SOCIETIES AND ACADEMIES

LONDON

Royal Society, Nov. 25.—"On the Replacement of Electro-positive by Electro-negative Metals in a Voltaic Cell," by J. H. Gladstone, Ph.D., F.R.S., Fullerian Professor of Chemistry in the Royal Institution, and Mr. Alfred Tribe, Lecturer on Chemistry in Dulwich College.

It is well known that one metal exerts a greater chemical force than another, and is capable of displacing it from its combinations. Among those metals with which we are familiar, potassium is looked upon as the most powerful; and it is a certain fact that calcium, barium, strontium, aluminium, and magnesium have been isolated by its agency. It could scarcely be expected, therefore, that any other metal could directly replace potassium. If such should happen, we should have an instance of reversal, and should expect to find, on examination of the conditions, an agent capable of doing just the reverse work of what is usually assigned to affinity.

It is also well known that in a simple voltaic cell, such as zinc connected with platinum in dilute hydrochloric acid, the more powerful or electro-positive metal, zinc, displaces the hydrogen that is in combination with chlorine, and the hydrogen makes its appearance against the less powerful or electro-negative metal, platinum. The chemical theory of galvanism supposes that the force originates in the chemical action which takes place between the zinc and the acid; the contact theory supposes that it originates in some unexplained manner in the opposite electrical condition of the two metals induced by their contact. If the chemical theory be the true one, it is evident that a zinc-platinum cell can only become active when the binary liquid contains hydrogen or some metal which is less powerful than zinc. If, for instance, we were to employ a potassium-salt instead of a hydrogen compound, it is inconceivable, on the pure chemical theory, that there should be any action at all.

Such an action, however, does take place if we substitute the chloride of potassium for the hydrochloric acid; the zinc combines with the chlorine, and the potassium is set free in some form against the platinum, manifesting itself by the presence of free alkali and hydrogen gas. The same holds good with chloride of sodium, or ammonium, or barium, strontium, calcium, or magnesium.

This action is slow; but if magnesium be used instead of zinc, it takes place sufficiently rapidly to be easily observed, and we have therefore studied the action of platinum and magnesium in connection.

After an account of the experiments, the paper concludes as follows:—

If one metal in conjunction with another more electro-negative than itself will decompose the salt of a more positive metal, it may be expected, *à fortiori*, that it can decompose one of its own salts. Instances of this are not wanting.

Magnesium connected with platinum will decompose a magnesium salt, the almost insoluble hydrate of magnesium being found adhering to the negative metal. The deposition of zinc on the plates of an old-fashioned battery, when the battery is pretty well exhausted, is a well-known phenomenon. In our experiments with copper and silver in conjunction in a solution of nitrate of copper, we never succeeded in reducing the galvanic action to *nil* by our utmost efforts to exclude all oxygen, and the whole of the present inquiry originated in an experiment described by us before the Physical Society, that mercury and gold in conjunction would decompose mercuric chloride, with deposition not only of lower chloride, but also of metallic mercury upon the gold.

These experiments are inexplicable on the theory that the chemical action supplies the whole of the decomposing force, but show that there is an antagonistic force produced somewhere in the circuit which is greater in amount than the superior affinity of potassium over magnesium for the negative radicals.

Little doubt can be entertained but that this force is called into existence by contact; but our experiments do not teach us whether the energy requisite to keep up the action results from the disappearance of heat at the junction of the metals or contact of the metals and liquids (an idea that has long been in our minds), or at the expense of some other form of energy. Of course a momentary disappearance of heat would give only a momentary supply of voltaic energy; but since the loss of heat would be constantly made up by absorption from surrounding objects, the action would be continuous.

Linnean Society, Dec. 2.—Dr. G. J. Allman, F.R.S., president, in the chair.—Mr. J. G. Baker made some remarks on *Pyrus Briggsii*. The following papers were then read:—On Polynesian Ferns of the *Challenger* Expedition, by Mr. J. G. Baker. The new species amounted to ten or twelve, closely allied to species already known, and establishing no new genus.—Genera and Species of Liliaceæ, by Mr. J. G. Baker. The present instalment, completing the series, comprises the Tribes Anthericeæ and Eriosperineæ; the latter characterised by remarkably woolly seeds.—Botanical Notes from Darjeeling to Tongle, by Dr. C. B. Clarke.—On *Edgaria*, a new genus of Cucurbitaceæ, by Dr. C. B. Clarke.

Chemical Society, Dec. 2.—Prof. Abel, F.R.S., president, in the chair.—Dr. J. H. Gladstone read a paper, by himself and Mr. A. Tribe, on the decomposition of alcohol and its homologues by the joint action of aluminium and its halogen compounds. The action on alcohol gives rise to hydrogen and aluminic ethylate, a greenish white fusible solid.—The second communication, a note on incense resin, by Dr. J. Stenhouse and Mr. C. E. Groves, was read by the latter. The authors have succeeded in obtaining a crystalline substance and a liquid hydrocarbon from it.—Mr. J. Spiller gave a notice of the occurrence of native calcium chloride at Guy's Cliffe, Warwickshire; after which Mr. G. S. Johnson described certain sources of error in the ultimate analysis of organic substances containing nitrogen, upon which an interesting discussion took place.—The other papers were: On certain bismuth compounds, by Mr. M. M. P. Muir; and On bismuthiferous tesseral pyrites, by Dr. W. Ramsay.

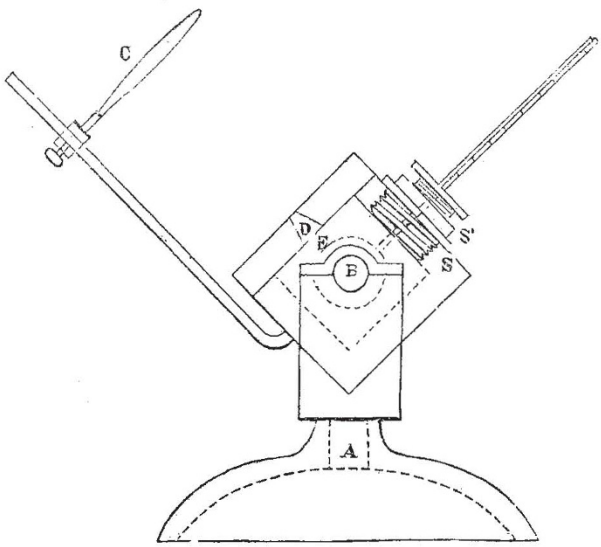
Royal Microscopical Society, Dec. 1.—Mr. H. C. Sorby, F.R.S., president, in the chair.—A number of presents were announced, including an injected specimen of the ova of *Amphiuma* presented by Mr. Beck.—A very useful addition to microscopes with concentric rotating stage was exhibited by Mr. Crouch, by which the instrument could be accurately adjusted to the centre of the stage when different objectives were employed.—Dr. Lawson exhibited and described a new apparatus termed the *Hematimetre*, designed by M. Hagen and constructed by Nachet, for the purpose of estimating the number of corpuscles in a given quantity of blood.—Mr. A. W. Bennett called attention to some minute organisms which he had discovered upon the leaves of Drosera and other carnivorous plants, and which he regarded as being intimately connected with the process of nutrition.—A very interesting paper was read by Prof. W. Rupert Jones, on Foraminifera with special reference to their variability of form. The subject was profusely illustrated by large diagrams, models, &c.

MANCHESTER

Literary and Philosophical Society, Nov. 2.—Mr. R. Angus Smith, F.R.S., vice-president, in the chair.—Mr. Peter Spence, F.C.S., &c., exhibited a piece of 2 to 3-inch lead pipe in which the metal had been entirely transformed into galena, the crystallisation being visible through the whole of the specimen. The pipe had been used for the conveyance of gas ammoniacal water, and was sunk under ground. A considerable leak of gas-water having occurred, a constant atmosphere of sulphide of ammonium would surround the pipe, and this seems to have been the cause of the conversion of the lead into sulphide, as only that part of the pipe which was in the vicinity of the leak was found to be transformed.—On the principle of the electro-magnet constructed by Mr. John Faulkner, by Prof. Osborne Reynolds. The magnet which forms the subject of this paper consists of a soft iron bar with a flat plate attached to one end, and surrounded by a coil of wire in the same way as the ordinary electro-magnet. Outside this coil is placed a tube of soft iron of the same length as that portion of the interior bar which projects beyond the plate; this tube has flat ends, one of which is in contact with the plate, while the other comes up flush with the end of the bar, so that a plate or keep placed over the end is in contact with both the bar and the cylinder. The magnet is excited in the ordinary way, by connecting the ends of the wire which forms the coil with the poles of a battery. When thus excited this magnet exhibits certain peculiarities as compared with a common magnet. The object of the paper was to suggest explanations of these phenomena.

Nov. 16.—Rev. William Gaskell, vice-president, in the chair.—On an instrument for measuring the direct heat of the Sun, by Prof. Balfour Stewart, F.R.S. The instrument generally em-

ployed for giving the radiant energy of the sun's rays acts upon the following principle:—In the first place the instrument is sheltered from the sun, but exposed to the clear sky, say for five minutes. Let the heat so lost be termed r. Secondly, the instrument is turned to the sun for five minutes. Let the heat so gained be termed R. Thirdly, the instrument being now hotter than it was in the first operation, is turned once more so as to be exposed to the clear sky for five minutes while it is shielded from the sun. Let the heat so lost be termed r'. It thus appears that r denotes the heat lost by convection and radiation united, when the instrument, before being heated by the sun, is exposed for five minutes to the clear sky, while r' denotes the heat lost by these same two operations by a similar exposure after the instrument has been heated by the sun; and it is assumed that the heat lost from these two causes during the time when the instrument is being heated by the sun will be a mean between r and r', and hence that the whole effect of the sun's rays will be in reality $R + \frac{r + r'}{2}$. Now although this assumption may in the average of a great number of experiments represent the truth, yet in many individual cases it may be far from being true. It would therefore seem to be desirable to get rid of this uncertainty by constructing an instrument in which we are sure that the causes of variability are not allowed to operate. These causes of variability I have attempted to get rid of in the following manner. With the help of Mr. Jordan, mechanician at Owens College, the following instrument has been constructed. It consists of a large mercurial thermometer with its bulb in the middle of a cubical cast-iron chamber, this chamber being of such massive material that its temperature will remain sensibly constant for some time. The chamber with its thermometer has



a motion in azimuth round a vertical axis A, and also a motion in altitude round a horizontal axis B. A 3-inch lens C of 12 inches focal length is attached by means of a rod to the cubical chamber, so as to move with it. The nature of this attachment will be seen in the figure. Thus the whole instrument may be easily moved into such a position that the lens, as well as the upper side of the chamber which is parallel to the plane of the lens, may face the sun, and an image of the sun be thrown through the hole D in the side of the chamber upon the thermometer bulb E. The stem of the thermometer protrudes from the chamber as in the figure. A screw S, somewhat larger in diameter than the bulb of the thermometer, is made use of to attach the thermometer to its enclosure, and a smaller screw S′, pressing home upon india-rubber washers, enables the thermometer to be properly adjusted and kept tight when in adjustment. In the present instrument the internal diameter of the chamber is two inches, while the bulb of the thermometer is about $1\frac{1}{4}$ inches in diameter. The scale of the thermometer is very open, more than an inch going to one degree. I have generally allowed the image of the sun given by the lens to heat the thermometer bulb for one minute, during which time an increase of temperature, not exceeding in any case two degrees, has been produced. As far as principle is concerned there appears to be no objection to the present instrument; nevertheless it is open to a very serious practical objection. The scale being so very open, the stem comprehends only a few degrees; frequently, therefore, the temperature is such that the extremity of the mercurial column is either below or above the stem. Now the thermometer has a small upper chamber, and by means of a method of manipulation well known to those who work with thermometers, it is possible to add to or take away from the main body of mercury in the bulb, so as to keep the end of the mercurial column always in the stem. But experience has convinced me that for a thermometer with such a large bulb, frequent manipulation of this kind is not unattended with danger to the bulb. On this account the instrument in its present form is, I conceive, unsuited for steady work in an observatory from year to year. It is however possible, without any appreciable sacrifice of the scientific principle of the instrument, to alter it in such a manner as to remedy this defect. Without altering the size of the bulb, I should propose for a permanent instrument a stem say eighteen inches long with a bore of such diameter that the stem should embrace a range of temperature between 20° Fahr. and 92° Fahr. Thus somewhat less than five degrees will go to the inch. The stem might be protected from the risk of accident by an appropriate shield. Let such a thermometer be heated for two minutes and the size of the lens be somewhat increased. In this case a rise of something like 5° Fahr. will be obtained, and this heating effect might very easily be estimated to one hundredth of the whole, while the same thermometer would serve for all the temperatures likely to occur in these islands during the course of the year. I ought to add that a pasteboard cover, gilded on the outside, is made to surround the chamber, and also that between the lens and the chamber there is a pasteboard shield with a hole in it to permit the full rays from the lens to pass—the object of this shield being to prevent rays from the sun or sky from reaching the instrument. In such an instrument r, or the change taking place in the thermometer before exposure to the sun, will in all probability completely disappear, while r' will be extremely small. At any rate we may be quite certain that $R + \frac{r + r'}{2}$ will accurately represent the heating effect of the sun.

We may probably suppose that in the same instrument the lens (which must always be kept clean) will always stop the same or nearly the same proportion of the solar rays. But the lens of one instrument may not stop the same proportion as that of another instrument. This, however, is no objection if it be borne in mind that the instrument is a differential one. In practice there would be some standard instrument which would be retained at a central observatory, and all other instruments would, before being issued, be compared with it. It would be thus possible to compare together the indications of various instruments working in different places, provided that these before being issued had their co-efficients determined at the central observatory.—On a colorimetric method for determining small quantities of copper, by Thomas Carnelley, F.C.S., Demonstrator in the Chemical Laboratory of Owens College. Communicated by Prof. H. E. Roscoe, F.R.S.

BERLIN

German Chemical Society, Nov. 22.—A. W. Hofmann, president, in the chair.—V. Gomp-Besanez has discovered diastatic ferments, transforming fibrine and albumin into peptones in malt and in linseed and hemp-seed, proving thereby a hypothesis of Hooker and Darwin respecting the power of plants for dissolving starch, &c. (expressed in Darwin's "Insectivorous Plants," p. 362).—F. Salomon, in a paper on the formation of anhydrides in chemical reactions, tries to explain why sulphocarbonate of ethyl treated with methylate of potassium yields sulphocarbonate of methyl, while *vice versâ* sulphocarbonate of methyl and ethylate of potassium yield sulphocarbonate of ethyl. He supposes that in these reactions CSO is set free and reacts on methylate or on ethylate of potassium.—H. Skraup described a product of the action of chlorine on ferricyanide of potassium, perhaps $FeCy_6K_2$.—L. Barth has obtained a ferrocyanide of tetramethylammonium (yellow crystals) by saturating ferrocyanic acid with tetramethylammonium-hydrate.—L. Barth and C. Senhofer, in preparing disulphobenzolic acid, have found this acid to be, when prepared at a moderate temperature, metadisulphobenzolic acid, at a higher temperature paradisulphobenzolic acid; the former yielding isophtalic, the latter terephthalic acid; both, however, by fusion with potash yielding resorcine.—C. Senhofer has prepared naphthalintetrasulphurous acid, $C_{10}H_4(SO_3H)_4$, by treating naphthalin with oil of vitriol and

phosphoric anhydride.—O. Hausamann, by distillation of β-naphtoate of calcium, has obtained a ketone identical with the one that β-naphthoyl-chloride and naphthalin yield by heating them with zinc.—C. Jaeger, by fusing nitrosophenol with potash, has obtained azophenol, $C_6H_4(OH)NNC_6H_4(OH)$, crystals of the constant melting-point 214°.—Robert Schiff has succeeded in producing nitroso-thymol, $C_{10}H_{12}(NO)OH$, by treating thymol with nitrite of potassium and sulphuric acid. Nitrosothymol yields nitrophenol when oxidised with ferricyanide of potassium. Nitrothymol has been transformed into amidothymol and diazothymol by the ordinary methods.—O. Rembold, by treating ellagic acid ($C_{14}H_8O_9$) with zinc powder at high temperatures, has obtained a new isomeride of anthracene, to which he gives the name ellagene (melting-point, 88°, boiling-point, 252°; its chinone insoluble in sulphite of ammonium, yielding itself no precipitate with picric acid). Ellagic acid boiled with potash yields a new acid ($C_{14}H_8O_6$), which, by sodium amalgam (?) and water, is transformed into the acid $C_{14}H_{10}O_7$.—F. Schardinger described nitro-derivatives of anthraflavone.—A. Vogel showed absorption-bands of manganic, uranic, and chromic salts; also absorption-bands of hydrate of cobalt, which, suspended in water, shows absorption-bands on D and between D and C. They appear also in the presence of nickel with great clearness. Sulphocyanate of iron shows an absorption-band between G and E.—A. Pinner, who from 1870 up to the present time has studied the derivatives of what he considered croton-chloral, has now come to the conclusion that the greater part of his researches have been erroneous, in as far as all the compounds described by him contain two atoms of hydrogen more than he has alleged. Thus what has been called crotonic chloral is really butyric chloral. Its derivative with hydrocyanic acid is not trichloroangelic, but trichorovalerianic acid. Its product of oxydation and subsequent reduction are not chlorocrotonic, but chlorobutyric acids. Potash does not produce a chloride $C_3H_2Cl_2$, but chloride of allylene ($C_3H_4Cl_2$), which by sodium is not transformed into "a new hydrocarbon, C_3H_2," of which he has lately taken the trouble of giving a structural formula, but into allylene, C_3H_4!—W. Weith has proved the sulpho-ureas produced by the action of aniline on ethylic isosulphocyanide, and of ethylamine on phenylic isosulphocyanide, to be identical. Oxide of lead transforms them into an imide, $C(NC_2H_5)(NC_6H_5)$; and the action of aniline and of HCl NC also produce identical derivatives.

Geneva

Society of Physics and Natural History, Nov. 4.—Prof. Calladon published in 1872 (tome xxi. of the Memoirs of the Society) a paper on the effects of lightning on trees, &c. A case of a pyramidal poplar struck by lightning on August 4 last, near Rolle, in the Canton de Vaud, enabled him to verify some of his previous conclusions, and to add some new observations. The flash which struck this tree, situated 11 metres from the shore of the Lake of Geneva, left perfectly intact the upper portion. At seven-eighths of its height commences the trace left by the lightning, in the form of a wound (*plaié*) three to four centimetres in width, and from seven to eight centimetres in depth. This wound descends as far as the ground, turning round the trunk in the form of a screw, and describing four-fifths of the complete circumference of the tree. Fragments of wood of various sizes were projected to distances as far as fifty metres. Some are pierced by jagged holes, indicating a violent eruption of the electric fluid from the interior to the exterior, the track of the fluid having probably been in the layer which separates the alburnum from the old wood or duramen. The places where the emission of the fluid occurred are sometimes indicated by spots of a red colour, similar to the effect which might be produced on wood by the application of a hot iron. They correspond to a slight depression of the surface of the wood. The wound of the tree is turned from the shore of the lake, lightning striking more readily plants which grow near watercourses, visible or underground.

Paris

Academy of Sciences, Nov. 29, M. Frémy in the chair.—The following papers were read:—Theorems in which there is a condition of equality of two segments taken on normals and tangents of curves of any order and class, by M. Chasles.—Reply to notes of M. Duchartre and M. Violette, *àpropos* of stripping off the leaves of beet, by M. Cl. Bernard.—Memoir on organic elements considered as electro-motors, by M. Becquerel.—Examination of a piece of wood petrified by subcarbonate of lime found at Bourbonne-les-Bains, in a Roman cesspool, by M. Chevreul. This is regarded as confirming the author's theory of petrefaction given in 1866.—Mineralisation of organic *débris*, vegetable and animal, in the thermal water of Bourbonne-les-Bains, by M. Daubrée.—Thermal researches on phosphoric acid, by MM. Berthelot and Louguinine.—Atmospheric perturbations of the hot season of 1875; group of rains from 21st to 24th of June; Flood of the Garonne, disasters at Toulouse, by M. Belgrand. The floods of the Garonne since 1770 have always been in spring or early summer, and, almost without exception, the maximum of rain and flood has been on the 23rd of June.—Reply to some objections raised by our recent communications on the useful effect of steam injectors, by M. Ledieu.—M. Daubrée presented a flattened angular meteorite sent by Prof. Hinrichs, from Iowa.—On the coefficient of capillary flow, by M. Guerout. The flow is in a horizontal tube; and in the case of alcohols the coefficients do not form a regular series; they diminish for alcohols richer in carbon; but bodies of similar composition and density often differ in fluidity.—On the composition of arable land in Auvergne; importance of phosphoric acid for its fertility, by M. Truchot.—On a system of irrigation of meadows by means of rain-water, in mountainous and impermeable regions, by M. Le Play.—On the Meteorological Observatory of the Pic du Midi de Bigorre (Hautes-Pyrenees), by General de Nansouty.—On some indications of the existence of Edentata at the commencement of the miocene epoch, by M. Gaudry.—On the contraction produced by rupture of the battery current, in the case of unipolar excitation of nerves, by M. Chauveau. The negative pole has but little aptitude to produce contraction at opening. Positive or negative, the opening contractions are distinguished for their brevity and equality.—On the poisonous principle in damaged maize, and its application in pathology and therapeutics, by M. Lombroso. The action is like that of strychnine.—On the earth-worms of the Philippine Islands, and of Cochin China, by M. Perrier.—Application of a theorem, complementary of the principle of correspondence, to determining, without calculation, the order of multiplicity of a point O, which is a multiple point of a given geometrical place, by M. Saltel.—On the discussion of equations of the first degree, by M. Rouché.—On the points of a curve or a surface, which satisfy a condition expressed by a differential equation or partial derivatives, by M. Halphen.—Crystallised sulphydrocarburet, from the interior of a mass of meteoric iron, by Mr. Lawrence Smith.—On the nature of flame, according to Galen and Aristotle, by M. Calliburcés. The experiment of the two candles, as proving that flame is a phenomenon produced by ignition of gas, is carried back to Aristotle.—On certain anatomical details of *Sarcoptes scabiei* and its numerous varieties, by M. Megnin.—On the musculoid cilia of the common mussel, by M. Sabatier. These organs have affinity with muscular tissue when they are agglutinated, and with vibratile cilia when dissociated and isolated.

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