the past few years. In London alone the Technical Education Board of the London County Council, and the Central Governing Body of the City Parochial Charities are spending about £120,000 annually on technical education; and, probably, an equal amount is being spent in the same direction by the Livery Companies of London through the Institute or by individual action. Apart from the City and Guilds of London Institute, mention may be made of the Goldsmiths' Company's Institute, at New Cross; the support by the Drapers' Company of the People's Palace; and of the Skinners' and Saddlers' Companies of the Northampton Institute; the Carpenters' Company's Schools at Stratford and Great Titchfield Street; the Tanning School, recently established by the Leathersellers' Company in the Borough; and the technical schools and textile departments in Leeds, Bradford, Huddersfield, Halifax, and other towns in the north of England supported by the Clothworkers' Company, as a few of the institutions of a specially technical character to which individual Companies are devoting their funds. From a table given in the report to show the amount of the donations to the funds of the Institute since its foundation, we have extracted the following totals, running into four or more figures, which to some extent supplement the information given in a recent article on the grants of the City Companies to education and research. Goldsmiths' Company, £83,064; Clothworkers' Company, £71,500; Fishmongers' Company, £70,550; Drapers' Company, £50,500; Mercers' Company, £50,000; Skinners' Company, £25,835; Grocers' Company, £19,000; Corporation of London, £15,500; Salters' Company, £15,138; Merchant Taylors' Company, £14,657; Leathersellers' Company, £10,105; Carpenters' Company, £8155; Armourers' and Braziers' Company, £7700; Ironmongers' Company, £5973; Cordwainers' Company, £5878; Saddlers' Company, £5600; Dyers' Company, £4646; Coopers' Company, £2770; Vintners' Company, £2500; Pewterers' Company, £2019; Plaisterers' Company, £1537; Cutlers' Company, £1386. The present report furnishes the City Companies with food for congratulation upon the results of the generous provision they have made for technical education.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, April 24.—Captain W. de W. Abney, President, in the chair.—A paper by Mr. R. A. Lehfeld, on symbolism in thermodynamics, was, in the absence of the author, read by the Secretary. The author proposes a system of about twenty-four separate symbols for the different quantities in thermodynamics. Prof. Silvanus Thompson said he was not at all favourably impressed by the symbols proposed. In particular, it was becoming usual to restrict the use of Greek letters to the representation of specific quantities or angles, and the author's proposal seemed in this way a retrograde step. Prof. Perry said he did not care for the suggested symbols. Mr. Elder thought the author's system would be a very severe tax on the memory, for he did not make use of suffixes, as was ordinarily done, which in a great measure define the symbol to which they are attached.—Mr. Appleyard read a paper on the adjustment of the Kelvin Bridge. In a recent paper read before the Society, Mr. Reeves had described a modified form of Kelvin Bridge, in which a double adjustment was necessary. The author proposes to employ two wires stretched side by side, with a sliding contact in connection with the galvanometer on each. These contacts are rigidly connected together, so that the segments into which one wire is divided necessarily bear to one another the same ratio as do the segments of the other wire. Hence a single adjustment is sufficient to give balance. Mr. Reeves said that apparently the author had completely missed the object of his (the speaker's) paper. For the object there aimed at was to make use of such sets of resistance coils as are always to be found in any laboratory. In the author's arrangement it would be necessary to carefully calibrate the two wires, and also, since the resistances used must neceesarily be small, to determine the resistance of the contacts. Prof. Ayrton (communicated) said the author's suggestion was ingenious, but did not obviate the necessity for much of Mr. Reeves' "addition." Further, Mr. Reeves' proposal to employ ordinary resistance boxes was not made because such resistances are absolutely necessary, but because, since they are to be found in any electrical laboratory, their use saves the expense of such a wire resistance accurately calibrated as Mr. Appleyard employs. Mr. Appleyard, in his reply, said that his instrument was designed for use in a factory where the time saved in making a series of tests was of more importance than the cost of the instrument.—Mr. J. Frith read a paper on the effect of wave-form on the alternate current arc. The author finds that an arc has the power of modifying the wave-form in a circuit in which it is included. Thus in the case of a dynamo for which, on open circuit, the curve of E.M.F. was decidedly peaked, it was found that when this dynamo was employed to feed an arc that the curve became changed to a flat-topped form. It is interesting to remember that the candle-power of the arc is greater when the wave-form is flat-topped than when it is peaked. By altering the resistance in series with the arc it is possible to alter the character of the curve, for as the resistance in series with the arc increases the arc affects the wave-form less and less. In some recent experiments described by Dr. Fleming, a resistance of about 7 ohms was used in series with the arc, so that the wave-form of the generator, which is not an efficient form, was forced on the arc. In practice, however, where a resistance is not used in series with the arc, this is not the case, and the differences between the efficiency obtained for alternate current arcs in the laboratory and that claimed in practice may thus be accounted for.—Mr. Blakesley said it seemed as if the more nearly the alternate current resembles a direct current, *i.e.* the longer in each period the current remains constant, the greater is the efficiency of the arc.—Mr. Price asked what was the cause of the reaction of the arc on the wave-form.—Mr. Tremlett Carter asked whether previous observers' results were vitiated by this action of the arc on the wave-form?—Prof. Ayrton (communicated) considered the author's suggestion of great importance as bearing on the question of the efficiency of the alternate current arc.—Prof. S. P. Thompson said that the dynamo employed by the author was one in which there was a large quantity of iron in the armature, so that the self-induction was large. Was it not on account of this large coefficient of self-induction, which would tend to keep the current constant, that the arc was able to alter the wave-curve? If an arc is connected to the mains of a supply station in which a number of machines in parallel are feeding a number of lamps, would the arc still be able to affect the wave-form of the current?—Mr. Tremlett Carter asked if the author had tried the effect of replacing the arc by a resistance such that it would absorb the same volts as did the arc, and comparing the curves for the current and impressed P.D. with those obtained with the arc.—The author, in his reply, said that the effect of the self-induction of the machine was shown in the curves. Current curves had not been taken with the arc straight on the machine. The current and self-induction were the same for all the curves, the voltage of the machine being increased by increasing the field when a resistance was placed in series with the arc. When, as is commonly the case, special machines are used to supply arcs, and the load consists solely of arcs, the arcs could alter the character of the wave-form. If the arc is replaced by a resistance, the wave-form is of the same type as is obtained for the E.M.F. of the machine on open circuit.

PHILADELPHIA.

Academy of Natural Sciences, April 7.—Mr. J. Willcox described the process of obtaining quartz from the Oriskany sandstone of Pennsylvania to be used in the manufacture of glass.—Mr. G. Vaux, jun., called attention to recent additions to the William S. Vaux collection, which included superb crystals of calcite from the Joplin region, Missouri. They occur in caves opened for the working of lead and zinc. The several mines are characterised by distinct forms of the mineral. The sphalerite, which is largely present, is being deposited at the present time, the handles of shovels and picks left in the mines being found covered with crystals.—Mr. Theodore D. Rand described a fine collection of polished serpentines presented by him to the Academy from numerous localities in South eastern Pennsylvania. They belong to two groups: one bordering the ancient gneiss, the other and the more recent occurring in the mica schists and gneisses. The former are altered igneous rocks, either crysolitic or pyroxenic, the chief material being Enstatite.—Dr. Bascom reported the microscopic examination of thin sections of serpentine from the Black Rocks of Lower Merion.—It was announced that Mr. G. Frederic Russell, accompanied by Dr. Juelal and a taxidermist, had started from Georgetown, British Guiana, March 11, on a collecting tour in the interior for the benefit of the Academy.

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PARIS.

Academy of Sciences, April 20.—M. A. Cornu in the chair.—On the subject of an unpublished letter of Gauss, by M. de Jonquières.—On a temporary case of parasitism of the *Glyciphagus domesticus* of Geer, by M. E. Perrier. An account of a case where this species of Acarus, usually free, became parasitic, with the result that two houses into which it was accidentally introduced became uninhabitable. Energetic measures of isolation and disinfection by sulphurous acid had to be adopted to stamp out the parasite.—The truffles (*Terfas*) of Mesrata, in Tripoli, by M. Ad. Chatin. — The extraction of the terpene alcohols contained in essential oils, by M. A. Haller. The essence is treated with a quantity of succinic or phthalic anhydride sufficient to convert the whole of the alcohol into the corresponding acid ether. Treatment of this with aqueous sodium carbonate gives the sodium salt of the acid ether, and this, digested with an excess of caustic soda, gives the alcohol free from hydrocarbons on appropriate purification. As an alternative method, the essence containing the alcohol is diluted with ether and treated with metallic sodium, then to the sodium derivative so formed the succinic or phthalic anhydride is added, and the salt worked up as before.—On the approximate value of the coefficients of terms of high order in the development of the principal part of the disturbance function, by M. A. Féraud. A study of the mutual influence of two planets upon each other, both of which are moving in elliptic orbits.—On the biuniform transformations of algebraic surfaces, by M. P. Painlevé.—On the diffraction of the Röntgen rays, by MM. L. Calmette and G. T. Lhuillier. By the use of two metallic screens pierced with narrow slits, photographs were obtained consistent with the assumption that the Röntgen rays exhibit the phenomenon of diffraction. The results obtained indicate that the wave-lengths are longer than those of light, but the photographs are hardly clear enough for exact measurement. The experiments are being continued.—Observations on a communication of MM. Benoist and Hurmuzescu, by M. A. Righi. A discussion of the conditions favourable to the discharge of an electrified body by the X-rays. The author maintains the accuracy of his earlier observations regarding the production of a positive charge upon isolated conductors by the Röntgen rays, and states that the potentials so produced are of the same order as contact electromotive forces. Hence a very delicate electrometer is required to exhibit these effects.—Photography in the interior of a Crookes' tube, by M. G. de Metz. The kathode rays in the interior of a Crookes' tube possess one of the properties of the Röntgen rays, inasmuch as they penetrate aluminium, cardboard and paper, but are stopped by platinum and copper.—Observations on the preceding, by M. Poincaré. The kathode rays, on striking the platinum or aluminium screen, may give rise to X-rays, which *then* go through the metallic plates. The kathode rays themselves may not necessarily possess this property.—On the compensation of the directing forces, and the sensibility of the galvanometer with moving coil, by M. H. Abraham. By attaching a small mass in front of the moving coil of a Deprez-d'Arsonval galvanometer so as to slightly displace its centre of gravity, and properly regulating the inclination of the instrument by means of its levelling screws, the effective sensibility is increased one hundred-fold, and is of the order of a Thomson galvanometer of equal resistance. —Rotatory dispersion of active non-polymerised liquid bodies, by MM. Ph. A. Guye and C. Jordan. An experimental study of normal and abnormal rotatory dispersion. The chief conclusions drawn are that active liquid bodies, not polymerised, present only normal rotatory dispersion, and that there is no simple relation between the refrangibility of the radiations and the rotatory dispersion.—On a new series of sulphophosphides, by M. Ferrand. These compounds, of which the copper, iron, silver, nickel, chromium, zinc, cadmium, mercury, lead, and aluminium salts are described, are thio-pyrophosphates, and possess the general formula $M'_4P_2S_7$.—The spontaneous adaptation of muscles to changes in their function, by M. Joachimsthal.—Influence of induced currents on the orientation of living bacteria, by M. L. Lortet. Living bacteria, in the form of mobile bacilli, are very sensible to the action of currents from a Ruhmkorff coil, and immediately set themselves in the direction of the current. This effect is only produced when the organisms are living, and is not observed after the introduction of an antiseptic, such as carbolic acid. Living organisms are unaffected by a constant current.—On the internal appendages of the male genital apparatus of the Orthoptera, by M. A. Fénard.—On the membrane of the *Ectocarpus fulvescens*, by M. C. Sauvageau.—On the abortion of the principal root in one species of the genus *Impatiens* (L.), by M. C. Brunotte.—The biochemical preparation of sorbose, by M. G. Bertrand. A specific organism, which can be obtained by exposing a mixture of wine and vinegar to the air for some time, is the cause of the conversion of sorbite into sorbose in the fermentation of the juice of various species of *Sorbus*. The direct production of sorbose in the fermentation of the latter is dependent upon the introduction of the organism by small reddish flies (the vinegar fly, *Drosophila funebris*).—On winter observations in the caves of the Causses (Padirac, &c.), by M. E. A. Martel.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—A Scientific Demonstration of the Future Life: T. J. Hudson (Putnam).—Studies in Ancient History: J. F. M'Lennan, 2nd series (Macmillan).—A Dictionary of Chemical Solubilities. Inorganic: Dr. A. M. Comey (Macmillan).—The Theory of Sound: Lord Rayleigh, Vol. 2, new edition (Macmillan).—Analytical Psychology: J. F. Stout, 2 Vols. (Sonnenschein).—Forschungsberichte aus der Biologischen Station zu Plön: Dr. O. Zacharias, Theil 4 (Berlin, Friedländer).—Know your own Ship: T. Walton (Griffin).—Annals of the Royal Botanic Garden, Calcutta, Vol. v. Part 1 (Calcutta).—The American Lobster: Dr. F. H. Herrick (Washington).—Artistic and Scientific Taxidermy and Modelling: M. Browne (Black.—Royal University of Ireland. Examination Papers, 1895; a Supplement to the University Calendar for the Year 1896 (Dublin).

PAMPHLETS.—The Physiology of the Carbohydrates: a Rejoinder to Dr. Paton's further Criticism: Dr. F. W. Pavy (Churchill).—City and Guilds of London Institute Report to the Governors, March 1896 (Gresham College).—Neber einige Eigenschaften der Röntgen, schen X-Strahlen: Drs. Winkelmann and Straubel (Jena, Fischer).

SERIALS.—English Illustrated Magazine, May (198 Strand).—Quarterly Review, April (Murray).—Good Words, May (Isbister).—Sunday Magazine, May (Isbister).—American Journal of Psychology, Vol. 7, No. 3 (Worcester, Mass.).—Encyklopædie der Naturwissenschaften, Dritte Abthg., 30 to 33 Liefg. (Breslau, Trewendt).—Journal of the Sanitary Institute, April (Stanford).—Longman's Magazine, May (Longmans).—Chambers's Journal, May (Chambers).—Terrestrial Magnetism, No. 2 (Chicago).—Journal of the Asiatic Society of Bengal, Vol. lxiv. Part 2, No. 3 (Calcutta).—Proceedings of the Academy of Natural Sciences of Philadelphia, 1895, Part 3 (Philadelphia).—Bulletin of the American Museum of Natural History, Vol vii. (New York).—Field Columbian Museum. Archæological Studies among the Ancient Cities of Mexico, Part 1: W. H. Holmes (Chicago).—Natural Science, May (Rait).—Schriften der Naturforschenden Gesellschaft in Danzig. Neue Folge, Neunten Bandes, Erstes Heft (Danzig).

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