tions were adopted paragraph by paragraph, after which the Association adjourned:

Resolved, That the American Forestry Association learns with satisfaction of the recent enactment of laws for the protection of forest property against destruction by fire in Wisconsin and Minnesota, and of the successful operation of such laws in Maine, New Hampshire and New York, deprecating at the same time the continuance of forest destruction by fire in other States and especially on the public domain.

That the question of dealing with forest fires is still the first and most important one to be settled in nearly all the States of the Union before rational forestry methods can become practicable.

That inasmuch as forestry property is taxed for the support of government, it has the same right to consideration and protection as other property and that the Legislatures of the different States which have no efficient forest-fire laws are recommended to provide the same.

That the policy of establishing forest reservations and parks is to be encouraged, and for this purpose it is recommended that timber lands offered for sale for non-payment of taxes be acquired by the State and held to form the nucleus of State forest reservations.

That it is the first duty of Congress in regard to the public timber lands to enact proper legislation for the National protection and administration of the forest reservations and unreserved timber lands, and we appeal to the Public Lands Committees of the Senate and House of Representatives to secure the passage of bills which received the sanction of the Senate and House of Representatives in the 53d Congress, and failed to become laws only for lack of time for consideration of amendments in conference.

That the American Forestry Association, recognizing that a practical advance in rational forestry methods requires the services of men trained in forestry practice, indorse the legislation proposed in the last Congress by Mr. Hainer, and expresses the hope that the same will be enacted during the coming Congress.

That the knowledge of the extent and conditions of our forest resources is a necessary basis for intelligent forest legislation, and that therefore the American Forestry Association recommends the coöperation of various government departments as far as practicable in ascertaining these areas and conditions, and especially recommends that both a topographic and forestal survey of National Forest Reserves be instituted.

F. H. Newell,
Corresponding Secretary.

Washington, D. C.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.

The second annual meeting of the Society for the Promotion of Engineering Education was held at Springfield, Mass., on Sept. 2, 3 and 4. This Society was organized in 1893 at the close of the session of the educational section of the International Engineering Congress, whose proceedings were published in the first volume of its transactions. It had 156 members at the close of the meeting held in Brooklyn in 1894. The sessions of the Society are largely devoted to the discussion and reading of papers, nearly all the business being transacted by a Council composed of 21 members, selected from 21 different engineering colleges.

The President of the Society, Professor George F. Swain, opened the first session with an address on the relation between mental training and practical work in engineering education. He alluded to the strong tendency toward practical engineering work as often dangerous in preventing a thorough educational development. The opinions of the public and of some engineers are often

directly opposed to those of teachers of long experience, and hence the importance of the discussions in this Society. Principles are more important than rules, and a broad foundation gives the best opportunity for success. The success of the middle-aged engineers of to-day, who had few opportunities for practical work during their college courses, is perhaps largely due to their broad and thorough training in fundamental subjects. The selection of teachers on the basis of practical experience alone seems a dangerous one. In short, education is more important than engineering in the school and college.

The report of the Secretary, Professor J. B. Johnson, brought out the fact that a considerable number of copies of the two volumes of transactions had been sold in Europe, and that the methods of laboratory instruction in the United States had formed the subject of a lengthy discussion in the Society of Engineers and Architects of Germany.

REQUIREMENTS FOR ADMISSION.

The Committee appointed at the Brooklyn meeting to collect facts regarding the requirements for admission to engineering colleges presented a report of progress through its chairman, Professor F. O. Marvin. Circulars had been sent to every engineering college in the United States and Canada and 55 replies had been received, which were tabulated in five groups by States. The New England, Middle and Central States are strong in mathematical requirements, over 50 per cent. in each of these groups requiring algebra through quadratics and plane and solid geometry, while in the West and South only 24 and 4 per cent., respectively, require the same amount. The Central States are much stronger in science requirements than the other groups, 14 colleges requiring an average of three or more science subjects. In advanced English requirements the Eastern colleges are the strongest. In foreign languages the central group stands highest. Drawing is required by only ten per cent. of all the colleges, and the larger part of these are in the Central or Western States.

In all the groups there is seen a strong tendency to increase the mathematical requirements, to abandon formal grammar and substitute a better knowledge of the English language and literature, and to introduce either French or German.

As to the conditions allowed and the time for their removal the replies show that the practice is subject to wide variation. The same is the case with respect to the acceptance of certificates in place of examination. It is significant, however, that out of 55 colleges 34 should report the certificate plan as more or less satisfactory.

Circulars were also sent to nearly 500 preparatory schools and 148 replies were received. Of these 59 think an increase in the requirements for admission to engineering colleges is desirable, and 75 are prepared to advance their courses to meet such an increase; 105 schools favor uniformity in requirements. With respect to the certificate plan only one-third think that it should be extended, those in the East favoring examinations and those in the South and West favoring admission by certificate.

The Committee refrained from presenting opinions upon the facts collected, and it was continued in order to further study the material on hand and report at the meeting in 1896.

PAPERS ON SEPTEMBER 2.

'The Scope of an Engineering School,' by Professor William G. Raymond, took the ground that culture and language studies should be mostly confined to preparatory courses, and that mathematics, except arithmetic, should be left to the engineer-

ing college. Here algebra and geometry should be begun and a broad and thorough training be given in general and technical science, while the specialties of engineering, like bridge and locomotive design, should be left to a post-graduate year. These views met with decided opposition from Mr. William Kent, who advocated geometry, algebra and Latin as most important subjects to be taught in the high schools.

'The Requirements of Engineering Colleges in Non-professional Studies,' by Professor Louis E. Reber, gave statistics relating to 37 institutions. The various subjects were classed as culture, indirect technical and technical. The average time devoted to culture studies was given as 16 per cent., while the technical subjects occupy from 50 to 60 per cent. Three colleges have no language studies in their technical courses, although requiring more or less for admission. The tendency toward specialization in engineering work seemed marked, one institution having no culture studies of any kind in the entire four years of the course.

'Graphic Methods in Engineering Education,' by Professor L. M. Hoskins. This paper urged the importance of more thorough instruction, not only in graphic studies, but also in general analysis by graphics. It was claimed that geometry often yields almost wholly to algebra as an instrument of investigation and that this results in a lack of clearness. The discussion on this paper developed the general opinion that technical students are usually very weak in arithmetical computations, and that graphic methods should not be used for cases where a slide rule gives sufficient precision.

'The Elective System Applied to Courses in Mining,' by Dr. M. E. Wadsworth, gave an outline of the method adopted at the Michigan Mining School. The discussion on this paper by several members indicated that elective courses in engineering were not in general regarded with favor, as the proper sequence of studies can not be thus well maintained. The experience of the Massachusetts Institute of Technology was cited as tending to a restriction of the elective system.

'Specifications for Text-books,' by Professor Ira O. Baker, treated of the principles which should be kept in view in preparing a text-book. Typographical arrangement, subdivisions, nomenclature and notation were discussed in a suggestive manner. The practice of publishers in bringing out volumes with wide margins was somewhat severely criticised in the discusion which followed, as also was the practice of inserting appendices filled with matter clipped from periodicals.

'The Place of Drawing and Shop Work in Engineering Schools,' by Professor C. H. Benjamin. This paper advocated a prominent place for free-hand drawing, it being regarded as equally important with mechanical drawing. Shop work should be taught to illustrate principles as well as for the advantages of manual training. Students should be required to pay for work that they spoil. The educational value of both drawing and shop work was regarded as high. In the discussions of this paper the methods of the workshops of the Worcester Polytechnic Institute were described by the Superintendent.

PAPERS ON SEPTEMBER 3.

'Theses and Degrees,' by Professor Storm Bull, was a plea for the propriety of giving the bachelor's degree at the completion of a course of technical study. The professional degree of civil or mechanical engineer properly demands a thesis of a different character from that prepared for the bachelor's degree, and should be given only after two or three years of practice. If a third degree is advisable after advanced study it should be Doctor of Engineering

rather than Doctor of Philosophy. The discussion which followed showed a general agreement with these views; it also brought out opinions that theses are of great educational value and that they should be prepared by students with little or no assistance from instructors.

'Modified Requirements for Students who have taken full Liberal Courses,' by Professor Ira N. Hollis. This paper claimed that, with a proper arrangement, a classical graduate could complete an engineering course in one or two years. The greatest difficulty in doing this seems to lie in the fact that the teaching of mathematics in liberal courses is conducted without reference to practical applications.

'Graduate Study in Engineering Courses,' by Professor William H. Burr, asserted that the value of these graduate courses is small compared with those in literary institutions. Four years of study in college is sufficient for most men who intend to follow the practice of engineering.

'The Economic Element in Technical Education,' by Professor L. S. Randolph, advocated the discussion of the commerical side of engineering problems, and the undesirability of making computations to an unnecesssary degree of precision. A study of questions of cost is often of essential importance, engineering being in fact the art of economic construction.

'Unsymmetrical Development of the various courses in Engineering Colleges,' by Prof. F. R. Hutton, favored a strong executive control in order to prevent one department from growing at the expense of others.

'The Engineer of the Twentieth Century,' by Elmer L. Corthell, was a vigorous plea for more thorough education on a broad systematic plan. Technical education was claimed to possess special advantages in training the mind so as to render it capable of being of most service to society and humanity. The boys of to-day who are to be engineers of the twentieth century were advised to secure a broad, liberal education before beginning the special study of engineering.

The afternoon of September 3d was devoted to a visit of inspection to the dam under construction at Holyoke, and also in observing the testing of turbines at the works of the Holyoke Water Power Company.

PAPERS ON SEPTEMBER 4.

On the morning of this day five papers on courses in the physical sciences were presented. Professor C. L. Mees discussed Physics, dwelling upon the importance of precision of nomenclature and in the use of units of measurement, also claiming that dynamics should properly be a part of the course in physics. Professor G. C. Comstock treated of Astronomy, showing the value of the precise training in observation and computation to every engineer. Professor R. S. Woodward's paper on Mechanics dwelt on the fundamental definitions and concepts, particularly those of force, mass and acceleration. These papers led to many interesting discussions by T. C. Mendenhall, Wm. Kent, J. Galbraith and others.

A second class of papers treated of the professional studies in engineering courses, of the subjects and the time to be given to each. Professor C. L. Crandall gave a tabulation of these for the course in civil engineering. Mr. C. C. Brown, city engineer of Indianapolis, discussed a course in sanitary engineering, claiming such specialization to be highly advantageous. Professor Mansfield Merriman, in discussing geodetic engineering, expressed his opposition to a specialized four years' course in this subject, saying that the aim should be, not training in a trade, but education, that is, the development of the powers of the mind. The discussion on these papers brought out

many opinions in opposition to trade specialization in engineering colleges, and many others in favor of thoroughness and precision in all technical work.

'Mechanical Engineering,' by Prof. H. W. Spangler, presented statistics showing the lines of work followed by graduates of mechanical engineering courses; out of 587 graduates all but 9 had followed their chosen profession. The relative importance of laboratory and shop work was treated at length.

'Mining Engineering Laboratories,' by Professor H. O. Hofmann, fully detailed the equipment and methods of work in the laboratories of the Massachusetts Institute of Technology, where 325 hours of practical work are required of each student in mining.

'A Course of Instruction in Engineering Materials,' by Professor J. B. Johnson, gave a comprehensive outline of both the theoretic and practical divisions of mechanics of materials, the laboratory work recommended being about fifty hours in length. The proper kinds of testing machines for the use of students received an extended consideration in the discussion.

The five sessions of the meetings were not sufficient for the reading of all the papers presented; three were read by title, their authors being absent. The time for discussion also often proved too limited. Perhaps the most interesting discussion of the session was that between the engineers and the physicists regarding the units of force best adapted for use in the teaching of mechanics.

THE NEXT MEETING.

It was decided to hold the next annual meeting at Buffalo, beginning on August 20, 1896. The following officers were elected: President, Mansfield Merriman, of Lehigh University; Vice-Presidents, F. O. Marvin, of the University of Kansas, and Cady Staley, of the Case School of Applied Science; Secretary, C. Frank Allen, of the Massachusetts Institute of Technology; Treasurer, J. J. Flather, of Purdue University.

The number of new members elected at this meeting was 33, thus bringing the total membership to 189, representing about 75 technical colleges. The number of members and guests present at the Springfield meeting was nearly 100. There is now little doubt but that the Society will have a great and lasting influence in shaping the development of engineering education.

THE SECOND SUMMER MEETING OF THE AMERICAN MATHEMATICAL SOCIETY.

The Second Summer Meeting of the American Mathematical Society was held in the High School building at Springfield, Mass., on August 27th and 28th. Among those present were: Prof. A. L. Baker, Dr. J. H. Boyd, Prof. C. H. Chandler, Prof. L. L. Conant, Prof. C. L. Doolittle, Prof. W. P. Durfee, Prof. E. Frisby, Dr. G. D. Gable, Dr. J. W. L. Glaisher, Prof. A. Hall, Jr., Prof. Ellen Hayes, Dr. G. W. Hill, Prof. W. Woolsey Johnson, Mr. P. A. Lambert, Prof. J. McMahon, Prof. M. Merriman, Prof F. Morley, Prof. H. B. Newson, Prof. W. F. Osgood, Prof. M. I. Pupin, Mr. R. A. Roberts, Mr. C. H. Rockwell, Prof. J. B. Shaw, Prof. W. E. Story, Prof. H. Taber, Prof. J. M. Van Vleck, Prof. E. B. Van Vleck, Prof. C. A. Waldo, Prof. H. S. White, Prof. J. M. Willard, Prof. C. B. Williams, Prof. F. S. Woods and Prof. R. S. Woodward.

The President, Dr. G. W. Hill, occupied the chair. Two sessions were held each day, meeting respectively at 10 A. M. and 2:30 P. M. The following papers were read:

1. *The periodic solution as a first approximation in the lunar theory:* Dr. G. W. Hill.
2. *The linear vector operator of quaternions:* Prof. J. B. Shaw.
3. *A new application of quaternions to geometry:* Prof. J. B. Shaw.