FRIDAY, MARCH 2, 1883.

THE INTERNATIONAL CONFERENCE FOR THE DETERMINATION OF THE ELECTRICAL UNITS.

AT a meeting of the electrical congress, Oct. 5, 1881, it was recommended that the French government should invite the other powers to constitute an international commission to discuss the following points: —

1. To determine for practical science the conditions which a column of mercury should fulfil in order to represent the electrical unit of resistance.

2. To determine upon a definite standard of light.

3. To arrange a systematic and universal plan for studying atmospheric electricity, terrestrial magnetism, and the exchange of international observations.

In accordance with this recommendation the French government communicated with the other powers; and representatives appointed by the various governments assembled in Paris, Oct. 16, 1882, at the residence of the foreign minister. At the first meeting there were forty-seven representatives present, among whom were Helmholtz, W. Siemens, Wiedemann, Kohlrausch, Fröhlich, Lorenz, Dumas, Mascart, Tacchini, and Weber. The representatives from Great Britain and the United States had not been notified in time to attend the opening of the conference.

Upon organization, three committees were formed, — one upon electrical units, one upon earth-currents and lightning-rods, and another upon a standard of light. At first the time of the conference was largely devoted to discussions of the best methods of determining the unit of electrical resistance. Various suggestions were made in regard to the limits of accuracy, and to the necessity of repeating the observations already made at different places on the earth's surface, in order to eliminate the errors due to locality. M. Broch of Norway suggested that the calorimetric determinations of the ohm should be carefully made; this method being the most direct one, although it required a precise value of the mechanical equivalent of heat. Sir W. Thomson and Helmholtz pointed out that the heat method depended upon the measurement of current, and could only be considered as a method of control. MM. Lorenz and Roiti presented papers upon the determination of the ohm, and Wiedemann gave a bibliography of the subject. After hearing the careful and minute discussion of the subject, the following resolutions were adopted: —

1. The commission consider that the determinations made up to the present time are not sufficiently concordant to allow the value of the ohm to be fixed.

They believe that it is necessary to continue the researches upon this value. Although they do not advise observers to restrict themselves in the choice of methods, they consider the following methods particularly adapted for exact determinations: —

a. Induction of a current upon a closed circuit (Kirchoff).

b. Induction by the earth (W. Weber).

c. Decrement of moving magnets (W. Weber).

d. Apparatus of the British association.

e. Methods of M. Lorenz.

It is also desirable to determine the ohm by the quantity of heat evolved by a given current, using this method as a control method.

2. It is thought desirable that the French government should take the necessary steps to prepare certain standards of resistance, which can be placed at the disposal of scientific men, in order to compare their values.

The commission was, at first, of the opinion, that when the results of the different observers reach an approximation of $\frac{1}{1000}$ of the true value, the value of the practical unit of resistance should then be fixed. After much discussion, it was felt that no decision upon the limit of accuracy could be reached at present. Mascart then described the methods adopted for the study of atmospheric electricity. Sir W. Thomson showed that it was important to make observations upon the air in a definite enclosure, or, in other words, upon the air itself. Helmholtz in this connection remarked,

that one of his students had shown that the electrification of the air in the interior of a laboratory could be readily perceived. Thomson then gave a short description of the kind of room and the disposition of its walls which would be desirable in an observatory for such researches. The commission concluded to recommend to the various governments regular observations on atmospheric electricity.

An interesting discussion upon lightning-rods then followed. Helmholtz said, that statistics in regard to strokes of lightning and in regard to the effect of various kinds of lightning-rods were about to be collected in the province of Schleswig-Holstein, the position of this province between two seas being particularly advantageous. It already had appeared that the country is more exposed to strokes of lightning than the cities, and that in villages the public buildings were more frequently struck than the houses. He also remarked, that the academy of Berlin had recommended the employment on telephone-lines, where they enter houses, of a lightning-protector, consisting of two little spheres very near each other, one of which is connected to the line, and the other to the earth. M. Ludewig of Germany gave some statistics in regard to damage to telegraphic and telephonic apparatus in Germany during the period from April 1, 1881, to Aug. 20, 1881. During this time there had been 2,301 storms; and these had produced 2,165 cases of damage, more or less serious.

It was debated whether a set of questions in regard to the perturbing effect of storms upon telegraphic apparatus should be issued. After much discussion, a sub-committee was formed to formulate a set of questions. Among the members of this committee were Helmholtz and Mascart. The question of the observation of earth-currents was then taken up. It was regretted that the existing telegraph-lines running north and south, and east and west, could not be utilized for the observation of earth-currents. The pressure of business usually prevented this. M. Blavier pointed out, that the earth-currents are generally too feeble to be observed on telegraph-lines which are in operation. Moreover, the polarization of the earth-plates of the battery would cause trouble. Mascart, in reply, said that he had noticed that the maximum disturbance was reached slowly, through a period of several days, and died out also slowly. He therefore thought that existing telegraphic lines could be used, notwithstanding the objections of M. Blavier. He proposed that observations should be made upon lines reserved for the purpose, and also on existing telegraphic systems. A question arose upon the length that these lines should have. Helmholtz remarked, that one could make observations on lines from one to two kilometres in length. It would be necessary, however, to shun the effects of polarization of the electrodes. He thought that special plates surrounded by peroxide of manganese might be serviceable.

The commission in general were in accord on the necessity of organizing a systematic study of earth-currents upon telegraphic lines, or at least records of these currents on the days specified for observations by the international polar expeditions (the first and fifteenth of each month, from September, 1882, to September, 1883). In a general discussion which followed, upon lightning-conductors and electrical storms, Helmholtz expressed his doubt about the efficacy of extent of contact of lightning-conductors with the earth, and the varied nature of the plates employed. M. Van der Mensbrugghe (Belgium) spoke of the desirability of studying the nature of lightning discharges, especially that termed ball-lightning. Mascart replied, that he did not believe that cases of ball or globular lightning were well substantiated. It might happen that it was an illusion of the senses, and could therefore be relegated to physiology rather than to physics. The commission then discussed the question of studying the best conditions for the establishment of an international telemeteorographic system, which would permit various stations in different countries to communicate continuously with each other. They decided that it did not appear that the time had come for the establishment of such a system; but they ex-

pressed the opinion that such a system would be highly desirable.

Then followed a long discussion upon the standard of light. It was generally granted that a white light was desirable. Wiedemann remarked, that a fine gauze saturated with the spirit of turpentine, burning in oxygen, gave a very white light. Siemens proposed to employ a current of oxygen passing through a carburetted hydrogen, maintained at some fixed temperature. One could thus obtain a constant mixture which would burn with a white flame. Helmholtz thought that it would be extremely difficult to produce a mixture of air and carburetted hydrogen in constant proportion, and to regulate the temperature. Dumas thought that the late experiments of Violle upon the light emitted by melting platinum might solve the problem. The point of fusion of a body seemed to him to be as good a fixed point as could be wished. He invited the commission to view the experiments of Violle.

After witnessing the experiments of Violle, the members of the commission appeared to think more favorably of Dumas' suggestion. Professor Leblanc, who has had charge for many years of the photometric determinations of the lighting-gas of Paris, was invited to explain his methods; and the members of the commission, in turn, were invited to witness the methods in his laboratory. Professor Leblanc stated his preferences for the employment of a Carcel lamp for photometric determinations. He showed that the personal equation could be practically eliminated, and that differences of tint did not influence the results to the degree supposed. Sir W. Thomson spoke of the advantages of Rumford's photometer. The following resolutions upon this subject were finally adopted: —

a. The conference express their hope that the experiments now in process upon the light emitted by melting platinum will lead to a definite standard of light.

b. They recommend the employment of the Carcel lamp as a secondary standard, this lamp to be employed with the precautions adopted by MM. Dumas and Regnault.

Candles can also be employed as a secondary standard, if sufficient care be taken in regard to their construction and constitution.

c. They call attention also to the necessity of the analysis of the different conditions under which comparisons of light are made, and reiterate the opinions, expressed at the meeting of the electrical congress of 1881, in regard to the necessity of taking into account the amount of light radiated from sources of light in different directions.

At the close of the conference, Sir W. Thomson expressed the opinion that the labors of the conference would stimulate researches during the coming year; and he congratulated the conference upon its important work.

On the 26th of October, President Grévy received the members of the commission at the Palais d'Elysées; and, after a reception by Minister Cochéry, on the afternoon of the same day, the conference was adjourned to the first Monday of October, 1883.

ON THE PHYSICAL CONDITIONS UNDER WHICH COAL WAS FORMED.[1]

THE mode of formation of coal has been much discussed, and various theories have been promulgated in regard to it; but the peat-bog theory, as it is called, has been generally accepted. This is the view, that coal is the residual hydrocarbon of plants which have grown where their remains are found, and that it has been formed precisely as peat accumulates in marshes at the present day.

So great has been the harmony of opinion on this subject, that it would at first sight appear unnecessary to renew discussion on a question that had seemed to be definitely and permanently settled. The calm of geological opinion which has prevailed on the coal-question has, however, been recently disturbed by a very voluminous and painstaking discussion of the mode of formation of coal, by M. Grand'Eury, which occupies nearly 300 pages in the *Annales des mines* for the present year. In this discussion the theory is advocated, that the carbonaceous matter forming beds of coal has been derived from plants, but plants transported from their places of growth, and deposited at a greater or less distance in the bottom of water basins.

[1] Read before the National academy of sciences at its semi-annual meeting in New York, Nov. 14-17, 1882.