The Centennial Celebration

of

Rensselaer Polytechnic Institute

TROY, NEW YORK

October 3rd and 4th, 1924

TROY, NEW YORK
PUBLISHED BY THE BOARD OF TRUSTEES
1925

EDITED BY PALMER C. RICKETTS

To the Memory
of
STEPHEN VAN RENSSELAER
AMOS EATON
and
BENJAMIN FRANKLIN GREENE

CONTENTS

THE FOUNDING OF THE SCHOOL

Rensselaer Polytechnic Institute was established in 1824 by Stephen Van Rensselaer of Albany, N. Y. His object in establishing it was defined in a letter written from Washington, while he was a congressman, to Rev. Dr. Samuel Blatchford, the school's first president. The letter was dated November 5, 1824. In it he appoints trustees, notifies them that a suitable building has been acquired and funds provided for necessary apparatus, gives rules for the government of the school, and defines his object as follows:

> I have established a school in the north end of Troy, for the purpose of instructing persons who may choose to apply themselves in the *application of science to the common purposes of life. My principal object is to qualify teachers* for instructing the sons and daughters of farmers and mechanics, by lectures or otherwise, in the application of experimental chemistry, philosophy and natural history to agriculture, domestic economy, the arts and manufactures.

His primary object, therefore, was to establish a school of high grade for teachers of science, and in his mind, as his letter shows, the broad field to be covered included *the application of science to nearly every branch of human endeavor.* It will be noticed that the *daughters as well as the sons* were to be taught by these teachers.

CENTENNIAL COMMITTEES

TRUSTEE COMMITTEE

PALMER C. RICKETTS, '75, *Chairman*
JAMES H. CALDWELL, '86
PHILIP W. HENRY, '87
ISAAC W. FRANK, '76
WILLIAM P. DENEGRE, '77

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PERCIVAL M. SAX, '90
H. H. ROUSSEAU, '91
DANIEL L. TURNER, '91

DESCRIPTION OF THE CELEBRATION

The celebration took place at Troy, N. Y., U. S. A. on Friday and Saturday, October 3rd and 4th, 1924.

The housing of the delegates and alumni during the days of the Celebration was difficult. The Trustees took over the Rensselaer Inn and provided rooms for some of the delegates. Others were the guests of residents of Troy who were asked to entertain them. More than two hundred alumni and friends came from New York on the Berkshire, a river steamer of the Hudson Navigation Line.

The processions on Friday and Saturday mornings were formed on the Campus at half past nine o'clock. The students led, followed by the alumni, alumni delegates, delegates from other organizations, faculty, trustees and speakers. Preceded by a band the procession marched to the State Armory on Fifteenth Street. The hall in which the exercises were held was built, inside the Armory, of muslin sides and ceiling, decorated with the flags of all the States and those of the thirty-eight foreign countries from which students have come to the Institute. Its seating capacity was 1850. Amplifiers carried the voices of the speakers throughout the hall.

At the conclusion of the address of Senatore Luigi Luiggi of Italy he announced that His Majesty, Victor Emmanuel III and the Government of Italy, had conferred upon the President of the Institute the honor of Knight Commander of the Order of the Crown of Italy. The President and Government of France had also intended to honor the school at the Celebration but delays occurred and it was not until several days after the Celebration that the President of the

Institute was notified that he had been made a Commander of the Legion of Honor.

The lunches, after the morning exercises on Friday and Saturday, were given in the '87 Gymnasium and the Sage Dining Hall, the alumni and alumni delegates and friends being entertained in the Gymnasium and the other delegates in the Dining Hall.

The bronze tablet, four feet by three feet in size, placed on the vertical face of the granite approach at the head of Broadway at Eighth Street, contains the following inscription:

1824 — 1924
On This Spot, For Forty Years,
Stood the Main Building of
RENSSELAER POLYTECHNIC INSTITUTE.
The Structure Was Destroyed
By Fire in 1904.

East Of This Place, Extending From
Eighth Street To Fifteenth Street,
Is the Campus of the Institute,
Acquired in 1904 — 1906

RENSSELAER POLYTECHNIC INSTITUTE

was established by Stephen Van Rensselaer in 1824. It is the first school, now in existence, to be established in any English-speaking country, primarily for the purpose of teaching Science and Engineering. During the last hundred years students have come to it from all parts of the world and have left it to become leaders in the scientific thought and physical development of many countries. Its graduates have become renowned not only as designers and constructors of many of the greatest engineering works, but also as organizers and executives of great industrial enterprises and as investigators and teachers in many branches of pure science.

This Tablet is Erected by the Board of Trustees
of the Institute in Memory of Stephen Van Rensselaer and
in Commemoration of the Hundredth Anniversary
of the Establishment of the Institution.

After an address by Seymour van Santvoord, Esq., of Troy, printed hereafter, the tablet, covered with the cherry and white colors of the Institute, was unveiled at 3:30 p. m.

by Mrs. Elizabeth Van Rensselaer Frazer, who made an address relating to the founder and his family. Mrs. Frazer is a great granddaughter of the Founder.

At the conclusion of these exercises a tablet, in memory of Samuel Wells Williams, '32, was unveiled in front of the Russell Sage Laboratory. It contains inscriptions in English and Chinese. The English inscription reads:

In Memory of

SAMUEL WELLS WILLIAMS '32

Author of the Middle Kingdom
and a Syllabic Dictionary
and Professor of Chinese Literature
in Yale University

This Tablet is Erected by
The Chinese Students' Club of
RENSSELAER POLYTECHNIC INSTITUTE
and Dedicated by
THE CHINESE MINISTER TO THE UNITED STATES
October 3, 1924

The translation of the Chinese inscription is as follows:

Hail, scholar and sage,
Illustrious son of an illustrious institution,
Maker of dictionaries,
And master of tongues!
Author and lecturer,
Interpreter of an ancient civilization,
Gratefully we salute thee;
And in thy memory we dedicate this tablet
As a perpetual reminder of thy achievements.

This tablet was afterwards placed opposite that to Andrew Carnegie in the lobby of the Carnegie Building. It was unveiled in front of the Russell Sage Laboratory because there was not room enough in the lobby of the Carnegie Building for those who wished to hear the address of Mr. Sao-Ke Alfred Sze, the Minister Plenipotentiary

from China to the United States, who unveiled the tablet. His address is printed in following pages.

The dinner, to the delegates and graduates, Friday night was given in the State Armory in a room made of muslin walls and ceiling adjacent to the hall constructed for the morning meetings. There were about 1000 guests present. Dr. William P. Mason presided and introduced the three speakers, President Livingston Farrand of Cornell University, Reverend Doctor Joseph H. Odell, Director of the Service Citizens of Delaware, and Doctor Huger W. Jervey, Dean of the Law School of Columbia University. Their addresses will be found in succeeding pages of these proceedings.

Honorary degrees were conferred Friday and Saturday, at the conclusion of the morning exercises, upon the distinguished men whose names follow. Each day the degrees were conferred in alphabetical order: on Friday morning the degree, Doctor of Engineering, upon Professor Henri Abraham, Senatore Luigi Luiggi, Sir Charles Langbridge Morgan, and Mr. Arthur Surveyer; on Saturday the degree, Doctor of Philosophy, upon President James Rowland Angell, President Edward Asahel Birge, President Livingston Farrand, and President Samuel Wesley Stratton; the degree, Doctor of Science, upon President Albert Abraham Michelson; and the degree, Doctor of Engineering, upon President Carl Ewald Grunsky, President William Kelly, President Frederick Rollins Low, and President Farley Osgood.

The Alumni meeting in the State Armory at two o'clock Saturday afternoon was well attended and interesting speeches were made by graduates of various classes. The Smoker in the evening was also very well attended. It was held in the Gymnasium and refreshments were provided.

The Pageant was written and directed by Thomas Wood Stevens, formerly Professor of Dramatic Art at the Carnegie Institute of Technology and now Head of the Department of Drama in the Chicago Art Institute. It was given between nine and eleven o'clock on both Friday and Saturday nights. There were between 2000 and 3000 spectators Friday night and between 7000 and 8000 Saturday night. The stage was built in front of the rocks at the east end of the '86 Athletic Field and wooden steps were built on the face of the rocks extending in several directions from the bottom to the top. These were utilized by the players during some of the performances, especially during the last act. The text of the pageant and the names of some of the principal actors are printed at the end of this volume.

PROGRAM OF THE EXERCISES

Thursday Afternoon, October 2nd
Registration of Delegates and Alumni, Pittsburgh Building

Friday, October 3rd

8:30 to 9:30 a. m. Registration of Delegates and Alumni, Pittsburgh Building

9:30 a. m. Procession of Trustees, Faculty, Delegates and Alumni forms at Russell Sage Laboratory

10:00 a. m. Exercises in the State Armory;
Presiding: Vice President James Henry Caldwell, B.S.

Selection: Master Melodies *Roberts*

Invocation: The Rt. Rev. George Ashton Oldham, D.D., Bishop Coadjutor, Diocese of Albany

Addresses:

Herbert Clark Hoover, Sc.D., Ph.D., D.Eng., LL.D., D.C.L., Secretary of Commerce of the United States

Frank Pierrepont Graves, Ph.D., Litt.D., L.H.D., LL.D., President of the University of the State of New York

Harry Esmond Clinton, A.B., LL.B., Mayor of the City of Troy

Gavotte: In Colonial Days *Ring Hager*

Addresses:

Sir Charles Langbridge Morgan, C.B.E., President of the Institution of Civil Engineers of Great Britain

Henri Abraham, Sc.D., Past President of the Society of Electrical Engineers of France

Luigi Luiggi, D.Sc., Dr.Ing., Past President of the Society of Civil Engineers of Italy

Arthur Surveyer, B.A.Sc., C.E., President of the Engineering Institute of Canada

Palmer Chamberlaine Ricketts, E.D., LL.D., President of Rensselaer Polytechnic Institute

"The Beginning of the School"

Entre Acte: Kiki *Savino*

Conferring of Honorary Degrees

Ballet: Ballet Music from Faust *Gounod*

1:00 p. m. Luncheon for Delegates and Alumni

3:00 p. m. Unveiling of Tablet on Site of Old Main Building. Address by Seymour van Santvoord, A.B., LL.B.

3:30 p. m. Address at the same place by Elizabeth Van Rensselaer Frazer, lineal descendant of Stephen Van Rensselaer

4:00 p. m. Unveiling of Tablet in memory of Samuel Wells Williams, A.B. (r.s.) LL.D.

Address by Sao-Ke Alfred Sze, LL.D., Envoy Extraordinary and Minister Plenipotentiary from China to the United States

4:30 p. m. Inspection of Buildings and Laboratories

7:00 p. m. Banquet for Delegates and Alumni, State Armory

Presiding: William Pitt Mason, C.E., M.D., Sc.D., LL.D.

Addresses:

Livingston Farrand, M.D., L.H.D., LL.D., President of Cornell University

Joseph Henry Odell, D.D., Director of the Service Citizens of Delaware

Huger Wilkinson Jervey, LL.D., D.C.L., Dean of the Law School, Columbia University

9:00 p. m. Pageant: Scenes from the History of the School, Written and Directed by Thomas Wood Stevens

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SATURDAY, OCTOBER 4TH

9:30 a. m. Procession of Trustees, Faculty, Delegates and Alumni forms at Russell Sage Laboratory

10:00 a. m. Exercises in the State Armory

Presiding: Vice President James Henry Caldwell, B.S.

Overture: Martha *Flowtow*

Invocation: The Rt. Rev. Edmond Francis Gibbons, D.D., Bishop of Albany

Addresses:

James Rowland Angell, Litt.D., LL.D., President of Yale University

Edward Asahel Birge, Ph.D., Sc.D., LL.D., President of the University of Wisconsin

Samuel Wesley Stratton, D.Sc., D.Eng., LL.D., President of Massachusetts Institute of Technology

Albert Abraham Michelson, Ph.D., Sc.D., LL.D., President of the National Academy of Sciences

Entre Acte: Orientale *Cui*

Carl Ewald Grunsky, Dr.Ing., President of the American Society of Civil Engineers

Frederick Rollins Low, President of the American Society of Mechanical Engineers

William Kelly, B.A., E.M., President of the American Institute of Mining and Metallurgical Engineers

Farley Osgood, President of the American Institute of Electrical Engineers

Ray Palmer Baker, M.A., Ph.D., Professor of English in Rensselaer Polytechnic Institute

"After a Hundred Years"

Characteristic: Forget Me Not *Macbeth*

Conferring of Honorary Degrees

Ballet: Dance of the Serpents *Boccalari*

1:00 p. m. Luncheon for Delegates and Alumni

2:00 p. m. Alumni Meeting in State Armory

3:00 to 5:30 p. m. Inspection of Buildings and Laboratories

4:00 to 5:30 p. m. Reception to Delegates and Alumni by President and Mrs. Ricketts, Pittsburgh Building

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8:30 p. m. Smoker for Alumni in the '87 Gymnasium

9:00 p. m. Pageant: Scenes from the History of the School, Written and Directed by Thomas Wood Stevens.

LIST OF DELEGATES

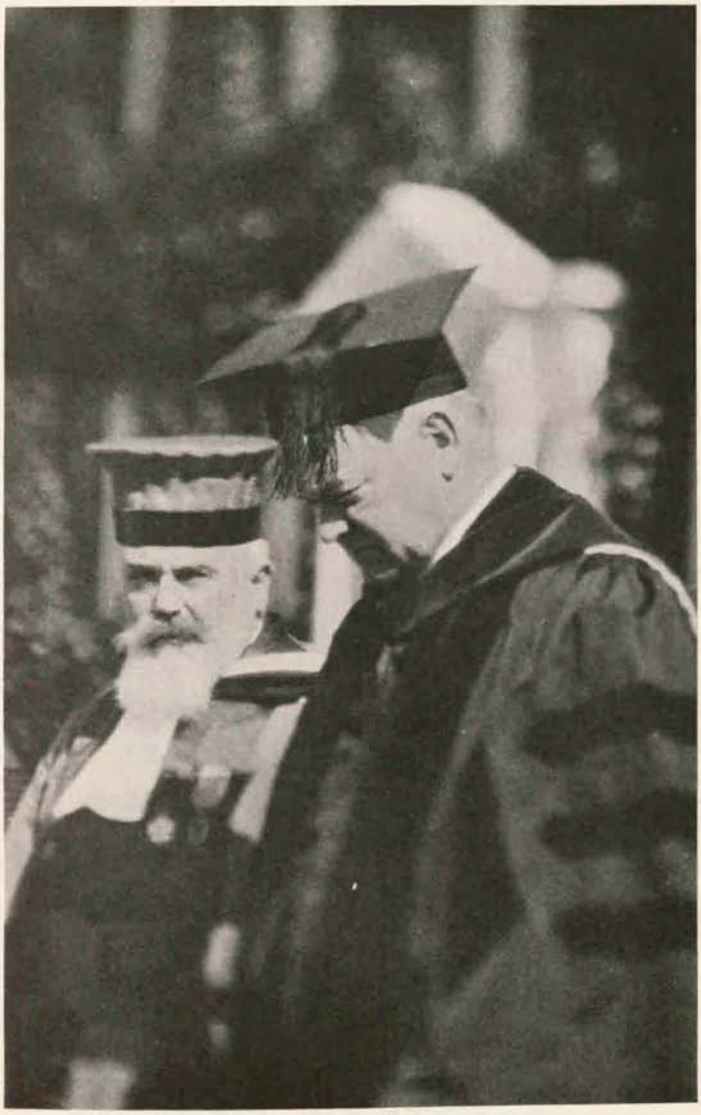
Alphabetical list of institutions, associations and societies of the United States and foreign countries which sent delegates to the celebration with the names of delegates appointed to represent them. Delegates unable to be present were generally replaced by alternates. The organizations number 250 of which 72 are from 23 foreign countries. The names of alumni representing 19 alumni associations and 64 classes, between 1857 and 1928, are also given.

Acadia University	Mary Irene Messinger Baker, B.A.
University of Alabama	President George Hutcheson Denny, Ph.D., LL.D., D.C.L.
Alfred University	President Boothe Colwell Davis, Ph.D., D.D., LL.D.
University of Allahabad, India	Professor Winfield Dugeon, Ph.D.
American Academy of Arts and Sciences	Henry Paul Talbot, Ph.D., Sc.D.
American Association for the Advancement of Science	President James McKeen Cattell, Ph.D. LL.D.
American Association of Engineers	President Harold Almert Director Allen Mark Knowles, C.E.
American Association of State Highway Officials	Paul Schultze, C.E.
American Association of University Professors	Harry Walter Tyler, Ph.D.
American Association of University Women	Katharine Margaret Kellas, M.A.
American Astronomical Society	Benjamin Boss, A.B.
American Ceramic Society	Past President Lawrence Eugene Barringer, E.M.
American Chemical Society	President Leo Hendrik Baekland, Sc.D., Ch.D.
American Concrete Institute	Frank Clinton Wight, C.E. William Stewart Thomson, C.E.
American Engineering Council	Arthur Maurice Greene, Jr., Sc.D., D.Eng.
American Gas Association	Frank Flentz Dunn, C.E.
American Geographical Society	Chairman Philip Walter Henry, C.E. Director Isaiah Bowman, Ph.D.
American Historical Association	Alexander Clarence Flick, Ph.D., Litt.D.
American Institute of Architects	Past President Richard Clipston Sturgis, A.B.
American Institute of Chemical Engineers	President Charles Lee Reese, Ph.D., Sc.D.

American Institute of Consulting Engineers	Alexander Crombie Humphreys, Sc.D., D.Eng., LL.D. Harry de Berkeley Parsons, B.S., M.E.
American Institute of Electrical Engineers	President Farley Osgood Honorary Chairman Edwin Wilbur Rice, Jr., A.M., Sc.D., D.Eng. Past President Paul Martyn Lincoln, E.E.
American Institute of Mining and Metallurgical Engineers	President William Kelly, B.A., E.M. Vice-President John Van Wicheren Reynders, C.E.
American Library Association	Mary Louise Davis
American Mathematical Society	George Ashley Campbell, Ph.D.
American Philosophical Society	John Mason Clarke, Ph.D., Sc.D., LL.D.
American Physical Society	Michael Idvorsky Pupin, Ph.D., Sc.D., LL.D.
American Public Health Association	George Albert Soper, B.S., M.A., Ph.D.
American Railway Association	James MacMartin
American Railway Engineering Association	James MacMartin
American Society of Civil Engineers	President Carl Ewald Grunsky, Dr.Ing.
American Society of Mechanical Engineers	President Frederick Rollins Low
American Society of Refrigerating Engineers	Alexander Russell Stevenson, Jr., C.E., M.S., Ph.D.
American Society for Testing Materials	Enrique Touceda, C.E.
American Society for Steel Treating	John Harland Nelson, M.S.
Amherst College	President George Daniel Olds, LL.D.
Archaeological Institute of America	Seymour van Santvoord, A.B., LL.B.
University of Arkansas	William Maurice Guynes, E.E.
Armour Institute of Technology	Norman Frank Kimball, B.S., M.E.
Association of Chinese and American Engineers, China	John Alexander Low Waddell, D.Sc., LL.D., D.E.
Association of American Colleges	Charles Alexander Richmond, D.D., LL.D.
Association of American State Geologists	President Edward Bennett Mathews, Ph.D.
Association of Italian Engineers and Architects, Italy	Senatore Luigi Luiggi, D.Sc., Dr.Ing.

Association of American Universities	Herbert Charles Sadler, D.Sc.
Auckland University College, New Zealand	Matthew Albert Hunter, M.A., D.Sc.
Birmingham Southern College	President Guy Everett Snavely, Ph.D.
Boston University	Philip Louis Frick, Ph.D., D.D.
Bowdoin College	George Arthur Holbrook, M.A., B.D.
Brown University	Professor William Herbert Kenerson, M.E., M.A., Sc.D.
Bryn Mawr College	Cora Hardy Jarrett, A.B.
Bucknell University	Frank King Singiser, D.D.
Butler College	Russell Caldwell Putnam, A.B.
California Academy of Sciences	President Carl Ewald Grunsky, Dr.Ing.
University of California	William Benson Storey, Ph.B., LL.D.
Canterbury College, Christchurch, New Zealand	Albert Robert Acheson, B.Sc., B.Eng.
Canton Christian College, China	President James McClure Henry, D.D.
Capital University	Oscar Charles Mees, D.D.
Carnegie Institute of Technology	President Thomas Stockham Baker, Ph.D.
Carnegie Institution of Washington	Benjamin Boss, A.B.
Case School of Applied Science	President Charles Sumner Howe, Ph.D., Sc.D., LL.D.
Central School of Arts and Manufactures, France	Henri Abraham, Sc.D. Charles Auguste Fabry, Sc.D.
Chemical Society, London, England	J. F. Thorpe, C.B.E., D.Sc., F.R.S.
University of Chicago	Professor Albert Abraham Michelson, Ph.D., Sc.D., LL.D.
University of Cincinnati	Howard Bourse Luther, B.S. Dipl. Ing.
Clark University	President Wallace Walter Atwood, B.S., Ph.D.
Clarkson College of Technology	President John Pascal Brooks, M.S., Sc.D.
Cleveland Engineering Society	James Welch Frazier, C.E. John William Leadley Kenneth Howard Osborn, C.E.
Colgate University	President George Barton Cutten, Ph.D., D.D., LL.D.
College of the City of New York	Dean Frederick Skene, B.S., C.E.
Colorado College	Ruth Gilbert, A.M., M.D.

Colombian Society of Engineers, Colombia	Marcel Gutierrez, C.E.
Columbia University	Dean George Braxton Pegram, D.Sc., Ph.D.
Connecticut Society of Civil Engineers	Director Edward Irvine Rudd, B.Sc., C.E.
Cooper Union	Professor Fred Eugene Foss, A.M., Sc.D.
Cornell University	President Livingston Farrand, M.D., L.H.D., LL.D. Dean Dexter Simpson Kimball, A.B., M.E.
Cuban Society of Engineers	Eduardo Justo Chibas, C.E. Francisco de Sola, C.E.
Cumberland University	Doctor Harris Taylor, LL.D.
Czecho-Slovakia Society of Engineers	Edward Schmidt
Danish Society of Engineers, Denmark	Director Holger Flensborg, C.E.
Dartmouth College	Secretary Eugene Francis Clark, Ph.D.
University of Delaware	President Walter Hullihen, Ph.D., D.C.L.
Denison University	President Clark Wells Chamberlain, Ph.D.
University of Denver	Edwin Arthur Rees, Ph.D.
Drexel Institute	President Kenneth Gordon Matheson, M.A., LL.D.
Ecole Polytechnique, Montreal	Director Arthur Surveyer, B.A.Sc., C.E.
Elmira College	President Frederick Lent, Ph.D., D.D.
Engineers Club of Philadelphia	Vice President Edward Brinton Temple, B.S., D.E.
Engineers Society of Western Pennsylvania	Past President George Stewart Davison, C.E.
Engineering Economics Foundation	President Hollis Godfrey, Sc.D., Eng.D., LL.D., D.C.L.
Engineering Institute of Canada	President Arthur Surveyer, B.A.Sc., C.E.
Florida Engineering Society	President Charles Herman Ruggles, C.E.
Fordham University	President Edward Patrick Tivnan, S.J., Ph.D.
Franklin Institute	William Pitt Mason, C.E., M.D. Sc.D., LL.D.



Professor Henri Abraham Herbert Hoover

French Society of Physics	Henri Abraham, Sc.D. Charles Auguste Fabry, Sc.D.
Geological Society of America	Past President John Mason Clarke, Ph.D., Sc.D., LL.D.
Georgia School of Technology	President Marion Luther Brittain, LL.D.
Georgetown University	President John Berchmans Creeden, A.M., Ph.D.
George Washington University	President William Mather Lewis, LL.D.
University of Ghent, Belgium	Leo Hendrick Baekland, Sc.D., Ch.D.
Glasgow University, Scotland	Rear Admiral David Watson Taylor, E.D.
Hamilton College	President Frederick Carlos Ferry, Ph.D., ScD., LL.D.
Harvard University	Dean Hector James Hughes, A.B., S.B.
University of Havana, Cuba	Antonio Fernandes de Castro, A.B. José Ricardo Martinez, A.B., C.E. Miguel Villa, C.E.
Haverford College	Professor Leon Hawley Rittenhouse, M.S.
Hobart College	President Murray Bartlett, D.D.
Howard University	Jesse Edward Moorland, D.D.
University of Illinois	Willard Leo Egy, M.S.
Illuminating Engineering Society	Director Harwood Ellsworth Mahan
Institute of Radio Engineers	Ernst Fredrik Werner Alexanderson
Institution of Civil Engineers of Great Britain	President Sir Charles Langbridge Morgan, C.B.E.
Institution of Electrical Engineers of Great Britain	John William Lieb, Eng.Dr.
Institution of Marine Engineers of Great Britain	Albert William Murray
Institution of Mechanical Engineers of Great Britain	President William Henry Patchell
Institution of Naval Architects of Great Britain	Rear Admiral David Watson Taylor, E.D.
Institution of Structural Engineers of Great Britain	Edward Godfrey
Iowa State College of Agriculture and Mechanic Arts	Edwin MacDonald Stanton, M.D.
University of Bologna, Italy	
University of Genoa, Italy	
University of Padua, Italy	Senatore Luigi Luiggi, D.Sc., Dr.Ing.
University of Pisa, Italy	
University of Rome, Italy	

Doctor Arthur Surveyer Senatore Luigi Luiggi Sir Charles L. Morgan
Professor Henri Abraham

SOME OF THE FOREIGN DELEGATES

Johns Hopkins University	Professor John Herbert Gregory, S.B.
University of Kentucky	President Frank LeRond McVey, Ph.D., LL.D.
Kenyon College	President William Foster Peirce, L.H.D., D.D., LL.D.
Kings College London, England	George Daniel Olds, LL.D.
Knox College	Trustee Edward Caldwell, A.B., M.E.
Lafayette College	President John Henry MacCracken, Ph.D., LL.D.
Lehigh University	President Charles Russ Richards, D.Eng., LL.D.
University of Liverpool, England	Philip Louis Pratley, M.Eng.
McGill University, Canada	Dean Henry Martyn MacKay, B.A., B.Sc.
Mackenzie College, Sao Paulo, Brazil	Kenneth C. Waddell, C.E.
University of Manchester, England	Professor William Lawrence Bragg, F.R.S.
University of Manila, Philippine Islands	Leon Ma. Gonzales, B.Sc., M.B.A.
Marietta College	Professor Emeritus William G. Ballantine, D.D., LL.D.
Massachusetts College of Pharmacy	Dean Theodore James Bradley, B.S., A.M.
Massachusetts Institute of Technology	President Samuel Wesley Stratton, D.Sc., D.Eng., LL.D.
Mathematical Association of America	John Nicholas Vedder, M.A.
Michigan College of Mines	Chairman William Kelly, B.A., E.M. Charles Verner Drew, B.S., E.M.
University of Michigan	Herbert Charles Sadler, D.Sc.
Ministry of Public Instruction, Italy	Senatore Luigi Luiggi, D.Sc., Dr.Ing.
University of Minnesota	Burt LeRoy Newkirk, Ph.D.
University of Missouri	Walter Rautenstrauch, M.S.
University of Missouri, School of Mines	Director Charles Herman Fulton, E.M., D.Sc.
Modern Language Association of America	Professor Edward Everett Hale, Ph.D.
University of Montana	William Sherman Edsall, E.E., B.C.S.
Mount Allison University, New Brunswick	Edwin Henry Colpitts, M.A.
Mount Holyoke College	Professor Eleanor Catherine Doak, A.B.
National River and Harbor Congress	Dwight Marvin, A.M., LL.B.
University of Nebraska	William Everett Hannan, A.B.

National Academy of Sciences	President Albert Abraham Michelson, Ph.D., Sc.D., LL.D.
National Association of Engineers and Architects, Italy	Senatore Luigi Luggi, D.Sc., Dr.Ing.
National Research Council	Maurice Holland
New York Academy of Sciences	President John Tatlock, M.A.
New York State College for Teachers	President Abram Royer Brubacher, Ph.D.
New York University	Chancellor Elmer Ellsworth Brown, Ph.D., LL.D.
University of the State of New York	President Frank Pierrepont Graves, Ph.D., Litt.D., L.H.D., LL.D.
University of New Zealand	Albert Robert Acheson, B.Sc., B.Eng.
Norwegian Institute of Engineers, Norway	Ole Singstad, C.E.
University of Notre Dame	Thomas Vincent Dollard, B.Arch.
Oberlin College	Edward Thornton Heald, B.A.
Ohio Wesleyan University	Maurice Alpheus Bigelow, M.S., Ph.D.
Olivet College	George Clare Sprague, Ph.D., LL.B.
University of Oregon	Peter Irving Wold, Ph.D.
Otterbein College	President Walter Gillan Clippinger, D.D., LL.D.
University of the Panjab, India	James Martin Benade, M.A.
University of Paris, France	Professor Henri Abraham, Sc.D.
	Professor Charles Auguste Fabry, Sc.D.
University of Pennsylvania	Provost Josiah Harmar Penniman, Ph.D., LL.D.
Pennsylvania State College	Dean Robert Lemuel Sackett, C.E.
University of Pittsburgh	Trustee Isaac William Frank, C.E.
Polytechnic Institute of Brooklyn	President Fred Washington Atkinson, Ph.D.
	Professor Harry Parker Hammond, B.S.
Polytechnic Institute of Padua, Italy	Senatore Luigi Luiggi, D.Sc., Dr.Ing.
Princeton University	Dean Howard McClenahan, E.E., M.S., LL.D.
	Dean Arthur Maurice Greene, Jr., Sc.D., D.Eng.
Purdue University	President Edward Charles Elliott, Ph.D.
Queens University, Canada	Principal Robert Bruce Taylor, D.D., LL.D.
Radcliffe College	Eliza Kellas, B.A., Ph.B.

Rice Institute	President Edgar Odell Lovett, Ph.D., LL.D.
Robert College, Turkey	Dean Lynn Adolphus Scipio, M.E.
Rochester University	President Benjamin Rush Rhees, D.D., LL.D.
Rose Polytechnic Institute	President Frank Caspar Wagner, A.M., B.S.
Royal School of Engineering, Bologna, Italy	
Royal School of Engineering, Rome, Italy	Senatore Luigi Luiggi, D.Sc., Dr.Ing.
Royal School of Engineering, Turin, Italy	
Royal Institution of Engineers, Holland	Rudolph Welcker, C.E.
Russell Sage College	President of the Trustees, William Leland Thompson, A.B. President of the Faculty, Eliza Kellas, B.A., Ph.B.
Rutgers College	Dean Walter Taylor Marvin, Ph.D.
University of Saint Andrews, Scotland	Charles Alexander Richmond, D.D., LL.D.
Saint Lawrence University	Dean Edwin Lee Hulett, A.M.
Saint Stephens College	President Bernard Iddings Bell, S.T.B., D.D.
School for Advanced Study of Posts and Telegraphs, France	Professor Henri Abraham, Sc.D.
School of Engineering, Guadalajara, Mexico	Palmer Chamberlaine Ricketts, E.D., LL.D.
Simmons College	Professor Leslie Lyle Campbell, Ph.D.
Smith College	President William Allan Neilson, Ph.D., LL.D.
Smithsonian Institution	Carl W. Mitman, A.B., E.M.
Society of Architects, Uruguay	Frank Rushmore Watson
Society for the Promotion of Engineering Education	Past President Charles Felton Scott, A.M., Sc.D., Eng.D. William Elgin Wickenden, B.S.
Society of Automotive Engineers	Paul Gerhard Zimmermann, C.E.
Society of Chemical Industry	Chairman Ralph Harper McKee, Ph.D.
Society of Civil Engineers, France	Henri Abraham, Sc.D.
Society for the Development of Manufacturing, Chile	Consul General Gustavo Munizaga Varela
Society of Electrical Engineers, France	Past President Henri Abraham, Sc.D.

Society of Engineers, England	Bertram Henry Majendie Hewitt, A.C.G.I.
South African Institute of Engineers	Ruel Chaffee Warriner, B.S.
University of Southern California	President Rufus Bernhard von Klein Smid, Sc.D., Ph.D., J.D.
Stanford University	Professor William Frederick Durand, Ph.D., LL.D.
Stevens Institute of Technology	President Alexander Crombie Humphreys, Sc.D., D.Eng., LL.D.
Swarthmore College	President Frank Aydelotte, B.Litt., L.H.D., LL.D.
Swedish Technological Society, Sweden	Petrus Wahlman, C.E.
Syracuse University	Chancellor Charles Wesley Flint, D.D., LL.D.
Technical High School, Aachen	
Technical High School, Braunschweig	
Technical High School, Breslau	
Technical High School, Charlottenburg	
Technical High School, Danzig	Rector Magnificus Adolph Nägel, Dr.Ing.
Technical High School, Darmstadt	
Technical High School, Dresden	
Technical High School, Hanover	
Technical High School, Karlsrühe	
Technical High School, Munich	
Technical High School, Stuttgart	
Technology Club of New York	Alexander Rice McKim, S.B., A.M.
Temple University	Dean James Henry Dunham, Ph.D.
University of Toronto, Canada	President Sir Robert Alexander Falconer, K.C.M.G., D.D. D.C.L., LL.D.
Trinity College	Professor Charles Edwin Rogers, C.E.
City of Troy	Mayor Harry Esmond Clinton, A.B., LL.B.
Union University	President Charles Alexander Richmond, D.D., LL.D.
United States Government	Secretary of Commerce Herbert Hoover, Sc.D., Ph.D., D.Eng., LL.D., D.C.L.
United States Army, Corps of Engineers	Lieut. Colonel John Rodolph Slattery
United States Bureau of Education	George Frederick Zook, Ph.D.
United States Department of Commerce, Bureau of Standards	Samuel Wesley Stratton, D.Sc., D.Eng., LL.D.

United States Navy Department, Chief of Engineers and Chief of Bureau of Yards and Docks	Rear Admiral Luther Elwood Gregory, C.E.
Ursinus College	President George Leslie Omwake, B.D., Ph.D.
Vassar College	President Henry Noble MacCracken, Ph.D., LL.D.
University of Vermont	Dean Josiah William Votey, Sc.D.
Victoria University, New Zealand	Harry Clark, A.M., Ph.D.
University of Virginia	John Mosby Campbell
Virginia Polytechnic Institute	Leon Paul Edwards, C.E.
Washington and Jefferson College	George Herdman Tappan, M.A.
Washington and Lee University	Colonel Ransom Hooker Gillett, B.S., LL.B.
Washington Society of Engineers	Arthur William Harrington, C.E.
University of Washington	Francis William Peters, E.E.
Washington University	Professor Hunley Whatley Herrington, Ph.D.
Wellesley College	Professor Louise Sherwood McDowell, Ph.D.
Wells College	President Kerr Duncan MacMillan, B.D., S.T.D.
West Point Military Academy	Major F. L. Purdon, U.S.A.
Western Society of Engineers	Oscar Frederick Dalstrom, C.E.
University of Western Ontario, Canada	Reverend Benson Cox, B.A.
Williams College	President Harry Augustus Garfield, LL.D., L.H.D.
University of Wisconsin	President Edward Asahel Birge, Ph.D., Sc.D., LL.D.
Wittenberg College	Chalmers Eugene Frontz, A.M., D.D.
Worcester Polytechnic Institute	President Ira Nelson Hollis, L.H.D., Sc.D.
Yale University	President James Rowland Angell, Litt.D., LL.D.

ALUMNI ASSOCIATIONS

General Alumni Association	Daniel Lawrence Turner, C.E.
Buffalo Alumni Association	George Conrad Diehl, C.E.
Central Hudson Alumni Association	Clarence Alanson Fowler, C.E.
Central New York Alumni Association	William Francis Acheson
Chicago Alumni Association	James Raymond Fitzpatrick, C.E.
Cleveland Alumni Association	James Welch Frazier, C.E.
Alumni Association of Cuba	Eduardo Justo Chibas, C.E.
District of Columbia Alumni Association	Harry Harwood Rousseau, C.E.

Hartford Alumni Association
Louisville Alumni Association
New Jersey Alumni Association
New York City Alumni Association
Philadelphia Alumni Association
Pittsburgh Alumni Association
Rochester Alumni Association
San Francisco Alumni Association
Schenectady Alumni Association
Troy Alumni Association
Utica Alumni Association

Rodney Lyman Loomis, C.E.
George Robert Bickel, C.E.
Morris Robeson Sherrerd, C.E.
Charles Macdonald, C.E., LL.D.
Percival Mosley Sax, C.E.
Walter Seward Church, C.E.
Francis Joseph Yawman
William Pitt Mason, Sc.D., LL.D.
Charles Hubbard Hill
Edward Wright Arms, C.E.
Henry Rumrill Beebe, C.E.

CLASSES

'57 Charles Macdonald, C.E., LL.D.
'61 William Lawrence Haskin, C.E.
'66 William Halsted Wiley, C.E.
'67 Frank L. Moore, C.E.
'68 John Joseph Albright, M.E.
'69 Edward Wright Arms, C.E.
'70 Jacob Esher Heyl, C.E.
'71 Frederick Leman Garlinghouse, C.E.
'72 William Hubert Burr, C.E., D.Eng.
'74 George Washington Carnrick, C.E.
'75 John Alexander Low Waddell, LL.D., D.Eng.
'76 Edward Carlos Carter, C.E.
'77 Howard Nixon Elmer, C.E.
'78 George Edward Thackray, C.E.
'79 Kenneth Allen, C.E.
'80 Strickland Landis Kneass, C.E.
'81 Townsend Vail Church, C.E.
'82 Frederick Griswold, C.E.
'83 Guy Hartwell Elmore, C.E.
'84 Charles Winthrop Crockett, C.E., LL.D.
'85 Clarence Alanson Fowler, C.E.
'86 John Knickerbacker, C.E., M.E.
'87 John Marshall Lockhart, C.E.
'88 Frank Julius Eppele, C.E.
'89 Frank Chatterly Bates, C.E.
'90 James Wilson Shields, C.E.
'91 John William Tumbridge, C.E.
'92 Charles Edwin Birch, C.E.
'96 William Earl Whitney, C.E.
'97 William Joseph Bergen, C.E.
'98 Horace de Roemer Haight, C.E.
'99 Elbert Scranton Platt, C.E.
'00 Edward Denison Hooker, C.E.
'01 George Walter Koss, C.E.
'02 Carl Julius Schumann, C.E.
'03 Harry Johnson Deutschbein, C.E.
'04 John Patrick Turner, C.E.
'05 Van Rensselaer Powell Saxe, C.E.
'06 Charles Francis Crowley, C.E.
'07 Charles Henry Andros, C.E.
'08 John Calvin Peck, C.E.
'09 Walter Vanderbilt Scott, C.E.
'10 John Francis Kelly, C.E.
'11 Grant Knauer Palsgrove, M.E.
'12 Harold MacLean Lewis, C.E.
'13 Frederick Martin Sebast, E.E., D.Eng.
'14 William Alphonso McMullen, Jr., B.S., C.E.
'15 Alfred Chapin Gallagher, C.E.
'16 Howard Elmore Stevens, M.E.
'17 Donald Bennett Patterson, C.E.
'18 Harry Franklin Parrott, C.E.
'19 Rowland Van Dyke Firth, M.E.
'20 Guy Bennett Waite, Jr., C.E.
'21 Richard Clarence Cook, M.E.
'22 Edwin Cameron Eller, M.E.
'23 Paul Barringer Tully, Ch.E.
'24 Franklin Monroe Garrett, E.E.
'25 Augustus Cleveland Brown

'93 Ralph Hamilton Chambers, C.E.
'94 John Newton Shannahan, C.E.
'95 Walter James Towne, C.E.
'26 William Busch
'27 Karl Frederick James von Kokeritz
'28 William John Carson

LIST OF FOREIGN ORGANIZATIONS SENDING CONGRATULATIONS BUT NOT SENDING DELEGATES

Letters of congratulation were received not only from the institutions, associations and societies which sent delegates but from many others, in this country and abroad, not able to send them. The names of these organizations in foreign countries are given below. They number 98 from 29 political subdivisions outside the United States.

Argentine, National University of Buenos Aires. *Australia,* University of Adelaide, University of Melbourne, University of Queensland, Institution of Engineers, Australia. *Austria,* University of Vienna. *Belgium,* School of Mines and Metallurgy, Mons; University of Liege, University of Louvain. *Bulgaria,* Sofia University. *Canada,* University of British Columbia, University of Kings College, McMaster University, Manitoba College, University of Manitoba, Nova Scotia Technical College, University of Ottawa, St. John's College, Victoria College, Engineers Club of Toronto. *China,* University of Amoy, University of Hong Kong, Peking University, St. John's University, Shanghai; Tangshan University, Tsing Hua College, Yale in China, Changsha; Government Education Bureau, Chinese Educational Mission. *Czecho-Slovakia,* Czech Technical College, Prague; German Technical High School, Prague. *Denmark,* University of Copenhagen. *England,* University of Birmingham, University of Bristol, British Association for the Advancement of Science, University of Cambridge, Chelsea Polytechnic Institute, Imperial College of Science and Technology, University of Leeds, Manchester Municipal College of Technology, Northampton Polytechnic Institute, Northern Polytechnic Institute, University College, Nottingham; University of Oxford, Sir John Cass Technical Institute, Iron and Steel Institute, North of England Institute of Mining and Mechanical Engineers. *France,* University d'Aix-Marseille, University of Dijon, Ecole Polytechnique, University of Grenoble, Special School of Architecture, Paris; School for the Advanced Study of Mines, Paris. *Germany,* Frederick Williams University, Berlin; Rhenish Frederick Williams University, Bonn; Silesian Frederick Williams University, Breslau; Albert Louis University, Freiburg in Breisgou; Frederick Alexanders University, Erlangen; George Augustus University, Göttingen; Fredericks University, Halle-Wittenberg; Thüringian University of Agriculture, Jena; University of Kiel, University of Leipzig, Louis Maximilians University, Munich; University of Würzburg, Fredericks Polytechnic Institute, Cöthen. *Greece,* University of Athens. *Holland,* University of Amsterdam, University of Groningen, University of Leiden, Technical High School, Delft. *India,* University of Bombay, Calcutta University. *Ireland,* University College, Cork; University of Dublin. *Japan,* Kyushu Imperial University,

Tohoku Imperial University. *Java,* Bandoeng Engineering University. *Mexico,* Association of Engineers and Architects of Mexico. *New Zealand,* University of Otago. *Norway,* Norway Technical High School, Trondhjem. *Poland,* Jagellonian University, Cracow. *Portugal,* University of Lisbon. *Scotland,* University of Aberdeen, University of Edinburgh, Royal Technical College, Glasgow. *South Africa,* University of Cape Town, University of Witwatersrand. *Sweden,* University College of Göteborg. *Switzerland,* University of Basel, University of Bern, University of Geneva, University of Lausanne, University of Neuchatel, University of Zurich, Technical High School, Zurich. *Trinidad,* Royal Victoria Institute. *Wales,* University College, Cardiff.

INVOCATION AND ADDRESSES

Friday Morning, October 3rd

Invocation by the Rt. Rev. George Ashton Oldham, D.D., Bishop Coadjutor, Diocese of Albany

Almighty and Eternal God, Creator and Sustainer of the universe, Who art the truth Thou lovest, send out Thy light and Thy truth and illumine us; give us a deep and clear knowledge of ourselves; help us to a growing knowledge of our world; confirm in us the holiness of true reason; enable us to see Thy hand and Thy handiwork in all the wonders of Thy laws and the marvelous activities of Thy creation; strengthen in us the aspiration towards noble and spacious thinking; and in Thy good time lead us to Thy holy hill where, lifted above the mists of prejudice and passion, we may think Thine own thoughts after Thee.

We come before Thee this morning, Heavenly Father, in a spirit of humble gratitude for Thy manifold mercies to us Thy children. We bless Thee for our creation, preservation and all the blessings of this life, and especially on this Centenary occasion for the many years of useful service of this Institute of learning. We thank Thee for the vision of its founders, the generosity of its benefactors, the devotion and efficiency of its teachers, the loyalty of its alumni; and we beseech Thee to grant that we may show forth our thankfulness not only with our lips but in our lives by, each according to his ability, doing his utmost to strengthen, promote and prosper the welfare of this school.

Send Thy blessing we beseech Thee upon this institution today, its officers, teachers and students. En-

able all who teach here earnestly and fearlessly to search after and proclaim the truth; illumine the minds of the students, purify their hearts and fashion their lives so that they may go forth a noble host equipped and eager for efficient and worthy service to mankind.

Finally, we beseech Thee to direct us in all our doings with Thy most gracious favor and further us with Thy continual help that in all our works begun, continued and ended in Thee, we may glorify Thy Holy Name and finally by Thy mercy obtain everlasting life, through Jesus Christ our Lord. Amen.

Address by Herbert Clark Hoover, Sc.D., Ph.D., D.Eng., LL.D., D.C.L., Secretary of Commerce of the United States

Mr. President; Ladies and Gentlemen:—

I have the honor to bear a message of felicitation from the President of the United States to the Trustees, the President of the Institute, its alumni and students. He bids me to express his appreciation and gratitude for that stream of blessings which this institution has poured forth to the American people over these 100 years. And further that it is through these institutions and their resolute service to our people that the mould of the next century must be builded.

The significance of this occasion requires no emphasis. Rensselaer was the first of that great brood of institutions which have spread through the English speaking world for the training of men in the application of science to human service. Indeed it came with the dawn of the era of purposeful science itself.

When this institution began its beneficent work the phy-

sical and chemical sciences were just taking, under the leadership of Davy and Faraday, their first great steps in transforming themselves from purely observational sciences to more exact experimental ones. And they were at the same time changing from the pursuit of the merely curious to that of the planned useful. They were changing from something casual to something purposive. The biological and the social sciences, also represented in this institution, are modern as would-be exact sciences when compared with these others.

But I prefer to speak to you this morning, however, not as a scientist about science in general but as an engineer about engineering in particular; for it is in its pioneer leadership in the creation of a new profession amongst men, devoted to the application of the sciences to human need and comfort, that Rensselaer Polytechnic especially deserves our gratitude.

At the time of the foundation of this institution, the application of science was an accident left to the hands of the artisan and mechanic. The real contribution of this institution has been that it grasped the duty of lifting the application of science from the rule of thumb of the artisan to the mobile hands of a skilled profession—a profession that ranks today, in its requirements of training, in intellect, and in ideals, with the highest of professions.

The realization that education of a body of men in pure science and in the humanities, combined at the same time with a knowledge of the mechanic arts, was the vital bridge over which science could alone become the implement of man, is the notable contribution of this institution. From her sons and her influence has grown that great spread of engineering schools in our country and that army of half a million trained engineers who have builded our transportation, our communications and our industries. With-

out this link for the skilled application of science to need, science itself would have to a large degree remained locked up in our laboratories and libraries. Far more than this, the demands which these men have made for more and more science has stimulated and supported the growth of discovery itself.

There are other reflexes from all this beside our vast industrialization with its enormous lightening of the burdens of men and with their larger comfort and happiness. This body of men whose work has been the application of the sciences to the control of force and the production of definite things are men who must from the nature of things be trained in precision of thought. To them every step is the quantitative valuation of forces and materials. There was but little such thinking in the newly born social sciences until, in these recent years, they have grasped from the engineering profession the necessity for such precision of thought and valuation of forces which should be applied to valuation of moral and social forces in the nation. But the recognition on the part of the newer sciences of this obligation to truth, to precision of thought, to honest, fearless valuation of moral and social and economic forces is as yet in its infancy. There is no spread of emotional untruth in physics and chemistry, geology and biology—yet in the social sciences we are still enmeshed in qualitative instead of quantitative thought. In them we still permit personal prejudice to take the place of impersonal and impartial attitude, emotion to take the place of reason, and assumed promise the place of proved fact.

But it is not my purpose to address you upon these subjects. Others will convey with more authoritativeness the felicitations of those who are entrusted with the progress

of science. Others, also, will speak for the profession of engineering.

I want to offer to the President, the trustees, the faculty, and the alumni of the Institute, my sincere congratulations upon its completion of a century of distinguished service. Mr. President, gentlemen of the Board of Trustees, gentlemen of the faculty and gentlemen of the Alumni Association, I congratulate you upon the traditions which you have inherited and which you have so worthily maintained.

For this Institution I can wish nothing better than that its influence in the next century may equal its influence in the last. There is an old Latin motto, "Ad astra per aspera" (Through the steep places to the stars), with which you are all familiar. Rensselaer has climbed the steep places. Through difficulties and discouragements it has persevered. Today its beautiful campus, planted firmly on the hills above this pleasant city, is a just symbol of its success—the fitting crown of its achievement. Surely we who have enjoyed its hospitality will return to our own tasks refreshed and invigorated with the inspiration of the service that men may do for their kind.

Address by Frank Pierrepont Graves, Ph.D., Litt.D., L.H.D., LL.D. President of the University of the State of New York

Mr. President; Ladies and Gentlemen:—

The errand that has brought me to Troy this morning is weighty but most congenial. At the request of the Governor and the Board of Regents, I have been commissioned to represent this great Empire State in various as-

pects—governmental, scientific, and educational—and to bear greetings from the proud mother to her distinguished daughter. Numerous are the associations and cordial the relations that have from the beginning bound together the State of New York and the world-renowned College of Engineering that has arisen within its borders. Many of them are embodied in the unique personality of the founder, Stephen Van Rensselaer of Albany and Troy and of the many other centers that have sprung up within his historic patroonship over the Colony and Manor of Rensselaerwick.

This great patroon-citizen was allied by blood or marriage with many of New York's leading families—the Livingstons and Schuylers, as well as the Van Rensselaers and Ten Broecks, and typified in his person the finest blood of the Commonwealth. For more than a generation he served his native state in various public offices—assemblyman, senator, representative to Congress, president of the Constitutional Convention, and lieutenant governor—and upon two occasions he was barely prevented from attaining the governorship itself through the ungrateful suffrage of his enfranchised vassals. In war, as major general in command of the State's forces, he fought her battles and preserved our liberties, and in piping times of peace, as head of the Canal Commission, he explored the route from the Hudson River to Lake Erie, and at his own expense, while President of the Central Board of Agriculture, he made a geological and agricultural survey of the State.

To the mind of Van Rensselaer assuredly "peace hath her victories as well as war." And the great benefactor of New York never exemplified this epigram more forcefully than in the foundation of the Polytechnic Institute that perpetuates his name. This, the pioneer School of Technology in America, has become by far the most influential

and enduring of all his many contributions and benefactions to his native state. The incumbency of state office is fleeting, even military glory is ephemeral, the authors of reports are soon forgotten, and surveys and canals gradually fall into disuse and decay. But the Rensselaer Polytechnic Institute has grown stronger and brighter in repute as time has sped, and each year of her century of existence has seen her further expanded and enriched in a constant geometrical progression. From her doors have streamed forth a continuous and ever increasing army of youthful knights and crusaders, sworn to subdue the forces of material nature and to compel them to serve the cause of humanity and civilization throughout the world.

To recount adequately the specific achievements of Rensselaer graduates would occupy at least all the time planned for these Centennial Exercises, and would extend far beyond the purview of this address. We may select as a single illustration the projects in bridging that have been completed here in New York. The Poughkeepsie bridge, the Niagara Falls bridge, the Brooklyn and Williamsburg bridges, the Washington bridge over the Harlem, and numerous other structures have been built by alumni of Rensselaer. Similarly, we might mention single accomplishments in each line of construction, invention, and research, but we are this morning concerned with large educational tendencies, rather than individual examples of achievement.

There are few movements in American education in which Rensselaer has not been in the vanguard. In its early objectives this institution may be considered the first school of agriculture, as well as the first school of engineering, and it may, therefore, well be considered the progenitor of the State College at Cornell, just as it is of Ithaca's famous Colleges of Civil and Mechanical Engineering. Likewise

Some of the Delegates

it early recognized the need for collegiate training in Domestic Science, and while lack of funds prevented the establishment of courses in this subject at the Rensselaer School, the idea has later germinated in the Russell Sage College close at hand. Similarly, the institution may be regarded as a pioneer graduate school, since Amos Eaton made provision for accepting the work of other colleges toward the degrees of Rensselaer and intended that the School should "be considered the common workshop of all colleges, academies, and other literary and scientific seminaries of learning." Again, in its desire to establish evening classes, and branch schools where a partial training might be obtained by persons unable to come to Troy for a whole year, did not Rensselaer become one of the earliest exponents of university extension? Moreover, under Eaton's method of pupil instructors, it devoted itself to the cause of practice teaching and teacher training a dozen years before the first normal school was contemplated by Horace Mann, and it prepared not only instructors for innumerable academies but even professors of science for most of the leading universities.

Thus in every way the Rensselaer Polytechnic Institute has intertwined itself with the development and welfare of New York and with the State's system of education. Most appropriate, therefore, was it that Stephen Van Rensselaer should not only have attained great prominence as a statesman, but should, during the last twenty years of his life, have served as a member of the Board of Regents of the University and have eventually become its Chancellor. And in the name of this State of New York and of its University, and in behalf of its Governor, Chancellor, and Board of Regents, I tender you, the authorities of this grand old institution, heartiest congratulations and best wishes for the future. The usefulness and influence of the

Rensselaer Polytechnic Institute have but just begun. What it has already performed for the state and the nation, the presence this morning of these distinguished ambassadors of Applied Sciences from foreign shores shows that it is beginning to perform for the world at large.

Address by Harry Esmond Clinton, A.B., LL.B., Mayor of the City of Troy

Mr. President; Distinguished Guests; Ladies and Gentlemen:—

I rise, Mr. President, to congratulate you and the representatives of this distinguished institution upon your most delightful program which has brought to our City a gathering not alone notable in the field of scientific thought but has attracted here from all parts of the world minds bringing a message of loyalty and faith which cannot fail in its inspiration to every loyal son of "Old Rensselaer."

During the incumbency of one occupying the office of Mayor of the City of Troy there come many duties that are but indirectly connected with his official position. The happy welcoming of visiting delegations, the addressing of various conventions, the contact with Federal and State officials in matters of welfare to the City, these are all a part of the routine of public life and are accepted as a pleasant relief from what we sometimes are inclined, and too carelessly call, a thankless and unsatisfied honor.

Other cities are thus approached; other Mayors have their burdens similarly lightened, but in no City in this Great Empire State, aye in no City in this or any other State, has any Mayor in any municipality ever been called upon to welcome within its friendly confines such a charac-

teristic gathering as I, in the name of Troy, proudly and cordially greet at this time.

Officials of scientific organizations throughout the world, are here as delegates from such societies, representatives of the great universities and colleges of the nation are here assembled, all paying tribute to the founders of our world famous school, and to the achievements of its sons as leaders and pioneers in every field of engineering activity upon the globe.

Here today mingle notable educators, men famous in scientific research, executives of vast industries pausing in their labors to celebrate the centennial of the oldest school of theoretical and practical science—Rensselaer Polytechnic Institute.

It is not my purpose nor is it within the line of my duty to enter upon the history of our famous institution, starting as a school for the "Sons and Daughters of Farmers and Mechanics," until it has broadened out into the Alma Mater of men prominent in scientific thought who have been torchbearers in the physical development of the various countries of the world.

Nor shall I bring to your attention the achievements of her alumni; the world is dotted with them, and history has in the past accorded and will in the future accord them their proper places, as it will the story of these three wonderful days of greetings and congratulations of the academic, scientific and engineering world.

These spacious buildings, this broad area which stretches before us, this temple of learning speaks to us in no uncertain tones of that marvelous vision of those fathers, and brings a visualization, real indeed as thought runs into retrospect, to that square brick building on the northwest corner of Middleburgh and River Streets, behind whose doors the dozen or more students were the first to enroll.

What a wonderful march of progress has been made from that humble beginning to these many magnificent collegiate buildings that tower above our City; whose laboratories, dormitories, gymnasium and study halls while speaking in terms of millions of dollars, speak also in clarion tones of the gratitude and affection of the alumni.

To that modest structure of an earlier day came those students, through the rustic fields and winding paths, up from the struggling village of Troy and down from the then flourishing and progressive village of Lansingburgh, following the decree that the school should be as near midway between the rival communities as possible. At that then central point this school remained until 1844, when the city offered inducements that enabled it to remove to a more convenient location. Three times has fire made havoc with its buildings and its contents; the one in 1904 nearly wiping out the last vestige of the Institute.

Standing by the smoking ruins of that fatal morning was a former student whose mind glowed with the prospects of larger and greater buildings, and whose efforts in detail are not mine to relate. The extremity in which the institute found itself received the thought of that great financier, the late Ruseell Sage. There must have come to his mind the marvelous opportunity in a practical way to be helpful to the City of his younger days. As a result of all this and the cooperation of the beloved Mrs. Sage, the ground was ploughed and the seed sown for those efforts, made by many of the men who are here, which have resulted in the Rensselaer Polytechnic Institute of today. In times of war and in times of peace upon all occasions everywhere, has the Institute risen nobly to its highest traditions.

I cannot, I shall not, in the face of this distinguished gathering, tell its glorious history, but in this City of patriotic thought with its every building and every street aglow

with the flag and colors of our country, I cannot fail to call to the attention of this very diversified but wholly loyal assemblage the part played by the Sixth President of the Institute at one of the most critical times in the Civil War.

Here and from out of this institution came the Honorable John F. Winslow of the noted Iron and Steel firm of Corning & Winslow, who, fired by the deepest patriotism and enthused with a zeal that knows no bounds, undertook to furnish the labor and materials in the production of an experiment that practically turned the tide of war in favor of the federal government and revolutionized the armament of navies in the construction of ironclad ships of war. Making real the dreams of the inventor, John Ericsson, he constructed, in marvelous record time, the famous little "Monitor," which sped forth to the successful engagement of the "Merrimac," then ravaging our towns and shipping, in southern waters.

This institution, as well as every Trojan, has always felt the honor of this incident, which stands out most brilliantly in the history of the greatest Civil War of modern times. But it is not alone in critical emergency, nor the carnage of battle that the wisdom and judgment of a graduate of the Institute is shown at their best.

"Peace hath her victories, no less than those of War." In times of peace, in the natural order of affairs, the rare and practical knowledge, the capacity to make quick and accurate decisions, taught in the four years, have brought about results invaluable and beyond comparison.

Through the application of this engineering skill, disease has been banished from heretofore uninhabitable districts. The great municipal problems of sewage, the clarifying and making potable the poisonous waters of streams and ponds are but ordinary problems confronting the graduate, while the reclamation of vast districts lies to-

day to the credit of the thoroughness and the intensity of the schooling here received.

The debt due Rensselaer Polytechnic Institute by the nation and by the world at large is beyond compensation. The full measure can never be paid. What can be done is to honor and encourage the faculty that teaches and amplifies the wonders of scientific research.

Sufficient for me, as the representative of a city glorifying in the honor you are conferring upon it by your presence, to again welcome you heartily and proudly and to bid you God speed in the marvelous work in which you are engaged.

Address by Sir Charles Langbridge Morgan, C.B.E., President of the Institution of Civil Engineers of Great Britain

Mr. President and Gentlemen:—

I wish, first of all, to make use of this opportunity to convey to you the heartiest greetings and good wishes of the Institution of Civil Engineers and their congratulations on this memorable occasion in the history of your Institute. The chance which has caused my presidential year to coincide with your centenary has brought it about that I am the bearer of these congratulations to you. I have thus been able to see for myself a little—far to little for my own taste—of the work you do and the methods you employ and I should like to express my high personal appreciation of all that I have seen and learned. Further I have to thank you for the honour you have done to my Institution and, through it, to the Engineering Profession in the British Empire, by inviting us to be represented here today. It is an honour that we greatly prize, not only because it gives us an opportunity to come into contact with

a professional organization with a distinguished past and a future full of bright and increasing promise, but because, when Americans and Englishmen meet together on an occasion such as this, they meet as men who have long worked in a common scientific cause and their meeting adds yet another to the many links which already bind together your great country and my own.

I notice that you justly claim for your Institute that it is "the first school now in existence which was established in any English-speaking country primarily for the purpose of teaching Science and Engineering." This strengthens the bond between you and the Institution of Civil Engineers in London. We are not primarily a teaching institution at all. Our place is among the learned societies and those who are admitted to our full membership are already qualified and experienced engineers. Our purpose and function, therefore, are considerably different from your own, but we have this in common—that, whereas you claim to be the senior teaching organization, we are the mother Institution of the Engineering Profession. We were established in 1818 and incorporated by Royal Charter ten years later. We are proud of our seniority as you are proud of yours. But the more I reflect upon the past of the engineering profession in England and the more I see of the work you have so long been doing over here, the more I realize that we in England have lacked something which you supply. To-day there are of course many opportunities in England for the young man who is entering the profession to obtain the systematic training which is necessary to him. Technical education is now more easily come by, and we older engineers cannot help sometimes being envious of the opportunities which young men take as a matter of course. But the work which you have now been doing for a hundred years—I mean the work of

scientific and engineering education—has, until quite recently not been sufficiently fostered in England. It has been necessary to fight against a very strong prejudice. I dare say you also have felt it to some extent, though in America the prejudice has probably not been so strong as it has been with us. Those who wished in England to provide scientific and engineering education and to persuade boys and young men of the right class to accept it, have had to fight against the classical or literary prejudice. It is a prejudice that has been strong everywhere, particularly in the Old World. You will remember that when at the end of the eighteenth century the first polytechnic school was founded by the National Convention in France, it was founded as a protest against the almost exclusive devotion to literary and abstract studies which at that time prevailed. From that time to this the old battle has been going on. It is not ended even now. In our own seats of learning, the men who are pursuing scientific studies and the men who are pursuing literary studies live almost in two separate worlds. I do not mean that they are not friends or that they do not mix: they are friends and they do mix and in some respects they have a great deal in common. But I think it is true that they have very little feeling of common purpose so far as their studies are concerned. The science man feels that he is on one track; the classical man feels that he is on another. Not to very many of them does it occur that ultimately the tracks meet. And so the struggle goes on.

Now the point I want to make is that it is a very foolish and unintelligent and wasteful struggle. It has two bad results. First, it stands in the way of scientific men getting all the scope and educational opportunity to which they are entitled. Secondly, it causes many classical men to hold aloof from what is in fact a part of true culture in

modern times. And I think that in the past both sides have been to blame. Those who have been unsympathetic to scientific and technical education have been wrong in denying to it a full share in the general training of a man's mind, and we who have supported it have often based our support on wrong, or at any rate too narrow grounds. We have been too apt to argue in this fashion. "Engineers are necessary. They must know their jobs. We teach it to them and we have justified ourselves if we turn out good engineers." All that is very true. But it is only a part of our real case. Our real case, as I see it, is briefly this. "A good engineer is always something more than a good engineer. If he has been rightly taught, he has been given a liberal as well as a technical education. He has not merely been shown how to do a particular thing or a particular series of things but has been encouraged in original thought and in scientific investigation and knowledge far beyond the obvious mechanical necessities of his profession." Take a small example. We teach a man how to build a bridge. What does that mean? Does it mean that we have shown him how to make a particular bridge so that it will not fail and will carry the loads imposed upon it? If that were all we had taught we should be bad teachers and if that were all the student wanted to learn he would be a very bad student. No: we and he between us have produced far more than one bridge or a hundred bridges. We have investigated and understood and applied in practice a scientific idea. We started a train of thought which may lead the student far beyond his bridge. For it is by what they think, far more than by what they do, that men live and will, I suppose, ultimately be judged. Ruskin used to argue that it was impossible that anyone should be a good artist who was not a good man. That is not historically true, but it is a highly suggestive paradox

which we may apply to scientists as well as artists. We may say, at any rate, that it is impossible to build a good bridge without being the better for it. And that, after all, is the literary and classical men's own argument. They say that it is impossible to read a good poem without being the better for it. I entirely agree. I am not so foolish as to reply that a poem is just a mechanical affair of ink and paper. Nor ought they to say that a bridge is just a thing of brick and steel. Bridges, like poems, are reflections of the human mind. Science is not simply a utilitarian affair as some of its detractors would have us believe. Like Art, it is an expression of the human soul. And you here who teach it and learn it are contributing to much more than the convenience or the material profit of civilization. You are contributing to its peace, its happiness, and, if I may say so, to its goodness. Someone (I think one of your countrymen, though I have lost the reference) said recently that an engineer was a man who could do for one dollar what other men could do for five. That is one aspect of the truth, but it is not all the truth. I would much rather say that a scientist—and by a scientist I mean one who loves science for what it is and not merely for what it earns—that a scientist is one who, not only enables man to subdue nature to his profit and convenience, but teaches him to understand himself through nature. This is the connection between science and politics and between science and philosophy. It is the link between our work and the work of poets and classical scholars and men of letters. It is our true title. And whether we are approaching science as teachers or learners or active professional men, we ought, I think, to take this wide view of our purposes, or else we reduce our work to far less than it is.

Now, this is my first visit to your country. My time has been short and I have not seen all that I should like

to have seen. But I have seen enough in Troy to make it abundantly clear to me that your Institute takes a very wide, I may say a very noble, view of its educational duties. On the purely technical side nothing is wanting. Your highly qualified staff of lecturers and teachers, your splendid organization and your well-equipped laboratories and workshops give to your students opportunities which could not be bettered at the present time and which, to one who like myself learned his profession long years ago, are a real cause of envy. But this is not all. Your Institute, drawing students from all over the world, gives them an opportunity to become and encourages them to become much more than competent workers by rule of thumb. The teaching you give is education in the highest sense and is clearly inspired by the highest ideals. I wish some of those who have so small an opinion of scientific education could see what I have seen here. I think the most stubborn of them would go away converted. And the opportunities you give carry with them responsibilities equally great. If every modern student could realize the advantages he has by comparison with those who studied science when your Institute was founded or even so late as fifty years ago, I am sure it would be very unusual to find a slacker. Perhaps they realize it better than some of us think. Perhaps that is the reason that in Troy slackers are altogether unknown, and certainly I have seen no signs of them. However that may be, there are so many famous names among the list of graduates that a great responsibility rests upon the present students. They will, I am sure, discharge it to the full, and will in years to come add yet further to the great prestige of your Institute throughout the world.

I must once more thank you, Mr. President and Gentlemen, for your patience in listening to me, and say again how grateful I am for having been given this opportunity to share in your centenary celebrations and to bring you the good wishes of the Institution of Civil Engineers. It will

be remembered by me as among the most pleasant and memorable days of my life. I wish the Institute all success in the future. May the next hundred years witness a growth of your influence even greater than that which has distinguished your history during the hundred years now ended. And may it by then have proved beyond all doubt that science is the friend and not the enemy of the peace of the world.

Address by Professor Henri Abraham, Sc.D., Past President of the Society of Electrical Engineers of France

Monsieur le Ministre; Monsieur le Président; Mesdames et Messieurs:—

Permettez-moi d'abord de dire un bien sincère remerciement pour le charmant accueil que vous avez réservé aux délégués venus de toutes les parties du monde saluer le Rensselaer Polytechnic Institute.

Laissez-moi dire aussi combien j'ai été personnellement touché de tant de cordialité.

J'ai le grand plaisir de remettre entre les mains de Monsieur le Président Palmer C. Ricketts les adresses que nous apportons de France, de la part de l'Université de Paris, de l'Ecole Centrale des Arts et Manufactures, de la Société Française des Electriciens, de la Société des Ingénieurs Civils de France, de la Société Française de Physique, de L'Ecole Supérieure des Postes et Télégraphes.

L'Université, les Grandes Ecoles, les Sociétés Scientifiques de France sont heureuses de s'associer bien cordialement à la célébration du Centenaire de la fondation du "Rensselaer Polytechnic Institute" que nous fêtons aujourd'hui.

C'est pour moi un grand honneur d'être ici le repré-

sentant de mon pays dans une si magnifique manifestation. C'est aussi avec une grande joie que nous nous sommes retrouvés de ce côté de l'océan parmi des amis très chers avec qui depuis bien des années se sont présentées tant d'occasions d'un fructueux travail en commun, pour le labeur scientifique de la paix, comme aussi pour la collaboration coeur à coeur lorsque la guerre a été imposée à nos deux pays.

Puisse à jamais le fléau de la guerre être épargné à nos enfants. Puissent tous les hommes comprendre enfin que la paix dans la liberté, et la collaboration de tous les pays aux oeuvres de paix sont les conditions indispensables du progrès humain.

Pour vous, Messieurs, vous avez tenu à manifester de la manière la plus courtoise votre propre désir de collaboration internationale dans les domaines de la science et des arts techniques, en conviant les nations étrangères à prendre part aux cérémonies du Centenaire du grand Institut de Troy, à cette fête de famille qui est aussi la fête du travail et de la science.

Lorsque l'homme dont nous honorons aujourd'hui la mémoire, Stephen Van Rensselaer, a jeté les bases de cette institution, il a voulu qu'il fût créé une école dans laquelle une élite de jeunes hommes viendraient achever leur formation intellectuelle par des études de science désintéressées, en même temps que par l'acquisition des connaissances techniques nécessaires à l'ingénieur. Et dans sa pensée ce n'étaient point là des choses séparées, car en vérité la Science est une et ses applications en sont inséparables.

La foi de votre fondateur dans la puissance éducative des études scientifiques n'a jamais cessé d'animer ceux qui ont développé son oeuvre. Comme lui, vous avez eu foi dans la valeur incomparable de l'enseignement technique que vous donnez ici en sachant en même temps en faire un

enseignement libéral de haute culture scientifique. Vous avez donc enseigné aux jeunes gens ce que l'on est convenu d'appeler les sciences exactes et ils ont vu de leurs yeux des théories qui prétendaient être l'expression de la vérité toute entière s'écrouler les unes sur les autres, mais non pas sans que malgré toutes ces ruines nous n'ayons pu garder entre nos mains, chaque fois, quelque nouvelle parcelle de la vérité éternelle.

Vous avez cru fermement que l'effort quotidien dans la recherche passionnée de la vérité scientifique forgerait des âmes ardentes et généreuses, des esprits larges et tolérants. Vous étiez certains qu'une telle culture ferait s'épanouir les plus belles floraisons intellectuelles et formerait ainsi des hommes qui sauraient bien âgir parce qu'ils auraient appris à bien penser.

Et voici que pendant tout un siècle, l'immensité des services rendus, l'importance des hautes situations occupées de tous côtés par les hommes qui doivent à cette école la formation de leur esprit—et dont nous voyons aujourd'hui même de si éminents représentants réunis pour cette fête—ont prouvé d'une manière éclatante la justesse des vues de votre fondateur et toute la puissance de vos disciplines; tandis que dans un splendide développement, le rayonnement de votre illustre maison se propageait bien au delà des limites de ce continent.

Je suis infiniment heureux, Messieurs, d'avoir été appelé à venir au nom de mon pays vous présenter les voeux de la France pour la constante prospérité du "Rensselaer Polytechnic Institute." Les années accumulées vous ont apporté une nouvelle et toujours plus ardente jeunesse. C'est le glorieux avenir qui s'avance, dont est un sûr garant le passé magnifique de la maison à qui nous apportons aujourd'hui l'hommage de notre admiration pour ses traditions séculaires de travail, de science et d'honneur.

Address by Senatore Luigi Luiggi, D.Sc., Dr.Ing., Past President of the Society of Civil Engineers of Italy

Mr. President; Distinguished Guests; Ladies and Gentlemen:—

It was a cause of great satisfaction among Italian Engineers and Professors of our Universities, to know that the learned Academic Council of Rensselaer Polytechnic Institute of Troy, N. Y., had honored one of their members by inviting him to attend the solemn commemoration of the Centenary of this famous institution, which, although so far away, is very well known in Italy. We know the high standard of its scientific teaching, and the thousands of Engineers, who have done such good work in developing the natural resources of this immense continent of America and in bringing comfort and prosperity to the people of your great nation.

Therefore, I thank you all for this honor, in the name of all Italian Engineers and University Professors and in my own name.

But also in the name of many others, especially of the Academic Councils of the universities of Rome, a center of learning from the remotest times; of Padua, the oldest University of Europe; of Genoa, the birthplace of Columbus, where he learned many facts and theories which enabled him to discover this New World, mark a new epoch in history and do an immense good for the progress of mankind.

I thank you also in the name of the Polytechnic Institute of Turin, the oldest in Italy, of Rome and of Bologna: and our other schools of engineering of Milan, Pisa, Naples and Palermo wish to be remembered.

Our Italian Society of Civil Engineers, with its nearly 9,000 members, wishes to take part in this great festivity of science applied to engineering.

Our Italian Ambassador, Prince Gelasio Caetani, who is proud of his degree in engineering received at Columbia University, and of the many honorary degrees of your other great universities wishes especially to be remembered, as his heart beats very fast when he speaks of his American colleagues. And last but not least, our Minister of Public Education, Senator Casati, entrusted me with a message to you Honorable President, Dr. Ricketts, from which message I beg of you to allow me to read you this one period:

"In my capacity of chief of the Ministry of Public Instruction, I am most glad to entrust to you, honorable professor, the task of offering to the Academic Council of the Polytechnic Institute of Troy the cordial greetings of this Ministry, of the Universities and of the Higher Engineering Schools of Italy; and of bringing to the professors and students of engineering in the ancient and celebrated American Institute, the hearty and cordial salutations of our own professors and students."

Also our great and beloved Premier, Mussolini, said to me he will be present in spirit here today, as his heart beats for the welfare and friendship of Italy and America. These are the sentiments of Italians who have great reverence and sympathy for your American Nation.

Mr. President, ladies and gentlemen, as I have the honor of addressing you I should like so much to give you an informative sketch about engineering works at present in construction in Italy or finished lately, but time will not permit.

However, just a few words to call your attention to our recent hydro-electric plants, which are numerous, and some also very important, as for example that of Venans, near Turin, with a fall of 3,300 feet; and that of Santa Croce, in the Venetian Alps, with an installation of 20,000 h.p. I would like to speak of our great Apulian Aqueduct, 1800

Some of the Trustees

miles long, not including town mains, and of which two-thirds are completed and carrying water to nearly two millions of people, distributed in about 400 towns and boroughs.

However, allow me two minutes to mention the works on the river Tirso, in Sardinia, for regulating the flow of this most capricious stream, which from almost no flow passes in a few hours to a flow of over 60,000 cubic feet per second and brings desolation in the most fertile lower valley. A large multiple arch dam, nearly 2,000 feet long and 220 feet high, one of the most important of its kind, forms an artificial lake capable of impounding the flow of two years of the river Tirso; just like your great Roosevelt dam. The lake impounds nearly 320,000 acre-feet of water, which makes the Tirso the third artificial lake in in the world, following the Assuan lake on the Nile and the Roosevelt lake in America.

But time is short: I hope that I shall be able to describe to you these and many other Italian engineering works at some other time; or better still to have the pleasure to show them to you, if, as I hope, many of you will come to visit my country, Italy.

Mr. President, Distinguished Guests, Ladies and Gentlemen, I will conclude with the words of the Rettore Magnifico of the University of Rome:

"I am happy to have the occasion to send to the Professors and students of the distant—but spiritually so near —center of knowledge of Troy, the greetings of this our Great Mother of Studies."

"As long as there continue to exist on this earth beacon-fires of knowledge, like those kindled by the industrious people of America, centres of learning such as the Faculty of Science and Engineering of the Rensselaer Polytechnic Institute of Troy, it is certain that it will be granted the

Some of the Faculty

Good and the Willing, to reach unhoped for goals, on the troubled ocean of life."

"And it is also for this reason that the Academic Senate, the Teaching Staff and the Students of the University of Rome send to the Rensselaer Polytechnic Institute of Troy on the occasion of its centenary, their warmest greetings, and fervent hopes that its past glory and present greatness, may shine forth now and always, in the centuries to come, irradiating among men, peace, goodness, beauty and well-being."

"Persuaded that this message of immortal Rome will awake an echo in the hearts of studious youths and wise professors, I renew my fervent best wishes, I send my most cordial greetings."

These are the sentiments that the Students, the Engineers and the Professors of Italy send to their colleagues of the Rensselaer Polytechnic Institute of Troy.

Address by Arthur Surveyer, B.A.Sc., C.E., President of the Engineering Institute of Canada

Mr. President; Ladies and Gentlemen:—

I desire to offer to the Board of Trustees, to the Faculty, to the graduates, and to the undergraduates of Rensselaer Polytechnic Institute, the sincere congratulations of all the members of the Engineering Institute of Canada, on the occasion of the celebration of the one hundreth anniversity of the foundation of this great Engineering School. As a member of the Board of Directors of the Ecole Polytechnique of Montreal I also bring you the heartfelt greetings of the only engineering school in North America where tuition is given solely in French.

It is a great honour to be associated, on this occasion with such distinguished representatives of the American

Government and of American Education as Secretary of Commerce Hoover, the Mayor of Troy, Mr. Clinton, Dr. Graves of New York State University and your own President Ricketts. It is also very flattering for me, to be united to-day to such eminent engineers as Sir Charles Morgan, Dr. Henri Abraham, and Dr. Luigi Luiggi, representing the three greatest European countries, Great Britain, France, and Italy.

There is such an interchange of Engineers between the United States and Canada, that Canadian Engineers have been in a very good position to justly appreciate the soundness, the resourcefulness and the initiative of American Engineers. These qualities are the common heritage of all Americans but there is no doubt that they have been developed and fostered to a greater degree in your technical men through the system of education in vogue in your schools of engineering and more particularly at Rensselaer Polytechnic Institute.

To one who has examined the photographic reproductions of the work of your graduates, and who has read Professor Baker's admirable History of Rensselaer, it is easy to understand the pride which all the alumni of this Institute must take in their Alma Mater. Judging by the positions occupied by the graduates of this school, the Faculty has discovered the formula for turning out engineers who are not only good designers, good constructors, and good manufacturers but men who have also acquired that most important of all qualities, which the Spanish call *"don de gentes,"* "the gift of people," and which can be described as the ability to influence and to lead other men.

I desire, in closing, to thank the Board of Trustees for having selected the President of the Engineering Institute of Canada for recognition at this centennial celebration.

Address by Palmer Chamberlaine Ricketts, E.D., LL.D., President of Rensselaer Polytechnic Institute

THE BEGINNING OF THE SCHOOL

It is appropriate, upon this occasion, that reference should be made to the condition of scientific education in this country at the time of the foundation of the Institute and that an outline of its early history should be given.

At the beginning of the nineteenth century the study of the physical sciences in the United States was in its infancy. Scarcely any provision was made for scientific instruction in any of the colleges of the country. Astronomy, physics, chemistry and botany had indeed been taught, during the preceding century, in a few institutions of learning, a department of mathematics and natural philosophy having been created in Harvard College as early as 1727, a professorship of botany in Columbia in 1792 and a class of chemistry at Princeton in 1795. Instruction had also been given in physics and chemistry in the University of Pennsylvania and Dartmouth College and in physics in Union College. This short list, however, includes all the colleges which had given the physical sciences more than an insignificant place in their curriculums. Even in these the instruction was given by lectures, supplemented, at times, by experiments which the teachers performed. Anything approaching laboratory work by the student was almost wholly unknown. When Professor Silliman was elected, in 1801, to the chair of chemistry, geology and mineralogy in Yale College, he visited Dr. McLean, who was professor of chemistry at Princeton, and there for the first time saw experiments in chemistry performed. Considering the state of scientific knowledge at this period and the general lack of opportunity for the study of science, even in Europe, it

is not remarkable that this should have been the case in a new country, the total population of which, in 1800, was less than that of the city of New York to-day.

With the general awakening to the value of a knowledge of the natural sciences, during the first quarter of the nineteenth century, came provision for their study in other of the academic schools of the country. Within that time courses in various branches were inaugurated at Yale, Williams, Bowdoin, Dickinson, William and Mary and Hobart Colleges, and in the universities of Georgia, North Carolina and South Carolina. Facilities for practical work by the students were still wanting in nearly all of them, though the apparatus used for illustration had grown in quantity and variety. A chemical laboratory, already mentioned, was in existence at Princeton, one was fitted up at Williams College in 1812, and one at Harvard shortly after this date. A few others were also to be found. They were all, of course, crude and unpretending compared with those thickly scattered over our country to-day.

The time had now come, not only for the addition of scientific courses to the curriculums of institutions of learning, but for a general diffusion of scientific knowledge among those who could not have the advantage of an education higher than that offered by the common schools. Attempts in this direction had already been made in Europe. When Count Rumford returned from Munich to London in 1795 he endeavored to interest the people of England, as he had those of Germany, in his plans for public and domestic economy, more particularly in the economic consumption of coal, improvements in the construction of fireplaces and the heating of buildings by steam. Or as he put it in a circular issued in London in 1799, to interest them in the *application of science to the common purposes of life.* His efforts and those of others in this direction resulted in the estab-

lishment, in the year 1800, of the Royal Institution of Great Britian. Other men had not been blind to the benefits which would result if the people generally could be instructed in the application of science to the common purposes of life. Franklin's opinions upon this subject are well known. John Adams believed that the state should make provision for this purpose and Jefferson also proposed a school of technical philosophy, to be maintained wholly at public expense, where various artisans could learn as much of the sciences, as then known, as might be necessary to pursue their work understandingly.

The influence of such opinions gave impetus to the diffusion of scientific knowledge among the people of this country, and during the first quarter of the century two schools were established here avowedly for the purpose of giving instruction in the applications of science. The first was incorporated under the name of the Gardiner Lyceum in Gardiner, Maine, in 1822 and opened in 1823 by Benjamin Hale, who afterwards became president of Hobart College. In his inaugural address, delivered January 1, 1823, this young man, who was graduated only four years before from Bowdoin College, referring to the students to be, said:

"It is not sufficient for them, as for the general scholar, to be taught the general laws of chemistry, they must be instructed particularly in the chemistry of agriculture and the arts. It is not sufficient for them to be able to repeat and to demonstrate a few of the general laws of mechanics, they must be taught the application of the laws. They must be made acquainted with machines."

All honor to the young scholar who foresaw the trend of the times, but his school had a short life. The lyceum existed only about ten years and was discontinued on account of the withdrawal of a legislative appropriation.

The second school, the centenary of which we are gath-

ered here, at this time, to celebrate, was founded in 1824 in Troy, New York, by Stephen Van Rensselaer, of Albany, and was called the Rensselaer School, since changed in name to Rensselaer Polytechnic Institute. Thus was inaugurated the first school, having a continuous existence, to be established in this country primarily for the teaching of science and engineering.

The founder was a man of position and education. He was the fifth in direct line of descent from Killian Van Rensselaer, a merchant of Holland who purchased from the Indians, in 1637, a district about twenty-four miles in breadth by forty-eight in length, comprising the territory which has since become the counties of Albany, Columbia and Rensselaer in the State of New York. Stephen, born in 1764, was graduated from Harvard in 1782 and in 1783 took charge of his estates. He became a man of great prominence, experienced in large affairs. He was lieutenant-governor of New York State for six years; a member of the National House of Representatives for three terms; the general in command of the state militia in the war of 1812; a member of two constitutional conventions, of one of which he was president; for twenty-six years a trustee of Williams College; a regent of the University of the State of New York for twenty years and its chancellor during the last four years of his life; a member of the Erie Canal Commission from its creation in 1816, he was its president from 1824 until his death in 1839. As a great landholder he was naturally interested in agriculture, and while in the House of Representatives was chairman of its committee on agriculture. Some years before this time he was elected president of the short-lived Central Board of Agriculture of the state. Although the life of the board was brief, it was long enough to permit a geological and agricultural survey of the counties of Albany and Rensselaer, made

under its direction though at the expense of its president. This survey was executed by Professor Amos Eaton and was the first attempt made in this country to collect and arrange geological facts with a direct view to the improvement of agriculture. Analyses of soils were included, as well as a consideration of the proper methods of culture adapted to them, and the results were published in three volumes of transactions. Imbued with strong opinions as to the value of such scientific investigations, when the board ceased to exist Stephen Van Rensselaer was unwilling to discontinue work of this character and in the years 1822 and 1823 he caused to be made at his own expense, under the direction of Professor Eaton, a geological survey extending from Boston to Lake Erie, a distance of about five hundred and fifty miles. It embraced a belt fifty miles in width which covered, in this state, the line of the Erie Canal.

The intelligence and benevolence of the founder were now, when he had reached the age of sixty years, to be directed into a new channel. He had long been interested in the instruction of the poorer families of his tenantry and had reached the conclusion that the most valuable education to be given persons engaged in the ordinary occupations of life was one which would enable them to apply the principles of science to the "business of living." His first step in this direction was to engage Professor Eaton to deliver, in various places along the line of the Erie Canal, during the summer of 1824, a series of lectures, accompanied with experiments and illustrations on "chemistry, natural philosophy and natural history." This undertaking was entirely successful. Encouraged by it he determined to establish an institution, the object of which he defined in a letter written from Washington, while he was a congressman, to Rev. Dr. Samuel Blatchford, the school's first

president. The letter was dated November 5, 1824. In it he appoints trustees, notifies them that a suitable building has been acquired and funds provided for necessary apparatus, gives rules for the government of the school, and defines his object as follows:

"I have established a school in the north end of Troy, for the purpose of instructing persons who may choose to apply themselves in the *application of science to the common purposes of life. My principal object is to qualify teachers for instructing the sons and daughters of farmers and mechanics,* by lectures or otherwise, in the application of experimental chemistry, philosophy and natural history to agriculture, domestic economy, the arts and manufactures."

His primary object, therefore, was to establish a school of high grade for teachers of science, and in his mind, as his letter shows, the broad field to be covered included *the application of science to nearly every branch of human endeavor.* It will be noticed that the *daughters as well as the sons were to be taught* by these teachers and that domestic economy was one of the subjects in which instruction was to be given.

In his letter the founder appointed Amos Eaton professor of chemistry and experimental philosophy, and lecturer on geology and land surveying. He well knew his man and he appointed no common one to be the first director. Surveyor, chemist, botanist, geologist, author of many works on these subjects, called in after years "the father of American geology," Eaton was above all a born teacher. His reputation was already established. In the catalogue of 1826, the first one containing a list of students, of the twenty-five whose names were given, seventeen came from the state of New York and eight from five other states, Ver-

mont, New Hampshire, Massachusetts, Pennsylvania and Ohio. Some of these must have come on foot or on horseback, part of the way at least, to reach Troy. For while there were some canals and some steamboats, there were no railroads and few highways in those days, and it is a great tribute to the reputation of Eaton and of the school, then less than two years old, that students should have come to it so early after its foundation from such distant places. It may be said that since those times students have continued to come from distant places, the records showing that they have come from all the states and territories of the Union and from thirty-eight foreign countries.

While at the beginning the principal object of the founder was to establish a school for the instruction of persons who would disseminate among the people generally information relating to the application of scientific principles to their various occupations, neither the founder nor the management of the institution had in mind the narrowing of its scope or the limiting of its usefulness as a school for teaching the applications of science to the *"business of living."* And so while many of those who had been graduated in the early years afterwards became eminent in various departments of pure and applied science, the renown of the school is principally due to the work of its alumni in the field of engineering—a course in which was soon added to the curriculum.

Some of the principles of certain branches of the science now broadly called civil engineering had been known, of course, since the earliest historical times. Besides various branches of natural science, some of these principles were taught, in this country, in the early founded schools and colleges to which reference already has been made. They were taught, also, in the Military Academy at West Point, which was established in 1802, though it was a school in

name only until its reorganization after the war of 1812. On the continent of Europe a number of technical institutions had already been founded, most of which were maintained partly or wholly by the state. The Ecole des Points et Chausses was established in France as early as 1747, though it did not become of importance as a school for engineers until a much later period. The Königsliche Sächsische Bergakademie was founded in Freiberg in 1765; the Ecole Polytechnic in Paris in 1794; the Polytechnisches Institut in Vienna in 1815, and the Königsliches Geverbe Institut in Berlin in 1821. The latter at the time of its foundation and for twenty-five years thereafter was, as its name indicates, a trade rather than an engineering school. A technical high school was also established in Prague in 1806. The Ecole Centrale des Arts et Manufactures, a private institution, was established in Paris in 1829.

The continental schools of science antedated those of Great Britain. Mention, however, should be made here of Anderson College of the University of Glasgow, founded in 1796 with a bequest of Professor John Anderson, who provided for an institution for the instruction of artisans and others unable to attend the university. In 1799 lectures on mechanics and applied science were begun and these ultimately led to the establishment of mechanics institutes in many towns. But the college never developed into a school of engineering. It was later converted into a medical school. Among the English schools in which scientific instruction was early given may be mentioned University College, established in London in 1828. In the University of London engineering subjects were first taught in 1840. The school of engineering in Dublin University was founded in 1842. Other well-known British schools of science and engineering were established at still later dates.

Although science and some branches of engineering

were taught in the early foreign schools, at the time of the foundation of Rensselaer School, there were few engineers, other than military engineers. The term civil in distinction from military engineer had been coined during the last quarter of the eighteenth century, it is believed by Smeaton, but it did not come into general use until the end of the first quarter of the nineteenth century. There had been, of course, inventors and constructors of genius throughout all the ages. Great ruins on more than one continent attest the skill of forgotten engineers. During the Renaissance, Brunelleschi, Michael Angelo and the great Leonardo da Vinci lived and builded and at the later period about which we have been speaking such names as Smeaton and Watt and Fulton come to our minds. But these engineers were born; not made in schools.

There were no schools of engineering in the United States because civil engineering had hardly yet been recognized as a profession. A consideration of the condition of the country and of the state of scientific knowledge as applied to the constructive arts towards the beginning of the nineteenth century shows why this was the case. In comparison with the European states, in which early schools of science above mentioned had been established, the country was new and sparsely settled. Methods of communication were primitive and traveling was expensive. The first canal of considerable length, and these were the first engineering works of great magnitude to be built here, was begun in 1816 and finished in 1825; no steam railroad existed, locomotives not becoming practically successful until about 1830.

Steam navigation was in a more forward state, Fulton's Clermont having made the trip up the Hudson in 1807. In 1815 there were steamboats running between New York and Providence. It was not until 1838 that a transatlantic

voyage was made wholly by steam. Steam had however been used for pumping water at a comparatively early date, and there were about seven steam engines in this country at the beginning of the century, although the small amount of power required for manufacturing purposes was obtained from wind and water. During the first quarter of the century many wooden bridges of long span were built, but the era of iron bridges did not begin until 1840. The first tunnel was built in 1831.

The few historical facts above given serve to indicate the condition of engineering science at the period of the school's history we are now considering. Although many of the fundamental principles of applied mechanics were known as well then as now, the development of the science, particularly in its application to structures and machines for the production of useful work, had taken place largely upon empiric lines. Most of the eminent men to whom this development had been due were self taught, were mechanics whose results had been obtained by successive experiments and with little knowledge of the resistance of materials or of the principles of the design of engineering constructions as practiced to-day. And if with these conditions there are taken into consideration the comparative smallness of the population and its extended geographical distribution, the wise forethought and liberality of mind displayed by the authorities of the school in establishing at such an early date a department of civil engineering will be thoroughly appreciated.

An outline of the course of study given in the first catalogue, published in 1825, includes land surveying, mensuration, measurements of the velocity of flow of water in rivers and aqueducts, besides mathematics, chemistry, experimental philosophy, astronomy and geology. The catalogue of 1826 shows that instruction was given in hydrostatics

and hydrodynamics and in calculations upon the application of water power and steam, and in that of 1827 reference is made to land surveying and general engineering. In the catalogue of 1828 the duties of Professor Eaton included lectures on civil engineering. This is the first appearance of the term "civil engineering" in any of the catalogues and no well-defined course in the subject was formulated for several years, though the curriculum of 1831 included elements and applications of civil engineering. In 1835 the trustees created a department "for the purpose of giving instruction in Engineering and Technology" and in the same year the first class in civil engineering was graduated. The course in civil engineering was reorganized in 1849-50 by Director B. Franklin Greene, one of the ablest men ever connected with the faculty. Departments of mechanical and electrical engineering were established in 1907 and that of chemical engineering in 1913.

It will be noticed that this sketch has had reference almost entirely to a few of the early years in the life of the school. Much of interest, even of those days, has had to be omitted. Van Rensselaer's first orders for the government of the institute, the rugged character and original methods of instruction of Amos Eaton, sidelights on the lives of the students, all would be of interest to the historian. Nor have I touched upon the influence of the school upon the development of scientific education and the practice of engineering in this and other countries. These phases of its influence, admittedly great, will be considered to-morrow by Dr. Ray Palmer Baker, distinguished in letters, professor of English in this institution.

Friday Afternoon, October 3rd

UNVEILING OF TABLET ON SITE OF OLD MAIN BUILDING

Address by Seymour van Santvoord, A.B., LL.B.

Mr. President; Gentlemen of the Board; Invited Guests and Fellow Citizens:—

It is with no little diffidence that I respond to this call. Within the limits of the brief address to which very properly I am restricted, to correctly interpret the significance of this event and adequately express the emotions it arouses and the lofty sentiments it inspires is no commonplace task. Moreover it would seem that so important a service more fittingly should be entrusted to one of the Institute's own distinguished sons than to an humble outsider. But perhaps in the very fact that I am not a graduate of the Institute may be found the reason for my assignment to this honorable place in the program—in that, as only a plain citizen, it is possible for me without suggestion of filial bias or prejudice to voice for this community its friendly sentiment and admiration for, its pride and unbounded confidence in and its loyalty to the Rensselaer Polytechnic Institute. But any such protestation on behalf of the citizenship of Troy should be quite uncalled for: to borrow one of the similies of the inimitable Mr. Samuel Weller, which at least is most forcible, if not entirely apposite—"That is a self-evident proposition, as the dogs-meat man said to the pretty house maid when she told him he wasn't no gentleman!"

The tablet about to be unveiled has been erected by the Board of Trustees in memory of Stephen Van Rensselaer and to commemorate the one hundredth anniversary of the Rensselaer Polytechnic Institute—the first school, now in

existence, established in any English-speaking country primarily for the purpose of teaching Science and Engineering. So that it is both to the founder and the fact, that these exercises are addressed.

In the first official notice of the foundation Mr. Van Rensselaer announced that he had established a school at Troy "for the purpose of instructing persons who may choose to apply themselves *in the application of Science to the common purposes of life*"; and that his principal object was "to quality teachers for instructing the sons and daughters of farmers and mechanics, by lectures or otherwise, in the application of experimental chemistry, philosophy and natural history to agriculture, domestic economy, the arts and manufactures."

As thus established the institution was called "The Rensselaer School." Nine years later the name was changed to "The Rensselaer Institute." About 1850, after a comprehensive study of the scientific and technical institutions of Europe, the curriculum was thoroughly revised, the course of study extended and the name again changed to "Rensselaer Polytechnic Institute." The word "Polytechnic" means concerning or comprehending many arts: specifically it denotes an educational institution especially for instruction in technical subjects with reference to their practical application.

The occasion forbids other than this tersely stated outline of the gradual development, on an ever ascending plane, of Mr. Van Rensselaer's philanthropic project and the present day objective of the splendid institution he founded a century ago.

Ages before the event we commemorate today, marvelous things had been accomplished in the eternal quest of mankind to measure and control the fundamental forces of nature. Along some lines, especially in matters of sheer

material construction where gravitation is the principal force to be curbed, it would seem (I speak with diffidence, as one of academic education only) that scientific progress has not outrun, if indeed it has kept pace with the achievements of antiquity.

For example, in Rome may be seen a block of marble estimated at one hundred tons which more than two thousand years ago was brought from Africa in a vessel propelled by oars, carried up the Capitoline hill, two hundred feet above the Tiber, and lifted another hundred feet to form a single member in the entablature of the huge Temple of Jupiter!

In the same City, over on the Palatine hill, a flat arch of concrete with a spread of twenty feet, constructed without metal reinforcement upon vertical supports a hundred feet above ground, after eighteen centuries is yet *in situ* and traversed by incurious thousands!

I have walked through a section of the Cloaca Maxima, built of cut stone centuries before the Christian era and still an integral part of the Eternal City's drainage system.

Think also of those stupendous structures scattered throughout the ancient world—the huge stone aqueducts, the massive temples, the collossal tombs and monoliths—culminating in the mighty pyramids piled up four thousand years ago! And remember even are we told that centuries before the Egyptian dynasties certain ambitious men deliberately set out to erect a tower which should reach unto Heaven and enable converse with Almighty God—the enterprise halted only through Divine interposition. Although as a modern offset to this presumptious undertaking parenthetically it may be observed certain social and political regenerators are advancing equally ambitious projects designed to eradicate all social evils and put an end to all class and governmental wrongs!

But while we recognize the grandeur of these purely physical achievements of the earlier ages, in respect of those other and more subtle natural forces which have been defined and controlled during the last hundred years, so far as we know the ancients had no more practical knowledge than existed at the beginning of the last century. Only a decade before the foundation of the Institute Robert Fulton's great triumph had been won, and Stephenson had perfected the locomotive. But the important role that steam was to play in world development was undreamed of, while in other respects science and engineering were practically at a standstill.

If, like the cobbler in Whittier's charming poem, General Van Rensselaer had possessed a talisman to disclose the future, how staggering his vision of the amazing scientific discoveries which were to come, and the incidental enlargement and rare fruition of his modest conception! The earth gridironed with railroads and the oceans checkered with lines of ships, operated under power generated by coal, oil or electricity: practically instant communication between both nearby points and those thousands of miles apart by telephone, telegraph, cable or radio: flying machines girdling the earth—and just appearing above the horizon mighty air-ships which will carry their own weight in supplies and passengers, capable of crossing the continent in less than three days and encircling the globe in a fortnight more, without stoppage! And in the immediate foreground a vast procession of horseless vehicles—in number exceeding by several millions the population of the United States a century ago!

To the General and his contemporaries at least some of these things would have been considered miracles. To the present generation they are only commonplaces. Because a miracle involves suspension of some law of

Nature; while the things mentioned are merely the results of dealing scientifically with measurable forces acting in known ways. And to educate and equip men alike for the infinitely higher service thereby involved, as well as the original humbler objective, has become the present function of Stephen Van Rensselaer's foundation.

But in the best and highest scientific education, howsoever specialized, there are other elements than those purely technical. It is not enough that an engineer be well-grounded in scientific fundamentals. For the most successful application of his knowledge he must be endowed also with imagination, he must be able both to think and express himself clearly. Above all he must have acquired moral traits and learned to submit to the control of that other great fundamental force—the human conscience. Happily it is becoming more and more recognized that these traits and qualifications are quite as essential for an engineer as, for example, to be capable of measuring the voltage of a flash of lightning! In fine, always it is to be borne in mind that in whatsoever line of teaching the educational, in the highest sense of the word, is only an aspect of the moral.

How aptly, how inevitably all these reflections apply to and are upheld by that initial declaration of the man we honor today! And how we rejoice in the fact that in the administration of their trust, the governing body of the Institute has never overlooked their importance. Because, as in the case of ideals and forms of government, an educational institution which comes to stay must have moral force behind it.

But while we pay our unaffected tribute to the founder of the Institute and proudly contemplate its fine achievements, it should be emphasized that it is not alone to commemorate the past, or to glorify the present, that this tablet

is erected. Of course it is the generous and idealistic deed of that fine old philanthropic Holland Dutchman—become American—which prompted this commemoration, to which the present-day fruition gives added dignity and impressiveness. But the occasion has a far deeper significance than a centennial birthday celebration. The Trustees of the Institute have been animated by a higher motive than to set up a mile-stone and decorate it with plaudits and self-gratulation. For every living person, for each existing organization or institution—in short for every "going concern" there are three tenses: there is the Future, as well as the Present and the Past. And in the case of every creative idea the final test of value is the relative permanency of its potential service to humanity. For any truly great institution there is no such thing as "having arrived," so to speak; always there is a further duty to perform, another height to climb, a more exalted service to render, a loftier niche in the Temple of Fame to achieve. In those inspiring lines of "The Present Crisis," slightly paraphrased,

> "New occasions bring new duties,
> Time makes ancient good uncouth,
> We must upward, still, and onward,
> Who would keep abreast of Truth!
> Lo! before us gleam her watchfires
> We ourselves must Pilgrims be—
> Launch our Mayflower, and steer boldly
> Through the desperate wintry sea,
> Nor attempt the Future's portals
> With the Past's time-rusted key!"

And thus we are bound to believe that besides an imperishable record of the Past and an exploitation of the glorious Present, this memorial tablet is intended also to register a solemn pledge for the Future! Erected by those upon whom has devolved the custody and care of this priceless heritage, it is to be interpreted as an earnest of their continued high resolve to maintain and develop it on still

broader lines, with ever-mounting ideals and even more notable success. In such an affirmation, and in the conviction that the spirit and determination of those behind the governing body—that is to say, its loyal Alumni and an admiring and appreciative public—assure fulfillment of the promise, we find our deepest satisfaction in this Centennial celebration. Pride in the past, rejoicing over the present, steadfast resolve and abiding hope for the future—these are the flowers which we bring today to the memory of Stephen Van Rensselaer.

There is an Eastern saying that when the House is finished the Master dies. Sometimes, in pondering over this ancient adage I have wondered whether the Egyptians intended also to imply its converse. If such is the case, and if actually we might believe it to be true that the Master lives until the house is finished and his work completed, I am sure that everyone within the sound of my voice will rejoice that the great structure of the Institute, magnificent and imposing as it appears, is *not* finished; and will unite with me in the ardent hope that it never shall be finished—so that *its* Master, its efficient, respected and beloved President, may live forever!

Unveiling of Tablet in Memory of Samuel Wells Williams, A.B., (R.S.), LL.D.

Address by Sao-Ke Alfred Sze, LL.D., Envoy Extraordinary and Minister Plenipotentiary from China to the United States

Mr. President; Ladies and Gentlemen:—

I consider it a great privilege to have been invited to join you in honoring the memory of one of Rensselaer's early alumni. Permit me to congratulate Rensselaer upon

her good fortune in being able to count a man of Dr. Samuel Wells Williams' eminence among her graduates. Such a name on her graduates' roll is an inspiration to the student body and an honor to the college.

Born and bred in America, Dr. Williams could have claimed the epithet "Chinese" as a part of his name with as much justice and propriety as the hero of Khartum. Shortly after leaving college he went to China. In those days it was not a mere pleasure trip to go on a voyage across the Pacific Ocean. It took not days or weeks but months for a sailing vessel to make the distance from Boston to Canton by rounding Cape Horn. Dr. Williams' arrival at Canton was coincident with the beginning of China's relations with the Western Powers on a more clearly defined basis. China was then making her last determined effort to keep foreigners out of the country. It must be remembered that China was not dependent upon outside countries for her economic needs. She could produce all that she required for her own consumption. She paid little or no attention to her foreign trade. What she wanted was to be let alone. But the world could not let her alone. Tales of her fabled wealth and splendor brought adventurers from all lands to her shores. Their constant knocking at the door for entrance could hardly be long denied. At that time Canton was the only point in China at which Chinese and foreigners could come in contact. China trade, which laid the foundation of many family fortunes in old as well as New England, was synonymous with trade with Canton. Notwithstanding the immense profits derived from legitimate trade, smuggling, especially in opium, flourished and increased from day to day to an extent unknown before. The Government at Peking finding it impossible to check the introduction of the deleterious drug into the country to the utter demoralization of the people at

last decided upon the closing of the port of Canton to foreign trade. War was declared by England with results disastrous to China.

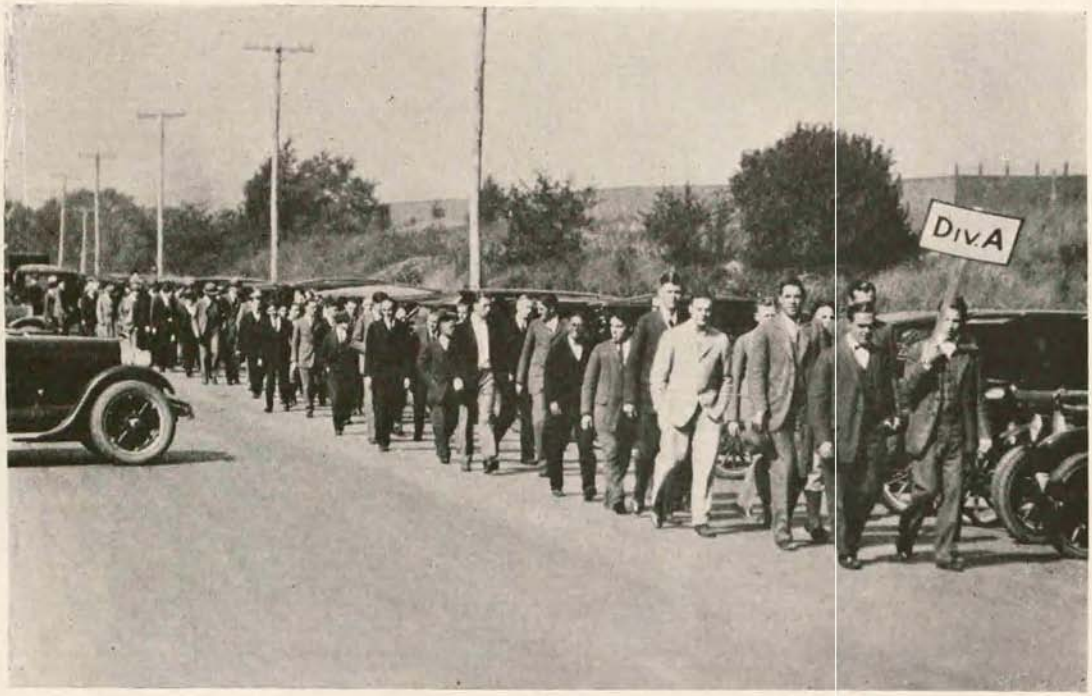
In pursuance of treaty provisions five Chinese ports south of the Yangtze River were declared open to foreign trade. Thus was a breach made in the Chinese wall, and the period of China's seclusion from the rest of the world passed forever. Throughout these stirring times, 1833–1844, Dr. Williams was on the spot, not only as an interested observer of what occurred before his eyes but also as a participant in many of the important events. Furthermore he was not satisfied with being a mere spectator in China. He strived to identify himself with the country. With infinite pains he learned and mastered the Chinese language with its many different dialects. He studied Chinese history, literature and philosophy in order to gain an insight into the existing conditions of things in China. Having thus prepared himself for his work he was eminently fitted to be an interpreter between China and the Western World.

Chinese, however, was not the only foreign language he had completely mastered. He was equally proficient in his knowledge of Japanese. When Commodore Perry went to Japan in 1853–1854 on his memorable mission to open up that country to Western commerce and intercourse, Dr. Williams joined the mission as an interpreter, and thus took no small part in the diplomatic negotiations that introduced Japan to the family of nations.

After more than twenty years of service as an American Christian Missionary in China, Dr. Williams resigned in 1857 to enter the diplomatic service of the American Government. The services of a competent interpreter were certainly needed at the time by the American Government in China.

The fortune of the Manchu Dynasty was then at a very low ebb. More than half the provinces were in open rebellion and foreign armies were pressing toward the capital. The time was opportune for the foreign Powers to pull down some of the absurd pretensions of the Manchu Emperor. The American Government saw its opportunity and took advantage of the situation. In such an emergency the services of a man like Dr. Williams were indispensable as well as invaluable. A treaty was duly signed in 1858 between the two countries, which has remained in force to this day. Nothing shows better the great changes that have taken place during the last seventy years in the relations between China and the United States than to examine some of the provisions of this treaty. Take the following for example:

> "Article 5.—The Minister of the United States of America in China, whenever he has business, shall have the right to visit and sojourn at the capital of His Majesty the Emperor of China. * * * His visits shall not exceed one in each year, and he shall complete his business without unnecessary delay. * * * He is not to take advantage of this stipulation to request visits to the capital on trivial occasions * * * and his entire suite shall not exceed twenty persons exclusive of his Chinese servants."
>
> "Article 25.—It shall be lawful for the officers or citizens of the United States to employ scholars and people of any part of China without distinction of persons, to teach any of the languages of the Empire and to assist in literary labors; and the persons so employed shall not for that cause be subject to any injury on the part either of the Government or of individuals; and it shall in like manner, be lawful for



Some Students of Division A

citizens of the United States to purchase all manner of books in China."

These provisions sound strange and antiquated nowadays, but they were considered serious propositions important enough to have a place in the treaty.

It will thus be seen that Dr. Williams took a most important part in two of the momentous events of modern times,—the opening of Japan to the world and the entrance of China into the family of nations. He was with Anson Burlingame when the American Legation was first established in Peking and from 1862 to 1876 was constantly called upon to act as Charge d'Affaires in the absence of the American Minister. He resigned from the American Diplomatic service in 1876, and ended his days in America as Professor of Chinese in Yale.

Dr. Williams has bequeathed to the English speaking people two monumental works; namely, "A Syllabic Dictionary of the Chinese Language," and "The Middle Kingdom." Even after these years these works have lost none of their usefulness and authority. "The Middle Kingdom" is as good an authority on China to-day as when it was first published in 1848. It gives a true picture of China with all her defects and virtues. It dispels the atmosphere of mystery that seems to wrap round everything connected with the East.

Dr. Williams was one of the few men of the West who tried to understand China. He did not adopt the methods of the tourist who tries to write a book on Chinese customs and manners after paying a flying visit to the country. He spent years in observing the customs and manners of the Chinese people and studying the Chinese language and literature in order to get the proper background for an intelligent grasp of Chinese ideas and actions. While he was connected with the American Legation at Peking the

Chinese Government always found in him a staunch friend who could be depended upon to sympathize with their aims and appreciate their difficulties and points of view.

One must not be misled by the oft-quoted lines of Kipling:

> "Oh, East is East, and West is West
> And never the twain shall meet
> Till earth and sky stand presently
> At God's great judgment seat."

If this is intended to convey the idea that the East and the West cannot understand each other, it is hardly true. "The Middle Kingdom" shows conclusively that Dr. Williams understood China as well as any native-born Chinese. But if the West has a desire to know the East intimately, the East will unfold itself like an open book which may be hard to read at first but will come easy gradually.

I need hardly say that China has always desired the most intimate relations with America. With this end in view we have in recent years availed ourselves of every opportunity to send young men over to this country to learn what your schools and colleges have to offer. We wish to know the secrets of your progress, your prosperity and your greatness. The remission of half the Boxer indemnity payments by your Government in 1908 enabled us to carry out a plan for sending every year a number of students to this country for education. The further remission of the remainder of the indemnity payments as passed by the American Congress in its last session will carry forward and broaden the work in the same direction. Upon their return to China, these students will in time take their places among the leaders of their country in every walk of life and cannot but exert a powerful influence in molding public opinion and governmental policies. Nothing more effective can be devised for the spread of American ideas and the

introduction of American methods. All this tends to promote a better understanding between China and America and bind the two nations with bonds stronger than steel and more enduring than bronze.

Friday Evening, October 3rd

BANQUET FOR DELEGATES AND ALUMNI, STATE ARMORY

Address by Livingston Farrand, M.D., L.H.D., LL.D.
President of Cornell University

Mr. Toastmaster; Alumni and Friends of Rensselaer Polytechnic Institute:—

I need not assure you of the sense of very high privilege with which I bring to you the greetings and congratulations of a sister institution upon this achievement of a century of distinguished service in the preparation for a great profession.

It is a somewhat fearsome position in which I find myself at the moment, being fenced in by an iron rail, being adjusted on all sides, being flanked by a lawyer and by a clergyman, and being myself in no sense an engineer. First of all let me say how greatly interested I was when the Toastmaster made those allusions to an earlier President of Rensselaer. Now, I had been living under the impression that my dear old friend, President Ricketts, had been President since the founding of the Institution; and it is with a feeling of keen personal pleasure that I have come here tonight and seen him in his perennial youth and vigor. I make the confident prediction that when you gather for your bi-centennial, he will still be guiding the destinies of

this Institution. And more than that, this long career of President Ricketts is a very cheering thing to those of us who belong to the Guild of College and University Presidents. According to the latest statistics, the expectancy of our professional life is four years and three months, and President Ricketts decidedly raises the average for the rest of us. We look forward to the future with more comfort and confidence than we used to do by reason of that distinguished and long service which he has rendered.

In searching my mind for a topic which I might appropriately present to you tonight I am frankly puzzled, for far be it from me, a layman, to venture into those fields which a gathering of this kind naturally suggests.

I understand that engineering education is under some active discussion at the present moment in university circles. Like any other member of that proverbial group which is eager to explore those surfaces which angels fear to tread, I, of course, have certain ideas on that subject which I have no intention whatever of presenting to this particular audience. It would be much safer for me to dwell upon certain tendencies in the field in which I was myself trained, the profession of medicine, and to allow certain inferences to be drawn. For, after all, gentlemen, engineering and medicine are sisters, in that they have been pioneers in the application of science and scientific discoveries to human life. As I have sat here tonight and as I have gone through the ceremonies of the day, my thoughts have been turned irresistibly to certain fundamental problems of these days, problems which every educational institution, whether technical or other, must necessarily face, and what I say in speaking of medicine, you may, if you like, apply to your own science and profession.

In a rather long experience with the application of medical science to public health, there is one fact which has been

very striking, and that is the tardiness of the medical profession to assume leadership in the public problems with which the world is faced, and with which the members of that profession should be eagerly concerned. It has been a slow and somewhat painful process to arouse them.

Now, those of us who are concerned with education are coming to realize more and more, whether we deal with the so called humanities, or with technical training, that education of any sort is primarily a preparation for life and citizenship and that after all it is not professional training, whether in this Institute or in Cornell or in any other college or university, which is the sole or fundamental object of these institutions of which this country is so justly proud.

In other words, the problem which is giving us much more concern than curriculum is the problem of inspiring this great, pressing army of eager American youth with sound and broad ideals of service and of citizenship. The gravest difficulties and dangers which beset technical education are perfectly obvious when we view the product of these institutions in our national life. The resounding call of the times is for the assumption of that leadership in civic affairs for which the privilege of higher education fits or should fit. My reason for emphasizing this point in this presence is because throughout this country we are scrutinizing as never before, not simply the technical aspects of our curricula, but the broader meaning of life and especially of preparation for that life.

Now, this Institute, proud of its history, this Institute from which we have all drawn inspiration, this Institute to whose pioneer work in the preparing for a great profession we gladly pay our homage, this Institute in whose sturdy maintenance of standards we have all taken pride, shares with the great sisterhood of American universities a grave

responsibility. My word is not for Rensselaer alone, it is for our educational institutions everywhere, that they realize that it is not technical preparation alone but the broad field of public service which justifies their foundation. Mr. Toastmaster, it is with enthusiasm that I bid this Institution God speed on its second century of glorious achievement and service.

Address by Joseph Henry Odell, D.D.,
Director of the Service Citizens of Delaware

Mr. Toastmaster; Dr. Ricketts; Alumni and Guests:—

It has dawned upon me as a curious incident that the Centennial Banquet of the earliest and most honored engineering institution of America and the world should have as its speakers a physician by training, a lawyer by training and a clergyman by training, and I am wondering whether there is an undertaker present to complete the quartette at this table. For we are here to bury the past with honor and begin a future of still greater honor.

I do not know whether I feel more like Saul among the prophets or Daniel in the lions' den, but I am conscious of a very decided embarrassment in addressing you this evening. Not often is it the privilege of a Christian minister to speak to an audience of men who have distinguished themselves so highly in various branches of science in many lands and as leaders in modern institutions of learning; therefore I speak with deep humility.

This is such a different assemblage from what it might have been. Professor Baker has told us that the Rensselaer Polytechnic Institute, as originally projected, was to have been a coeducational seat of learning. Such a step would probably have been a fatal error, for in those early days coeducation would have been too novel a venture to

command the approval of society. We must not anticipate human progress by innovations which are too abrupt. You know, it was not the apple which caused all the trouble in the Garden of Eden but the green pair. I do not know, I cannot imagine, I dare not try to conjure up what my dear friend, Doctor Ricketts, would have done if he had had five hundred or more modern young ladies on his hands. He knows men, knows how to handle men, knows how to make men; but I fear that with his stern mathematical mind and his highly scientific enthusiasm he would have been nonplused and baffled by the complex problem of the divine intuitions of individual and massed womanhood. And, then too, if Rensselaer had been coeducational, Troy might never have had the Emma Willard School and the Russell Sage College as sisterly though separate institutions which have been brought to such a high pitch of perfection by Miss Eliza Kellas.

Professor Baker's book also tells us that the Rensselaer Institute was originally designed to teach not only scientific subjects but to comprehend all subjects that man might learn—art, literatures, languages, music and anything else that could be squeezed into its curriculum. Frankly, I am glad that the curriculum was limited to the sciences, because specialized training in pure and applied science happened to be what was needed most in that period of our history. And I say this also because I do not wish to make an antithesis or mark a contrast or indicate a conflict between the humanities or classical subjects and the scientific and engineering. In the realm of scholarship there are no jealousies or rivalries. Every function of the human mind has its fitting and allotted place in the development of civilization. There was a tramp steamer starting across the Pacific, and even while she was nosing her way out of the Panama Canal the Captain and the First Engineer

began a discussion as to which one of them was the more important to the running of the ship, which was the more essential to the success of the voyage. They debated the subject day after day from every standpoint until they were well into the South Sea Islands. Then it dawned upon them suddenly that they could settle the dispute by changing places for a day; so the Captain went down into the engine and boiler rooms and First Engineer took his place upon the bridge. About four hours later the Captain came up covered with soot and grime and grease and sweat, the skin knocked off his knuckles and his clothes torn; and he shouted to the First Engineer on the bridge: "Chief, you are it; you are the more important; I've been trying to make her go for the last three hours and she won't budge an inch!" "No," the First Engineer shouted back, "No, you're the biggest man on the ship; I ran the damned thing ashore more than three hours ago."

That story merely indicates that there should be no quarrel about the various and varied functions which the mind may perform in life. Each according to his own kind and there is work enough for all—honest work, useful and honorable work. A moment ago we were all thrilled when we heard President Farrand plead so earnestly and eloquently for training for citizenship. Citizenship means the cooperation of men and women in realizing a spiritual ideal by means of a material medium. Practically everything resolves itself into that thesis: the strength of the Nation depends upon the manner in which the spiritual handles the physical, the way in which we cooperate consciously in the upward movement of evolution. If the motives, purposes, aims and ideals of our citizenry sag or deteriorate, then any movement we make in the mastery of physical forces becomes a curse to us and to the future.

I confess that I know very little of pure or applied science.

My occupations have not necessitated such knowledge. Long years ago, when I was a young man preparing for the ministry, everyone seemed to be talking about the conflict of science and religion, as though there could be no points of contact between the two, as though they could meet only in suspicion or actual combat, as though Huxley or Spurgeon must fight the issue out in the arena with Heaven and Earth as spectators. For a long while the tilting seemed to be indecisive and gradually I found myself losing interest in the battle. How philosophy would construe my present position I do not know or care; but it seems to me now that in everything and underneath everything, binding everything together and making everything real and vital and useful, there is one great principle—the spiritual meaning of the universe. And, while it is touching and blending and fusing everything, those who are closest and watch the process most intimately are often least aware of the significance of events.

If you go back into history, it was the men who built the old Roman roads and bridges who made it possible for Greek culture and civilization and for the newer evangel of Christianity to break through all barriers and permeate the distant regions with the message of hope and light. Even today, if you cut deep enough into any of our problems you will come to a spiritual content. For instance, we talk about our American tariff in terms of finance or commerce or political economy; but if you penetrate deeply enough—whether it is the low tariff of the Democrats or the high tariff of the Republicans—it turns out that the advocates are interested chiefly in the American standard of living; and the American standard of living simply means that men and women in this country shall not be so unduly handicapped by industrial conditions that they cannot develop their own personalities, that they demand a margin

of leisure in which to enjoy the real riches of the world in which they live, that they must be more than cogs and spindles in a soulless industrialism. When you recall the initial phrases of that great document—perhaps in some senses greater even than the Constitution of the United States—the Declaration of Independence, you find words which can never be misunderstood: that we have "certain inalienable rights—the right to life, to liberty and to the pursuit of happiness." Such rights are spiritual rather than material; indeed, they are so essential to our conception of government and to our individual self-realization that we regard all the efforts of science and industry as weapons with which to guarantee them and hold them inviolate.

An engineer, a scientist, the leader of a great industrial advance, or anyone else who can make it more easily possible for men to realize their liberty, to enhance the value of their lives and to secure the happiness to which all are entitled, I regard as one who is doing the work of God. I hail the Rensselaer Polytechnic Institute with as much reverence as I do any Theological Seminary, as being a servant of the Most High God, dedicated to the bringing forth of the real meaning and glory of humanity, through which we may have in our country that form of civilization for which the world has been waiting countless ages—a civilization not finally material but made up of the things of the spirit: just laws, fine chivalry, discriminating sympathy; a civilization in which we live together in brotherhood and neighborliness, each helping all the others to be braver and purer and more sincere.

Every road which you lay, every bridge you build, every dam you construct, every device that you contrive for controlling and directing the forces of nature, every invention you make for taking the strain off the human back, or

erasing the furrows from the brow, or bringing light and laughter into the eyes and hearts of men and women;—every such work is a miraculous and a divine work in the truest sense of the term.

So, may you go on in your Institute and prosper. May you continue as pioneers in the realm of science. May you multiply indefinitely your achievements of the past century. May you magnify your place in our increasingly complex civilization. Thus you will continue to be both priest and prophet of the noblest and highest order. If, as the Toastmaster has said, I speak as a representative of organized religion, then I salute you as a fellow servant in the work of realizing a spiritual world.

Address by Hugo Wilkinson Jervey, LL.D., D.C.L., Dean of the Law School, Columbia University

Mr. Toastmaster and Celebrants by matriculation as well as Celebrants by invitation at this great Centennial jubilation:—

When I was invited to come here tonight to speak to you, through my old friend Edwin Jarrett—of course, I use that adjective only in the sense of friend of long standing—I inquired of him whether I was expected to make a speech or to deliver an address. (For I take it that those are two very different things. A speech may be flippant, or at least humorous; but an address must be solemn, or at least serious. Politicians make speeches; although, of course, the humor is sometimes unconscious, but college professors and educators always deliver addresses.) Mr. Jarrett replied, with that perfect courtesy which is his charm, but nevertheless with some betrayal of anxiety, that, of course, I could do as I liked. He added, with what I took to be an

admonitory impressiveness, that this was going to be a very memorable and important occasion. So I took it that what I should say was to be not post-prandial, but serious. Perhaps before I get through you will wish I had been post-prandial instead of serious but you will have to visit your vengeance on Mr. Jarrett's head, because his was the general idea of being serious.

Those words, "general idea" recall a story to my mind. Just one piece of playfulness and then I shall try to be austere. Down in my native state of South Carolina a couple of Ku Klux Klansmen were after Uncle Henry. They wrote and told him that if he didn't put fifty dollars under a rock at the cross roads by nine o'clock of a certain night, they would abduct his wife. When they looked under the rock they found this note from Uncle Henry: "I'se sorry I ain't got fifty dollars, but I sho' does like you' gineral idea."

I don't quite understand how it has happened that a mere lawyer has been admitted into this exclusive company of scientists and engineers.

Perhaps it is that the sacrificial function of the teacher so far redeems my sinful life as a practicing lawyer, that I have been permitted, in this tolerant and generous mood of your centennial jubilation, to come and sit and speak in this high place among you.

It might appear at first blush that the legal educator has little in common with the task of the engineering school; and yet, in many ways, the Law School and the School of Engineering have similar problems. Both are primarily interested in training men to take their places in professions which have an established and formed body of knowledge and technique with which their graduates must be equipped. The undergraduate college of Liberal Arts can, if it likes, shoot experimental culture arrows into the air. There is no

satisfactory objective test by which we can prove whether or not the conventional college liberal education is adequately accomplishing its task of liberally educating.

Culture is not a profession with a hierarchy of successes, mere competents and failures. Culture is an imponderable thing, a feeling, an attitude, a fragrant blossoming of the spirit. It has no competitions, no measuring standards, no definite appraisals or accomplishments; for culture, like virtue, is its own reward.

But professional schools shoot at certain definite, tangible and visible targets. Their field of educational experiment is, in a distinct degree, restricted, and the validity of their educational theories can be practically tested. Their graduates at once apply their technical education under sternly realistic conditions in active life, so that the professional achievement of the graduate of a professional school measures pretty adequately the educational usefulness and success of that professional school.

Measured by that test, this distinguished Institution, now one hundred years young, has indeed every reason to feel proud. The roll-call of its graduates is a roster of great names, not only in the history of American scientific and engineering achievement, but also in the history of American education and productive scholarship and research. It is an amazing story, without parallel, I fancy, in the history of scientific education in this country, how this comparatively small institution here in Troy furnished the example, and not content with that, actually provided the men for the schools of applied science throughout this land, those schools whose rise and growth have constituted one of the most significant developments in the progress of this young, hardheaded, practical country of ours.

Now, what was the secret of this Trojan fecundity in great scientific practitioners and teachers? Why was it

given to you to be the source and the nurse of so much of our scientific traditions and practices? Whence came the revolutionary with the imagination, the patience and the courage to put aside what scientific men had done and are doing, and to devise new ways of doing things and proclaim a new purpose in doing them?

The easy answer to that question is, of course, Amos Eaton, but the answer to Amos Eaton is not quite so simple. The first Director and creative genius of this Institution was a man of extraordinary knowledge and even more extraordinary originality. He was in his own right a pure scientist who made important contributions by his own research in the fields of botany and geology. But his great achievement, of which this birthday party is the celebration, was his complete victory in establishing for all time the proposition that the final end of scientific knowledge is not to delight the contemplative soul of the scientific inquirer, but is the practical application of science "to the common purposes of life." That is the language used, I am told, in the first prospectus of this Institution.

It is difficult for us today to realize how original that simple phrase then seemed. Today we lead an every-day life in which applied science so completely serves our "common purposes" that it seems impossible that only a hundred years ago there was no place where men might go to experiment and to study how to use scientific knowledge for the practical betterment of the world we live in, for the comfort and happiness of the average man and woman.

Amos Eaton furnished the ideas and Stephen Van Rensselaer the opportunity for the founding of this strange place where men were to study science scientifically and then go out and practice it practically. The time was ripe for the experiment. At some of the large eastern colleges some physical science was being taught after a fashion, but the

educators of the day were beginning to suspect that something was wrong, yet before they came to a formulation of their educational dissatisfactions or devised ways and means for their correction, Van Rensselaer and Eaton had collaborated and Troy was an actuality.

Science, in the early days of civilized history, was indistinguishable from philosophy. The learned man of old looked up to God and in at himself and out upon the world with little difference in the mood and manner and interpretation of the three observations. At any rate, his speculation about nature and her laws, untrammelled by any accurate data and unfettered by the existence of any instruments of precision of measurement and observation, ranged from philosophy to poetry and from both to religion. The world and its natural phenomena were still an unmeasured mystery. Nobody knew what eccentric thing nature might do next. It was all as uncertain as man's own vagaries and as inscrutable as God.

As time went along, the easy and obvious inductions about the physical world's consistent and continuous behavior began to be made. It became a pretty safe bet that the sun was going to rise according to his accustomed habit, and that Phoebus Apollo was never going to dawdle and be late. Men presently learned that springtime, with its poetry of desire and its religion of resurrection, was going to follow winter with prosaic and unemotional regularity. After a while some of natures' useful habits were discovered and turned to practical account, but as long as physical phenomena were supposed to be as whimsical and unreliable as man's own unaccountable distempers, so long was man a fearful slave of the very human gods he created to explain the thunder and the eclipse and the wild and evil spirits of the sea and air. When recorded observations began to disclose sequences and progressions and unfailing

rules of nature's conduct, then the race of men took heart and dared to think that the quiet processes of human reason were after all the most godlike thing in the universe. The turbulent deities of wind and stream were unmasked and overthrown.

But this is the significant thing. There was not then, nor was there until quite modern times, any specialization of function between the philosopher and the scientist. The man of learning had all learning for his field, and since philosophy was strong and vigorous and science weak and crude, science was absorbed into the methods and the stuff of philosophy and made to serve its ends.

Now, the end of Platonic and Aristotelian philosophy, which largely ruled the learned world until the Reformation, was diametrically opposite to the end which Amos Eaton set his heart upon when he said that the only reasonable use of knowledge is to serve "the common purposes" of men. It was his aim to disseminate knowledge so that the masses of mankind might have access to it, and, by practical use of that knowledge, be enabled to build and plant and dig and fabricate with all the resources of an informed and scientific technology.

The ancient philosophy disdained to be useful. Macaulay reminds us that Seneca, the self-satisfied old Roman (the author, among other things, of an elaborate essay on "Anger") once exclaimed that the discovery of the principle of the arch was of no moment. It does not matter to the truly wise man, Seneca declared, whether he has an arched roof over his head or indeed any roof at all. He is bent only on perfecting his moral nature and his ardent aim is not to investigate facts but to make himself independent of all material things, of all mechanical contrivances. The inventing of devices, he thought, was drudgery, fit only for the lowest slaves. And in a moment when petu-

lance ruffled his philosophic calm, he complained: "We shall next be told that the first shoe-maker was a philosopher." Macaulay comments that it may be worse to be angry than to be wet, but that shoes have kept millions from being wet, while it may be doubted whether Seneca's learned essay on "Anger" has ever kept anybody from being angry.

So, too, before Seneca, Plato had not been much impressed with the practical usefulness of mathematics. Arithmetic, he thought, had a more important function than being practical. The study of the properties of numbers, he said, habituates the mind to the contemplation of pure truth and raises us above the material universe.

Again, an ancient geometrician, a friend of Platos, had invented some extraordinary mechanical devices on mathematical principles. Plato remonstrated with his friend, declaring that "this was to degrade a noble intellectual exercise into a low craft, fit only for carpenters and wheelwrights." The office of geometry, he said, was to discipline the mind, not to minister to the base wants of the body. Plato had no great admiration for that most useful of all human inventions, the invention of alphabetical writing. He thought the powers of the human mind would have been more fully developed without the aid of recorded written knowledge; that we are spoiled and made lazy by the assurance that we can find information when we want it, in books, and that therefore, we do not meditate our own way through to the ultimate truth, but rely superficially on what others have written about it.

Even Archimedes, the great scientist and inventor, expressed himself as half ashamed of his inventions, which were the wonder of the ancient world. He spoke of them as trifles in which a mathematician might be suffered to

relax his mind after intense application to the higher and really important parts of his science.

The great historian whom I have already quoted also suggested that the Stoic philosophers spent their time in preaching a philosophy which would make a man perfectly happy, even while suffering from a violent toothache, yet the humble dentist who cures the toothache and removes the necessity for the philosophy would have received short shrift at the hands of these noble, but one-sided intellectuals.

I do not mean to disparage the grandeur of Greek philosophy. I was trained a classicist and I am always ready to defend classical studies against unthinking, iconclastic attack. The whole course of the world's thought would have been different, to its irreparable injury, if Plato and Aristotle and their successors had not lived and written. I intend no contemptuous criticism of the value of Greek philosophy. That would be like shaking your fist at the sun. The trouble lay in the nature of things. Scientific thought had not and could not differentiate itself and become split off from philosophic thought until science itself had come to larger growth and had refused any longer to be satisfied with playing second fiddle to philosophic speculation.

Philosophy itself is frankly for the few. The comforts and satisfactions of its deepest secrets are only for the ones who brood and live detached. And this is, of course, the reason why revealed religion answers an otherwise unsatisfied desire in the universal heart of man.

But while science may be, indeed, profoundly suggestive to the contemplative philosopher, it has nevertheless its own very practical function to perform.

We must have democratization of applied science for the plain uses and purposes of all mankind.

That realization necessarily came about when two things happened. First, the body of scientific knowledge had grown to respectable bulk; and second, when the Reformation had dignified the moral importance of even the least of men.

When these things had happened, at once there began to be heard mutterings of intellectual revolution. The Schoolmen had made of learning a mere barren exploitation of verbal acrobatics, and now a few original thinkers began to formulate a new philosophy. It is significant that when learned men were first actually beginning to turn science to practical account, their achievements were still called "philosophy"—as they themselves called it the "*new* philosophy."

The man who made that thought articulate was one of the great intellects of all time, Francis Bacon, whom I am proud to claim because he was a lawyer, and whom all of you should honor because his was the first clear voice that proclaimed the truth upon which this institution of yours was founded, namely, that the end of scientific knowledge is not only the glory of God, but also, and not less importantly, the alleviation of the lot of common men.

As Macaulay points out, the Baconian philosophy was the precise reverse of the Platonic philosophy. Plato's aim was to exalt man into a god. Bacon's aim was to assist man, in the belief that man needs help now while he is yet man and without waiting for him to become a god. Certainly, Plato's aim was high and admirable enough; but clearly Bacon's aim was presently attainable. In an eloquent passage in one of his letters, Bacon said that "nothing can be too insignificant for the attention of the wisest which is not too insignificant to give pleasure or pain to the meanest." The philosophy of Plato began in introspection and ended in sublime self-contemplation. The philosophy

of Bacon began in observation and ended in the applied arts.

Bacon's work was, however, the work of the preacher. He saw the practical truth and told it to men, but he actually did nothing about it. He founded no college; he applied no theory.

And now, I think it is not too fanciful or extravagant, nor mere fulsome compliment to you to say that to finish this story we must come back to him with whom we began.

In this country, at least, the man who ratified the Baconian theory into fact was Amos Eaton, the creative intelligence that made this institution. Eaton was not content to have science continue to be taught as a part of the informational and cultural equipment of the ordinary college student. Eaton was intent upon reforming both the manner of its teaching and the purpose of its acquisition. He insisted that accurate scientific training could be acquired only first hand, in the laboratory or in direct contact with things themselves, on the farm or in the mine or on the job. He announced boldly that he was interested only in training men who could go out and actually build and mine and plant and manufacture with all the resources of the best that scientific knowledge had of theory and technical equipment. He pulled the scientific knowledge of his day out of the lecture and the text-book and put it where it belonged, into the experimental laboratory, and out through the doors of the laboratory into the practices and processes of daily life.

Most epochal achievements, once they are done, seem very commonplace and no more than was to be expected. The reason is that their very quality of rightness and inevitability makes them fit so perfectly into the scheme of things that they soon appear too natural and too ordinary to be revolutionary.

So it was with the founding of this school. Amos Eaton was so right, his theory and his practice so true that his radical educational innovation seemed to grow at once straight into the structure of educational practice in this country, and his name is therefore perhaps less well known than the names of many reformers whose ideas were not so immediately and so smoothly adjusted to the temper and conditions of their times.

As your Professor Baker has convincingly shown in his interesting book which he calls "A Chapter in American Education," the inspiration which brought forth this school spread rapidly by direct contact with Eaton's ideas and by the ardent discipleship of this school's early graduates; and it is not too much to claim that the development of America's State agricultural colleges, of our great private schools of technology, of our splendid scientific schools of graduate research have been the direct and traceable result of this man's extraordinary combination of the utilitarian and the theorist, and of this institution's fulfillment of his plans.

It is an unescapable law of life that those who inaugurate a great and useful movement soon find themselves in competition with their imitators. Yet, usually, if the movement be useful, the inaugurator must welcome the imitation. You began a great thing here; for years you were the pioneers; for decades you held undisputed leadership; today you are one of several rivals in the front rank of engineering education. Yet, no matter how rich or how powerful those rivals may grow, you will always have here a certain precious stamp of authenticity and of authority, and that will always fill you with a just pride for your splendid past, and fill you with the determination always to be worthy of Amos Eaton. You are built upon a principle which is as steadfast as the rock you put your

structural foundation on; for far beyond the scope of engineering and of engineers, in all things and with all men and for all time, it must remain inviolably true that no work of man's brain or hand is completely worthy of man himself, unless it be dedicated to the "common purposes of his fellowmen."

INVOCATION AND ADDRESSES

Saturday Morning, October 4th

Invocation by the Rt. Rev. Edmond Francis Gibbons, D.D., Bishop of Albany

Almighty eternal God, from whom descendeth every best gift and every perfect gift, with reverent and grateful hearts we thy servants turn to Thee this day. In sincerity and truth we acknowledge thy fatherly care for this great institution, during the hundred years which have gone by since it began to give the youth of our land knowledge of the laws of thy universe, and insight into its secrets.

Thou art wisdom uncreated. Thy word on high is its fountain-head. "Who shall teach Thee knowledge who judgeth those that are exalted?" It is thy glory that the heavens show forth and the firmament declareth the works of thy hands. The world and the fulness thereof Thou hast founded.

Father of lights, before whom the wisdom of the world is foolishness, make us humble, for where humility is there is wisdom. We are dull and blind, but for Thee its Creator, nature holdeth no secrets.

Pour forth on those who teach here thy spirit of understanding and counsel and knowledge and godliness, and fill them with the spirit of the fear of the Lord.

Send copious benedictions on the youth from near and far who throng these halls, that acquiring science and trained in its application they, like the thousands who have preceded them, may become benefactors of mankind and the joy and crown of their Alma Mater.

Teach Thou them goodness and discipline as well as knowledge, that dwelling here in docility and subjection to

authority, they may advance in wisdom and age and grace with God and men, even as it is written of Jesus of Nazareth thy own Divine Son, who with Thee and the Holy Ghost liveth and reigneth world without end. Amen.

Address by James Rowland Angell, Litt.D., LL.D., President of Yale University

Mr. President; Ladies and Gentlemen:—

It is at once an honor and a privilege to offer to Rensselaer Polytechnic Institute on behalf of the Eastern Universities of the United States the most sincere congratulations upon its completion of a century of distinguished scientific service and to wish for it in the future an indefinite continuation of its splendid record.

And may I extend to you, President Ricketts, our most earnest felicitations on the half century of invaluable service which you have given to this institution. Your faith in her future has stood firm before the most menacing buffets of fate and your unflagging devotion to her interests, and particularly during the long years throughout which you have been her leader, will always be remembered as one of the splendid examples in American education of the power of a fixed purpose in a strong unselfish character.

May I also be permitted before I take up the few thoughts which I wish to present upon this occasion to call attention to the fact that Yale has a peculiar interest in this celebration, in that she makes bold to regard Rensselaer Institute as in some sense one of her grandchildren, for the father of Stephen Van Rensselaer was a graduate of the Yale Class of 1763. I am therefore bringing you a particularly cordial greeting from my colleagues at Yale.

American institutions of higher learning have too often

Some Students of Division C

exhibited a disposition to approximate an identical standard, or at best to recognize a small number of types, to one of which each institution is expected to conform. Individuality, both in persons and in institutions, has thus tended in our education to be sacrificed to uniformity, and, so far as this has been true, the results have often been disastrous. We need variety in our educational resources, not only because men vary in ability and purposes and so require different training, but also because society demands variant human talents variously trained to meet its multifarious needs, and let me hasten to add that we need standards too—clear, distinct and honestly maintained, but not with a view to forcing every institution or individual upon a single Procrustean bed.

Rensselaer represents one of the earliest and most courageous attempts to break away from the classical tradition of New England and to find in the world of modern science the materials of an education which should be sound and fundamental and withal intrinsically cultural. Men will estimate its success in this effort somewhat differently, depending upon their peculiar individual educational creeds. But no one can question that Rensselaer has trained an extraordinary group of leaders in science, in technology, and in industry—to mention no other fields; and the percentage of its graduates who have failed to attain positions of responsibility or consequence has been remarkably small.

Founded a quarter of a century before the Sheffield Scientific School at Yale and the Lawrence School at Harvard, it was a real pioneer and its influence was quickly felt, especially in the West where educational conditions were naturally more plastic. From that time to this it has gone bravely about its business, adhering closely to its

Dr. Sao-ke Alfred Sze, Minister Plenipotentiary from China to the United States, Before Delivering His Address

early principles, ready to submit its methods to the test of actual results attained.

In schools of science and technology, for reasons which I will not pause to discuss, the technology has generally shown a tendency to out-grow, or at least to over-shadow, the mere science and we are to-day experiencing a reaction —in opinion at least—in accordance with which the modern engineer, let us say, should be less a technician than a man of broad general training, less an expert mechanic, or electrician, or miner, or what not, and more a man thoroughly grounded in pure science, with especial ability to face new problems and to prosecute original investigation. Those who carry the great scientific responsibilities of the engineering industries are increasingly men who have won their doctorate in pure science and then gone in to its applications, rather than men who have been trained conventionally in technological curricula.

The practical question of how to secure this broad general training and of what it shall consist is, of course, not one upon which we can profitably enter at this time. Probably each technical school feels that its own curricula satisfactorily achieve this purpose. The important point is the recognition of the fact, as Rensselaer men have repeatedly emphasized, that the highest proficiency in science and technology presupposes intellectual foundations of a very broad and searching kind, in which the humanities, and especially the social and historical sciences, must play an appreciable part. Many an engineer finds that a large part of his duty is the handling of men, and training in this field is therefore also imperative.

The celebration of this centennial gives us a fresh occasion to face the practical issues raised by this desire to deepen and broaden the foundations of our scientific and technical training. Undoubtedly the essential considera-

tion is not so much the introduction of particular topics or particular amounts of those topics into our curricula, as it is the explicit recognition of a certain kind of training and a certain attitude of mind toward that training which shall give us men of far-reaching vision, active and subtle imagination, intelligence symmetrically and widely disciplined, with intellectual initiative and self-reliant independence as its conspicuous mark. In this task we may look with confidence to Rensselaer to maintain its position among the leaders of our scientific and technical institutions.

In phrasing the purposes which he had in mind in its establishment, the founder spoke of "The applications of science to the common purposes of life" and, although superficially considered the program of the Institute has apparently developed on lines somewhat more ambitious than these words immediately suggest and perhaps a bit remote from anything that the founder himself may have had in mind, from a deeper and truer point of view, its development has simply kept pace with these purposes as they have necessarily been modified by the changes in science and in civilization. No one can hope to convey in a few brief phrases any just conception of the degree to which modern life is dependent upon science and its applications; but every one who may pretend to some breadth of knowledge is well aware that it would be difficult to over-estimate the importance of this contribution to the very maintenance of the fabric of civilization itself. Men and institutions which serve these ends are adding, in much the way that Stephen VanRensselaer intended, to the safety, the richness, and the satisfactions of our human experience. To this purpose the Rensselaer Institute has been ever faithful and we who come from institutions founded on a somewhat different faith are glad to offer her the homage

of our admiration and the assurance of our sincere wishes for her abiding prosperity.

Address by Edward Asahel Birge, Ph.D., Sc.D., LL.D., President of the University of Wisconsin

Mr. President; Ladies and Gentlemen:—

I bring to this auspicious occasion the greetings of the state universities—those foundations which to-day represent learning as at once the possession and the care of the state. In that capacity it is also my duty to represent, in a peculiar sense, the public—to offer the congratulations not only of the institutions which I represent but also those of the states from which their lives are derived—the greetings of those commonwealths to whose prosperity the graduates of this Institute have contributed so greatly.

Such a duty may seem to exclude all words of a personal tone. Yet I must suppose that some element of personality was present in the thought of those who invited me thus to represent state institutions. Perhaps they were moved by the fact that my birth was in Troy at a date nearly three-fourths of the way back to the year which we commemorate to-day. Possibly also some influence came from my education at Williams College of which Stephen Van Rensselaer was a trustee for a quarter of a century; and—what is of far greater significance—the college which was the alma mater of Amos Eaton, the spiritual founder and first Director of Rensselaer Polytechnic Institute.

Director Eaton and his ideals are the text for the few words which fall to my lot to-day. He was a home-taught surveyor, graduating the compass-circle of his first instrument on the bottom of a pewter plate. As years passed he became noteworthy as geologist, botanist, chemist, and

agriculturalist in those early years of the 19th century when science had hardly begun its life in this country. He was deeply interested in pure science, to which his own temper was inclined. But with a singularly penetrating vision of the future he foresaw the coming dependence of civilization in this country upon the application of scientific principles not yet worked out—hardly even sketched—in the thoughts of man and in this spirit he guided the early policy of the Institute.

Thus it came about that the Institute represented for the first time in our national life those purposes and ideals which nearly forty years later had risen to national recognition and were incorporated in the Morrill Act of 1862, the measure which more than any other one influence has determined the history of state universities. "The application of science to the common purposes of life"—these are the words used a century ago to set forth the aim of the founder of the Institute. They are identical in meaning and closely similar in phrase to those which characterize the land-grant college, established by the Morrill Act.

Thus the state university represents the same idea as that of your founder, broadened indeed to include the whole circle of knowledge, yet not different in essential content. Central to it is the sense of the dependence of the happiness and prosperity of the people upon knowledge and its application. Equally central is the insistence upon institutions to promote the advance of knowledge in a world where only advance can maintain prosperity. Equally central is the recognition of the double purpose of such institutions—the wide diffusion of higher learning throughout the people and the selection and training of those souls who can mediate between the unknown world and the life of men. Equally central also is the recognition of the essential unity between man's life and powers

and the greater life and powers of the world about him, so that science becomes on the one side the natural way of human development and on the other side the indispensible condition of his advance alike in his material, mental, and moral life.

Thus in bringing the congratulations of state universities I represent institutions whose life is animated by the same ideals as those which your founder embodied in the Institute.

Nor is this all. These general principles must be realized in concrete and specific courses of study if they are to be effective in the world. In this respect your Institute followed a natural and rational course of development. Your administrators saw and met the public need for engineers, for the education of that great profession which more directly than any other mediates between science and the common life. Applied science rather than pure knowledge has rightly been the center of your work and your influence on the nation. I draw the distinction because it has been of significance in your history; and yet to-day, in the fulfillment of a century, it seems to be vanishing from the larger life and clearer thought of the world and the wider ideals of your founder are returning in new and higher form.

Even so lately as in my younger days applied science was regarded as a sort of rule-of-thumb application of principles elsewhere wrought out. But this wrong and ignoble attitude is disappearing as the vision of man has developed with the advance of science. Applied science and pure science are no longer sharply distinguishable; for human life and human thought are finding a larger and a more perfect synthesis under the guidance of science. We are slowly learning that the bread by which man lives is itself the expression of the formative word of God.

Here too state university and Institute share a common life—guided by a common insight. It is therefore with no light or trivial sentiment of sympathy that I present to you the congratulations of those universities upon the completion of a larger life and a greater service as the coming century brings its increase to the Rensselaer Polytechnic Institute.

Address by Samuel Wesley Stratton, Sc.D., D.Eng., LL.D., President of Massachusetts Institute of Technology

Mr. President; Ladies and Gentlemen:—

I most gratefully appreciate the opportunity to join with you in commemorating the one hundredth anniversary of Rensselaer Polytechnic Institute; the completion of a century of work which has been of the most profound and far-reaching importance in the Nation's progress. The Institute had turned out two generations of technical men before most of the great engineering schools of to-day were established. Among these men were many of the pioneers in the location and construction of our railroads, in bridge design, in the development of the locomotive and other forms of the steam engine; in the introduction of precision measurements, in the manufacture of machinery, and in the interchangeable method of construction. Among them were great leaders in all the fields of engineering and industry of the period.

During the past fifty or sixty years, we have seen the remarkable development of the Land Grant or State Universities. Engineering courses have been added to the curricula of the educational institutions of the east; professional schools for training in the various branches of technology have been established. Furthermore, the fields to be covered by technological training have multiplied at

a rapid rate, including such subjects as automotive engineering, electrical transmission of power, electrical communication, gas and fuel engineering, refrigeration, aeronautics, and many phases of chemical and physical engineering, closely related to and fundamental in industrial development.

Throughout this period of phenomenal growth in technical training this institution has continued to maintain a high standard of quality as to its product. Notwithstanding the great demand at times for men ready to step at once into practical work in the field, office or factory, the Institute is to be most highly commended for adhering steadfastly to the policy of basing technical training on a substantial foundation of theory, a thorough training in the fundamentals essential to the work of an engineer. This policy has never been more important, or more difficult to comply with, than at present, and the question is often asked "What are the essentials in the training of the future engineer?"

The problems that confront the engineer are growing more and more difficult. He must plan longer spans, greater structures, more efficient prime movers, the transmission of power over greater distances, the control of floods for safety and irrigation; he must cope with the problems of industry, where an improvement in equipment, in the efficiency of a process, or the prevention of waste, may mean the life of a business, or even an industry.

There can be no question as to the importance of physics, chemistry, and applied mathematics, as fundamental subjects in the training of an engineer; but to meet the problems of the future, he must have a much more thorough and broader training in these subjects.

In the practice of his profession the engineer cannot always be content with the scientific data at his disposal.

He must often take the initiative in its production, working in conjunction with the expert mathematician, physicist, chemist, geologist and even the biologist. To know when and how to utilize the services of experts, scientific or otherwise, is one of the things that should not be overlooked in technical training.

The engineer now has at his disposal a far greater range of materials than heretofore: alloy steels for every purpose,—the wide variety of aluminum and magnesium alloys where lightness is desirable, bronzes and other non-ferrous alloys of almost any given characteristic. In the non-metallic materials of construction, such as the clay products, cement, concretes, glass and many others, there is quite as great a range of materials with which he must be familiar. If the desired material is not available, the possibility of its production must be considered. To know these materials, their characteristics, and how to use them, how to cooperate with experts in the production of a material for a definite purpose, is another essential that must receive earlier attention.

Our dependence upon the public utilities for transportation, communication, and power, for so many of the necessities and comforts of life, is such that the relation between the companies operating them and the public is one of the great questions of the day. It is to the engineer, serving as an expert, or on the Public Service Commissions, or as their advisers, that we must look for that form of regulation which will be fair to the public and to the producer alike, and thus avert the disaster that would follow public ownership.

Sound financing is essential to progress in industry, so much so that financial institutions constantly require the services of technically trained men. In industry and many forms of business a technical training is the best prepa-

ration for administrative positions. This is evidenced by the large number of technically trained men filling such positions. In each of these fields of business, the technical man's usefulness depends largely upon his ability to determine costs of production and construction, to prepare reports and present facts to Boards or Committees. Certainly a training in English, written and spoken, economics, accounting and report writing, are essentials of great importance in his education.

In the consideration of the complex questions that arise between capital and labor, between Government and industry, or in the formation of laws and ordinances, the engineer is destined to take an increasingly important role. In a very large number of the affairs of the community in which he lives he is best fitted to serve or advise; hence, it is highly essential that his training should include the main principles of government, national, state and local.

The engineer or technologist must assume responsibility and guarantee results more than other professional men. The results of his work can generally be measured or tested. Therefore, the things that develop courage in taking responsibility and getting at the facts of a case must be emphasized in his training. He should look at every task with an open mind, with a view to securing information that will enable him, or someone else, to do it better in the future, a producer of knowledge, not alone a consumer, a leader as well as a follower in his profession.

The stimulation of the initiative and the desire to know the reasons why, are of the greatest importance, and are not accomplished in book or routine work; they are developed by being in contact with men who are enlarging the boundaries of knowledge, and sharing with the student some of the delights of original work.

These are a few of the subjects other than those generally

agreed upon as fundamentals in any given field of training, to which we might well give more serious attention in the future.

In closing, I bring to you greetings and sincere congratulations from the Faculty and Corporation of the Massachusetts Institute of Technology, an acknowledgment of the debt of gratitude which that Institution in common with so many others owes to this one, and the assurance of its hearty cooperation and continued friendship.

Address by Albert A. Michelson, Ph.D., Sc.D., LL.D., President of the National Academy of Sciences

Mr. Chairman; Mr. President; Members; Friends; and Guests of Rensselaer Polytechnic Institute:—

It is my great privilege to represent, on this occasion, the National Academy of Sciences, and the University of Chicago. I bring from both institutions cordial greetings and hearty congratulations on this one hundredth birthday of Rensselaer Polytechnic Institute, with grateful recognition of all your Institute has done for science in the century past, and with the confident expectation of her continuing to promote the welfare of Humanity in the future as she has in the past.

In view of your many remarkable achievements in engineering triumphs, it may not be amiss to point to the most outstanding of the results contributed to pure science in the work of Henry A. Rowland, your most famous alumnus; the foremost scientist which America has produced.

It is with the keenest regret that we recall his premature death and I may venture to express the fear that this may have been hastened by financial difficulties which certainly

did have the result of diverting his attention from the field in which his best work was accomplished.

I trust it will not be deemed inopportune to point out the debt which the industries owe to pure science, in the hope that men like Rowland may be relieved from all financial cares—that their entire time and thought may be given to the work for which they are best equipped, and the results of which may be of vastly greater importance to humanity than the more immediately evident results of their applications.

To mention only one case in point: consider that, without the labors of Faraday, Maxwell, and Hertz, the wonderful development of the telegraph, the telephone, wireless, the electric transmission of power,—in short, the whole tremendous achievement in dynamo electric machinery would be impossible; and yet these names are comparatively unknown, while the names of the inventors who have applied their labors are household words.

I would not for a moment be thought to undervalue the services of the inventor. In fact, pure science is in very large degree dependent on the applications,—the services are mutual. It is only to be regretted that the practical results being so much more readily recognized by the public, the source is so completely ignored. I would especially urge the alumni here present (men who will undoubtedly be called upon to fill positions of power and responsibility) wherever it is possible, to give help and encouragement to men of original ideas in fundamental research in pure science; and to regard such generous assistance and encouragement not as a favor to be conferred but as an obligation to be fulfilled.

Men of the attainments required for such work are not very numerous, and the demands on the liberal donor will be more in the way of careful cultivation of the few than

in indiscriminate endowment of the many. The select few, it must be remembered, are not at all likely to make known, voluntarily, their needs. As a rule, they are men of retiring disposition, who regard their work as the artist regards his painting, the composer his music, the poet his poetry. If, as in the illustration just mentioned, his labors result in some outstanding benefit to humanity, so much the better; but the true investigator will always be the one who does his work for the pure joy he gets from the work itself.

I trust that this defense of pure science in an institution which has so distinguished a record in its application will not be taken amiss—and I have ventured to feel encouraged to put it forth by the statement made in Professor Baker's booklet: "In the pure sciences it (the Rensselaer Polytechnic Institute) remained supreme for thirty years."

In conclusion, let me once more express my appreciation of the honor of the invitation to address you on this occasion; and to record my pleasant memories of the thoughtful care which you have taken for our comfort and my hearty appreciation of your kindly cordiality and your charming hospitality.

Address by Carl Ewald Grunsky, Dr.Ing.,
President of the American Society of Civil Engineers

Mr. President; Ladies and Gentlemen:—

Whenever we are called upon to celebrate an anniversary of some conspicuous event in our own lives or in the lives of those who are near or dear to us the mind at once calls up visions and memories of the past, marking the contrast with the conditions of today, and, then, is prone to speculate a bit as to what the future may yet have in store. This tendency to review the past and to forecast

or to conjecture as to the future is no less present on such occasions as this, with the life and activities of an institution under review, than in the case of events in the lives of human beings.

The completion by Rensselaer Polytechnic Institute of its first one hundred years of useful service to humanity is indeed worthy of celebration. Its founder had vision. He saw clearly the need of providing facilities for better education along technical lines. To make the ascertained scientific principles and the vast store of information accumulated as the result of research and human experience along technical lines more completely available to the living generation, than was being done at the old types of universities, has been the purpose of the foundation of this as of others of our similar younger institutions.

The tendency of our times, it needs no telling, is toward specialization. The fields of information are becoming so vast that he who would make sure of an equipment to be of service to his fellow man must set a limit to the subjects which, in the brief time usually allotted to university training, he will endeavor fully to compass.

At such colleges as this the selection of the course of study by those who desire to enter upon a technical profession has been made easy. The essentials are pointed out, the required guidance is furnished. Moreover the success of the methods that have been adopted is amply evidenced by the achievements of the many who have gone forth from this institution in the hundred years of its life.

And, now just a word of retrospect. We are told that the profession of civil engineering is young. This may be true if we regard civil engineering by itself, that is, disconnected from architecture and from military engineering. Mr. John Smeaton, it is said, was the first engineer who used the term "Civil Engineer." (The anniversary of his

birth, too, the 200th anniversary, occurred this year in June.) But engineering as an art is as old as civilization itself. It reached a high development among the ancients. This is true for all countries where civilization had made progress. The engineer began to function just as soon as people began to find permanent homes desirable. The permanent abode entrained problems of water supply, of the disposal of waste and very soon of transportation. However, I shall not dwell on the influence of the engineer on social and economic progress. It will suffice to say that he has been a large factor making for human progress adding ever to the comforts and conveniences of the human race.

What I want to do at this time is just to call attention to the fact that the great engineering feats of which we have record in the survival of ancient structures and in fragments of ancient history were carried out by engineers who did not have the facilities of our day for ascertaining how, at other times and places, certain difficulties were overcome. They were dependent mainly upon their own experience and judgment and had to achieve their results with the sole aid of human and animal labor. They had not learned to use generated force. No such institutions as our modern schools and universities could be appealed to for information relating to the laws of nature and the methods of work and types of structures that were best adapted to meet any given requirement. These institutions have only gradually been brought to their present day state of perfection.

It is only about 60 years ago that the usefulness of the laboratory began to be generally recognized. Many of the most successful engineers of the last few generations did not have the advantage of any technical education. They succeeded despite the greater difficulties which they had to surmount in equipping themselves with a knowledge of

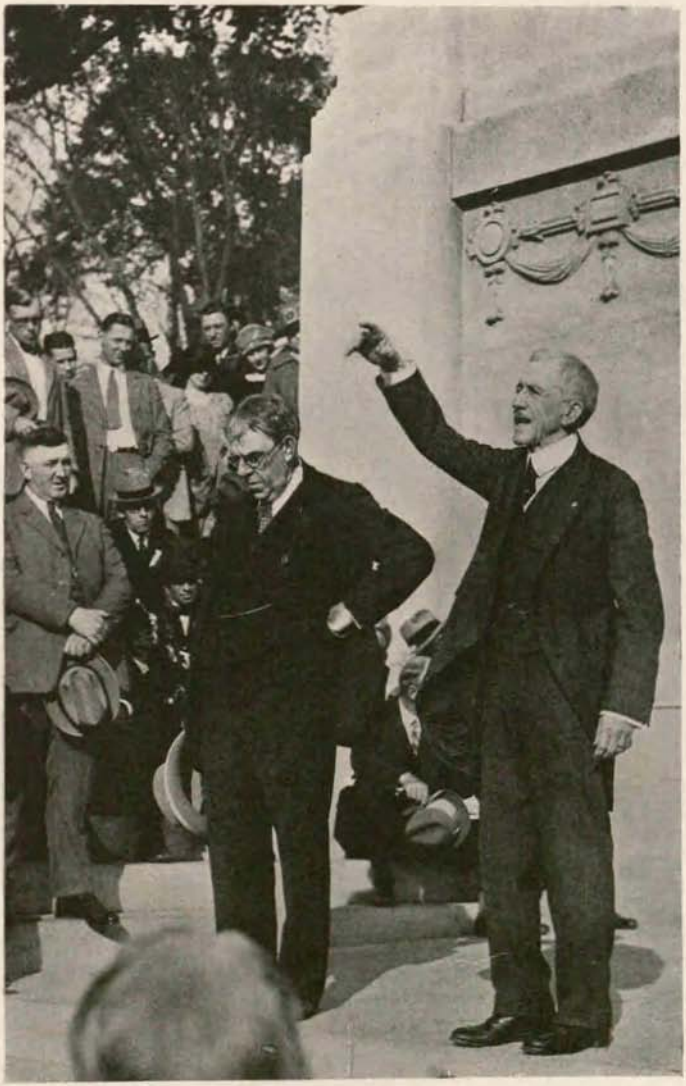
nature's laws and with information relating to approved methods of solving problems.

It is not to be assumed, however, that success in the technical field is only attainable through the aid of the technical school. Many of the most successful engineers, even of the last few generations, have without its aid equipped themselves with a sufficient knowledge of nature's laws and of approved methods of solving technical problems, to attain eminence.

The vast store of engineering knowledge, upon which we base our accomplishments of today, has grown from the practices worked out in large part by men who were without technical training in any modern sense. Canals, bridges, water works, irrigation systems, great architectural structures were built by the ancient Egyptians, Greeks, Romans, Peruvians. The practice of engineering in their day was a matter of practical craft rather than the application of known principles. It is our modern age which has added most to the widening reservoir of known fact and tested theory.

Nor is the end at hand. Let no man feel discouraged. Banish the thought that the young engineer has entered a world already fully explored—a field without adventure. To the student of today as much as to the engineer of Pharaoh's time there remains the lure of exploration—the high romance of discovery—the opportunity of signal service in bringing nature's forces more completely under man's control.

Smeaton, himself may be cited as a conspicuous example of a successful engineer who had no technical schooling. He commenced life in a lawyer's office and yet, but a few years later, when the Eddystone Lighthouse was to be rebuilt, he was pointed out as the one man peculiarly fitted to undertake the work. Numerous other examples could be



Unveiling the Tablet at the Head of Broadway
Address by Seymour van Santvoord

cited to show how occasionally success in engineering has been achieved despite lack of educational opportunities. May we not regard such examples as an inspiration, an encouragement and an inducement to profit yet more fully from the advantages which the technical school now provides? How much easier would it have been for Smeaton and other engineers of his type if they could have had access to such a reservoir of information and such facilities for research as are now provided by such technical schools as this.

But, as a final word, let not the individual who desires to specialize along some technical line forget that his highest obligation is not to his profession but to humanity and that he can not function normally and render the highest service unless his training at the school has been on a broad plane. Morally and intellectually the graduate of the technical school should measure up to the standard which the world sets for educated members of the Community.

This Institute is to be congratulated on the completion of its first hundred years of service. May its usefulness continue to increase. It is with particular pleasure that I voice these sentiments on behalf of the members of the American Society of Civil Engineers and of the entire engineering profession all of whom recognize the obligation of the engineering profession to our institutions of learning in general and to the technical school in particular and are ever ready to assist and encourage those who devote themselves to the work of research and instruction.

Address by Frederick Rollins Low,
President of the American Society of Mechanical Engineers

Mr. President; Ladies and Gentlemen:—

When men began to learn systematically of the properties of materials, the laws of structures and the principles of mechanics and to apply this knowledge to the progress of the race, the professional engineer was born.

It was long before the physical began to rank with the metaphysical, before, as John Sweet characteristically expressed it, the man who knew what to do and how to do it was given recognition equal to that accorded to him who knew only what had been done and who did it.

It is significant of the newness of the professional recognition of the engineer that we should be celebrating here today the centenary of the first school now in existence to be established in any English-speaking country primarily for the purpose of teaching science and engineering, of encouraging and directing research and applying its results to the common purposes of life.

I bring you the greetings and felicitations of the American Society of Mechanical Engineers.

How much has the mechanical engineer contributed to the struggle of the race with its environment in the century, the completion of which we are celebrating? How much has he lightened labor, eliminated drudgery, increased the radius of the life of the average human being and helped in bringing to him the comforts and culture of our modern civilization?

In 1824 the steam engine was feeling its way into general use. James Watt and Oliver Evans had been dead only five years and Fulton less than ten. Corliss did not patent his engine until twenty-five years later. Stephenson's successful trial of the Rocket did not come until five years

afterward, and it was a half dozen years before the first American steam railroad was built; but Fulton had run the Clermont from New York to Albany seventeen years before. The prize of the Société d'Encouragement, won by Fourneyron, which started the development of the modern hydraulic turbine, was not offered until 1827, and mechanical engineers have developed that turbine up to capacities of 70,000 horsepower and efficiencies of over 90 percent. The first structural iron beam was not produced until after this institution was a quarter of a century old. Alexander Holley, one of the founders of the Society that I have the honor to represent here today and one of the leaders in the development in this country of the Bessemer process, which has done so much to make structural steel abundantly available, was elected a trustee of Rensselaer in 1865. It would take long to enumerate the inventions like the sewing and knitting machines, textile, agricultural, wood-working and printing machinery and machine tools for their manufacture that the engineer has invented and developed.

It is a long cry from the Clermont to the Mauretania, from the Rocket to the Flying Scotchman, from the ponderous slow-speed beam engine of Watt to the 60,000 kw. steam turbine, from the low-pressure plain cylinder boiler of 1824 to units that in a single setting evaporate 150 tons of water an hour at three or four hundred pounds pressure and eighty-odd percent efficiency. The development of the internal combustion engine has made the automobile and the aeroplane possible and produced the most efficient of all our appliances for converting heat into power.

The idea behind this institution was the teaching of "the application of science to the common purposes of life." The methods used were unique in that the students were directed to give lectures on the subjects studied and to apply theory in a practical way. Work began at twenty-five

minutes after sunrise and "recreation" consisted of practicing in the open the application of the principles that they had learned in the classroom. The term "Civil Engineering" occurs in the catalogue of 1828, in which it is stated that "the senior professor is required to give lectures on land surveying and civil engineering." In 1835 it was resolved that "a department of Mathematical Arts is hereby established as a branch of the Institute for the purpose of giving instruction in Engineering and Technology." It was decided that the degree, A.B. should be changed to B.N.S. and that graduates of the Mathematical Arts should receive the degree, C.E. The civil engineering, as then and later taught, included much mechanical engineering and was evidently intended to cover broadly all engineering that pertained to civil rather than to military service. A mechanical engineering course was added in 1862–3 and lasted until 1870 when it disappeared from the catalogue, and in 1871 all courses but Civil Engineering were abolished. In 1907 the trustees were enabled, through the bounty of Mrs. Margaret Olivia Sage, to establish the Russell Sage School of Mechanical Engineering. This course was planned and the mechanical section of the Russell Sage Laboratory was equipped by Dean Arthur M. Greene, Jr. a past vice-president and much beloved member of the American Society of Mechanical Engineers, and the fourth Greene to hold the rank of professor here.

Rensselaer has however, always taught engineering broadly and always much of what later became specialized as "mechanical." The list of its alumni contains many names which loom large in the history of mechanical achievement. Among the contributions of its alumni the redetermination of the mechanical equivalent of heat by Henry Augustus Rowland is outstanding, and many of the early teachers and practitioners of professional engi-

neering received their inspiration and their training within these walls. We have too few institutions whose roots reach so deeply into the past and whose records justify so much pride and satisfaction.

I am proud to be of those to whom an opportunity is thus afforded to wish for Rensselaer Polytechnic Institute a long career of continued prosperity and usefulness.

Address by William Kelly, B.A., E.M.,
President of the American Institute of Mining and Metallurgical Engineers

Mr. President; Ladies and Gentlemen:—

The American Institute of Mining and Metallurgical Engineers extends its cordial felicitations to Rensselaer Polytechnic Institute upon the completion of a century's work in preparing young men for the profession of engineering in its various branches. Two reasons make this offer of good will appropriate.

The celebration of a centenary suggests a look into times past. It may be permitted then to call to mind that in the second chapter of Genesis, in a description of Eden and the waters flowing therefrom, there is mention of the "Land of Havilah where there is gold" and in the fourth chapter we are told of "Tubal-Cain, an instructor of every artificer in brass and iron." In tombs that are prehistoric are found precious stones and ornaments and vessels of metal. The finding and manufacturing of the metals were among the earliest of the arts and, in the course of time, have given rise to those branches of science which pertain to the mineral constituents of the earth. It is fitting then that the American Institute which is concerned with these most ancient of the arts and sciences should tender its appreciation to Rens-

selaer Polytechnic Institute which is the earliest English speaking school to be devoted to scientific and engineering education.

There is, too, a special and personal reason for a feeling of gratitude and obligation on the part of our Institute toward this great school. Of the three men who fifty-three years ago met and called together their associates for the purpose of organizing a mining institute, one and perhaps the leading spirit was Richard P. Rothwell, a graduate of this college in the class of 1858. The incentive to research and the purpose of disseminating knowledge as exemplified in this institution have been wonderfully and most usefully developed through the founding and growth of the American Institute of Mining and Metallurgical Engineers.

While Rensselaer Polytechnic Institute does not now offer a regular course in mining and metallurgy many of its graduates have taken up and devoted themselves to these branches of engineering and some of them have earned useful and prominent positions in these fields. This fact illustrates and emphasizes the educational theory that the true scope and purpose of engineering education is to set forth and inculcate the fundamental principles of mathematics, physics, chemistry and mechanics which underlie engineering undertakings of every kind. There is not the time nor is this the place for a thorough discussion of the methods of engineering education but it should be added that besides the scientific training the so-called cultural studies must be considered and the development of personality; for it must be borne in mind that technical graduates must be prepared to take their proper part, not only in their professional and business relations, but also as members of the community in which they live and in performing their duties to their state and country.

It is not only an honor but a very pleasant duty on be-

half of the American Institute of Mining and Metallurgical Engineers to congratulate Rensselaer Polytechnic Institute upon its hundred years of successful service in the maintaining of high standards of scholarship, in the training of young men for scientific work and the practice of engineering, as shown by their varied and important accomplishments, and by its own work and that of its graduates through careful research, new designs and ingenious methods, in gaining more knowledge of our physical surroundings, in vastly increasing the comforts of life and making more and better use of the natural resources which a Divine Providence has given us for a heritage.

Address by Farley Osgood,
President of the American Institute of
Electrical Engineers

President Ricketts; Ladies and Gentlemen:—

On behalf of the American Institute of Electrical Engineers, and for its whole membership, I extend the heartiest congratulations to Rensselaer Polytechnic Institute in arriving at this, its one hundredth birthday.

We may well be proud of our first school of science, whose sons have made famous the world over, her teachings and fine traditions.

Rensselaer Alumni have raised many monuments to their *Alma Mater* in the form of engineering feats and constructions of every kind, and it has been with pride and satisfaction that the Electrical Engineers, with their more lately developed art, have assisted in its application to the more venerable branches of engineering as they have been developed during this long span of years at your Institute.

The roster of the American Institute of Electrical En-

gineers carries its share of Rensselaer Alumni, and surely none can forget your famous physicist, the late Henry A. Rowland, graduated in 1870, who endeared himself to electrical men in particular through his original work in the printing telegraph.

This is no time for me to recite even a small number of the many accomplishments of national and international note of your graduates, but it is fitting to record that the American Institute of Electrical Engineers realizes what exceptional work has been done by Rensselaer, as is evidenced by the lasting structures, enormous organizations, and original discoveries carried on by her fellows. From the little Rensselaer School to the beautiful far reaching Institute of today, as we here see it, is a long look—an equally successful forward step of a century, and then another, and others to the Nth multiple, is the sincere wish of the American Institute of Electrical Engineers, which it is my specific duty and personal pleasure to record here today at this celebration of your Centennial.

Address by Ray Palmer Baker, M.A., Ph.D.,
Professor of English in Rensselaer Polytechnic Institute

AFTER ONE HUNDRED YEARS

We are met to celebrate the hundredth anniversary of the foundation of Rensselaer Polytechnic Institute. It is therefore fitting that we should ask ourselves how far the aspirations of its founders have been justified by its fruits.

To-day the first fruits seem remote indeed. As President Ricketts explained yesterday, Stephen Van Rensselaer proposed to establish in Troy a school for the "sons and

daughters of farmers and mechanics." Nominally, therefore, the institute was devoted to the education of both sexes. Actually, it existed for men only. Nevertheless, it exerted a profound and lasting influence upon the colleges and universities which opened their doors to women during the nineteenth century. Before its incorporation, Eaton had conducted courses in botany, zoology, physics and chemistry throughout the eastern states; and not a few of the women who had attended these courses followed him to Troy. One, Mary Lyon, who had been a student in Northampton, became the founder of Mount Holyoke College. Others, also, profited directly by the facilities provided by the authorities of the Institute. Naturally, however, its greatest services were rendered by its sons who had been moulded in the spirit of the senior professor. One of them, Eben Norton Horsford ('38), believing, like him, that the failure of women to achieve intellectual distinction was due to lack of opportunity and not to the "perversion of female genius," endowed the laboratories of Wellesley College. Others were active in the state universities. In two at least they were largely responsible for the inclusiveness of which they rightly boast; and in many others they upheld that equality of privilege which we now accept as a matter of course. To the education of women, therefore, Rensselaer made no slight contribution.

Not only was it the first institution to provide—though unofficially—for the scientific education of women, but it was also the first to offer a curriculum in agriculture leading to a degree. Of the interesting features of that curriculum, which it maintained for ten years, I cannot speak today. Suffice it to say that the young men who enjoyed its advantages established the first state department of agriculture, the first state bureau of entomology and one of the first state experimental stations. The influence of the insti-

tute was not limited, however, to governmental departments, bureaus and stations; for in the universities of Alabama, California, Iowa and Wisconsin, as well as in a number of smaller institutions, its alumni served as first professors of the sciences in their relation to agriculture. As in its provision of educational facilities for women, Rensselaer was thus a pathfinder in a field which it has long since abandoned.

Somewhat similar has been the history of its influence upon the academic college. Rensselaer was the first institution to offer the degree of bachelor of arts to students who had completed a course of study in the natural, mental and social sciences. The curriculum leading to this degree—a curriculum embracing mathematics, the sciences, public speaking, literature, rhetoric, composition, government, political economy and philosophy—foreshadowed, in many ways, the type toward which instruction has tended in the last two decades. More significant, however, than this fact, striking as it is, is the theory on which it was based. "Things, not words," was Eaton's motto; and this touchstone he applied to every subject which he professed. As a result of his success, he lived to see the experimental methods which he advocated introduced into many of the colleges which had attacked his proposals. Indeed, before his death he was generally recognized as the originator of field work and laboratory practice in the United States. In themselves these two contributions, rich in result and richer in promise, would almost justify the foundation which we are met to commemorate.

There are other reasons, however, for this celebration. Although Eaton was inclined to challenge the value of the disciplines inherited by the colleges which had scouted his efforts, he soon realized that they were destined to play an essential part in the system which he was attempting to

develop; and he was not slow to accept their assistance. As early as 1827 the authorities announced that graduates of recognized colleges and of the United States Military Academy could complete the requirements for a degree in half the usual time. Somewhat later Eaton added that the courses at Rensselaer were intended primarily for those who had completed their academic education; and, in 1832, he asserted that it had become "*the common workshop* for all colleges, academies and other literary and scientific seminaries of learning." What he visualized, therefore, was a graduate school with distinct professional standards; and such a school—the first of its kind—existed in this city for nearly three decades. At times almost half of those enrolled were college graduates—alumni of older institutions like Amherst, Columbia, Dartmouth, Harvard, Pennsylvania, Princeton, Yale, Union and Williams—represented here to-day. In all, the Institute drew in this way upon nearly one hundred centers of higher learning in Europe and America. In the variety of its contributions to educational practice it has not been surpassed.

Nevertheless, in all the enterprises which I have mentioned its achievements were restricted by the years apportioned to them. Indeed, it might almost seem as if its history is a history of lost causes and as if its greatest glory has been due to its renunciations. No such supposition is justified; for each of the developments of which I have spoken—by-products, as it were—bore a definite relation to the ideal which actuated its founders. From the beginning Rensselaer had been devoted to the advancement of science and engineering. In science and engineering it has contributed most to the progress of humanity; and it is because of its primacy in science and engineering that we are met to-day. It is therefore proper that we should attempt to evaluate the fruits of its leadership in these two fields.

I have already stressed Eaton's interest in science. In botany and zoology, physics and chemistry, geology and mineralogy, he was a pioneer; and in all these subjects Rensselaer was a pathfinder.

Of its contributions to botany and zoology I have given you at least an inkling. From the Institute came the first text-books in the vernacular. From it came many of the earliest reports, especially those on the flora and fauna of the northwest. Moreover, the young men educated here were the first to establish departments and bureaus for the application of botany and zoology to the needs of agriculture. It is interesting, too, to recall that in a dozen institutions they dealt with them in their relation to medicine as well. Nor, in view of those assembled here to-day, ought we to forget that they not only served such colleges as Middlebury, Rutgers and Williams, but that they also introduced these subjects at such universities as Iowa, Michigan and Wisconsin.

Nevertheless, distinguished as is the record of the Institute in the biological sciences, it was terminated at an early period by another shift of emphasis. Only in the physical sciences has it maintained its traditions of achievement. With what it has accomplished since 1885, a date that marks approximately the beginning of a new era in the scholarship of America, I shall not deal. Instead, I shall carry you back to the days when it was still a pioneer, a source of inspiration to the men who laid the foundations of the physical sciences in the universities of the United States. Of the physicists, who have first claim to attention, I can mention only two—De Volson Wood ('57) and Henry Augustus Rowland ('70). In Michigan, Wood instituted the policy of separating the pure and applied sciences which has been adopted by most, or all, of the state universities. At Rensselaer, and later at Johns Hopkins,

where he became first professor of his subject, Rowland conducted the researches which gave such a striking impetus to the development of physics during the last fifty years. In the old main building which stood not far from the head of the Approach, he completed his investigations of the maximum magnetization of iron, nickel and steel; and there, too, he formulated the principles governing his classic researches on the magnetic effect of electrostatic charges in motion. To those of us who are entrusted with the advancement of knowledge, it is a sobering reflection that the results of these studies can be compassed by the narrow span of a single generation; for there are not a few here to-day who remember as students the little corner room which Rowland abandoned for his famous "shop" in the city of Baltimore.

In speaking of the contribution of the Institute to the development of chemistry, I can not do better than follow the plan which I have adopted in the case of physics. If I had time, I would like to describe the emphasis placed upon the subject in the curriculum. It was this emphasis which made it possible for the alumni to establish departments of chemistry in many institutions of high rank. It was this emphasis, also, which drew them—the first Americans—to the universities of Europe. With the name of one of these adventurers, Eben Norton Horsford, to whom I have previously referred, the campaign now being conducted by Harvard University has made many of you familiar; for it was Horsford, who, as Rumford professor, induced Abbott Lawrence to establish a school devoted to analytical and practical chemistry in which he conducted the first laboratory courses of any importance given in Cambridge. Of the influence of those courses upon the fortunes of President Eliot, the Massachusetts Institute of Technology and countless other men and institutions you

are all aware. The name of another, James Curtis Booth ('31), is also not unknown to some of you. Booth, the most eminent chemist of his day, who founded in Philadelphia the first commercial laboratory devoted to analysis and research, performed for the University of Pennsylvania a service not unlike that rendered by Horsford for Harvard. I might well speak, too, of other men—with no training except that which they received here—who served with no less distinction at smaller institutions such as Rutgers and Williams. Nevertheless, it is to the west that I must turn again in conclusion; for to the great universities like Michigan and Wisconsin they carried the new learning of the school founded by Stephen Van Rensselaer. In the two which I have mentioned, as well as in the universities of Alabama and California, they also led in the application of chemistry to the needs of agriculture. Moreover, in the medical departments of half a dozen universities and a dozen medical colleges, such as Rush and Pennsylvania, they were professors of chemistry in its relation to medicine and sponsors of new and revolutionary methods of analysis and diagnosis.

In geology and mineralogy, of course, Rensselaer was long supreme. From those connected with the Institute came the first standard texts—the first, you may be interested to know, in which figures and plates were used to supplement the text—and from them also came the first epoch-making reports. Indeed, approximately half of all the notable developments in these two subjects before 1850 were due to graduates of the Institute. They were responsible for the official surveys of Alabama, Delaware, Iowa, New Jersey, New York, North Carolina, South Carolina, Michigan and Wisconsin. In other states their advice and assistance were hardly less useful. Moreover, in a number of colleges and endowed universities as well as in the state

universities of Alabama, Iowa, Michigan and Wisconsin, they established a tradition of research which has been honorably maintained by their successors. Among them were many who deserve to be remembered and yet I must hurry on with a passing reference to two who have special claim to consideration—Ebenezer Emmons ('26), junior professor at the Institute and discoverer of the Taconic System, and James Hall ('32), professor of geology and "father of American stratigraphy."

If time served, I would like to speak of other subjects such as astronomy—long stressed at Rensselaer—in which it was able to aid the universities, like Cornell, which were founded after it. In mathematics, also, handmaid of both science and engineering, its graduates were pathfinders at half a dozen institutions. Of necessity, however, I must turn to engineering, a field in which the Institute was a pioneer and in which it was long without a rival. In the beginning, however, it did not offer a distinct course in engineering. Not until 1835, as President Ricketts has indicated, was the first class graduated with the degree of Civil Engineer. Of more immediate result from an educational point of view was the reorganization of 1850 affected by Benjamin Franklin Greene ('42), who became Director in 1847. His report is the most significant event in the history of engineering education. It is doubtful whether any other document of similar character has exerted such a profound and far-reaching influence. Aside from local variations in content and method, the scheme formulated by Greene has remained the norm throughout the United States. It is no exaggeration, therefore, to say that by 1850 the essential features of every technical school had appeared at Rensselaer. Nor is it an exaggeration to say that, during the next thirty years, it impressed them,

through its alumni or its curricula, upon every institution dedicated to similar aims.

Lafayette and Swarthmore, Cornell and Princeton, Michigan and Minnesota—such are the types—colleges, endowed universities and state institutions—in which the graduates laid the foundations of the departments and colleges of engineering. Columbia and Pennsylvania, Missouri and Texas—such are the types in which they have done valiant service. Nor, above all, ought we to forget the great technical schools—of which Massachusetts and Stevens are symbolic—which drew on Rensselaer not only for some of their first and most eminent professors but also for the curricula which it had evolved. And yet I would lead you astray if I were to suggest that the influence of the institute has been limited to the states of the Union. For a century it has drawn students from other lands, and for a century they have returned to duplicate in them the departments and colleges established by their classmates in the Republic. In Canada they have left their mark on several of the provincial universities. In Mexico, in the countries of Central and South America, in China and in Japan they have also been explorers, carrying the sacred fire from the altars of this modern city with its ancient name to the temples of learning which they have helped to rear. Such is the tradition of achievement which we are met to commemorate.

Though it seems fitting that, on an occasion like this, we should emphasize the part which the Institute has played in the republic of education, we should remember that the majority of its graduates have spent their lives in the world of affairs and that there is no field of activity which they have not made their own. The mechanisms which they have invented; the structures which they have designed; the canals which they have dug; the railroads which they

have constructed; the ships which they have launched; the mines which they have sunk; the ores which they have treated; the businesses which they have organized; the industries which they have directed—these, the final fruits of its endeavor, are subjects to which I can not do justice to-day. Emory, Gurley, Riddell, Thatcher—figures inseparately associated with the development of exact standards of measurement and calculation! Do I need to remind you, the legatees of their success, of the services which they rendered to their generation? Murphy, Roberts—pioners in design and manufacture, workers in iron, spanners of floods! Do I need to mention them? Boller, Buck, Cooper, Hodge, Macdonald, Roebling—a brilliant galaxy—craftsmen in steel, conquerors of chasms! Shall I remind you, the inheritors of their traditions, of the achievements which you have so faithfully emulated? Ferris, Shankland—intrepid experimenters in a new architecture! Menocal, Fuertes—explorers, linkers of seas! Evans, Kneass; Casatt, Crocker; Roberts, Voorhees—trailbreakers and executives whose names are grooved across the continent! Babcock, Mallory; Hopkins, Morse—shapers of ships, masters of men! Pardee, Rothwell; Metcalf, Reeves; Cogswell, Wallace, Lewis, White—spoilers of earth, moulders of metal, generals of organization, conservors of humanity—with their careers I can not deal.

> Thou hast sent us forth to labor,
> Old Rensselaer.
> We have wrought to win thy favor
> Year after year.
> Steel to weld and stone to shiver,
> Sink the mine and span the river,
> For thine honor toiling ever,
> Old Rensselaer.

This is their story and this is yours—no bleak record of chill materialism but a single-minded devotion to the "com-

mon purposes of life" that men may find in them the essence of those higher purposes which are the goal of existence. Such is the ideal which Rensselaer, in every decade, has held before those to whom it has been the mother of learning; and this ideal, realized in the life of its sons, gathered here to do it homage, is not the least of the contributions which it has made to the civilization of America.

THE CENTENNIAL PAGEANT

OF

RENSSELAER POLYTECHNIC INSTITUTE

OCTOBER 3 AND 4, 1924

THOMAS WOOD STEVENS,
Author and Director of the Pageant.

The Pageant was performed on a series of stages which included the various levels of a picturesque eminence at the end of the Rensselaer Polytechnic Institute Athletic Field. The lower stage served for the historical episodes (Scenes I, II and III,) the settings being changed by the use of a secondary sliding stage at the back. The levels of the cliff, and the rocky trails connecting them, gave setting to the Prologue, Interludes, and Triumph. Each stage and level was disclosed by a separately controlled zone of light.

The historic scenes are based on documentary evidence, and in each, certain speeches are given directly from the correspondence of the characters, or from early official publications of the school. These episodes can not, of course, carry an expression of the far-reaching significance of the simple events which they represent. Hence the symbolic method has been employed in the Interludes, to give a larger and more vivid picture of the forces at play. The book of the words will, however, suggest the intention of the pageant as a whole—to make, in the form of a community drama, a swift and graphic statement of the record, in aim and achievement of the oldest engineering school in America.

SCENES AND ACTORS

PROLOGUE

Man, led by Knowledge, encounters Nature and her Elements.

NATURE	Miss Laura Ruback
AIR	Miss May Fales
FIRE	Miss Florence O'Connor
WATER	Miss Jennie Tigar
EARTH	Miss Isabel Mann
KNOWLEDGE	Mrs. John L. Arts
MAN	Mr. John E. Howell

SCENE I—THE FOUNDING

Stephen Van Rensselaer and Amos Eaton confer with the prospective Trustees regarding the plan for an important experiment in education. They arrive at a decision, and the Rensselaer School is established. The scene takes place in Van Rensselaer's garden, in the autumn of 1824.

STEPHEN VAN RENSSELAER	Judge Michael A. Tierney
MR. HOLLEY	Mr. Robert G. Moser '27
DR. HALE	Rev. Henry Goodwin Smith
MR. JEDEDIAH TRACY	Mr. John P. Dorney
MR. GUERT VAN SCHOONHOVEN	Mr. Frederick C. Filley
DR. SAMUEL BLATCHFORD	Rev. John S. Zelie
AMOS EATON	Mr. John M. Francis
LEWIS C. BECK	Mr. James Lloyd '25
MRS. VAN RENSSELAER	Miss Louie Minor
MRS. EATON	Miss Elizabeth A. Buckley
MARY LYON	Mrs. Orana Marcoux
A SERVANT	Mr. H. P. Allen '26
JAN	Mr. M. F. Brickner '28
JOOST	Mr. Charles F. Ffolliott '27
WOUTER	Mr. H. A. Irving '26
PETER	Mr. R. A. Blinn '26
COBUS	Mr. Legrand Spicer

Farmers

INTERLUDE

Man, the Philosopher, called by the needs of the toiling world, leaves the golden book of tradition for the unknown fields of Knowledge.

SCENE II—THE FIRST FIELD WORK

The Rensselaer School made annual expeditions on the Erie Canal, for the study of Botany and Geology. The scene takes place in 1826.

Prof. Constantine Rafinesque . .	Prof. A. de Pierpont
Dr. Eights	Mr. S. C. Bateson '27
Master Fitch	Mr. T. F. Cassidy, Jr. '28
Master Clinton	Mr. C. W. Mackay '25
Master Cady	Mr. Rowland D. Reeve '28
Master Emmons	Mr. Elmer F. Kooman '28
Major Fraser	Mr. W. F. Petry '25

Students, members of the R. P. I. Dramatic Club.

INTERLUDE

Youth lights his torch and accepts his charge from the Philosopher.

Youth	Mr. M. F. Brickner '28

SCENE III—THE POLYTECHNIC INSTITUTE

In 1849–1850, under the Directorship of B. Franklin Greene the Rensselaer School was re-organized into the Polytechnic Institute.

President N. S. S. Beman . . .	Mr. William A. Nial '99
Mr. Slocum	Mr. O. J. Swensson '09
Director B. Franklin Greene . .	Mr. Walter Snyder Jr. '15
Mr. McConihe	Mr. Charles D. Calkins '09
Mr. Warren	Mr. Gabriel Solomon '02

Trustees and Citizens, by Troy Alumni

THE TRIUMPH

The Spirit of Rensselaer holds festival at the end of the century, rejoicing in the memory of many achievements.

SPIRIT OF RENSSELAER . . . . Mr. John Andrew Knoll '25

The Music for the Pageant arranged by Mr. William L. Glover, and played by the Troy City Band, William Noller, Conductor.

PAGEANT COMMITTEES

DR. WM. LISPENARD ROBB, Chairman of Lighting Committee.
PROFESSOR LEROY W. CLARK, Chairman of Construction Committee.
DR. RAY PALMER BAKER, Chairman of Publications Committee.
PROFESSOR W. W. ROUSSEAU, Chairman of Music Committee.
MR. E. A. POULIOT, Chairman of Properties Committee.

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STAFF OF THE PAGEANT

THOMAS WOOD STEVENS, Author and Director.
HOWARD FORMAN SMITH, Assistant Director.
WILLIAM L. GLOVER, Musical Editor.
G. H. VAN ARNUM, Dance Director.
SARA BENNETT SMITH, Costume Designer.
WILLIAM NOLLER, Conductor of the Band.
ALEXANDER WYCKOFF, Technical Director.
STANLEY B. WILTSIE, Director of Lighting.
JOSEPH LAZARUS and WILLIAM H. BEYER, Stage Managers.

TEXT OF THE PAGEANT

BY

THOMAS WOOD STEVENS

PROLOGUE

AN OVERTURE

Then the Nature motif is heard, and the cliff appears gradually out of darkness. In the center of the cliff, a majestic figure of elemental *Nature.* Her robe falls away into the green of the grass and the gray of the rocks. She lifts a great staff, and strikes with it on the rocks, and the blow reverberates like distant cymbals. She lifts the staff again, as if in incantation; there is a sound as of a storm, and the spirit of *Air,* accompanied by a wind-driven flock of whirling clouds appears on the rock level above, at the right.

AIR

Nature, my mother, with thy staff of power thou hast called me. I come. What wouldst thou?

NATURE

Spirit of Air, pause in thy flight.

(Again she raises the staff, and *Fire* appears over the eminence at the left, his flame-dancers wavering around him.)

FIRE

Spirit of Nature, mother of all, I, the heart and voice of the Fire, feel the summons of thy staff. What wouldst thou?

Scene from the Pageant—The Prologue

NATURE

Fire, all-devouring one, wait.

(Again the gesture, and below, in a stream of sea-blue light, glitters the spirit of *Water* and her train.)

WATER

Great Nature, my mother, I, with my tributary rivers, and the deep springs of the ocean, attend thee.
What is thy will?

(The staff again strikes, and almost beside her appears, slowly revolving, the Spirit of *Earth.*)

EARTH

Thou hast awakened me, Nature my mother,
Thou who commandest all things that grow and age, and perish, and endure.
I, the Earth, answer and hearken. What wouldst thou?

NATURE

Elements of the world, Earth, Air, Flood and Fire,
Hearken to me, the voice of Nature your mother, speaking;
I have called you hither to warn you.
There is come upon us a new being, a dreamer,
One who will shape us all to his will—
The creeping dreamer, Man.

AIR

He is but another new beast, born of Earth.
He is less than the eagles.

FIRE

I have seen him. He dies when his flame burns down.

WATER

I know. He faints in the desert, without me.
He fears the surge of my waves in the tempest.

Scene from the Pageant—Interlude I

EARTH

Of me is he fashioned. He flowers for a moment, and dies.

NATURE

Be not deceived, you who have flown and flamed and surged and slumbered,
Since first I curdled the Earth out of the whirling cloud
In the beginning.
This creature Man, this dreamer, burns with new ardors, and climbs,
In a new onset, toward a high dominion over you all—
Yea, over me.
He is of us, our child, but now he rebels and aspires,
And makes us to move in his image.
He will conquer us all, and make of the Elements of the world Slaves to his will.

FIRE

Nature, my mother, I, Fire, laugh at thy warning.
This man shall serve me. And so long as he feeds me well,
I will dissemble my wrath.

NATURE

He will master thee, Fire. He will pry into thy mystery.

WATER

I too will do his will for a little, and whelm him under my wave
When I grow weary.

NATURE

He will have his way with thee, Spirit of the Waters.

AIR

For me, I laugh at this creeper,
And I will blow his dreams to ruin

When I have laughed enough.

NATURE

Thou too, fickle and wavering Air, in the end he will master.

EARTH

I will give him the milk of my bosom while he is tender,
And wean him to desolation when he grows lordly. He is my child.

NATURE

He cometh of thee no more than of thee, O Flame,
For he burns within; nor of thee, swift Air,
For he wavers toward flight; nor of thee, soul of the Waters,
For he flows with the juices of life.
Hearken now. Strike him down!
Or . . . If the Will from above be upon you to spare him,
Baffle his path to the stars. Thus alone
Shall we keep from becoming his slaves.

EARTH

Ages have passed, and we are supreme.
What should we fear, Mighty Mother?

NATURE

He has found a spirit to aid him.
You shall know, and beware.
He faints and stumbles, but Knowledge beckons him on.

(The word Knowledge startles the Elements.)

EARTH

Ho, my children!

(From the crevices of the rocks the gnomes of the hills appear.)

I will frustrate this dreamer.

Heed well. Let my treasures be hidden deep.
And deepest, vein by vein in the rock, hide Gold,
Where its quest may allure him to ruin.
And Iron, strong servant, bone of my body, cloak and disguise.
And Coal, too vast of bulk to conceal, let him creep
Flattened between the rocks of the ages to come.
Streak my green garment with flowers that serve not but entice him,
Spawn of the seasons, fail with the seasons and wither;
So meanly my breast shall nourish this rebel.

AIR

Stay, spirit of Earth. Look aloft.

(Above, *Man* enters, led by *Knowledge.*
The spirits of Nature and the Elements stand transfixed as the two make their way downward along the rocks.
Then Nature bars the way with her staff.)

NATURE

Stay! Who art thou?

KNOWLEDGE

I am Knowledge.

NATURE

I forbid you—here in my realm.

KNOWLEDGE

Thou can'st not forbid, dim Nature.
I am of that Intelligence thou knowest, older than thou, and mightier.

NATURE

For thee alone I make way. Who is this other?

MAN
I am the spirit of Man.

NATURE
Man the Seeker?

MAN
Man the dreamer. I come to inherit my dream.

EARTH (mockingly,)
And inherit the Earth?

AIR
And to ride on the tempest?

FIRE
And to tame the fires of the suns to thy hearthstone?

WATER
And to lead forth thy flocks on the pastures of the seas?

NATURE
Make an end ere the dream begin. Set upon him!

(To a great tumult of music, the Elements and their attendant spirits rush threateningly upon *Man,* who cowers beside the serene figure of *Knowledge.* Frightened, he kneels and holds up beseeching hands. The lamp of *Knowledge* glows suddenly, and the elements fall back as she places the light in Man's hands. Man rises, lifting the lamp.)

MAN
O Knowledge, by this thy light I see them—see them anew.
They are the servants of my dream.

KNOWLEDGE
Spirit of Man, child of the lofty Intelligence,

I give thee this light. Let it guide thee.
Long is the road, and dark. Be thou steadfast.
Bend to thy will all elemental things.

(The Elements move rebelliously.)

Make them thy servants. Follow—follow thy dream.

(Knowledge moves up the cliff. The Elements surge forward, but *Man* holds the light aloft and faces them.)

FIRE (Mockingly)
Let me serve thy light, O Seeker, while it pleases me.

WATER
I smile on thee, Child of Earth. Set forth on my meadows.

AIR
I shall be last—last of all—to allure thee.

EARTH
Put down thy lamp. Thou shall sleep at the end in my bosom.
For I am the Earth, and thou art fashioned of me.

MAN
I am fashioned of thee—but not of thy body alone.

NATURE
But in my realm thou movest, Man.
And against me thy dream is devised.

EARTH
I bide my time. I hide from thee my treasures.

NATURE
And I the laws of the moving world.

MAN
I shall find them out.

AIR
How soon, creeping Dreamer?

MAN
In a thousand years I shall know.

NATURE (scornfully)
In a thousand years I breath, and move with one finger, a little,
And you have perished a score of times.

EARTH
In your doom, you will return to me, for you are of Earth.

MAN
Not Earth alone, nor Water, nor Air, nor Fire,
But all these—and the Dream.
I serve the dream of my rise and mastery.
I lift this lamp. Look well, mighty Nature,
For in me these Elements all are mixed,
And blown in the light by the breath of God.

(A solemn music. The Elements and their groups fade and vanish. For a moment *Man* confronts *Nature* with his lamp. Then he goes up the central cliff, turns, looks down on a darkened and empty world, and passes on.)

SCENE I

THE FOUNDING

The lower stage is set as the garden of the Van Rensselaer manor house; the time is a late afternoon in September, 1824.

Mr. Holley and Dr. Moses Hale are knocking at the gate. A servant opens it, and Mr. Holley's voice is heard as he and Dr. Hale step in.

HOLLEY

Tell General Van Rensselaer we have come about the matter of the school. It's very important.

(The Servant goes off left, into the house.)

HALE

I'm afraid we have come on a wild goose chase, Mr. Holley.

HOLLEY

Not if General Van Rensselaer stands firm.

HALE

But if Dr. Blatchford and the other gentlemen object strongly—as they do—

HOLLEY

Dr. Hale, the other gentlemen are not paying for the experiment.

The Patroon is doing that. And here in the Rensselaerwyck, while they may talk to the contrary, I observe that most men act as the Patroon wants them to.

HALE

We shall see. I hope you are right.

(Enter Stephen Van Rensselaer, from the left. He is a tall, erect, gracious gentleman of sixty.)

VAN RENSSELAER

Mr. Holley—Dr. Hale. I'm glad to welcome you.

HOLLEY

How are you, General Van Rensselaer.

HALE

Your servant, General.

VAN RENSSELAER

(Turning to Mr. Holley).

I looked for Dr. Blatchford with you.

HOLLEY

He's on his way. We came ahead. He is not favorably disposed to your school plan, nor are the others.

VAN RENSSELAER

They are coming too?

HOLLEY

Only Mr. Van Schoonhoven and Mr. Tracy.

VAN RENSSELAER

They also oppose our idea?

HALE

Horse, foot and dragoons.

VAN RENSSELAER

On what grounds?

HOLLEY

Religious, economic, and personal.

VAN RENSSELAER

Personal? I suppose you mean they disapprove of Professor Eaton?

HALE

Yes.

HOLLEY

You see, they have heard that Professor Eaton——

VAN RENSSELAER

I have heard all about Professor Eaton——from the best authority.

HALE

Then I suppose you had it from Sam Blatchford.

VAN RENSSELAER

No. I had it from Professor Eaton.

(He turns again to Holley.)

You told them the use I purpose to make of the school—and the new plan of instruction?

HOLLEY

I did my best with them.

VAN RENSSELAER

And they are still firm in their opposition?

HOLLEY

Obstinate as granite, all three of them, sir.

HALE

Here they come.

(Van Rensselaer goes to the gate to welcome Dr. Samuel Blatchford, Mr. Jedediah Tracy, and Mr. Guert Van Schoonhoven.)

VAN RENSSELAER

Welcome, gentlemen, Dr. Blatchford, Mr. Tracy—Guert—your servant.

(They greet him and stop, looking sternly at Dr. Hale and Mr. Holley.)

TRACY

I trust you have not been discussing this matter in our absence, Mr. Holley.

VAN SCHOONHOVEN

Stephen, I hope you've a drop of schnapps in the cellar. This is like to be a dry business.

(Van Rensselaer gives an order to the Servant, who has come and closed the gate. The Servant goes.)

VAN RENSSELAER (motioning the guests to be seated)

Dr. Blatchford, Mr. Tracy, Mr. Van Schoonhoven, I have

asked you to come to consider with me a plan of education. I wish to establish here a school of a new sort, where the sons and daughters of farmers and mechanics may be instructed in the application of science to the common purposes of life.

TRACY (brusquely)
Why bring us into the matter, Mr. Van Rensselaer?

VAN RENSSELAER
I shall have need of your advice.

TRACY
Everybody knows that the common purposes of life have no need of science. That's why they're common. I advise you not to do it.

BLATCHFORD
One moment, Mr. Tracy. We have come to learn more of your plan, General. We've had only the outline from Mr. Holley.

VAN SCHOONHOVEN
Your father never had any such notions, Stephen.

VAN RENSSELAER
My father died when I was a child. The world has changed since 1769.

VAN SCHOONHOVEN (nodding gravely)
It hasn't changed so much as you think.

VAN RENSSELAER
Permit me, gentlemen, to lay my plan before you.

TRACY
Tell us, first, what you want with us, General Van Rensselaer.

VAN RENSSELAER

I shall, as you know, be serving in Congress. I want some sure friends to act as my Trustees, to regulate the granting of certificates and the government of students.

TRACY

I thought so. You want us to hold the bag for this man Eaton—

BLATCHFORD

One moment, Mr. Tracy. Before I can consider acting as a Trustee Mr. Van Rensselaer, I must know what is to be taught. For much that now passes under the name of science accords but ill with the service of God.

VAN RENSSELAER

I will try to satisfy you, Dr. Blatchford.

(The servant enters with glasses and a decanter.)

THE SERVANT

There are five of your farmers, sir, from up the Poesten Kill, say they must see you, sir.

VAN RENSSELAER

Tell them I will see them soon. Has Professor Eaton arrived?

THE SERVANT

He and Mrs. Eaton, and a young lady, and Professor Beck are in the best room with the mistress, sir.

VAN SCHOONHOVEN (sipping his glass, his eyebrows raised)

In the best room, eh?

TRACY

We may as well be round with you, General. We don't want to be associated too closely with Mr. Amos Eaton.

VAN RENSSELAER
Do you know Professor Eaton, Mr. Tracy?

TRACY
Certainly not, sir.

VAN RENSSELAER
Then you shall meet him, and judge for yourself.

TRACY
I don't care to. I've heard enough.

VAN RENSSELAER (firmly)
Exactly, sir. You have heard . . . yes. Well, I have employed Professor Eaton. I know.

(to the Servant,)

Ask Professor Eaton to be kind enough to step this way.

(The Servant goes out.)

I know the gossip that follows him, and I know the answer to it. He is a man of learning, fit and able to teach others.

BLATCHFORD
Mr. Van Rensselaer, no man, however able, is fit to teach others unless he is himself sound in faith. And those who profess the material sciences—

THE SERVANT (re-entering)
Professor Eaton, sir.

(Amos Eaton enters. He is about forty-five, a heavy-set, intellectual man, with quick eyes and ready speech.)

VAN RENSSELAER
You are acquainted with some of these gentlemen, Professor Eaton. Mr. Holley, Dr. Hale, Dr. Blatchford; my old friend Mr. Guert Van Schoonhoven, Mr. Tracy.

(They bow, the first graciously, Mr. Tracy scarcely at all.)

I had hoped that these gentlemen, prominent citizens of Troy and Lansingburgh, would act as our Trustees. I still hope so. But I find them less willing than I imagined. We must now have it out with them, for I am unwilling to give up the project, and unwilling to go on without their counsel.

EATON (looking over the group)
I see, sir. I am prepared to answer any questions they may wish to put to me.

TRACY (testily)
We did not come here to examine you, sir.

(An awkward pause, and Mr. Van Schoonhoven takes matters into his own hands.)

VAN SCHOONHOVEN
Professor, my friend Stephen the Patroon has strange ideas. He gets them from his mother's family. One of them is book learning. Not that I'm set against it. Every child should read and write and cipher up to the rule of three. Beyond that is good for nobody. . . . There was my great Uncle Dierick—went to the University of Leyden. When he came home he couldn't abide it. And he married a Huguenot girl and ran off to Amsterdam, and the family never heard from him, only when they wanted money. So we Van Schoonhovens have known ever since about learning. Too much of it is bad.

EATON
I've heard of this Dierick. What did he do in Amsterdam?

VAN SCHOONHOVEN
The good God knows. They do say he wrote books there.

EATON
That's the man. Books he wrote—on the works of the good God. I've seen one of them.

VAN SCHOONHOVEN
What was it about?

EATON
Tulips. It made the tulips of Holland famous. That was something to your Uncle Dierick's credit, Mr. Van Schoonhoven.

VAN SCHOONHOVEN
Not at all. I started to prove to you, sir—Stephen, what was it I started to prove?

VAN RENSSELAER
You proved the contrary, Guert.

VAN SCHOONHOVEN (after a slow drink)
Let's get on with our business.

(The Servant returns.)

THE SERVANT
Pray you, sir, but these farmers from up the Kill. They will not go and they will not wait.

VAN RENSSELAER
I'll go to them.

(The Servant goes out.)

Pray excuse me, gentlemen.

TRACY (looking from his host to Eaton)
Lord preserve us!

EATON (to Van Rensselaer, who is about to go)
Perhaps I could be of some assistance, sir.

(As they move toward the house, the Servant re-enters, protesting, followed by the farmers.)

THE SERVANT
I tell you to wait. The master won't like it—your coming out here—

JAN (the first farmer)
I tell you I won't wait—

VAN RENSSELAER
What's this? Jan, and Peter—and you, Wouter?

JAN
They keep telling us, Mynheer—this man, and your Factor, and all of them—that we may see you. But we never do, since you went to Congress. I'm done with the farm. I can't pay the rent any longer.

VAN RENSSELAER
What's this, Jan? Your rents haven't been raised, have they?

JAN
No.

PETER AND WOUTER
No, Mynheer.

VAN RENSSELAER
I take for the land a tenth of your crop.

PETER
Ja. And three fat fowls for my farm, on account of the good spring water.

VAN RENSSELAER
Then what is your complaint?

WOUTER
You know it well, Mynheer. The tenth is now too much.

VAN RENSSELAER
Was it so when you took the farms in the first place?

PETER
No, Mynheer. Not then. The crops were good then.

JAN

Ja—they were good once. I mind me when I had a thousand bushels of Indian corn, one year. But now I have only four hundred bushels, Mynheer; and now I have nine children. We can not live, Mynheer. I work. My vrou she work. My children work. But we have only four hundred bushels. So I come to you, Mynheer, and I say, I will not pay.

VAN RENSSELAER

You owe me only one tenth of a bad crop, and then you complain. Why should I not complain too—I am the loser.

WOUTER

I did not think about that.

JAN

Ja—but it makes no difference. I can not pay.

VAN RENSSELAER (turning to Tracy)

And you say the common purposes of life have no need of science?

TRACY

The man is a bad farmer—that is all.

VAN RENSSELAER

No. He is not a bad farmer. I know him.

EATON

You have planted the same fields to Indian corn each year?

JAN

Every year, Mynheer.

EATON

And this year you have only four hundred bushels. Next year it will not be three hundred.

PETER

How can you tell? It is in the hands of God. We may have a good year.

JAN

You can not tell what a year may bring forth, Mynheer. I work—and work—

EATON

Will you listen to me?

JAN

No. I say I will not pay. I can not pay—

VAN RENSSELAER (with quiet authority)

But you can listen.

JAN

What do you want to tell me?

EATON

I know that soil—on the Poesten Kill. It will not grow Indian corn more than one year in three. And it will grow wheat one year in three.

JAN

Must we starve in the third year?

EATON

Divide the farm into three fields; one corn, one wheat or rye, or barley and one fallow. And give each winter a little lime to the fallow field. You need not work so hard, my friend, by a third, each year.

WOUTER

And what shall we do with the fallow land, Mynheer?

EATON

Does a Dutchman ask me what to do with pasture?

PETER (laughing boisterously)
Ja—Wouter, answer him that!

EATON
One thing more. If you will send your oldest son to me, I will teach him to test the soil, and to know for himself, not leaving it all to God.

JOOST (the fourth farmer, who, with his companion, Cobus, has taken no part in the protest.)
Mynheer Van Rensselaer—

VAN RENSSELAER
Surely you have no complaint to make of your farm, Joost.

JOOST
No, Mynheer. But I have heard you are starting a school, for young gentlemen. Is that so?

VAN RENSSELAER
Yes.

JOOST
So I have heard. And I have heard you will have the scholars go on some farms, to learn how they should be worked. And we hear that you mean to send them on our farms—Cobus's and mine. Is that so, Mynheer?

VAN RENSSELAER
We have thought of it.

COBUS
So my boy said. We are much afraid about this, Joost and I, Mynheer.

VAN RENSSELAER
Why should you be afraid?

JOOST
Tell him about the apples, Cobus.

COBUS

In the school, my boy said, the young men are to learn manners and morals, too, along with the book learning about the crops, and how to survey land, and all. Is that so?

VAN RENSSELAER

Yes, Cobus.

JOOST

But tell us this, Mynheer: which do they learn first?

VAN RENSSELAER

Why do you ask that, Joost?

JOOST

Cobus and I, we both have good apple crops, and late melons, and young daughters. Now if the scholars learn manners and morals first, they can come. But if they learn only the book learning first, we will not have them on our farms, Mynheer. No.

VAN RENSSELAER (smiling)

We will consider your request, Joost.

COBUS

Good. We leave it to you, Mynheer. If you had young women and good apples—but you will take care of us, Mynheer.

VAN RENSSELAER (to the first group of farmers)

Now, Jan, Wouter—all of you. I will forego my tithe this year, if you will plant as Mr. Eaton tells you next year. Is that fair?

THE FARMERS

Ja—that's fair. We agree to that. God keep you, Mynheer.

(They go out by the gate, bobbing to the Patroon and talking together.)

VAN SCHOONHOVEN (meditatively)
There is good sense in that. Yes.

HOLLEY
So, Mr. Schoonhoven, you see our school plan with a more friendly eye now?

VAN SCHOONHOVEN (not committing himself)
Maybe, maybe.

HOLLEY
And you, Mr. Tracy?

TRACY
I see no reason to change my view, Mr. Holley. Any one can tell a farmer to change his crop.

(As Van Rensselaer returns from the gate, with Eaton, Mrs. Van Rensselaer comes out of the house with Mrs. Eaton and Mary Lyon, accompanied by Lewis Beck, a scholarly looking man, younger than Eaton. Mrs. Van Rensselaer addresses her husband; Beck turns to Holley and Dr. Hale.)

MRS. VAN RENSSELAER
My dear, I wish to take Mrs. Eaton and Miss Lyon through the garden to show them the asters. We shall leave Professor Beck with you. (Van Rensselaer greets Beck and presents him to the others as the three ladies pause to speak with Eaton.) Professor, Mrs. Eaton and Miss Lyon have been showing me your prospectus about teaching the sciences to young women. It is very interesting.

EATON
I think it very important. If it can not be done otherwise, (with a glance toward the prospective Trustees) I shall do it in my private capacity.

MARY LYON (enthusiastically)
It is the most brilliant idea in modern education.

MRS. VAN RENSSELAER
Very interesting, Miss Lyon, I am sure. But do you think it can be done?

MARY LYON (impulsively)
I know it can. In less than a year under Professor Eaton, I have done more in mathematics and chemistry—

MRS. VAN RENSSELAER
I am sure you have, Miss Lyon. But I was thinking of the young women my husband has in mind—the daughters of farmers and mechanics, as the prospectus says.

EATON
The difficulty of teaching science to young women, Mrs. Van Rensselaer, is in the false methods of instruction that have been pursued—not in any perversion of the female intellect.

MRS. VAN RENSSELAER
I am glad to hear you say that, Professor Eaton. But we are interrupting. Let us go on, Mrs. Eaton—Miss Lyon.

(She leads the other ladies off, right, Mary Lyon looking back wistfully at the educational discussion. As they go out, Eaton is left for a moment isolated from the group which is dominated by Van Rensselaer.)

BLATCHFORD
General Van Rensselaer, you have asked us to lend our names to a plan of education which is new; a plan not based on the humanities nor upon those grounds of tradition and belief to which gentlemen are accustomed. Surely you must pardon us if we question it.

VAN RENSSELAER

If we can not answer you, it is a bad augury for the plan.

TRACY

You say the school is to teach the sciences. That takes apparatus—very expensive—only to be had in Europe. And who is to expound the experiments?

VAN RENSSELAER

I have discovered a man who can go into the forest and find there, or make with his own hands, the apparatus for the teaching of the sciences. I have sent him into various communities, and he has made natural philosophy the common talk of the people in each. I have given him a county—a state—to survey, and he has answered me with the systems of its rocks and soil, and the classification of its every plant and tree. Such a man is fit for my purpose. I am not minded to found a university, but to make common life richer by men's understanding of it. I wish him to be a teachers of teachers, who shall in turn go forth. It comports better with the habits of our citizens and the genius of our government that advantages be placed within the reach of all. This is my purpose.

TRACY (drily)

You will do well in Congress, sir. And what of your new plan of instruction in the forest.

VAN RENSSELAER (controlling his temper)

It behooves me to be patient, Mr. Tracy. . . . The method of the school is to reverse the usual. The Professor is to listen, the students to lecture. Thus, and thus only, shall we stimulate the resources of the individual.

TRACY

What's that, sir! Damme, the students to lecture and the professors to listen? It's mad, Van Rensselaer—stark mad.

EATON (still standing apart)
No, Mr. Tracy, it is not mad. It is right. What the student does with his own hands, he will understand. The plant he himself dissects, the rock he breaks with his own hammer, he will know.

VAN SCHOONHOVEN
Good sense, sir! What do you want of us, Stephen?

BLATCHFORD
A moment, gentlemen. I for one must remember the cloth I wear, and the word of God it is my duty to teach. I can not be a party to irreligious works.

EATON (very gravely)
I can not look upon a flower, understanding it as little as I do, save as a miracle. I can not cleave a rock, and not ponder the laying of these terrestrial foundations. I can not look upward and calculate the return of a planet in its appointed track and doubt God.

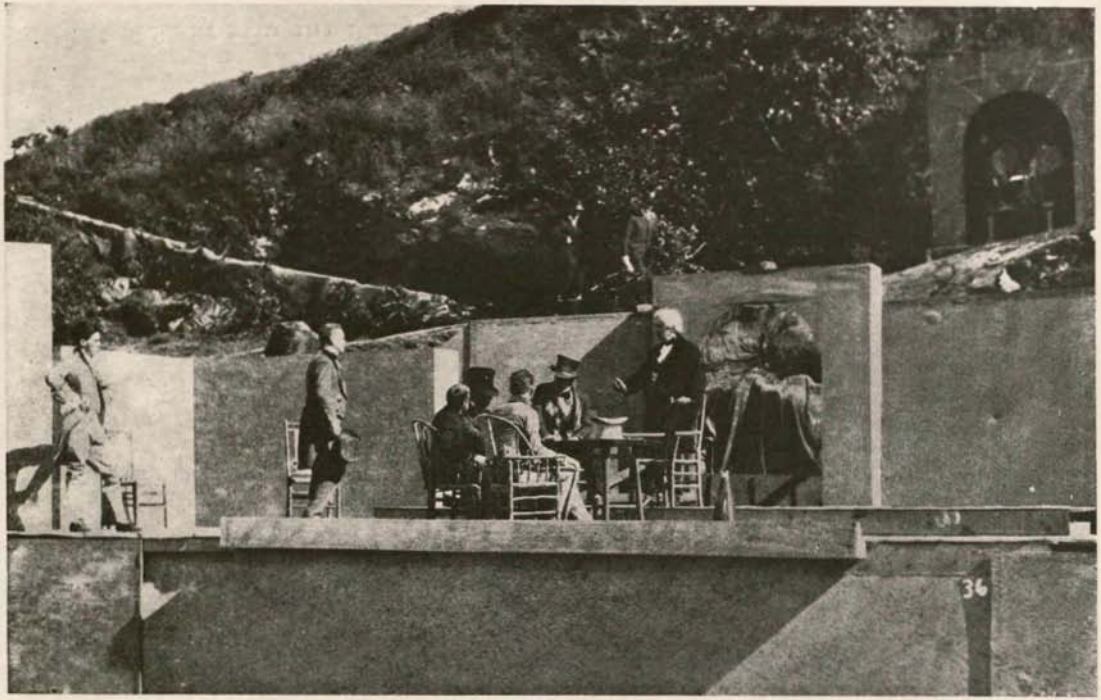
(Blatchford goes thoughtfully over to Eaton and lays a hand on his shoulder.)

BLATCHFORD
You may count on me, while I live. (He turns to Van Rensselaer.) And you, sir.

(He goes slowly back to his place, and Mr. Tracy rises and stands beside him.

VAN RENSSELAER
I believe we are at one in this. You may count on me, Amos Eaton. Open the doors of your school when you are ready.

EATON
I have opened them, in imagination. I have gone further.



Scene from the Pageant — First Meeting of the Board of Trustees

Professor Beck and I have found the first group of students —the valiant few to begin work under your plan.

BECK

They are waiting. Shall I bring them, sir?

(At a nod from Eaton, Beck goes off.)

BLATCHFORD

You were very confident, then?

EATON

I had General Van Rensselaer's interest behind me, Dr. Blatchford. (Beck returns with a group of students. It is growing dark, and the garden is lighted by a shaft of light from within the house—a shaft which touches Van Rensselaer, Eaton and the students, and leaves the others in twilight.) Young gentlemen, General Van Rensselaer has given us word to proceed with the work of the school. You all know its purpose. You become, from this hour, the Rensselaer School.

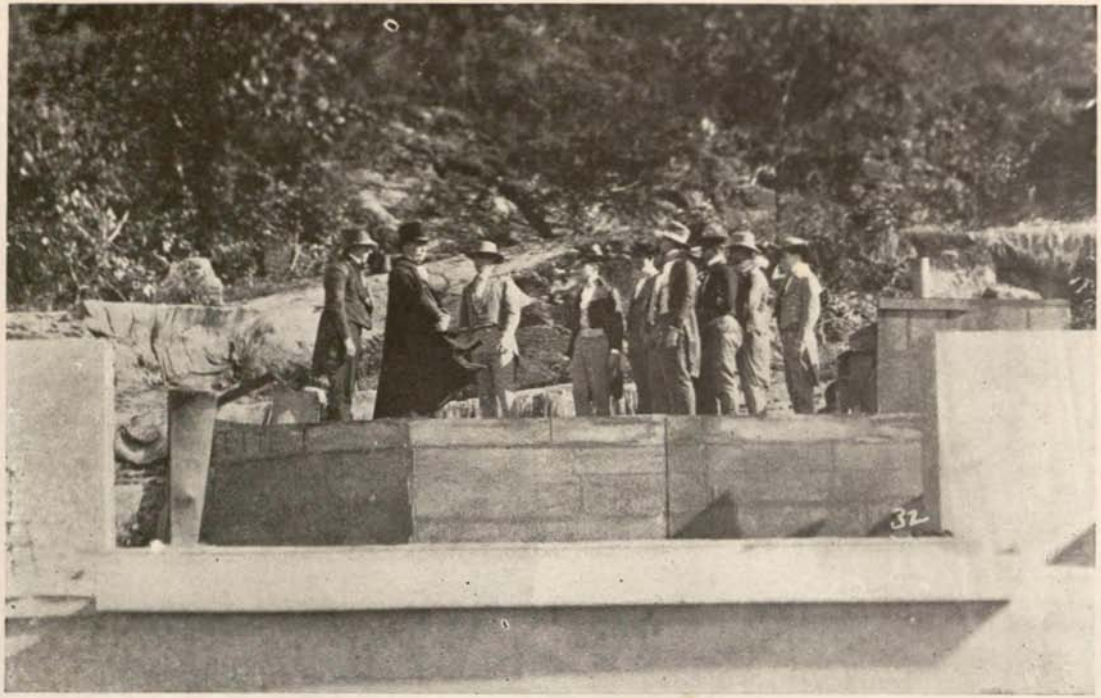
General, Dr. Blatchford, I beg you to stand with me to receive their pledge.

Men of Rensselaer, do you here promise, each on his honor as a gentleman, that you will endeavor to the utmost of your abilities to improve yourselves in learning and morals, while you are members of this body; and that it shall be the chief business of your lives to study the word and works of the Creator, and to learn to perform acceptably your duties in society?

THE STUDENTS (in a firm, deep chorus)

We do.

(The light fades from the scene, and the garden disappears.)



Scene from the Pageant — An Excursion Along the Erie Canal

INTERLUDE I

In the centre of the cliff appears a lighted cell, in the arched doorway of which sits the Spirit of Man, as a cloistered, mediaeval Philosopher; before him is a great closed book. Knowledge stands at his shoulder.

THE PHILOSOPHER

Here, in this golden volume all is writ
That Man hath visioned: all philosophies,
All songs and prophecies that age to age
Hands onward still. What shall I further seek,
O Knowledge? For what man shall ride through glory
More glittering-starred than Alexander's pride;
Or look on power with such a level eye
As Caesar's; or on beauty perishing
More fair than Grecian Helen's; or see life
With a directer gaze than Aristotle;
Or question it more keen than Socrates?
Why should I seek beyond the golden book
Of the wise generations?

KNOWLEDGE

Man, are you content?

PHILOSOPHER

No. For the world's need haunts me.

KNOWLEDGE

Open the book. Look backward, to the past.

PHILOSOPHER

I dare not, for mine ears are filled with cries
Of dearth and hunger, bondage and bafflement
This golden book and all the storied past

Can never silence. . . . Knowledge, I have called,
And I will heed thee. What shall still the cry
Of this material, hard-driven world?

KNOWLEDGE
Have you the heart and courage, and the faith,
To leave behind you old traditioned paths
And walk alone into mine unknown fields?

PHILOSOPHER
What shall I find there?

KNOWLEDGE
A waste of starlit stone and wild-grown ranges,
Untilled, unserviceable, vast; a land
Dark till your light reveal it. But at last,
Some solace for life's needs, some bondages
Struck off. The way is hard. Will you adventure?

PHILOSOPHER
You promise harshly.

KNOWLEDGE
I do ever so.

PHILOSOPHER
Where lie the unknown fields?

KNOWLEDGE
Close by your door;
And thence they stretch unto the farthest star.

PHILOSOPHER (shrinking away from her)
I dare not venture. . . . What should they disclose
Save what the ages' book holds written clear?
I'll to the book—and hail to all the past.
Here be mine incantation; let me look
On all the fairest, mightiest, wisest ones,
And live by their divine emblazonment.

(There is a great, serene passage of music, as he opens the book. Before him the light streams, as from the volume, out into the night, and discloses, ranged aloft in splendid groups, the glories of the ancient world—soldiers, sages, rulers, queens.)

Lo, he who would be learned, let him read
Deeply the garnered past, and know all greatness.
What should I seek save these?—and to all else
Less fair, less mighty or less wise, be blind!

KNOWLEDGE

The past is rich. . . . But—is your soul content?

PHILOSOPHER

I know not. . . .

KNOWLEDGE

Look yonder.

(In a new light, far below, appears a group of toiling figures, engaged in the most primitive industries; they are hopeless, and their action seems futile.)

PHILOSOPHER

Who are they? . . . Lo, yon smith who strikes, helpless,
Upon a silent anvil. Who is he?

KNOWLEDGE

Yourself.

PHILOSOPHER

And she who weaves, failing, a thread that falls,
Unfabricked, from yon webless loom?

KNOWLEDGE

Her soul and yours are one—for all you know.

PHILOSOPHER
And yonder child who cries, uncomforted?

KNOWLEDGE
Your very self.

PHILOSOPHER
Look up, ye toilers, to the starry past!

KNOWLEDGE
They hear you not. For them, the grave enfolds it.

PHILOSOPHER
They cry to me more loud than Caesar's battles.
Let the book close, and the dim night swallow all
The past's high glories. Now my heart is firm
To pass the boundaries of thine unknown fields.

KNOWLEDGE
The paths are rough. Grim Nature guards them well.

PHILOSOPHER
I will adventure them.

KNOWLEDGE
Take then the lamp.

(A throbbing, elemental passage of music, as he takes the lamp and starts out, moving from the darkened cell along the path to the left; a blue-green light glows along the cliff, and the Elements with their groups, with Nature at their head, seem to bar the way. The Philosopher pauses, struck with fear.)

KNOWLEDGE
Be of stout heart.

PHILOSOPHER
And may I question them?

KNOWLEDGE

If you have courage to divine their laws,
The very Elements must answer you.

PHILOSOPHER

I go to still the crying of my soul
In the common dust of life; and they shall give—
Each one of thy grim daughters, Nature, tribute
To this endeavor. For life's purposes
Are more than visions, and they must be served.
Nature—give way. For by this light, I pass.

(He goes on down the path, the Elements sullenly yielding. Below, he faces the toiling smith, who pauses, looks up, and the bonds fall from his arms. The music swells exultantly as the toiling people look upward. Then all vanish.)

SCENE II

THE FIRST FIELD WORK EXPEDITION

The scene is the deck of the canal boat Lafayette, lying in the Erie Canal near Buffalo; the year, 1826.

The students are gathered on deck, and Professor Eaton is giving them their day's instructions.

EATON

Young gentlemen, we have now completed the passage of the Erie Canal, and to-day we start homeward. Some of you, I rejoice to say, have profited by the journey. Others have considered it chiefly as an entertainment. I look for greater diligence on the return voyage—a greater volume of notes, and more discrimination in the gathering of specimens, both botanical and geological. Professor Beck, who is the Officer of the Day?

BECK

Master Cady.

(A groan goes up from the students.)

EATON

Young gentlemen, why this disorder?

CLINTON (after a pause)

If you please, sir, can't somebody else be Officer to-day? Cady's such—

EATON

Well, Master Clinton? Cady's such—

CLINTON (blurting it out, after a hesitation)

Cady's so strict—he's such a fool about discipline—

EATON

It is far better, on an expedition of this sort, to be governed by a fool than to have no government.

CADY (very meekly)

If you please, sir—

EATON

Master Cady.

CADY

May some one else be Officer to-day? I'm still lame from the last time. And I have my specimens to put in order.

BECK

They all have their specimens in disorder, except Fitch.

EATON

Very good. Master Fitch will serve as Officer of the Day, and will see to it that all the specimens are in order before the boat leaves. Dr. Eights, will you kindly bring your sketch-book and accompany me to the other end of the next lock. There is a formation there which we may wish

to engrave for the next edition of our "Survey." Young gentlemen, I leave you to Professor Beck and the Officer of the Day.

(Eaton and Dr. Eights go off. Fitch stands in the cabin door and rings a large bell.)

FITCH (calling the roll)
Cady. Clinton. Danker. Edgerton. Emmons. Hale. Hanks. McManus. Pelton. Weston.

(They line up in a disorderly squad.)

Into the cabin now, and each man put his specimens in order. Remove from the cabin all material of no scientific value. Forward, march.

(The students swarm into the cabin.)

BECK
All material of no scientific value? Aren't you pretty sweeping, Master Fitch?

FITCH
Not at all, sir. They can clear out half of it, and make room for the return voyage.

(Clinton and Emmons come out, in argument.)

CLINTON
Look here, Master Fitch, I appeal to you. Emmons objects to my keeping my live specimen of *menobrachus lateralis*—

EMMONS
I only object to his keeping the slimy thing in my bed.

CLINTON
I appeal to you, Fitch—is this menobrachus lateralis slimy?

(He holds up the reptile by the tail.)

EMMONS

I withdraw the adjective. I only insist that I won't have it in my bed.

CLINTON

I can't help it, Master Fitch, but the little creature seems to prefer Emmons's corner.

EMMONS

A man can't be expected to sleep with a salamander—

FITCH

Master Clinton, I confess that I did not recognize your specimen except as a *menobrachus lateralis*. Now that I know he is a salamander, the matter is simple. You will domicile your specimen in the cabin stove.

CLINTON

Now look here, Fitch—

FITCH (very gravely)

You will also make careful notes of his behaviour when the fire in the stove is lighted. We should examine every popular scientific opinion for fallacy. I for one have always had some doubts about the salamander's standing fire.

CLINTON (deeply wounded)

I shall enter your order in my journal. And I shall restore the specimen his liberty, sir.

(He goes to the side and solemnly drops the salamander overboard.)

The students come out of the cabin in a disorderly procession, each heavily burdened with an armful of culled specimens, many of them highly incongruous. They are about to drop them overboard when Fitch interferes.

FITCH

One moment. You must not fill the canal. Place these collections on shore, in a suitable cairn, to provide the next expedition with an insoluble geological and botanical problem.

BECK (drily)

By next year, the problem will be entomological as well.

FITCH

On shore. Forward, march.

(As they move, a fantastic figure in a great cloak appears on the hillside above, and watches the scene with interest. As some of the lads reappear from their cairn-making the man on the hill hails the boat.)

THE MAN (who speaks with a marked French accent)

Allo! What boat is this?

FITCH

The Lafayette, sir. Scientific Expedition of the Rensselaer School.

THE MAN

Scientific expedition! Magnifique! 'Oo is in command?

FITCH

Professor Beck, sir, at present.

(The stranger comes down the hill and aboard the boat.)

THE MAN

Professor Beck. Permit me to introduce myself. I am Constantin Rafinesque, Professor of Natural Philosophy in the University of Transylvania.

BECK

We are very glad to see you, sir. We have often heard of you—

RAFINESQUE

To think of that! Nom de Dieu—to find in this wilderness men who have heard of the philosophers! I am overjoyed, Professor Beck. I had not heard there was a college in this vicinity.

BECK

There isn't, sir. The Rensselaer school is in Troy, at the other end of the canal. We are on an expedition—

RAFINESQUE (trying to place the word—)

Ah, yes—Troy—Troy. I have correspondence . . . Who is your Principal in Troy?

BECK

Professor Amos Eaton.

RAFINESQUE

Certainment! Eaton. He is my dear friend. Eaton—yes . . . He is wrong about my nomenclature of the supposed petrifaction in the geodiferous lime-rock. But he is my dear friend. Where is he?

BECK

He has just gone down to the lock to direct some sketching.

RAFINESQUE

I will wait. And are all these young men graduates of your Rensselaer School?

BECK

No, sir. Undergraduates.

RAFINESQUE

What! Undergraduates! And you take them out to study nature directly? It is unbelievable.

BECK

It is Professor Eaton's idea, and that of our patron, General

Van Rensselaer, that the student must take nature at first hand from the beginning.

RAFINESQUE

It is splendid—but it is a revolution! Ah, that Amos Eaton—he is a great man. He is wrong about my nomenclature, but he knows how to ring the rising bell in the dormitory of the soul. May I speak with your students, Professor Beck?

BECK

They will be highly honored, sir. Young gentlemen. (The students gather on deck.) Permit me to present you to the distinguished scientist, Professor Constantin Rafinesque, of the University of Transylvania.

(The students make a profound, unanimous bow.)

RAFINESQUE

My young friends, it delights me to meet you. Since I am a Professor in the University of Transylvania, I have seen not one student—not one. Our University is, I regret to say, *in posse.* (He makes a grand gesture, sweeping the sky, to indicate his University's foundations.) But you have the very high privilege to study under one great man. (He recalls Beck's presence.) Or, for all I know, two great men. . . . And what is the object of your present expedition?

FITCH

To observe the formations along the Erie Canal, sir; to learn the geology of New York; and to collect specimens.

RAFINESQUE

You all collect?

FITCH

Each man should have a suit of the New York system, and such plants as he can preserve as well.

RAFINESQUE

And have you made any new discoveries on this voyage?

(A pause; then a voice—Cady's is heard from the group.)

CADY

Show him your leeches, Clinton.

(Clinton is pushed forward.)

CLINTON

I'm not seeking the honor, sir. I don't really belong to the school. But the others insist. I have found some leeches which I believe to be new.

(He holds up a small bottle of leeches.)

RAFINESQUE

Leeches—ah, yes. And what is their class, gentlemen?

THE STUDENTS

Chaetapoda.

RAFINESQUE

Correct. And Division?

FITCH AND EMMONS

Hirudinea.

RAFINESQUE

Again correct. And there is ground for new discoveries in this class. May I have one out of the bottle for examination?

CLINTON

Take care, sir, they'll bleed you.

RAFINESQUE

I have spilled more blood than he can hold, in the interest of science. Let him suck. Yes . . . yes—I believe you are right, sir! He is new to me. He is probably new to science, then. We shall call him Hirudo Chloronatus—the green back. I congratulate you, sir.

(Clinton is filled with pride. A hail from the shore, and Eaton is seen returning with Major Fraser, and two men carrying kegs.)

EATON

Officer of the Day—two men to embark supplies. Major Fraser, of Buffalo, presents us, for our return voyage, with a barrel of beef and a barrel of beer.

FITCH

Three cheers for Major Fraser!

(The cheers are given with great spirit, and Major Fraser acknowledges them in fine military style from the shore. The kegs are brought abroad, Eaton following.)

BECK

Professor Eaton, we have a guest—Professor Rafinesque.

(Rafinesque embraces Eaton warmly.)

RAFINESQUE

Ah, mon cher ami! I am so delight to see you.

(Beck steps ashore to join Major Fraser.)

And your expedition—it is magnifique. To bring the young mind out into the great presence of nature—direct. But it is not usual. What will your Trustees say to it?

EATON

My patron, our Founder, favors it. And I believe it is necessary, if education is to take root in this land. These

lads have a continent to bring under the plow; roads, bridges, canals, buildings, mines—everything. They must approach nature with courage, and with knowledge. Our problems are new. Our methods must be new also.

RAFINESQUE

My friend, you are a Danton in education. I have seen your report on this canal; it is revolution' too. Why have you insert' no strata of European geology?

EATON (firmly)

I do not insert them because I can not find them.

RAFINESQUE

You can not find them?

EATON

If you will accompany us, I will convince you, Professor Rafinesque.

RAFINESQUE

Why not? I am greatly honored by your invitation.

EATON

We will send for your impedimenta.

RAFINESQUE

I have no impedimenta. Except what is mental.

EATON

We can offer plain fare, and hard lodging.

RAFINESQUE

My University offers me no fare—and the wilderness for a lodging.

EATON

Master Fitch, will you instruct the Captain to start our eastward journey. And sound the bugle for Dr. Eights—

he will catch up with us when he has finished his sketch. (turning to Rafinesque) You will come, sir?

RAFINESQUE

I will come. I congratulate you on this expedition. I join it with pride. It is the beginning of scientific field work in America. You may be wrong about my nomenclature of the geodiferous lime-rock, but you are a planter of mighty seeds; you have under your hand the work of the future.

(The bugle sounds to quarters. Beck hurries aboard. Farewells are shouted to Major Fraser, who waves *bon voyage,* as the Lafayette moves on.)

INTERLUDE II

Again the cell of the Philosopher, who, lighted by the lamp of Knowledge, speaks to a band of young men, his disciples.

THE PHILOSOPHER

My years are done. No more I lead you on.
Take up the torches, lighted at this fire,
And go your ways.

A YOUTH

Nay, leads us still.

PHILOSOPHER

I can no longer lead you. . . .

YOUTH

Why do you pause?

PHILOSOPHER

I rest. For a new day is come, and mine

Is gone forever. I, who took all Nature
To be my province—I have come to see
How far too vast the fields. One lightning flash,
One flame, one flower, one riven rock, one force
Were wide enough, and all too deep, to know. . .
I turn unto the golden book of Time
To join my brethren in their centuries—
More kin to them than to the world you face,
The world that you must shape, and mould, and conquer.

YOUTH

But what of us? How shall we mould a world,
Unguided, in the darkness—we so few?

PHILOSOPHER

There shall be many. . . .

YOUTH

If the task be found
Too vast for your experienced, cunning brain,
How shall we compass it?

PHILOSOPHER

Each one—one corner of one field; dig deep,
And build upon each other's handiwork.
Thus, stone on stone, and thought on thought,
Arise the high creative sciences.

YOUTH

Grim Nature still stands guard.

PHILOSOPHER

But you shall come to fear her less,
Knowing her better. For she cherishes,
Even as she with ruthless hand destroys.

YOUTH

Show us our ways.

PHILOSOPHER

Youth—you my chosen—hear my seasoned word
And then set forth. To each of you his task.
Here lies America; a continent:
Rock for a million hammers; roadless, vast,
Untamed, unfurrowed. Youth, this land is yours,
And this land's people, yours to serve—and lead.
This lands is yours. Lace it with roads of iron,
And at their crossings rear its roaring cities.
Set your controls upon its flooding rivers,
Bridge them, and lead them through long laboring sluices.
The land is yours. Search out its hidden treasures,
Its gold and silver, iron and coal and oil,
And make them yield you tribute. Set swift engines
To free toil-wearied arms; and cunning signals
Flashing aloft to speed the flying word,
Till thought to thought set fire across the skies,
And the bound spirit, lifting into light,
Cast off the fetters of its discontent,
And laughing, seize its destiny in joy.
The land is yours. Youth, lift your torches high.
Be firm. Be steadfast. Spare no toil. Look deep.
And out—each one—to claim his chosen task.

YOUTH

I light my torch here. Brothers, you have heard. . . .
And you, who have been guide to us so long,
Whither go you?

PHILOSOPHER (opening the great book)

Into the golden past.

(He dips his pen and begins to write.)

YOUTH

Each to his task: one flame—one flower—one riven rock.
Know deeply. Out! And for the years to come,

Take we America, and learn, and serve.
Set on!

(Music. They light their torches, and separate, going out over the face of the cliff in all directions; and as they go, and our eyes follow their gleams, we see each torch divide into two, and these into two others, as the bearers are joined by hitherto invisible figures, until in the distance and the darkness they are innumerable—each one a youth with his own light, blazing a path for himself.)

SCENE III

Reorganization: The Polytechnic Institute

The scene is a meeting of the Trustees with a committee of citizens of Troy, during the reorganization in 1849–1850.

It is a formal occasion. President Nathan S. S. Beman presides. On one side appears the citizen's committee—Dr. Thomas Blatchford, Mr. John A. Griswold, and Mr. Joseph M. Warren, Mr. Warren speaking for them.

On the other side are Vice-president William P. Van Rensselaer, the Trustees, and the Director, B. Franklin Greene, a comparatively young man, very much in earnest and ready with his information. Mr. Warren is arriving at his peroration.

Warren

The Rensselaer Institute has come to the cross-roads. A quarter of a century ago, when it was founded, its patron, Stephen Van Rennselaer, whom we all remember with the highest respect and esteem, placed it in the hands of Amos

Eaton. He needed to go no further, for Amos Eaton possessed all the knowledges and abilities the task of scientific education then required. He asked little of us as citizens of Troy—nothing of the world except what his patron so generously gave. And from the Rensselaer School a band of graduates went forth who have already set their marks deeply upon the science, the education, and the material progress of our time. The family of the Founder has continued to bear its share in fulfilling the needs of the school. (Mr. William P. Van Rensselaer bows slightly to the applause of the Trustees.) But now we have come to the cross-roads. Shall we, either as Trustees under the will of the Founder and the law of the State, or as citizens of this community, let this great work fall, or shall we carry it forward to new usefulness?

(Mr. Warren sits down. Mr. Slocum turns in his seat and speaks without rising.)

SLOCUM

Mr. Warren, you gentlemen keep telling us how good the School is—and yet you come here wanting to change it. Why is that? You want to change it, and you want a lot of money to change it with. Old Amos Eaton never wanted half so much, and he made it. I, for one, don't follow you, sir.

GREENE (rising)

Mr. President.

PRESIDENT BEMAN

Director Greene.

GREENE

The question the gentleman asks should be answered. I have foreseen it, and have prepared a document in rejoinder, which I will submit to him at his leisure. . . . But to-night let me remind him that since the school was

founded, science has become a new factor in the arts and industries, has given us new powers over mechanical forces. Professor Eaton was the last of the old philosophers. He took all knowledge to be his province. No man can attempt this now. The range is too vast, and its cultivation too deep.

McConihe

And what do you recommend, sir?

Greene

I have investigated the schools which most fully and successfully perform the work we were founded to do—

Slocum

Old Amos Eaton always told me there wasn't a school like this in the country.

Greene

That was true. The nearest to this school, in aim, is the *Ecole Centrale des Arts et Manufactures,* of France.

Slocum

Oh, you're going to Europe for it, are you?

Warren

Why not? All the manufacturing chemists that are worth their salt come from Europe. Perhaps we couldn't do better—

Slocum

Well all I've got to say—

President Beman

Please come to order, gentlemen. Director Greene has the floor.

Greene

I speak not of the Institute as it has been, but as it may be-

come. In the essential features of its design and intention, it may occupy a position between *L'Ecole Centrale des Arts et Manufacturers* and *L'Ecole Polytechnique.* I can claim for it no other resemblance to these celebrated and richly endowed institutions. To its peculiar mode of study, the Rensselaer idea, there is no known counterpart. In its purposes, and in its achievement so far, it is worthy of our utmost effort. And to-night we come to lay before the Board, and the citizens of Troy, our plans for its future.

McConihe

That's business. What do you want to do?

Greene

To reorganize the school; to give three years of each young man's life to its course of instruction; again to narrow the field and more thoroughly cultivate it; to restrict it to matters immediately cognate to General Science and Engineering; to look forward and plan for the opening opportunities that must follow the new theories in mechanics, and the researches of Faraday in electricity; to make the school in deed what we here ask your permission to call it—the Rensselaer Polytechnic Institute.

(Applause among the Trustees and citizens.)

President Beman

And for this purpose, our responsibilities as Trustees and as citizens are simple: we must find the means, and create the atmosphere for this growth, which shall make the work secure, that its service to these States and to mankind may continue through the years to come. Are you ready, fellow citizens, asking the blessing of God on our endeavors, to set your shoulders to the wheel?

(The vote is Aye, in a strong, deep chorus.
The scene disappears.)

EPILOGUE

The Triumph

(Again the cell of the Philosopher glows with light, as he pauses and looks up from his book.)

Philosopher

Another page is turned; a hundred years.

Knowledge

And they who lighted torches at this fire
Have borne their flames afar and now turn home.

Philosopher

And this is well: to pause in mid-career,
Break bread; look back; rejoice in victories;
Recall a struggling century; and hold
High festival before they take again
The roads of service and enlightment.
Then be it so. I look beyond the hills
And cry into the night: who cometh home?
What bring you from these hundred laboring years—
You, who went forth to serve? Who answers me?

(High on the cliff above, the heroic figure of the Spirit of Rensselaer springs into light—a leather-clad engineer of the pioneer type, his left hand resting on a transit, his right raised in salutation.)

Spirit of Rensselaer

I, Rensselaer! Let my voice answer you
For all who lighted here their torches' flame.

Philosopher

A hundred times beneath the autumn stars
The youth have gathered; and the opening summers
A hundred times have sped them, eager, forth.

Their spirits tempered in these studious fires,
Inspired of Knowledge, touching hands with power,
This hundredth year the autumn stars swing back,
And you return in triumph. Let these hills
Blaze with your rich achievements, Rensselaer.

SPIRIT OF RENSSELAER

My work is woven in the warp of life
Across the continent you bade me serve:
Far-flung the roads that I have laced with iron,
The roaring rivers I have spanned; the sluices
Bridling their power; the mighty ships sent sea-ward;
The treasures of the stubborn Earth uncovered;
The alchemies of matter tried and turned
To formulae of service; and the lightning
Poured with its power to human need and will. . . .
To-night I am come home, remembering,
Bringing a century's visions. For my work,
Look out upon America. And for my triumph,
Look on these shadowy standards, and let them
Soar in your swift imagining aloft,
To towers that battlement the modern world.

(Music. Along the pathways of the cliff come the banners of a hundred classes; and borne with them each one casting its momentary shadow in lofty disordered grandeur on the night mist, great heraldic standards suggestive of the most notable achievements—bridges, buildings, engines—works of the sons of Rensselaer.)

(Below, on the lower stage, the light gradually discloses Nature and the Elements with their groups, dancing in obedient, slowly measured orbits.)

The music changes to Old Rensselaer, and to its strains the hillside fills with the blaze of light and color, banners and standards.

"OLD RENSSELAER"
(Words by CORA HARDY JARRETT.)

Thou hast sent us forth to labor,
Old Rensselaer.
We have wrought to win thy favor
Year after year.
Steel to weld and stone to shiver,
Sink the mine and span the river,
For thine honor toiling ever,
Old Rensselaer.

When thy sons are met together
From far and near,
Scarred with service, worn with weather,
Old Rensselaer,
Proud they lay their deeds before thee,
Done to show the love they bore thee,
Stronger grown as years pass o'er thee,
Old Rensselaer.

When they write our nation's story,
Splendid and clear,
Surely great shall be thy glory,
Old Rensselaer.
In their works thy sons enshrined thee,
Mighty works to leave behind thee,
Motherland, let these remind thee
Of old Rensselaer.

(At the end of the song there is a great shout: HAIL, RENSSELAER! and the pageant ends.)