It is striking evidence of the great velocity attained in tornadoes that straws and bits of hay are often driven like darts into pine boards, and even into the dense bark of hickory-trees. Professor Mees found, that, to obtain similar results by shooting straws from an air-gun, velocities of from one hundred and fifty to one hundred and seventy-five miles per hour were necessary.

Professor Mendenhall read a paper giving an account of the changes in the electrical condition of the atmosphere that are observed during thunder-storms, and referred to the excellent work done by the New England Meteorological Society in the study of these most interesting phenomena.

Prof. E. S. Nichols gave an account of a battery-cell on which he and Mr. W. S. Franklin had been experimenting, in which both electrodes were iron; but one was in a magnetic field, and the other not. The magnetized electrode was found to be sometimes electro-positive to the other, and sometimes electro-negative, depending on whether its magnetic poles were exposed to the liquid, or whether the neutral part alone was so exposed. A difference was also found between those liquids tending to produce ferric salts and those forming ferrous compounds.

Professor Barker presented two papers on behalf of Mr. Edison, in one of which a magnetic balance similar in principle to Wheatstone's bridge was described, by which the relative magnetic permeabilities of different samples of iron can be rapidly tested. In the other paper, Mr. Edison described an ingenious form of apparatus, which he calls a 'pyro-electric dynamo,' in which an electric current is obtained directly from heat-energy through the induction produced by alternately heating and cooling an iron core placed in a strong magnetic field and surrounded by an insulated coil.

Mr. C. E. Monroe presented to the section the results of some curious experiments in which blocks of gun-cotton, after having been stamped with certain letters, were exploded on flat plates of wrought iron. The gun-cotton blocks were placed with the lettered side down, and it was found, that, when the letters were stamped in relief, they appeared in relief on the iron after the explosion, and, on the other hand, when the letters were depressed in the gun-cotton, they were also depressed on the iron plate.

The session this year has been of considerable interest, and the number of communications presented to the section unusually large.

Section C.

[*Report not received in time for this issue.*]

Section D.

NINETEEN papers or subjects were presented during the sessions of this section by twelve gentlemen, as follows: on Nicaraguan woods, and friction of engines, by R. H. Thurston; on the American system of water-purification, by Albert R. Leeds; a new method of finding an equivalent uniform load, producing bending moments approximately equal to the maximum moments under a moving train, the deflection of girders and trusses, and re-action polygons and their properties (a new general class of graphical polygons suitable for the comparison of the bending moments and shearing stresses in simple girders and single intersection trusses, due to a moving train of wheel weights), by H. T. Eddy; on an improved method for testing metals, by Charles E. Monroe; on the effect upon the strength of iron by subjecting it to a pull while hot, Rankine's solution of the problem of turbines, and downward draught device for a furnace, by DeVolson Wood; on a new high-speed steam-engine indicator, by J. Burkitt Webb; on errors of approximate calculations of the effect of the inertia of the moving parts of a steam-engine, by D. S. Jacobus; on the theoretical effect of errors of observation in calorimeter experiments for determining the latent heat of steam, and improved arrangement of Siemens's platinum electrical pyrometer, by J. E. Denton; on the uniformity of planimeter measurements, by T. C. Mendenhall and John Mack; on mechanical inspection of railway-tracks and results obtained, by P. H. Dudley; on the theories of the lateral pressure of sand against retaining walls, by Mansfield Merriman; on national armament, by J. R. Haskell.

A number of these papers were accompanied by illustrative models or drawings, and some by both models and drawings. In some cases only a partial treatment of the subject was given, a complete consideration being reserved for another paper. In this way new lines of thought were suggested. and the authors thus indicated their intention of occupying the fields of thought which they thus partially opened up.

The section united with Section B (Physics) for an hour on Friday to hear two papers by J. Burkitt Webb, — one on a new dynamometer, which was illustrated by a working model; and the other on the experimental determination of the re-action of a liquid jet.

On Monday afternoon Sections D and I combined to listen to four papers relating to different aspects of a plan for a Nicaragua ship-canal. The first of these was on the general subject of isthmian transit, by H. C. Taylor; the second, on the engineering features of the Nicaragua Canal, by K. E. Peavy; the third, climatic and sanitary notes on the Nicaragua Canal route, by John F. Bransford; and the fourth, historical and geographical notes concerning the Nicaragua Canal route, by J. W. Miller. The work of the section may be mainly classified under four heads: —

1. Papers recording actual practical work in new fields; as, for example, the paper on the mechanical inspection of railway-tracks, which was accompanied by rolls of diagrams taken upon different lines of railway, showing the condition of their tracks, and from which the interesting and valuable results set forth in the paper were obtained.

2. Papers illustrating new or improved special machines or devices for accomplishing difficult ends. The new high-speed steam-engine indicator, by Professor Webb, illustrates this class. A model and drawings of the instrument were shown, by means of which the theory and operation of the indicator were readily understood.

3. Papers based upon laboratory experiments, like Professor Denton's, on calorimeter experiments for determining the latent heat of steam, in which the results of experiments with two forms of calorimeter were recorded, and made the basis of valuable deductions in regard to the theory and operation of the calorimeters compared.

4. Discussions, suggestions, and criticisms relating to the application of laws and principles, and to methods of research and computation, of which Professor Eddy's paper, on re-action polygons and their properties, is an example.

The papers were generally fresh and stimulating, and clearly aimed to advance scientific thought and attainments, to secure the practical achievement of valuable work upon a scientific basis, and to perfect theories and harmonize them with actual facts and to secure their easy and correct applications in new fields of scientific work. The sessions of the section must have proved of value to all who followed the work done, and many regret that most of the papers must appear in abstract rather than in full in the Proceedings of the association.

Section E.

GEOGRAPHY is by title included with geology in Section E of the association; but geology takes all the attention, and, in the present vigorous condition of geological investigation, geography as a science is almost forgotten. Under geology itself, the work of the International Congress of Geologists and of its American committee received the greatest share of time, as the vice-presidential address of Mr. Gilbert considered the first, and the several reports read by Dr. Frazer introduced the second. There has been apprehension among some that more might be attempted by the congress in the way of authoritative dictation and majority rulings on matters of opinion than would be justifiable in our rapidly advancing science — or, indeed, in any science. The dangers of such a course were well pointed out by Mr. Gilbert: "The proper function of the congress is the establishment of common means of expressing the facts of geology. It should not meddle with the facts themselves. It may regulate the art of the geologist, but it must not regulate his science. Its proper field of work lies in the determination of questions of technology; it is a trespasser if it undertakes the determination of questions of science. It may decree terms, but it must not decree opinions. . . . For science it is not merely illogical, it is

suicidal, to establish facts in any other way than by observation. No vote of the most august scientific body can possibly establish a fact, and no vote can have any weight against a good observation." On these grounds, Mr. Gilbert said, "I am opposed to the classification by the congress of the sedimentary formations, and likewise to the classification of the volcanic rocks, and I also regard it as ill advised that the congress undertook the preparation of a map of Europe, for that — if more than a work of compilation — is a work of classification;" and "a classification, if it has any value whatever, is merely a generalized expression of the facts of observation, and is outside the domain of the voter."

The section was well prepared, after hearing this address, to listen on Friday to several abstracts of reports of semi-official character, by the various individual 'reporters' of the American committee, and submitted to it for approval at the recent meeting at Spring Lake. These were all read by Dr. Frazer, secretary of the committee, before discussion was opened, and their good judgment and conservatism excited general approval. The abstract presented by Dr. Frazer demands especial attention, both from the care in its preparation, and from its including at once a discussion of certain general principles, and of that most difficult of geological divisions, the Archæan; and it is to be hoped that these reports may be given to the association for publication, as expressing the matured opinions of many able workers on questions most frequently before American geologists. Among the paragraphs of Dr. Frazer's report, the following will doubtless be generally commended: "American geologists will acquiesce in the recommendations of the committee by sacrificing individual opinion to a reasonable degree, provided that these recommendations do not hamper the efforts of research by requiring more correlation of beds between the two continents than research can justify." "Until such time as the Archæan rocks can be correlated with each other in distant parts of the earth, it is best that geologists should distinguish them from each other petrographically, without attempting to ascribe more than local chronological value to such distinctions." On the other hand, the recommendation that all pre-Cambrian rocks should be called Archæan savors too much of pre-judgment, especially in view of the recent studies of Irving and Walcott. The possible metamorphism of eruptive rocks was properly emphasized; and, as they are thought to differ more as a result of such changes than by conditions characteristic of their eruption, their classification by composition as indicating age is not recommended.

The most animated discussion occurred over the recommendation that it should be "officially declared that neither the color-scheme for the proposed map of Europe, nor the classification of the eruptives of Professor Lossen, provisionally adopted by the map committee in order to bring out the map, are other than tentative schemes, subject to alteration when their application to the map shall have shown to what extent they are deficient." It was strongly objected by Major Powell that this implied the official adoption of the color-scheme alluded to, in case serious defects were not discovered in its test on the European map, and that it did not sufficiently dwell on the fact that the scheme of colors had been devised only by a committee of the congress, and not by the congress itself. A resolution approving the action of the committee, and hoping for its continuance, was adopted in the evening session; but it may be mentioned that it received only two or three affirmative votes, although the session was well attended at the time.

It is difficult to choose among the many papers read before the section, and we mention only the few that our space allows. Prof. H. S. Williams presented a model paper on the different types of Devonian in America; Mr. Hill gave the results of his recent studies in Texas; Professor Claypole described 'Lake Cuyahoga,' an extinct glacial lake in Ohio; Mr. Walcott contributed a paper on the so-called 'Taconic,' that promises, with his other studies, to bring about accord on this vexed problem; and Dr. G. H. Williams gave an excellent general account of petrographic methods and their application. These titles can only suggest others of like interest that are regrettably omitted from our report.

Section F.

THOSE who think that scientists are seriously divided on the question of evolution would have come to a different conclusion by attendance at the Biological Section during the meeting of the American Association, just closed. Reputable scientists no longer avoid the question as formerly, or mention it only in defence, but accept it as the basis for the discussion of questions of structure and classification. Dr. Farlow, vice-president of the section, following in harmony with the subject chosen by the president of the association, Professor Morse, chose for his subject 'Vegetable Parasites and Evolution.' Botanists have a smaller basis than zoölogists for the study of development, owing to the incompleteness of the paleontological record, especially with reference to the lower plants, to which most parasites belong. The study of different degrees of parasitism has, however, rendered it probable that parasites may have originated at a remote period from non-parasitic plants, first as saprophytes, then as true parasites. The parallelism which exists between algæ and fungi seems also to indicate that the different groups of fungi have arisen from corresponding groups of algæ at different periods in the process of evolution.

The paper of Professor Cope, on the mechanical origin of the suctorial teeth of the *Carnivora*, showed in a striking manner the value which mechanical force may in some cases have as a factor in development. His statement, also, that a given structure may or may not be the best which could be devised for performing its particular function, but that it must be such as could be developed from a pre-existing form, is one which, if earlier understood, would have saved much misdirected effort.

Among the other papers presented, that of Professor Cook on the antennæ-cleaners of *Hymenoptera*, the series of structural papers by Dr. Beal, that of Dr. Schrenk on *Brasenia peltata*, and the papers on morphology by Professor Baur, were excellent examples of the present methods of study. The paper of perhaps the most practical importance was that of Dr. Rusby, on the cultivated cinchonas of Bolivia.

In the treatment of the topics relating to classification, there was manifested a tendency to restrict the number of species and increase the number of varieties. In regard to terminology, there was exhibited on one or two occasions a decided opposition to the introduction of comparatively unimportant new terms.

The proportion of botanical to zoölogical papers presented before the section was less than last year, although the attendance of botanists was greater. There is still a general desire, on the part of the botanists, to confine the discussions and short papers chiefly to the botanical club, and the necessity is felt of providing more time for that purpose. Among the work of the club was the appointment of a committee, consisting of Drs. Vasey, Britton, Watson, Morong, and Halstead, to devise a system for the exchange of specimens.

One of the most enjoyable features of the meetings was the excursions provided by the citizens of New York and the local societies. These gave an opportunity for the members to become acquainted, and to compare personal notes. Of especial interest was the excursion of the botanical and entomological clubs to Sandy Hook, which included an informal 'field-meeting' on board the boat during the return. Much is due from botanists to the Torrey Botanical Club, which, besides the delightful entertainments provided, furnished sets of the local plants to those in attendance.

Section H.

THE meetings of this section are always interesting on account of the great variety of papers read. At the present meeting the discussions were more lively than they used to be, and this is due to the skilful vice-president, Dr. D. G. Brinton, who encouraged discussion in every way, and, by giving summaries of the doubtful points, elicited remarks from all interested in the subject.

Among the different classes of papers, archæological ones take a prominent place. This is somewhat remarkable, when we consider that in many parts of America we have still the very best opportunities of studying the natives themselves; but the antiquity and doubtful origin of relics have always proved a stronger incentive for scientific remarks than the living neighbor, to whose customs and strange appearance we become accustomed. The most important one among this class of papers was Professor Putnam's report on the purchase of the serpent-mound of Adams County, O., by a number of ladies,