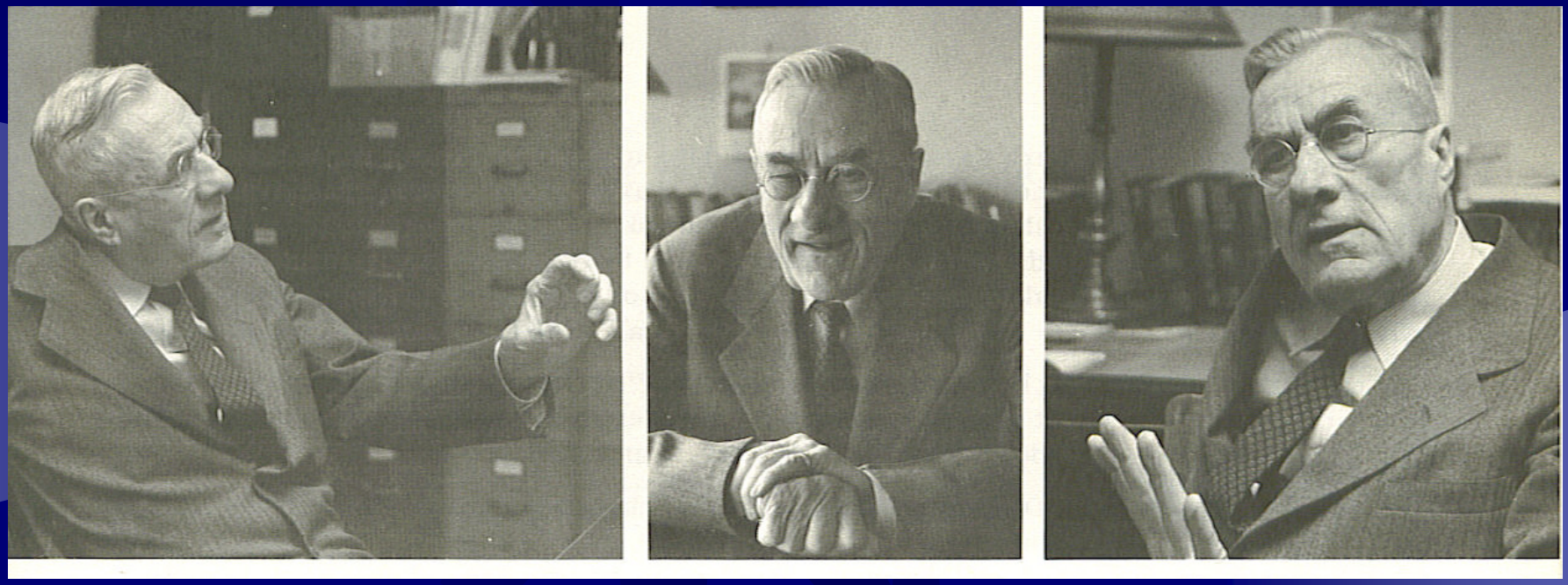
Chemical Engineering at MIT: The First Sixty Years 1888-1948

Rosalind Williams

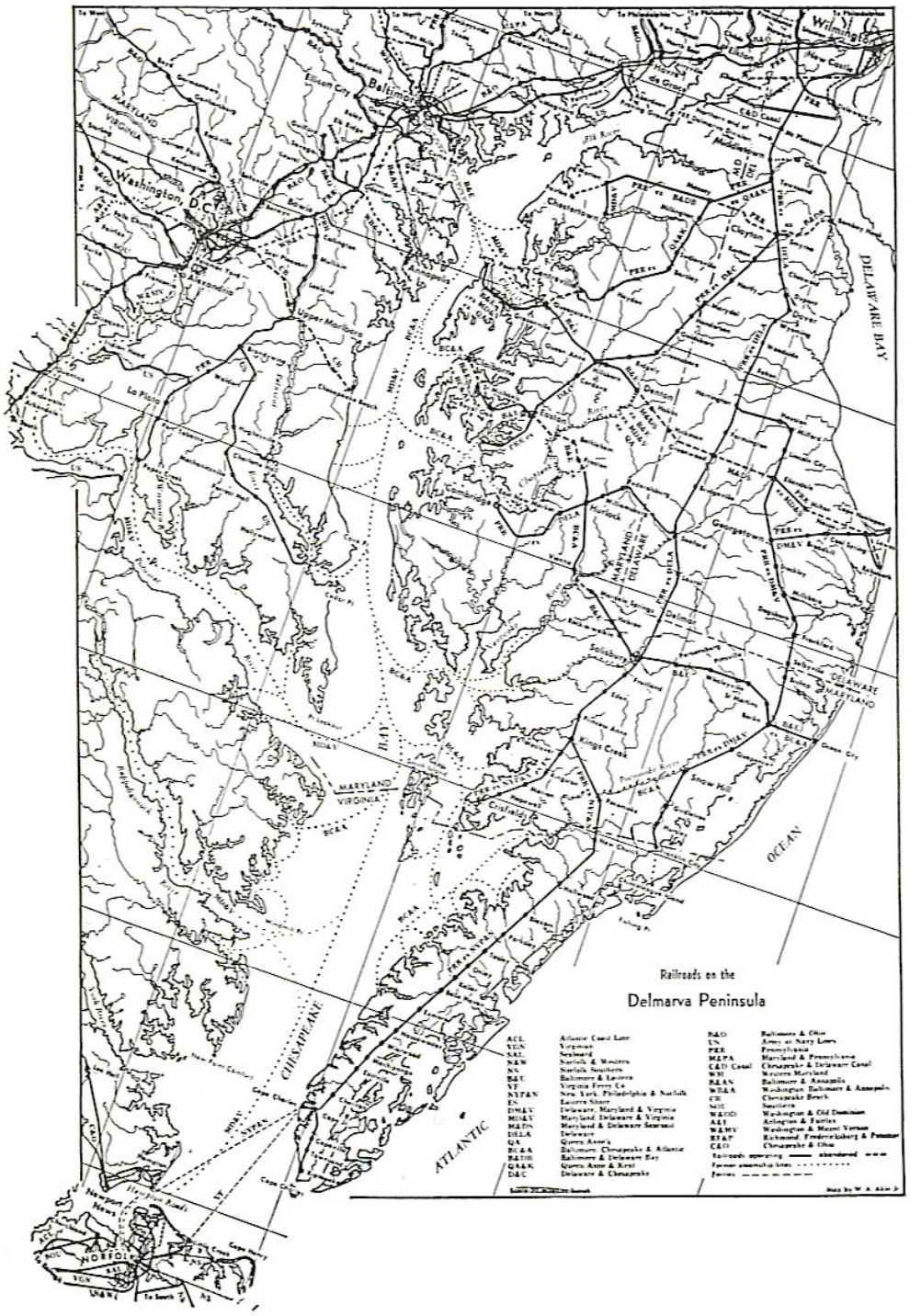
April 2010

Warren Kendall Lewis
1886-1972

Note: Warren Kendall Lewis is Prof. Williams' grandfather.
Many of the images in this presentation are from her personal archive.

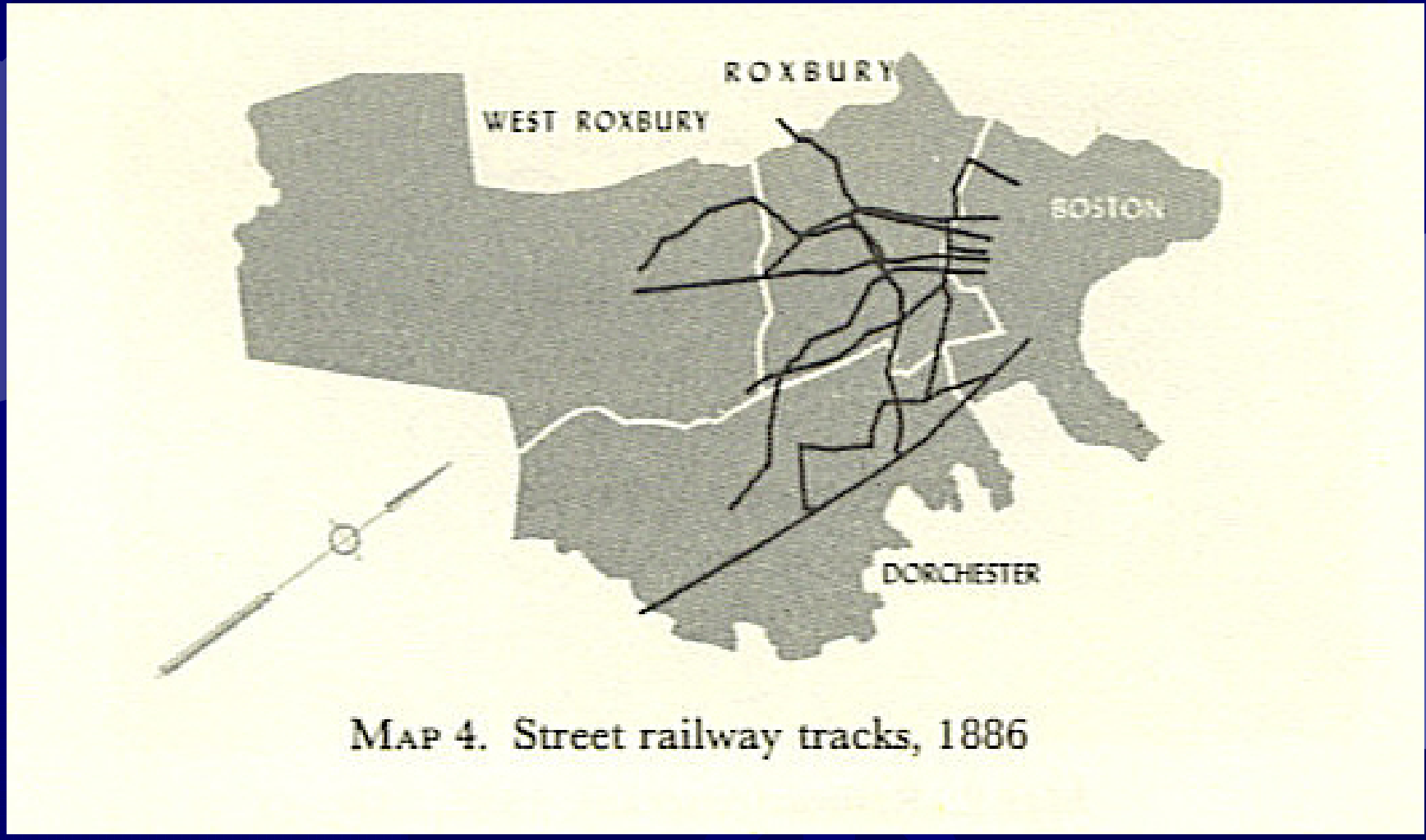


Spring Garden Farm
Laurel, Delaware


Railroads on the
Delmarva Peninsula
DELAWARE BAY
ATLANTIC OCEAN
CHESAPEAKE BAY
Washington, D.C.
Baltimore
Wilmington
NORFOLK

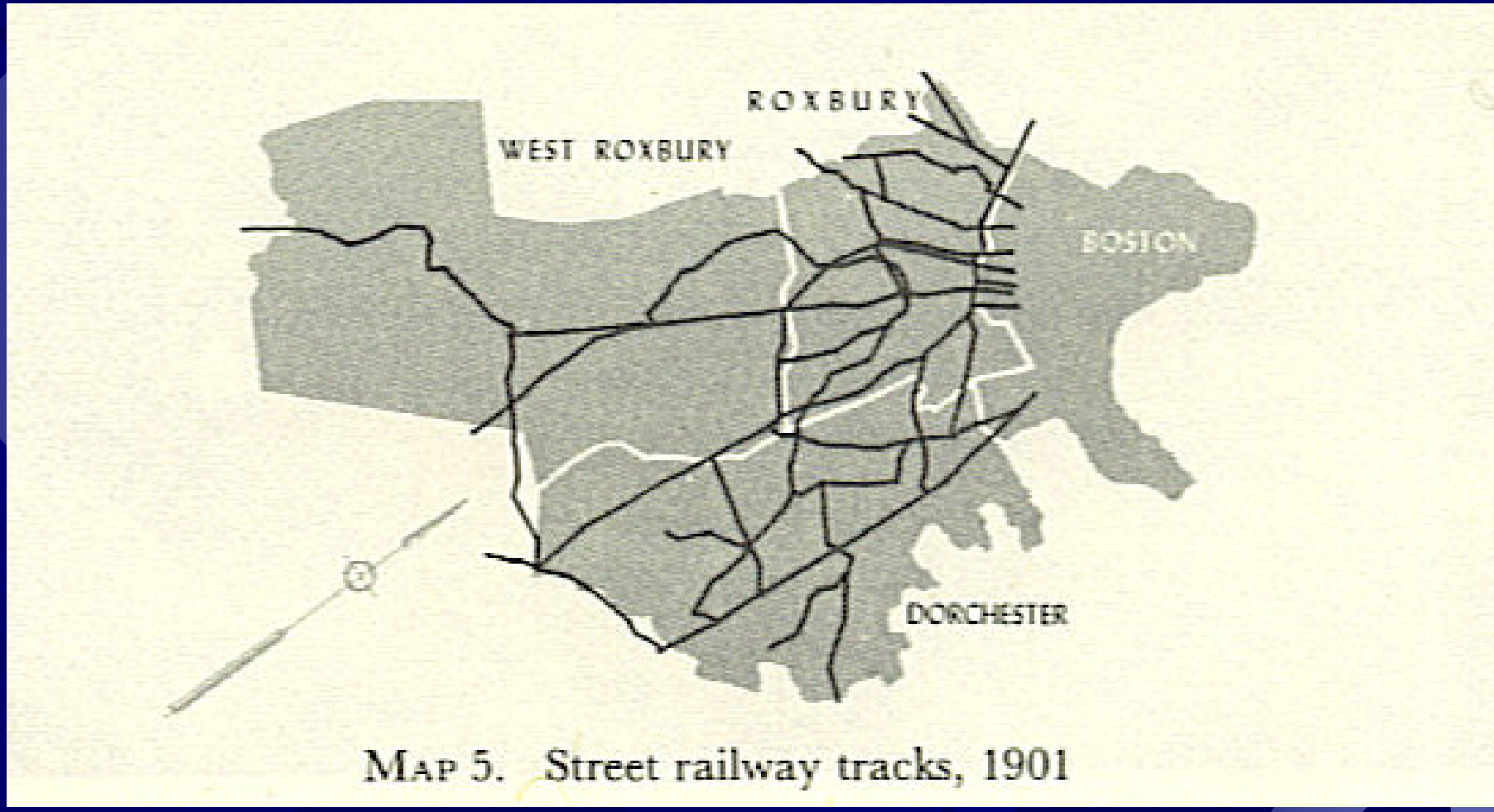
45 Hunnewell Avenue
Newton, Massachusetts

The streetcar suburbs of Boston 1886 (Warner, 1969)



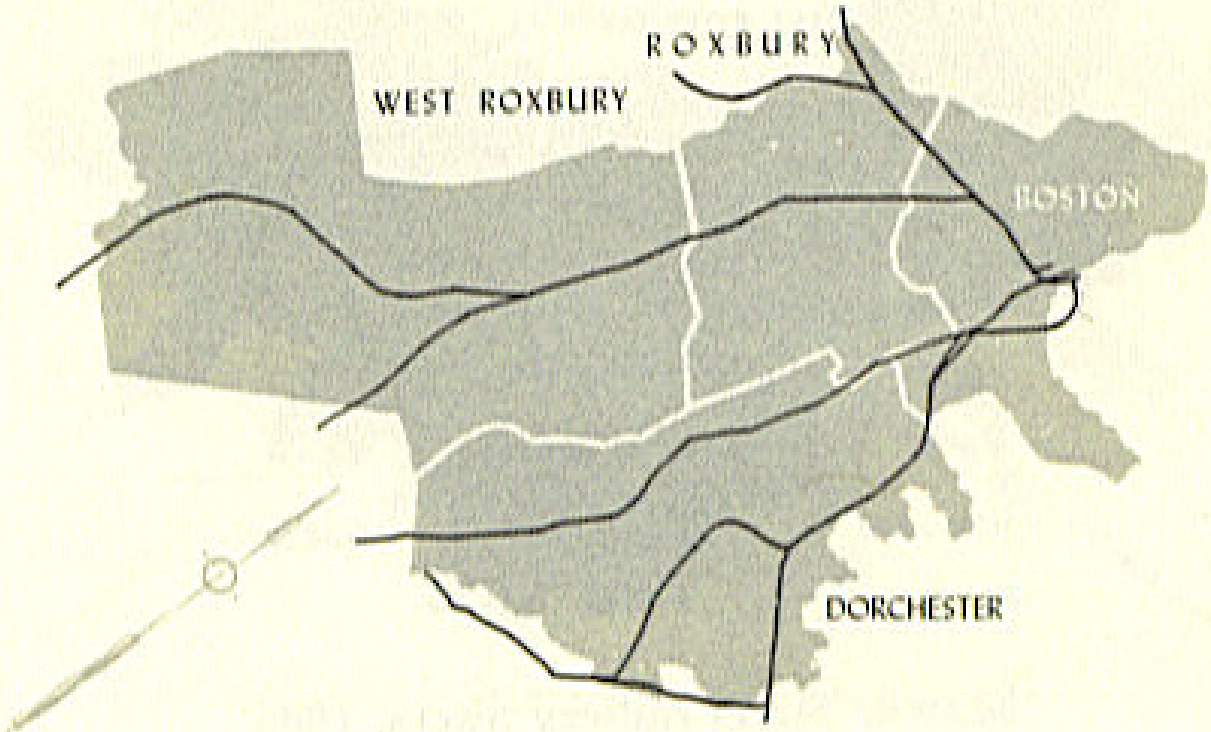
MAP 4. Street railway tracks, 1886

The streetcar suburbs in 1901 (Warner, 1969)



MAP 5. Street railway tracks, 1901

Railroads around Boston (Warner, 1969)



MAP 2. Railroad trackage, 1870–1900

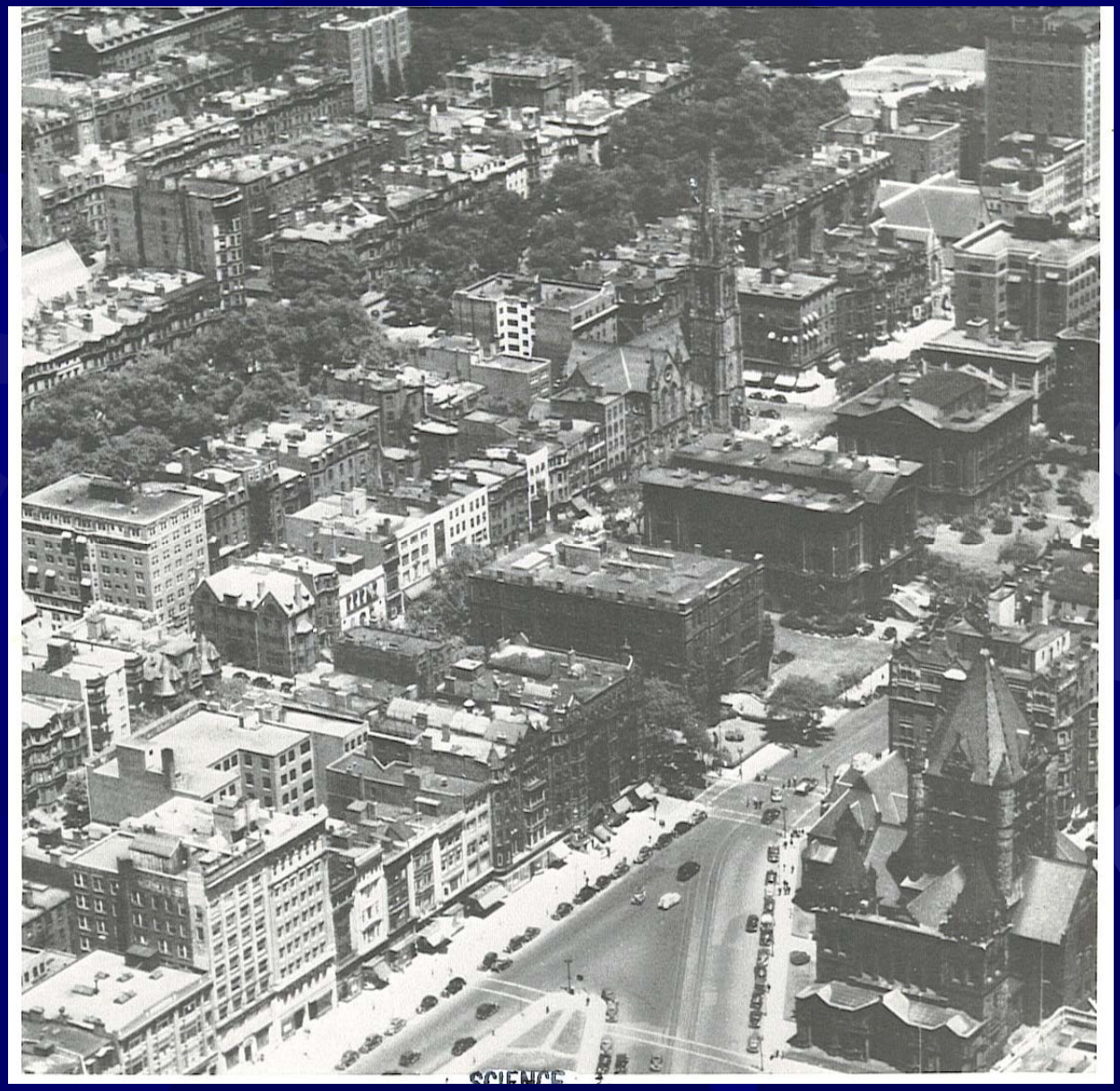
Increasing number of engineers in US 1880 - 1920

- Number of practicing engineers multiplied ca. 20-fold (7000 to 136,000)
- Engineering enrollments in land grant colleges went up 40-fold

Class origins of engineers (1924 survey)

- “drawn from ….poorer and less well-educated segments of the middle class”
- Many parents had small businesses or were farmers
- 13% fathers had college degrees
- 40% fathers had finished high school
- 90% freshmen had to work a year before starting college

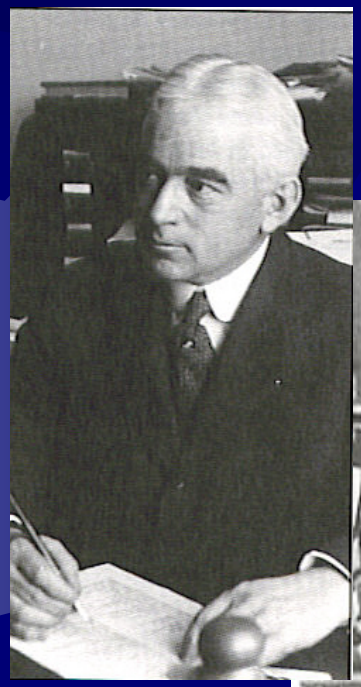
“Boston Tech” in early 1900s



Industrial chemistry lab at MIT 1893

Arthur A. Noyes

William H. Walker



were called "options," and in each of the major prescribed courses at M.I.T. there were from four to six options. This catered to the demand of the industries that they should be supplied with men who had become expert in special lines of work peculiar to that certain industry. Experience taught me that this was all wrong. What an industry needed was not a man who had been taught what that industry already knew, but rather a man who was trained to do what the industry had not been able to do. I think I was the first to clearly formulate the idea that the ideal man for the industries was one who had been given a sound knowledge of chemistry and physics, and then as a part of the curriculum had been given systematic experience in the application of this knowledge to the solution of industrial problems; that he should not be a specialist but a solver of problems--any kind of problem that industry might present. This idea met opposition both from established courses of chemical instruction and from industry.

To prove the soundness of this idea I returned to M.I.T. in 1903 and after a hot fight with both the chemical and the engineering faculties I reconstructed Course 10 as a general educational course without options. I cut such courses as mechanical drawing, analytical chemistry, shop and foundry practice, and introduced all the physical chemistry that was then available and greatly strengthened the courses in organic and advanced inorganic chemistry. I then organized a laboratory course in industrial chemistry which was designed to teach method of attack in the solution of industrial problems through the application of chemical engineering already acquired. This was the beginning of the course in chemical engineering which has grown as you know it, and which was copied more or less by many other institutions. This method of teaching students how to attack chemical industrial problems by experience in the laboratory was exhibited in the educational section of the International Exposition at St. Louis in 1903 and was awarded a gold medal for its outstanding merit.

In 1905, owing to the continued illness of Charles R. Sanger, I was asked by Harvard University to give the instruction there presented in industrial chemistry known as Chemistry 11. I was given carte blanche to develop the course as I chose. Unhampered by tradition I struck out on a new path in the method of presentation and in so doing developed the idea of unit processes in chemical engineering which was the genesis of my notes on this subject which with the able cooperation of associates were later to be developed in a textbook on the principles of chemical engineering.

Walker's innovations:

Science-based engineering

Unit operations

Research Lab in Applied Chemistry

Practice school

Chemical engineering majors at MIT, Class of 1905

Aus der physikalisch-chemischen Abteilung des chemischen Instituts
der Universität Breslau.

Die Komplexbildung zwischen Bleinitrat und Kaliumnitrat.

Inaugural-Dissertation

zur Erlangung der Doktorwürde

der philosophischen Fakultät der Königl. Universität Breslau,

eingereicht und mit Genehmigung derselben veröffentlicht

von

Warren Kendall Lewis

(Swett Fellow, Mass. Inst. Tech.)

aus Laurel, Delaware, U. S. A.

Am Montag, den 20. Juli 1908, 11½ Uhr,

in der Aula Leopoldina

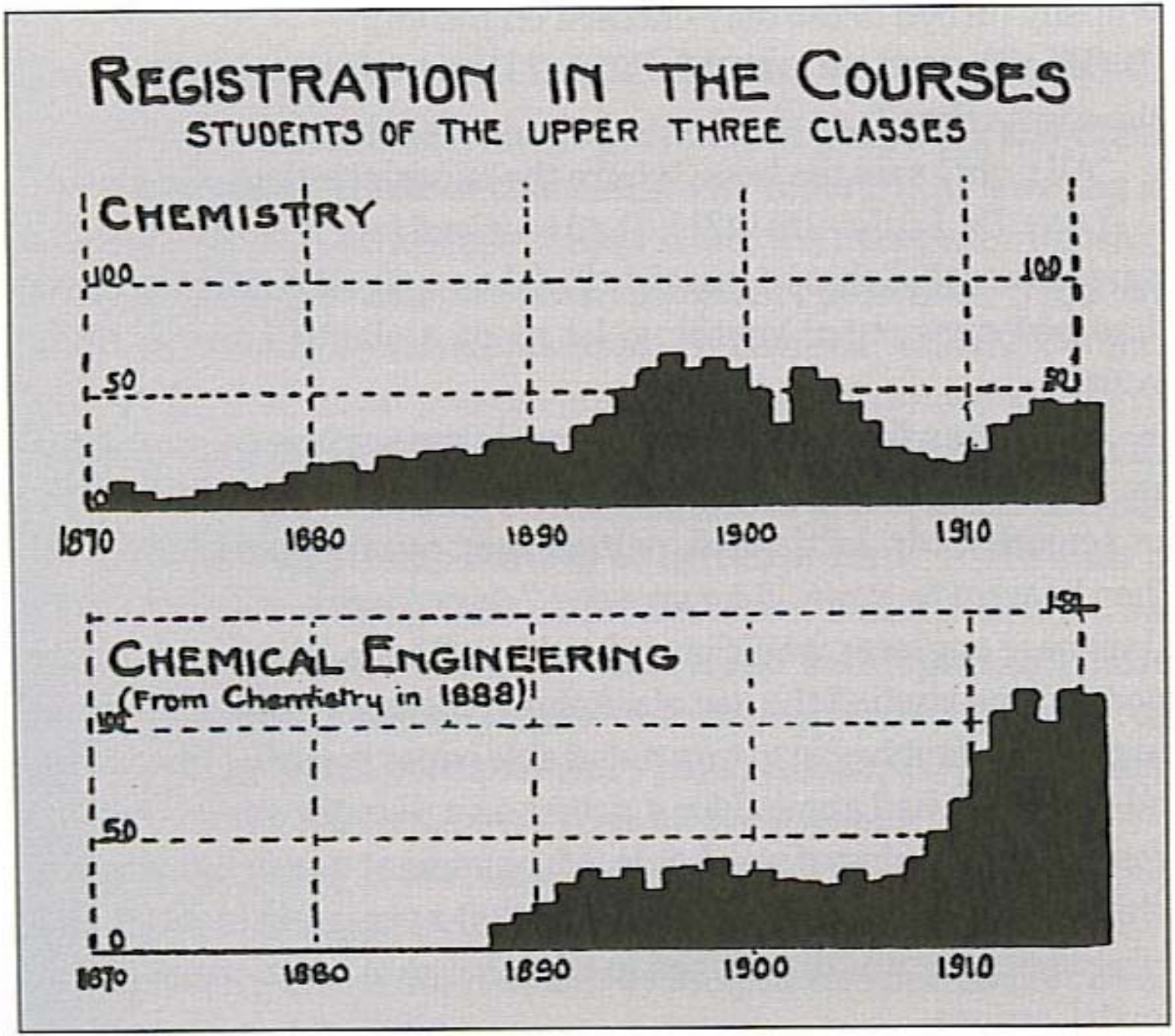
Vortrag:

Das Massenwirkungsgesetz in wässrigen Lösungen,

nachher

Promotion.

Druck von Graß, Barth & Comp. (W. Friedrich) in Breslau 515 08



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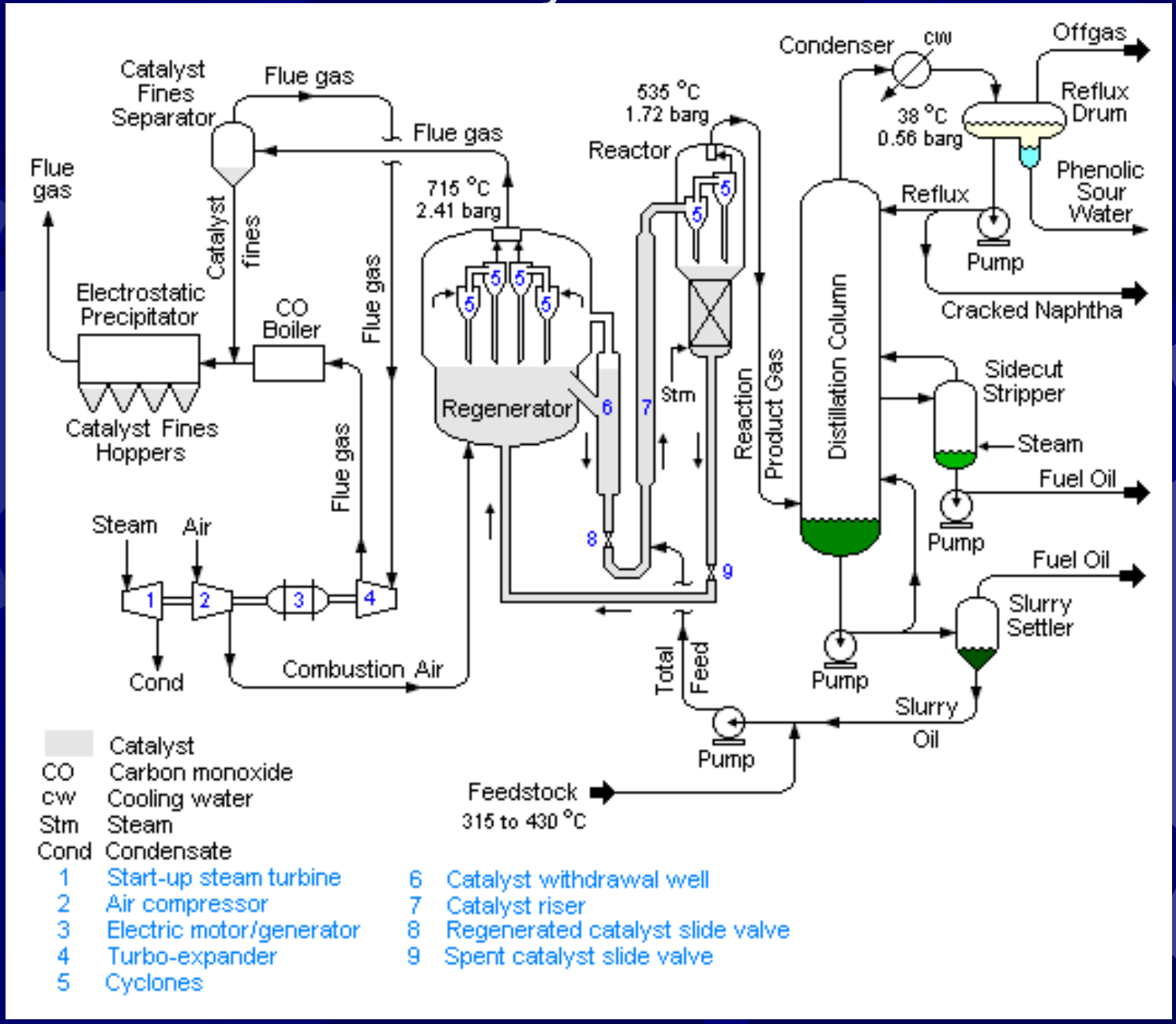
Schematic flow diagram of a Fluid Catalyic Cracker



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Response

W. K. LEWIS

Mr. President, I want to express my deep appreciation of the honor which the American Petroleum Institute has conferred upon me in giving me its award. In order to do this the more effectively, let me outline to you what the great petroleum industry and this Institute which represents it mean to me.

My first work in the industry was with a small research group in one of the country's large refineries. I had had a limited experience in industrial distillation and was convinced that the distillation methods currently in use in the refinery were bad. In due course the research group likewise became convinced and we were able to secure the cooperation of refinery management and ultimately of the stillmen and their helpers in the introduction of continuous tower rectification in full scale refinery distillation of crude oil. Success was achieved through cooperation.

How it happened that I was first in our industry to suggest such a development is more than I can understand. Long before me there were engineers in the country fully as com-

The Lewis Report, 1949:

In our increasingly complex society, science and technology can no longer be segregated from their human and social consequences. The most difficult and complicated problems confronting our generation are in the field of the humanities and social sciences…they have resulted in large measure from the impact of science and technology upon society…

The human-built world:

"We are well on our way, in our timeless effort to bring the natural environment under control, to replacing it by an artificial environment of our own contriving."

MIT historian Elting Morison, 1946

Doc Lewis, in his older years:

"If I could be reincarnated, I would like to return as a social scientist. That is where the really difficult and important problems are."

20-year decline in engineering enrollments

- Total bachelor's degrees in US in 1966: 35,826
- Total bachelor's degrees in US in 2001: 59,258
- Peak enrollments (over 70,000) in 1983-1988

NSF data on chemical engineering degrees in US

- Bachelor's degrees doubled 1966 to 2001 (ca. 3000 to ca. 6000)
- Master's degrees up modestly (1072 to 1368)
- Doctoral degrees approximately doubled (367 to 727)
- Number of women up 10X for bachelor's, 50X for master's, 90X for doctoral degrees

Some signs of the times:

- Among MIT alums from the 1990s, only 21% aspired to be “technical leaders” (30% wanted to be “entrepreneurs”)
- In 1994-95 only 4.7% of firms recruiting at MIT represented companies in traditional engineering fields such as oil, chemicals, materials, or food

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