SCIENTIFIC SERIALS

Poggendorff's Annalen der Physik und Chemie, 1875, No. 1. This number contains the following papers:—On the electric conducting power of solutions of the chlorides of alkalies and alkaline earths, and of nitric acid, by F. Kohlrausch and O. Grotrian.—On the gliding of electric sparks, by K. Antolik. The author published his first paper on this subject at the beginning of last year, and has since then been gaining much new experience on the subject; he had observed long ago that if the two discharge balls of a Holz electric machine are at a certain small distance from each other, the path of the spark is not in a zig-zag line, but straight, and that the spark is often strongly bent or broken in a certain point, which lies nearer the negative pole. Mr. Antolik's idea was that negative electricity leaves bodies somewhat slower than positive electricity, and that the bending point in the spark was the place where the two electricities united. He successfully tried to obtain an image of the spark by letting it pass over a blackened glass bulb; thus he found that the spark glides in three and often five parallel lines. The paper is very elaborate and highly interesting, the author having varied his experiments in all possible ways.—On a universal meteorograph for solitary observatories, by E. H. von. Baumhauer. The Dutch Scientific Society of Haarlem offered its gold medal and a purse of 300 florins in January 1872, for a sufficient means to determine temperature, density, and degree of moisture of the atmosphere at a considerable elevation above the surface of the earth, and in a manner which makes self-registration and constant repetition of observations possible. Herr Baumhauer's paper enters into the details of this problem and describes certain instruments which the author devised, and which go far to solve the question at stake, although certain modifications of the Society's demand became necessary, there being a great difference when the term "at a considerable elevation" is applied to a spot which is comparatively easy of access at any time, or when, for instance, it denotes a captive balloon. The author, however, describes instruments which would answer very well in both cases.—Continuation of researches on rod magnetism, by A. L. Holz (see vol. 151, p. 69 of these *Annals*).—On the measuring of angles by means of the eyepiece micrometer in astronomical telescopes, by Dr. Matern.—On the proportion of specific heats under constant pressures and in constant volumes, by J. J. Müller.—On some observations of the spectra of gases, by Eugen Goldstein. The author has made a series of experiments which tend to show that Wüllner's idea as to the independence of the gas spectra from differences in the temperature is an erroneous one. They principally consist in interpoisng a layer of air into the induction current, which lights up the spectral tubes filled with the rarefied gases, sometimes with a simultaneous insertion of a Leyden jar, and thus forcing the current to produce a spark. Mr. Goldstein then shows that in the whole circle of the current the discharge takes place in the same rhythm, therefore that the current passes the tube filled with the rarefied gas just as momentarily as any other part of the circle; from this he concludes that also in the tube the discharge takes place in form of a spark, that therefore the gas ought to show a line spectrum. Now, as this is not the case, and the gas on the contrary shows a band spectrum, the author thinks this a contradiction of Wüllner's explanation.—The next paper in the number is by Herr Wüllner himself, and explains the subject very satisfactorily, as he proves that not one of Herr Goldstein's experiments is contradictory to his theory of the different spectra of gases; the form of the electric discharge in the tubes containing the gases is the main point in question, and Herr Wüllner proves this to be in the so-called *dilated* form, and not as a spark.—Finally, the number contains a preliminary report by Dr. V. Dvorak, on the velocity of sound travelling in water.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 8.—"Experiments to ascertain the Cause of Stratification in Electrical Discharges *in vacuo*." By Warren De la Rue, Hugo W. Müller, and William Spottiswoode.

Some results obtained in working with a chloride-of-silver battery of 1,080 cells in connection with vacuum-tubes, appear to be of sufficient interest to induce us to communicate them to the Society in anticipation of the more detailed account of an investigation which is now being prosecuted, and which it is intended to continue shortly with a battery of 5,000 cells, and possibly with a far greater number.

The battery used up till now consists of 1,080 cells, each being formed of a glass tube 6 inches (15·23 centims.) long and $\frac{3}{4}$ of an inch (1·9 centim.) internal diameter; these are closed with a vulcanised rubber stopper (cork), perforated excentrically to permit the insertion of a zinc rod, carefully amalgamated, $\frac{3}{16}$ (0·48 centim.) of an inch in diameter and 4·5 inches (11·43 centims.) long. The other element consists of a flattened silver wire passing by the side of the cork to the bottom of the tube, and covered, at the upper part above the chloride of silver and until it passes the stopper, with thin sheet of gutta-percha for insulation, and to protect it from the action of the sulphur in the vulcanised corks; these wires are $\frac{1}{16}$ of an inch (0·16 centim.) broad, and 8 inches (20·32 centims.) long. In the bottom of the tube is placed 225·25 grains (14·59 grms.) chloride of silver in powder; this constitutes the electrolyte; above the chloride of silver is poured a solution of common salt containing 25 grammes chloride of sodium to 1 litre (1,752 grains to 1 gallon) of water, to within about 1 inch (2·54 centims.) of the cork. The connection between adjoining cells is made by passing a short piece of indiarubber tube over the zinc rod of one cell, and drawing the silver wire of the next cell through it so as to press against the zinc. The closing of the cells by means of a cork prevents the evaporation of water, and not only avoids this serious inconvenience, but also contributes to the effectiveness of the insulation. The tubes are grouped in twenties in a sort of test-tube rack, having four short ebonite feet, and the whole placed in a cabinet 2 feet 7 inches (78·74 centims.) high, 2 feet 7 inches wide, and 2 feet 7 inches deep; the top being covered with ebonite to facilitate working with the apparatus, which is thus placed on it as an insulated table.

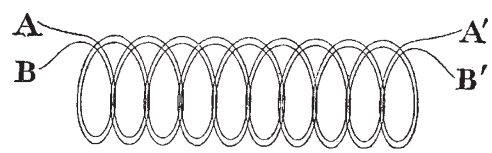

FIG. 1.

The electromotive force of the battery, as compared with a Daniell's (gravity) battery, was found to be as 1·03 to 1,* its internal resistance 70 ohms per cell; and it evolved 0·214 cub. centim. (0·0131 cub. inches) mixed gas per minute when passed through a mixture of 1 volume of sulphuric acid and 8 volumes of water in a voltameter having a resistance of 11 ohms. The striking-distance of 1,080 elements between copper wire terminals, one turned to a point, the other to a flat surface, in air, is $\frac{1}{263}$ inch (·096 millim.) to $\frac{1}{250}$ inch (0·1 millim.) The greatest distance through which the battery-current would pass continuously *in vacuo* was 12 inches (30·48 centims.) between the terminals in a carbonic acid residual vacuum. This battery has been working since the early part of November 1874, with practically a constant electromotive force.

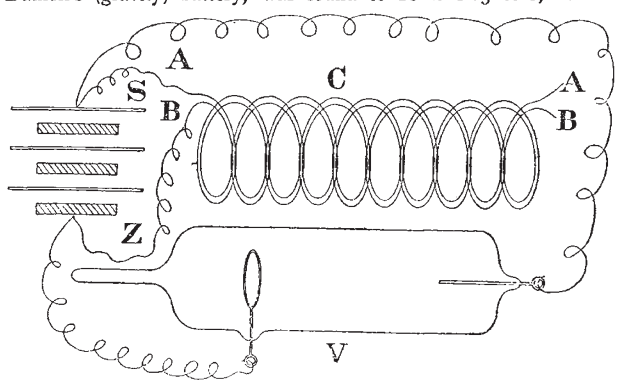

FIG. 2.

Besides 2,000 more cells like those just described, we are putting together 2,000 cells, with the chloride of silver in the

* Compared with a Daniell's battery, in which the zinc is immersed i dilute sulphuric acid in a porous cell, its electromotive force is about 3 pe cent. less than th Daniell.

form of rods, which are cast on the flattened silver wires, as in a battery described by De la Rue and Müller,* but in other respects similar to the battery above described; the glass tubes being, however, somewhat larger in diameter; the rods of chloride of silver are enclosed in tubes open at the top and bottom, and formed of vegetable parchment, the object of these vegetable parchment cases being to prevent contact between the zinc and chloride-of-silver rods. The internal resistance of batteries so constructed is only from 2 to 3 ohms per cell, according to the distance of the zinc and chloride-of-silver rods, and they evolve from 3 to 4·5 cub. centims. (0·18 to 0·27 cub. inch) per minute, in a voltameter having a resistance of 11 ohms. Their action is remarkably constant.

For the experiments detailed below, the vacuum-tubes were generally used of about 1½ to 2 inches (3·8 to 5 centims.) in diameter, and from 6 to 8 inches (15·24 to 20·32 centims.) long; also prolate spheroidal vessels 6 inches by 3 inches (15·24 by 7·62 centims.) The terminals are of various forms, and from 4 inches to 6 inches (10·16 to 15·24 centims.) apart, and made of aluminium and occasionally of magnesium and of palladium; the latter showing some curious phenomena with a hydrogen residual vacuum, which will be described in a future paper. A tube which has given the most striking results is 8 inches (20·32 centims.) long, and has a series of six aluminium rings varying in diameter from ⅜ of an inch to about 1¼ of an inch (0·95 to 3·17 centims.), the thickness of the wire being about $\frac{1}{10}$ (0·16 centim.) of an inch; the rings are a little more than 1 inch (2·54 centims.) apart; and connecting wires of platinum pass through the tube from each ring and permit of the length and other conditions of the discharge being varied.

At times the terminals of the battery were placed in connection with accumulators of different kinds—for instance, two spheres of 18 inches (45·72 centims.) in diameter, presenting each a superficies of 7·07 square feet (65·68 square decims.), and cylinders of paper covered with tinfoil, each having a surface of 16 square feet (148·64 square decims.); the globe and cylinders were in all cases carefully insulated. Other accumulators were composed of coils of two copper wires $\frac{1}{16}$ of an inch (0·16 centim.) in diameter, covered with gutta percha, in two folds, $\frac{1}{32}$ of an inch (0·08 centim.) thick. One coil contains two wires, A A′ and B B′, coiled side by side, each being 174 yards (159 metres) long, another with two wires each 350 yards (320 metres) long; of the latter we have two coils.

In addition to these accumulators we have several others formed of alternate plates of tinfoil and insulating material, such as paper saturated with paraffin, and also sheets of vulcanite. These are of various capacities and contain from 5 to several hundred square feet. The largest has a capacity of 47·5 microfarads; when it is discharged it gives a very bright short spark, accompanied by a loud snap; the charge deflagrates 8 inches (20·32 centims.) of platinum wire, ·005 inch (0·127 millim.) in diameter, when it is caused to pass through it. Each accumulator gives different results, but for the present we shall confine ourselves to a description of the experiments made with the coil accumulators.

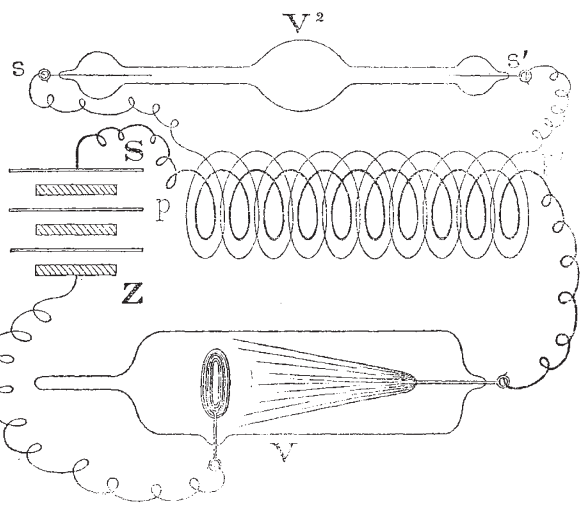

Fig. 3.

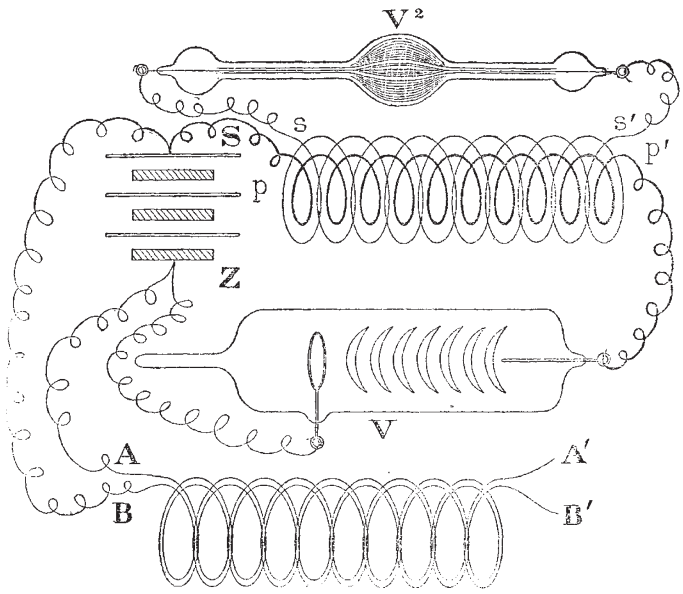

Fig. 4.

When the terminals of the battery are connected with the wires of a vacuum-tube which permits of the passage of the current, the wires (especially that connected with the zinc end) become surrounded with a soft nebulous light, in which several concentric layers of different degrees of brilliancy are seen In most cases there is either no indication of stratification or only a feeble ill-defined tendency to stratification; the tubes selected for these experiments were those in which the stratification did not appear at all.

When the battery, already in connection with the vacuum-tube, was also joined, as in Fig. 2, on to one or more coil-condensers (coupled to introduce a greater length of wire) in the following manner, then immediately well-defined stratifications appeared in the vacuum-tube.

S Z represents the battery, V the vacuum-tube, C the coil-condenser; one terminal is connected with the end A of the wire A A′, and the other terminal with the end B of the second wire B B′; connections are also led to the wires of the vacuum-tube. The ends A′ and B′ are left free; and it is clear that the coil forms a sort of Leyden jar when thus used; an interval, however short it may be, must elapse in accumulating a charge which at intervals discharges itself and causes a *greater flow* in the vacuum-tube in addition to that which passes continuously. It may be stated that the capacity of the accumulator has to be carefully adjusted to prevent any cessation of the current, to avoid, in fact, a snapping discharge at distant intervals. The periodic overflows, so to speak, which increase the current from time to time, would seem to have a tendency to cause an interference of the current waves, and to produce nodes of greater resistance in the medium, as evinced by the stratification which becomes apparent. To the eye no pulsation in the current is apparent; and in order to convince ourselves whether or not there was really any fluctuation in the current when the apparatus was thus coupled up with the battery, we made several experiments, and ultimately hit upon the following arrangement:—

The primary wire p p′ of a small induction-coil, both with and without the iron core, was introduced into the circuit as well as the vacuum-tube V; to the secondary wire, s s′, of the induction-coil was connected a second vacuum-tube, V². Under these circumstances there was no change in the appearance of

* Journal of the Chem. Soc., Second Series, vol. vi. p, 488; Comptes Rendus, 1868, p. 794.

the discharge in V, in consequence of the introduction of the induction-coil, the terminals being still surrounded by the soft nebulous light before spoken of; no luminosity appeared in the second vacuum-tube, V^2, in connection with the secondary wire of the induction-coil, except on making and breaking the connection with the battery. At other times there was evidently no fluctuation in the continuous discharge, no periodic increase or diminution of flow, and consequently no induced current in the secondary wire, s s', of the induction-coil.

In the second experiment wires were also led from the terminals of the battery (all other things remaining as before) to the coil accumulator, as in Fig. 4; then immediately the discharge in V became stratified, and the secondary vacuum-tube, V^2, lighted up; clearly showing that under these circumstances a fluctuation in the discharge really occurs on the appearance of stratification.

The brilliancy of the discharge in V^2 (the induced current passes through complicated vacuum-tubes through which the primary current cannot pass) depends greatly on the quality and quantity of the discharge in the primary vacuum-tube, V. Under some circumstances the secondary discharge is extremely feeble, and the illumination in V^2 barely visible; under others it is very brilliant.

Preparations are being made to render evident induced currents in the secondary wire of the coil too feeble to produce any illumination. Pending the further development of our investigation, we have ventured to give an account of our progress in elucidating some points in the theory of the vacuum discharge, without any wish to ascribe to our results more weight than they deserve.

Batteries of this description may be had from Messrs. Tisley and Spiller, Brompton Road. Their cost, in large numbers, is about one shilling per cell, exclusive of the charge of chloride of silver, which costs about two shillings per cell. The latter, either in the form of powder or of rods cast upon flattened silver wire, may be obtained from Messrs. Johnson and Matthey, Hatton Garden. When the battery is exhausted, the reduced silver may be readily reconverted into chloride with scarcely any loss.

Zoological Society, April 20.—Robert Hudson, F.R.S., vice-president, in the chair.—A letter was read from Lieut. R. J. Wardlaw-Ramsay, dated Tonghoo, British Burmah, 22nd November, 1874, containing additional remarks on the Woodpecker (*Gecinus erythropygius*) described by him at a former meeting (P.Z.S. 1874, p. 212, pl. xxxv.)—Mr. Edward R. Alston exhibited and made remarks on a rufous variety of the Murine Dormouse (*Graphiurus murinus*, Desm.) from West Africa.—Mr. W. B. Tegetmeier exhibited and made remarks on two hybrid pheasants, the result of a cross between *Phasianus colchicus* and *Euplocamus nycthemerus*.—Mr. A. H. Garrod read a paper on the structure of the deep plantar tendons in different birds, in which the different modes of arrangement of these tendons was pointed out, and their importance in the classification of the order insisted upon.—A communication was read from Mr. R. J. Lechmere-Guppy on the occurrence of *Helix coactiliata* in Trinidad, and on the general distribution of the land and freshwater mollusca of that island. A second communication from Mr. Guppy contained a note on a variety of *Bulimus constrictus* found in Venezuelan Guiana.—A communication was read from the Rev. O. P. Cambridge, in which he gave descriptions of nine new species of spiders of the genus *Erigone* additional to those described in a former communication on the same subject.—A communication was read from Mr. George Gulliver, containing a description of the spermatozoa of the Lamprey, *Petromyzon marœnus*.—Mr. R. B. Sharpe exhibited and made remarks on some specimens of some rare species of birds of prey lately received by the British Museum from Australia.

Entomological Society, April 5.—Sir Sidney Smith Saunders, C.M.G., president, in the chair.—Mr. Jenner Weir exhibited a number of young *Mantidæ* that had emerged from an egg-case received from Ceylon.—Mr. Bond exhibited a specimen of an exotic locust taken alive at the bottom of a well near Brighton. Mr. Sealy read some notes on the habits of the species of *Ornithoptera* from the Malabar coast, exhibited at the last meeting.—Mr. McLachlan read a letter from an Englishman residing in Pueblo, Colorado, U.S., stating that from his experience of the potato beetle the insect could live on the tubers as well as on the haulm, and that unless the English authorities took some steps to prevent the importation of potato bulbs, he believed the beetles would soon be in this country.—Mr. Edward Saunders communicated the first part of a Synopsis of British Hemiptera (Heteroptera).

PARIS

Academy of Sciences, April 19.—M. Frémy in the chair.—The Secretary read a telegram from M. Janssen, dated Singapore, 16th April: "Eclipse observed; weather not absolutely fine. The results, specially those concerning the atmosphere of the corona, confirm those of 1871."—M. Ch. Sainte-Claire Deville then replied to the remarks made by M. Faye, at the last meeting, on M. Hildebrandsson's paper.—On the waterspout of Les Hayes (Vendômois) of Oct. 3, 1871, and the ravages produced by the same, by M. Faye.—On a great dust-fall observed in a part of Sweden and Norway, in the night of March 29-30, 1875, by M. Daubrée.—On the observations made at the island of St. Paul by the Transit of Venus party, by M. Ch. Vélain.—A (second) note by M. J. M. Gaugain on a theory of the processes of magnetisation.—A note by M. Donato Tommasi, on a new source of magnetism.—A note by M. de Boisbaudran, on the unequal solubility of the different planes of the same crystal.—On Japanese bronzes, a note by M. E. J. Maumené.—A note by M. Pagnoul, on the influence exercised by alkaline salts upon the vegetation of beet-root and potatoes.—On the equivalence of alkalies in beet-root, a note by MM. P. Champion and H. Pellet.—On the discovery of two new types of Conifera in the Permian schists of Lodève (Herault), by M. G. de Saporta; the names proposed for the new Conifera are *Ginkgophyllum grasseti* and *Trichopitys heteromorpha*.—M. J. Francois then addressed a communication to the Academy on the hydrothermal and saline emanations from the thermal sources in the Caucasus.—A number of gentlemen then made some communications with regard to Phylloxera.—M. J. Lichtenstein addressed a note on the insect mentioned by M. Holzner (not Helznem, as was erroneously stated in the last *Compte rendu*), which lives on the roots of *Abies balsamea* and *Abies Fraseri*.—A note by M. Granjon on the means of increasing the sound of a bell by constructing the same of two concentric bells.—On the theory of storms; a reply to M. Faye, by M. H. Peslin.—A note on tartaric acid, which turns the polarisation plane to the right, by M. E. J. Maumené.—On the part played by Microzymata in the acid, alcoholic and acetic fermentation of eggs; reply to M. Gayon, by M. A. Béchamp.—On the therapeutic effect of oxygen, a note by M. Tamin-Despalle.—On a sepulchral retreat of the old Aleouts of Aknañh, on the Isle of Ounga, in the Shumagin Archipelago (Alaska), by M. Alph. L. Pinart.—On the ice conditions on the Danube in the winters of 1836 to 1875, by M. C. Champoiseau.—A note by M. Woillez, on the reproduction, in the lungs of a corpse, of the pulmonary sounds perceived during life by auscultation.

BOOKS AND PAMPHLETS RECEIVED

FOREIGN.—Jahresbericht der Commission zur wissenschaftlichen Untersuchung der Deutschen Miere in Kiel, 1872-73: Dr. H. A. Meyer, Dr. G. Karsten, Dr. V. Hensen, Dr. G. Kupffler (Berlin: Wiegandt, Hempel, und Parey).—Revue Bibliographique Universelle. 2nd series, 1st vol. (Paris, Bureaux du Polybiblion)—Discorso letto in occasione della festa Centenaria di Ambrogio Fusinieri, by Enrico dall Pozzo di Mombello (Foligno, P. Sgariglia).—Verhandlungen der Naturforschenden Gesellschaft zu Freiburg, I.B. (Carl Trœmer).

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