



Actinoelectrical investigations

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Theory of Differential Equations.—Part I. *Exact Equations and Pfaff's Problem.* By A. R. FORSYTH, *Sc.D., F.R.S.* (Cambridge: University Press, 1890. Pp. xiv + 340.)

THE work before us is the first instalment in fulfilment of a promise made by the author in his 'Treatise on Differential Equations' (1885), and is written after the same thorough fashion as the earlier volume. The author's aim is "to include every substantial contribution to the development of the particular subject herein dealt with; and the historical form, into which the treatment has been cast, has facilitated the indication of the continuous course of the development." He has drawn upon all available sources, duly acknowledging his indebtedness to the several previous explorers in this field, and has further contributed investigations of his own. A few illustrative examples have been made up or culled from the memoirs above referred to.

The first part consists of 13 chapters. The first two chapters discuss the single exact equation and a system of exact equations. Under the former head we have a full account of the methods of solution given by Euler, Bertrand, Collet, Natani, and Du Bois-Reymond; and under the latter head we have a generalization of the above method given by Euler, with an examination of Natani's method and of a theorem by Mayer in development of this method. Frobenius's conditions for uncanonical form are also discussed. The next 4 chapters are devoted to a historical summary of methods of treating Pfaff's problem, Pfaff's reduction as completed by Gauss and Jacobi, Grassmann's method, and Natani's method. Chapter vii. contains the application of previous results to partial differential equations of the first order. The next four chapters are occupied, in order, with Clebsch's method, tangential transformations, Lie's method, and Frobenius's method. Chapter xii. gives an abstract of Darboux's method. The closing chapter discusses Systems of Pfaffians, and is prefaced with a list of the memoirs which form the principal sources of our information on this subject. The whole treatise is a splendid piece of work, but, from the nature of the subject, is "caviare to the general." A full index makes consultation easy. We have detected only two trivial typographical errors (on pp. 92 and 99).

L. Intelligence and Miscellaneous Articles.

ACTINOELECTRICAL INVESTIGATIONS. BY A. STOLTETOW.

THE author sums up as follows the results of his researches, which have extended over almost two years, and some of which have already appeared.

1. When the rays of the voltaic arc fall on a plate charged with negative electricity it is discharged; this discharge is accompanied by a marked fall of potential or not according as the discharge occurs more or less rapidly.

2. The action of the rays is strictly unipolar ; positive electricity is not carried away.

3. The apparent charge of neutral bodies by the rays may probably be ascribed to the same cause.

4. By far the strongest action is possessed by rays of the highest refrangibility ($\lambda < 295 \times 10^{-6}$ millim.), which are wanting in the sun's spectrum.

5. It is necessary that the rays be absorbed by the surface of the body ; the discharge is accordingly greater, the greater the absorption.

6. All metals are sensitive to this action ; some colouring-matters (aniline colours) are the most sensitive. Water, which is transparent for the active rays, was found to be insensitive.

7. There is no appreciable interval of time between the moment of illumination and the corresponding discharge.

8. Other things being equal, the discharge is proportional to the energy of the active rays, and of the illuminated surface.

9. The action is perceptible even with very small densities ; its magnitude depends on the density, and at first increases more rapidly than the latter and afterwards more slowly.

10. Two plates between which a difference of potential due to voltaic contact exists, represent a kind of voltaic element as long as the electrically negative plate is illuminated by active rays.

11. We are entitled to consider this actinoelectrical discharge as an electrical current ; the air (either by itself or by the action of the particles mixed with it) plays the part of a bad conductor ; the apparent resistance does not follow Ohm's law.

12. The actinoelectric action is increased by the temperature.

The author states in conclusion that the phenomena described are only to be observed in gases. Experiments with solid and with liquid insulators always gave a negative result. It follows from this that actinoelectrical currents represent a kind of convection current. (Compare the results of Bichat, Righi, Blondlot, Lenard, and Wolff.) If it be assumed that at the boundary of metal and air there is a difference of potential due to contact, then from the discharge of the negatively electrical body, we may in some way explain the charge of the feebly positively charged or neutral body. Whether in this there is an electrolysis of gas (Arrhenius) or not must be left an open question.

Convection explains only the further progress of the phenomenon ; the first step of the electromotive excitation remains an enigma.

The hypothesis of E. Wiedemann appears to the author very rich in consequences ; but the inactivity of ordinary luminous rays (that is, visible), as well as the decidedly unipolar character of the action, is unintelligible. The analogy between the phenomena described and the well-known discharges in Geissler's and Crookes's tubes is striking.

As regards the observations of Borgmann (see below), the author
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observes that he has repeated the experiments with success; they may be explained by assuming that the telephone which is sensitive for a circuit is not so when the same quantity of electricity acts as a feebly intermittent current. By experiments with intermittent illumination and a rotating commutator it is proved that any possible retardation of the action could not amount to $\frac{1}{10000}$ of a second.—*Journal of the Russian Physicochemical Society*, vol. xxi. p. 159, 1889; *Beiblätter der Physik*, vol. xiv. p. 322.

ON ACTINOELECTRIC PHENOMENA. BY J. BORGMANN.

The net condenser of Stoltetow is illuminated by a rotating disk with sectors cut out; the galvanometer is replaced by the telephone. On closing the circuit a distinct shock is heard in the telephone, but this is not the case with intermittent illumination. The author concludes from this that the actinoelectrical discharge is not instantaneous.—*Ibid.*

STATIONARY LUMINOUS VIBRATIONS. BY O. WIENER.

The author has published in Wiedemann's *Annalen*, vol. xl. p. 203, an important Memoir, in which by photographic methods he has demonstrated the existence of stationary luminous vibrations. The memoir is accompanied by phototypic illustrations of the results of his experiments. His conclusions are given by himself as follows:—

By the foregoing research the experimental proof has been furnished for the existence of stationary waves of light. A sensitive, perfectly transparent collodion lamina, the thickness of which was small in comparison with the wave-length of light ($\frac{1}{80}$ about) was placed between two glass plates at a small distance from a metal mirror and making a small angle with this. After protracted exposure to the spectral rays the lamina was developed, and bands were formed which it was proved could only be due to the action of stationary waves.

A more accurate investigation of stationary waves showed that with perpendicular reflexion at the optically denser medium, the nodal points of the chemical luminous action are at distances equal to the multiple of half a wave-length from the reflecting surface; the ventral segments are between these, that is at distances equal to the odd multiples of a quarter wave-length.

Experiments in which two rectilinearly polarized waves of light were used, which crossed each other at right angles, showed that a chemical action on the sensitive plate due to an inference of the two rays occurred when their planes of polarization coincided, but failed when they were at right angles to each other. It was to be concluded from this, that the chemically active vibrations of a rectilinearly polarized wave of light are at right angles to their plane of polarization.