Congresses accordingly afford a valuable opportunity for railway, hydraulic, and sanitary engineers of expressing their views, and enlarging their experience by consultation and discussion with engineers of various countries. My experience of the six maritime, inland navigation, and water-works international congresses I have attended in England and abroad, has convinced me of the very great value of such meetings in collecting information, comparing views, and obtaining some knowledge of foreign works and methods; whilst the acquaintances formed with some of the most celebrated foreign engineers, afford opportunities of gaining further information about works abroad, and deriving experience from their progress and results.

Engineering Literature.—Lawyers have been defined as persons who do not possess a knowledge of law, but who know where to find the law which they may require. It may be hoped that a similar definition is not applicable to engineers; but with the rapid increase of engineering literature, it is most desirable that engineers should be able readily to refer to the information on any special subject, or descriptions of any executed works, which may have been published. Much valuable matter, however, is buried in the proceedings of engineering and scientific societies, and in various publications; and often a considerable amount of time is expended in fruitless search. This great waste of time and energy, and the loss of available information involved, led me a few years ago to suggest that a catalogue of engineering literature ought to be made, arranging the lists of publications relating to the several branches under separate headings. There is a possibility that this arduous and costly task may be partially accomplished in separate volumes; and, at any rate, the first step has been effected by the publication, under the auspices of the Paris Inland Navigation Congress of 1892, of a catalogue of the publications on inland navigation. A start has also been made in France, Italy, and England, towards the preparation of a similar catalogue on maritime works, which it may be hoped means one day will be found to publish on the meeting of some future congress. Engineers who have searched, even in the best libraries, for the published information on any special subject, will appreciate what a great boon an engineering subject catalogue would be to the profession, and indirectly to the public at large.

The occasional publication of comprehensive books on special branches of engineering, and concise papers on special subjects, by competent authorities, are extremely valuable in advancing and systematising engineering knowledge; but the time and trouble involved in the preparation of such publications must, like the organising of congresses, be regarded as a duty performed in the interests of the profession and science, and not as affording a prospect of any pecuniary benefit.

Concluding Remarks.—In this address I have endeavoured, though very imperfectly, to indicate how engineering consists in the application of natural laws and the researches of science for the benefit and advancement of mankind, and to point out that increased knowledge will be constantly needed to keep pace with, and to carry on, the progress that has been made. The great advantages provided by engineering works in facilitating communications and intercourse, and consequently the diffusion of knowledge, in increasing trade, in extending civilisation to remote regions, in multiplying the comforts of life, and affording enlarged possibilities of enjoyment and change of scene, may be regarded as amply acknowledged; but the more gradual and less obvious, though not less important, benefits effected by engineering works are not so fully realised.

A comparison of engineering with the other chief branch of applied science, medicine, exhibits some similarities and differences. In both professions, the discoveries of science are utilised on behalf of mankind; but whilst physicians devote themselves mainly to individuals, engineers are concerned in promoting the well-being of the community at large. Persons reluctantly consult doctors when they are attacked by disease, or incapacitated by an accident; but they eagerly resort for enjoyment to railways, steamships, mountain tramways, piers, great wheels, and Eiffel towers; and they frequently avail themselves of the means of cheap and easy locomotion to complete their restoration to health by change of air and climate. Physicians try to cure people when they are ill: whereas engineers endeavour, by good water-supply and efficient drainage, to maintain them in health; and in this respect, the evident results of medical skill are far more readily realised than the invisible, though more widespread, preventive benefits of engineering works. Statistics alone can reveal the silent operations of sanitary work; and probably no better evidence could be given of the inestimable value of good water and proper drainage on the health of the population of large towns, when aided by the progress of medical science, than the case of London, where, towards the close of the last century, the death-rate exceeded the birth-rate, and the numbers were only kept up by constant immigrations; whereas now, in spite of the vast increase of the population and the progressive absorption of the adjacent country into the ever-widening circle of houses, the number of births exceed the deaths by nearly nine hundred a week.

In engineering, as in pure science, it is impossible to stand still; and engineers require to be ever learning, ever seeking, to appreciate more fully the laws of nature and the revelations of science, ever endeavouring to perfect their methods by the light of fresh discoveries, and ever striving to make past experience and a wider knowledge stepping-stones to greater achievements. Engineers have a noble vocation, and should aim at attaining a lofty ideal; and, in the spirit of the celebrated scientific discoverers of the past, such as Galileo, Newton, Laplace, Cavendish, Lyell, and Faraday, should regard their profession, not so much as an opportunity of gaining a pecuniary reward, as a means of advancing knowledge, health, and prosperity.

The remarkable triumphs of engineering have been due to the patient and long-continued researches of successive generations of mathematicians, physicists, and other scientific investigators; and it is by the utilisation of these stores of knowledge and experience that engineers have acquired renown. A higher tribute of gratitude should perhaps be paid to the noble band of scientific investigators who, in pursuit of knowledge for its own sake, have rendered possible the achievements of engineering, than to those who have made use of their discoveries for the attainment of practical benefits; but they must both be regarded as co-workers in the promotion of the welfare of mankind. The advancement of science develops the intellectual faculties of nations, and enlarges their range; whilst the resulting progress in engineering increases their material comforts and prosperity. If men of science, by closer intercourse with engineers, could realise more fully the practical capabilities of their researches, and engineers, by a more complete scientific training, could gain a clearer insight into the scientific aspect of their profession, both might be able to co-operate more thoroughly in developing the resources of nature, and in furthering the intellectual and material progress of the human race.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECOND SPRINGFIELD MEETING.

THE forty-fourth meeting of the American Association for the Advancement of Science was held at Springfield, Mass., August 29 to September 4, being the second meeting held at that city; the first was in 1859.

In the early history of the Association frequent meetings were held in New England, but fifteen years have passed since the last preceding New England meeting, held at Boston. The social and intellectual life of all New England cities ranks high, and the Association found a most appreciative and hospitable community.

A copy of the address of the retiring President, Dr. Daniel G. Brinton, on "The Aims of Anthropology," has already been sent to NATURE. It was a matter for regret that the author was unable to attend and read it personally.

The vice-presidential addresses were not quite so many as usual, owing to the resignation of Profs. Holden and Jordan as presidents of the Sections of Astronomy and Zoology, respectively, because of the change in place of meeting from California, where they reside, and where it was intended to meet if the trans-continental railroads had reduced fares sufficiently. The addresses delivered were by W. L. Stevens, on "Recent Progress in Optics"; William McMurtrie, on "The Relation of the Industries to the Advancement of Chemical Science"; William Kent, on "The Relation of Engineering to Optics"; J. Hotchkiss, on "The Geological Survey of Virginia, 1835-1841: its History and Influence in the Advancement of Geologic Science"; J. C. Arthur, on "The Development of Vegetable Physiology"; F. H. Cushing, on "The Arrow"; and B. E. Fernow, on "The Providential Function of Government n Relation to Natural Resources."

One of the first and most important matters of business presented was in reference to the proposed meeting of the British Association in Toronto in 1897. The writer offered a resolution cordially inviting the Association, in case they decide to accept the invitations already sent them from Toronto to hold the meeting there, to attend our meeting also as our guests, and requesting them to send early notice of the time of meeting to the Permanent Secretary of our Association, that ample time may be had to make suitable arrangements, and to renew the delightful memories of the Philadelphia meeting in 1884. This was referred to the Permanent Secretary with power.

Should the Association come to America as proposed, it seems probable that the long-deferred San Francisco meeting will then be held, as it is believed that many visitors will desire to cross the continent by the Canadian Pacific Railroad, which was incomplete at the time of the Montreal meeting in 1884; but many who attended that meeting went as far west as the road would then take them. As Sir Wm. C. Van Horne, President of that road, is a member of the British Association, and has been a member of ours, his influence is relied on to secure favourable rates of transportation. Still another factor is that the Christian Endeavour Societies expect to meet at San Francisco in 1897, and as they are a mighty army—70,000 attended the Boston meeting this summer—the railroads usually offer exceptional rates to secure their patronage, and the Associations can share in the benefit of the reduction.

Of the 207 papers read before the several Sections, many might be mentioned. The subject of colour and colour standards, on which Mr. Pillsbury had an article in a recent number of NATURE, was presented by him and others, and resolutions were passed looking toward the establishment of a colour standard. E. R. von Nardroff exhibited and described a new apparatus for studying colour phenomena. Colour photography was discussed and photographs exhibited by F. E. Ives.

A process for photographing the vocal cords in action has been discovered by F. S. Muckey and Wm. Hallock, and it is found that the pitch of a note is raised by rotating the arytenoid cartilages without increasing the tension of the cords, just as a violinist makes high notes by shortening the string with his finger. Voice analysis also has been studied by Messrs. Hallock and Muckey, by an ingenious system of resonators for the fundamental and seven overtones, covering three octaves from the fundamental C. These resonators are so arranged that the vibration of each causes the flickering of a tiny gas jet, and by observing these it can be seen which of the overtones are sounding, and by drawing straight or wavy lines to correspond with each of these, a picture of the tone can be made. This will enable a singer to see every tone in his voice, and learn wherein he needs to correct it.

The Weather Bureau of the United States supplied experts to fill up an afternoon in a joint meeting of four Sections. Willis L. Moore, the new chief of the bureau, spoke of the work in hand and that contemplated. An elaborate scheme of observation of upper strata of the air by kites and balloons and kite-balloons is to be carried out; and regular observations are to be made of "sensible temperature" by the wet bulb thermometer.

Frank N. Bigelow, in his paper on solar magnetic radiation and weather forecasts, made some very remarkable statements. The sun, he says, throws out curved lines of magnetic force. These are connected with sun-spots, and with storms on the earth. They have been studied by him so carefully that he fixes the time of the sun's axial revolution more accurately than ever before at 26·67928 days, with a probable error only in the last or possibly the two last figures. A surprising inference from his studies is that the earth has a crust 800 miles thick, and the sun has also a crust. Future investigation will supply data for a long forecast of seasonal weather conditions, years ahead. Cleveland Abbe followed with a paper on clouds and their nomenclature, and Alfred J. Henry with some very beautiful cloud photographs.

Electro-metallurgy has made rapid strides, and a paper on calcium carbide, by P. de Chalmot and J. T. Morehead, gave an account of the process used at their works in Spray, N.C., for cheap production of this compound by smelting together lime and coke in the electric furnace. This enables them to produce acetylene, the illuminating principle of gas, much cheaper than any other process.

A paper on the new process of making white-lead by electric action was read by R. P. Williams before the American Chemical Society, which met at Springfield two days earlier than the Association. Mr. Williams describes the process, which will work a revolution in this industry. Instead of acetate of lead, as in the old process, sodium nitrate is used together with sodium bicarbonate. A number of cells are filled with the solution, with plates of lead at one pole and of copper at the other. The current from a dynamo causes nitric acid to be liberated and tc combine with the lead. A number of reactions occur, with the final production of white-lead in a very fine and uniform state and of superior colouring quality. The chemicals can be re-used indefinitely. As many as 500 pounds have already been made at one charge.

The Economic Section has always been one of great popular interest. The monetary question, monometallism or bimetallism, by J. W. Sylvester and Henry Farquhar; taxation in the United States, by Edward Atkinson; growth of great cities, by E. L. Corthell; manual training in horticulture, by W. R. Lazenby, were among the matters treated of. An effort was made to widen the scope of this Section by a change of name. Its name —Section of Economic Science and Statistics—was deemed peculiarly undesirable, and after much discussion of the respective merits of "sociology" and "social and economic science," the latter title was adopted as the name of Section I.

Buffalo was unanimously chosen as the next place of meeting, following the practice of the Association to meet at that city every tenth year, beginning with 1866, when 79 members there reorganised the Association after six years of suspended animation, during which no meeting had been held.

The time for meeting was much controverted. The Council recommended a change to Monday as the opening day, which met decided opposition, and on an informal vote 30 were opposed to it and only 27 favoured it; but opposition at length gave way, and the next meeting will begin on Monday, August 24, 1896, at Buffalo.

Officers elected were—President: Edward D. Cope, of Philadelphia. Vice-Presidents: A, Mathematics and Astronomy, William E. Story of Worcester; B, Physics, Carl Leo Mees of Terre Haute, Ind.; C, Chemistry, W. A. Noyes of Terre Haute, Ind.; D, Mechanical Science and Engineering, Frank O. Marvin of Lawrence, Kan.; E, Geology and Geography, B. K. Emerson of Amherst; F, Zoology, Theodore N. Gill of Washington; G, Botany, N. L. Britton of New York city; H, Anthropology, Alice C. Fletcher of Washington; I, Social Science, William R. Lazenby of Columbus, O. Permanent Secretary: F. W. Putnam of Cambridge. General Secretary: Charles R. Barnes of Madison, Wis. Secretary of the Council: Asaph Hall, Junr., of Ann Arbor, Mich. Secretaries of the Sections: A, Mathematics and Astronomy, Edwin B. Frost of Hanover, N.H.; B, Physics, Frank P. Whitman of Cleveland, O.; C, Chemistry, Frank P. Venable of Chapel Hill, N.C.; D, Mechanical Science and Engineering, John Galbraith of Toronto, Can.; E, Geology and Geography, A. C. Gill of Ithaca, N.Y.; F, Zoology, D. S. Kellicott of Columbus, O.; G, Botany, George F. Atkinson of Ithaca, N.Y.; H, Anthropology, John G. Bourke, United States Army; I, Social Science, R. T. Colburn of Elizabeth, N.J. Treasurer, R. S. Woodward of New York.

WM. H. HALE.

LETTERS TO THE EDITOR.

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August Meteors.—Red Spot on Jupiter.

As supplementary to my paper on the August meteors (NATURE, No. 1347, August 22) and to Prof. A. S. Herschel's interesting letter on the same subject (No. 1349, September 5), I may note that a further comparison of the recent observations has revealed two additional instances of doubly observed meteors.

On August 11, 10h. 59m., Prof. Herschel at Slough recorded a meteor equal in brightness to a first magnitude star and moving swiftly along a path of $22\frac{1}{2}°$ from 264° + 52° to 252° + 31°, or from the head of Draco into Hercules. The meteor left a long, thin, white streak for 2 secs., and the duration of flight was estimated as 1 sec. Mr. H. Corder, at Bridgwater, observed the same object, noting the time as 10h. 58m., and the apparent path as 23° + $53\frac{1}{2}°$ to 14° + 50° between Cassiopeia and Andromeda.