, 25, 31, 32
Competitors, 12
Conant, James B., 26
Congeners, 23, 24
Consulting, 32
Cotton prices, 28
Cracking stills, 22
Crap game, 15
Cyclohexane, 6, 7, 25
Cyclohexane pilot plant, 7

D

Dancing school, 10
Dayton, Ohio, 1, 2, 3, 4, 5, 8, 10, 12, 18, 19, 20, 27, 29
Dayton Metal Products, 3, 5, 6, 8
Dayton, University of, 2, 3, 4, 5, 13, 27
Dayton Wright Airplane Company, 8
Decatur, Alabama, 29
Dehydration process, 24
Depression, 15
Detergents, 16, 20, 27, 34
 non-sudsing, 20, 21
 synthetic, 19
Detroit, Michigan, 8
Diene products, 28
Dimerization of acrylonitrile, 32
Directors of research, 31
Distilled spirits, 23
Dog bench shows, 1
Dow Chemical Company, 12, 20, 28
du Pont de Nemours & Co., E. I., Inc., 19, 26, 27, 29, 31
du Pont, Henry, 19
DuBois, Gaston, 19

E

Eastman Kodak Company, 5
Electrodimerization of acrylonitrile, 32
Engines
 airplane, 6
 automotive, 16
 test, 9
Ethyl Corporation, 12, 16
Ethyl chloride, 10
Ethyl iodide, 10
Ethylene oxide adduct, 20

F

Fibers

- silk-like, 29
- synthetic, 16, 18, 19, 27, 28
- wool-like, 29
- Field trials (for dogs), 1
- Fieser, Louis F., 26
- Fire extinguisher, 2, 5, 12
- Fluorobenzene, 16
- Fortune, 14, 22
- France, 18
- Freon refrigerant, 13
- Fribourg, Switzerland, 2
- Fyr-Fyter Company, 13, 15, 22

G

- Gasolines, 6
- General Motors Corporation, 3, 10, 11, 12, 13, 22, 25
- General Motors Chemical Company, 8
- General Motors Laboratories, 8
- General Motors Research Corporation, 3, 8
- General Motors Research Department, 13
- Germany, 1, 2, 18
- Gibson Island conferences on polymers, 30
- Grain whiskey, 23
- Greenewalt, Crawford H., 19
- Greenness (in whiskey), 23

H

- Harvard University, 26
- Henne, Albert Leon, 13
- Hexamethylenediamine, 16, 32
- Hochwalt, Albert F. (father), 1, 3
- Hochwalt, Carroll A
 - brothers, 2
 - marriage, 10, 11
 - mother, 1, 2, 3
- Holleman, Arnold F., Textbook of Organic Chemistry, 7
- Hydrocarbon cracking, 25
- Hydrocarbon plastic, 28
- Hydrodimerization of acrylonitrile, 16
- Hydrogen, 7
- Hydrogenating benzene, 7
- Hydrogenation, 6, 7, 23, 24

I

- Illinois, University of, 26, 27
- Italy, 18

K

- Kettering, Charles F., 5, 6, 7, 8, 9, 11, 13, 20, 25
- Kistiakowsky, George B., 26, 27
- Knocking motor, 6
- Krilium Soil Conditioner, 33
- Kyrides, Lucas Petron, 27

L

Lead oxide, 12
Lead poisoning, 10
Lead residues, 12
Lead tetraethyl, see tetraethyl lead
Little, Arthur D., Inc., 12, 15, 22, 23
Louisville, Kentucky, 23
Ludlow Street (Dayton, Ohio), 3, 8

M

Mallinckrodt Chemical Works, 32
Marianist Brothers, 2
Marvel, Carl S. (Speed), 26
Mead Paper Company, 22
Mechanical washer, 21
Merger (of Monsanto and Thomas and Hochwalt Laboratories), 19
Merrimac, Massachusetts, 20
Michigan, University of, 27
Midgley, Thomas A., Jr., 3, 5, 6, 7, 8, 9, 10, 11, 13, 22
Massachusetts Institute of Technology (MIT), 10, 19, 26
Molecularized acrylonitrile, 32
Monsanto Chemical Company, 4, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, 28, 31, 32, 33
Monsanto World News, 14
Montecatini Edison, 18
Montedison, 18, 32
Moraine City, Ohio, 3, 8
Morton Salt Company, 14, 15

N

Nason, Howard, 34
National Distillers, 23, 24
Newfoundland, 18
Nickel catalyst, 7
Nitro, West Virginia, 20
Nitrocellulose, 24
Nylon, 28, 29, 30, 32
Nylon intermediates, 16

0

Octane number, 6, 9
Oil additives, 16
Old Granddad Distillery, 23
Orange peel in lacquers, 24, 25
Organometallic compounds, 6, 9

P

Palladium, 7
Patent literature, 7
Penn State University, 26
Periodic Table (for predicting metals with antiknock effect), 10
Petrochemicals, 27, 31
Petrolite Corporation, 32
Phenyl chloride, 16

Phosphorus Group (of Periodic Table), 16
Pilot plants, 5, 6, 20, 27
Plasticizers, 16
Platinum, 7
Polymerization
 of dienes, 22
 of acrylonitrile, 30
Polymers, 16
Preignition, 6
Printing inks, 23
Procter and Gamble Company, 20
Prohibition, 23
Pumice (impregnated with nickel), 7

Q

Queeny, Edgar M., 14, 17, 18, 27

R

Raney catalyst, 23
Rayon, 28
Resin, 22
Roosevelt, Franklin D., 15, 23, 24
Royalties, 14, 15
Rubber Reserve, 20, 22, 27, 28
Rubber Reserve Discussion Group, 28
Rubber, synthetic, 3, 13, 22

S

Salt liquors, 14
Santolube, 22
Scaling up (the laboratory process), 7
Scrapbook, 32
Sharples Chemicals, Inc., 24
Sharples, Philip, 24
Sodium blend alloy, 10
Sodium tripolyphosphate, 16, 17
Spinnerets, 30
Sporting dogs, 1
Sporting magazines, 1
Springfield, Massachusetts, 30
Standard Oil of New Jersey, 22
Starter (for automobile engine), 9
Styrene, 13, 16, 20, 22, 27, 28
St. Louis, Missouri, 4, 18, 20, 27
St. Mary's Institute, 2, 4
Synthetic detergents, See detergents
Synthetic fibers, see fibers, synthetic
Synthetic rubber, see rubber, synthetic

T

Tetraethyl lead, 6, 10, 12

Thirty Years War, 1

Thomas, Charles A., 2, 11, 12, 14, 19, 28

Thomas and Hochwalt Laboratories, 3, 11, 13, 16, 17, 25, 26, 27,
31

Tin ethyl, 6

U

United States Air Corp, 6

United States Justice Department, 19

Unsaturated compounds, 22

W

Watt, Lynn, 16

Wells, Russell, 9

Westinghouse Corporation, 21, 33

Witco Chemical Corporation, 32

Wohlleben, William Joseph, 2, 3, 4, 34

World War I, 5

World War II, 27, 30

Z

Zinc ethyl, 6, 10