

Calendar of Industrial Pioneers.

November 19, 1883. Sir William Siemens died.—One of four brothers who were all closely associated with the application of science and the management of great industrial concerns, Siemens was born in Lenthe, Hanover, on April 4, 1823. He settled in England in 1844 and in 1859 became a naturalised British citizen. His name is connected with the introduction of the regenerative furnace for steel-making and the enunciation of the principle of the modern dynamo. He designed the cable ship *Faraday*, and was president of various technical institutions.

November 20, 1713. Thomas Tompion died.—The father of English watch-making, Tompion began his apprenticeship in London in 1664 and by 1675 had gained a foremost place among his fellow mechanicians. He supplied the first clocks to the Greenwich Observatory, and under Hooke's direction made one of the first English watches with a balance spring. His work made English watches the finest in the world. He is buried in the nave of Westminster Abbey, in the same grave as his famous pupil and successor, George Graham.

November 20, 1898. Sir John Fowler died.—A great railway engineer, and jointly responsible with Baker for the design of the Forth Bridge, Fowler's early work was done in the Sheffield district, while he afterwards became engineer to the Metropolitan Railway.

November 21, 1555. Georg Agricola died.—Agricola has been called the Bessemer of his age. He was born in Saxony in 1494, studied medicine at Leipzig and in Italy, and practised in Bohemia. Subsequently he abandoned his profession, became absorbed at Chemnitz in the study of metals and mining, and was given a pension by the Duke of Saxony. He collected specimens of ores, studied their chemical characters, and described them accurately. His work, "De re Metallica," is considered the most important technical book of the sixteenth century.

November 21, 1863. Samuel Hall died.—A native of Basford, Nottingham, Hall made a considerable fortune by his invention of a method of gassing lace and net. In 1836 he took out a patent for a surface condenser for ships which embodied most of the features of condensers as in general use to-day.

November 23, 1902. Sir William Chandler Roberts-Austen died.—The successor of Graham as chemist to the Mint, Roberts-Austen did much valuable work on the study of alloys, and was regarded as an authority on all that appertains to coinage. He delivered many important lectures, and in 1899–1900 served as President of the Iron and Steel Institute.

November 24, 1916. Sir Hiram Stevens Maxim died.—One of the greatest inventors of the nineteenth century and a pioneer worker on the flying machine, Maxim, like Edison and Swan, assisted to introduce the electric light, and then, turning his attention to the construction of an automatic gun, brought out his Maxim gun, which ever since has played so important a part in all warfare. He was also the first to combine nitroglycerine and true gun-cotton in a smokeless powder.

November 25, 1893. Johann Bauschinger.—A distinguished investigator of the strength of materials and the founder of the International Association for Testing Materials, Bauschinger was born in Nuremberg in 1834, and for twenty-five years was professor of mechanics and graphic statics at the Technical High School at Munich.

E. C. S.

Societies and Academies.

LONDON.

Royal Society, November 9.—Sir Charles Sherrington, president, in the chair.—H. E. Armstrong: Studies on enzyme action. XXIII. Homo- and hetero-lytic enzymes.—A. V. Hill and W. E. L. Brown: The oxygen-dissociation curve of blood and its thermodynamical basis. An attempt has been made to test the validity of the hypotheses (i) that the reaction of hæmoglobin with oxygen is represented by the equation $(\text{Hb})_n + n\text{O}_2 = (\text{HbO}_2)_n$, where Hb represents the simplest possible molecule of hæmoglobin (containing one atom of iron), and n the average degree of polymerisation of the molecule in the presence of the salts in blood: and (ii) that the dissociation curves of oxyhæmoglobin under various conditions can be deduced by simple application of the Laws of Mass Action. The heat of reaction q of one gm. mol. of hæmoglobin $(\text{Hb})_n$, with oxygen has been determined by the application of the van't Hoff isochore to the effect of temperature on the dissociation curve of blood, while the heat of reaction Q of one gm. mol. of oxygen with hæmoglobin has been measured directly in a calorimeter. The value of q/Q is practically equal to n determined in other ways, affording strong confirmation of hypothesis (i). The apparent heat of reaction of oxygen with blood may be very considerably reduced by the driving off of carbon dioxide by the more acid oxyhæmoglobin formed. A direct measurement of the heat of combination of carbon dioxide with blood confirms the theory that carbon dioxide combines with blood by taking base from the ionised hæmoglobin salt to form bicarbonate, leaving the non-ionised hæmoglobin acid. The heat of combination of carbon monoxide with hæmoglobin in blood is about 50 per cent. greater than that of oxygen: this proves that temperature affects the equilibrium of oxygen and carbon monoxide with blood.—H. Hartridge and F. J. W. Roughton: The velocity with which carbon monoxide displaces oxygen from its combination with hæmoglobin. Pt. I. When light falls on a solution containing oxyhæmoglobin and carbon monoxide hæmoglobin, the incoming light energy changes the position of equilibrium, tending to cause a reduction in the amount of the latter with a corresponding increase of the former. In the dark the original position of equilibrium is gradually recovered, the rate of return depending on the velocity constants of the reactions. By determining the percentage saturation of the hæmoglobin with carbon monoxide gas at intervals after the light has been turned off, the velocity constants can be calculated. This is done by causing the fluid to flow through two glass tubes in series; in the first it is exposed to a powerful light, while in the second it is kept in the dark, so that the original position of equilibrium is gradually regained. The percentage saturation with carbon monoxide gas of the solution at different parts of the "dark" tube was determined with the reversion spectroscope. At 15° C. the two velocity constants had mean values of 0.0067 and 0.55 respectively. At 34.5° C. the value of K_2 was 2.66, which gives a temperature coefficient for this velocity constant of 2.3 for a 10° C. rise of temperature,—approximately that given by many ordinary chemical reactions. Pt. II. The method of measuring the velocity of the reaction $\text{CO} + \text{O}_2\text{Hb} = \text{COHb} + \text{O}_2$ consists in ascertaining, by means of an electrically controlled stop-watch, the time taken for the equilibrium to shift from an unstable position to a stable one, the change being ascertained by

measurements on the absorption bands by means of the reversion spectroscopy. The system was changed to an unstable position by (1) subjecting the solution to the action of a powerful beam of light, and by (2) suddenly obstructing the light rays. Thus chance fluctuations in the catalysing light source, and in the flow of the liquid under observation were avoided, but it was difficult to make accurate estimations on absorption bands moving from one position in the spectrum to another. Observations of the equilibrium constant were made by method (1) at 1° C. and laboratory temperature, and by method (2) at laboratory temperature and 34° C. At laboratory temperature, method (1) gave 0.51 and 0.59, and method (2) 0.44 and 0.40. The temperature coefficient per 10° C. calculated from values obtained by method (1) was 2.3, while method (2) gave 2.5 and 2.7.—L. T. Hogben: Studies on internal secretion. I. The effect of pituitary (anterior lobe) injection upon normal and thyroid-ectomised axolotls. While pituitary feeding has no influence on the metamorphosis of medium-sized or sexually mature axolotl larvae of *Amblystoma tigrinum*, injection of anterior lobe extracts into axolotls of the same ages and dimensions was followed by the assumption of the adult characteristics, with rapidity comparable to metamorphosis induced by thyroid administration, and beginning about two to three weeks after the initial injection. Anterior lobe extracts also induce metamorphosis in thyroidless larvae. Spontaneous metamorphosis does not generally occur, as Marie de Chauvin stated, in larvae of six to nine months when placed in shallow water with opportunities for emerging.—L. T. Hogben and F. R. Winton: The pigmentary effector system. II. Apart from caffeine, the only reagents found to induce melanophore contraction were those known to excite peripheral sympathetic nerve-endings, namely, adrenalin, tyramine, ergotoxine, and cocaine. Apart from pituitary extract, the only reagents found to bring about melanophore expansion were apocodeine and nicotine, in quantities sufficient to paralyse all sympathetic nerve-endings. No unequivocal direct evidence is advanced that nervous control of pigment responses in Amphibia has been found. Synchronous colour changes of Amphibia in response to normal environmental stimuli are possibly determined mainly by endocrine influences.—A. Fleming and V. D. Allison: Further observations on a bacteriolytic element found in tissues and secretions. Strains of *M. lysodeikticus* resistant to lysozyme action can readily be developed. The resistance is not specific, *i.e.* strains made resistant to one tissue or secretion are equally resistant to all tissues, whether derived from man, the lower animals, or from vegetables, showing that the lysozyme affecting *M. lysodeikticus* is the same whatever tissue it is derived from. After solution of a large number of *M. lysodeikticus* there is an increase in the lytic power of the fluid, which affects wholly or mainly the homologous microbe. Different tissues and secretions vary in their capacity to dissolve different bacteria, and some tissue extracts have a marked lytic action on many of the well-known pathogenic bacteria.

PARIS.

Academy of Sciences, October 23.—M. Albin Haller in the chair.—Ch. Barrois, P. Bertrand, and P. Pruvost: Observations on the coal measures of the Moselle.—W. Kilian: The stages of the retreat of alpine glaciers and the origin of Lake Lauvitel (Oisans).—A. Angelesco: A functional property of conics.—E. Merlin: Some properties of networks.—M. Desaint: The general representations

of analytical functions.—P. J. Myrberg: The singularities of automorphic functions.—Frithiof Nevanlinna: The relations which exist between the distribution of the zeros and the poles of a monogen function and the increase of its modulus.—Alf. Guldberg: A theorem of M. Markoff.—Constant Lurquin: The criterium of Tchebycheff.—MM. Constantin, Joessel, and Daloz: A boat which moves against the wind using the wind itself as motive power. The motor is an air turbine of 9 metres diameter connected with a screw propeller by gearing. No drawings or details are given, but it is stated that a small 6-ton fishing-boat fitted with the motor has given successful results on trial.—L. de Broglie and A. Dauvillier: The spectral system of the X-rays. The proposed system is based on the principle of rigorous alternation of regular and irregular doublets (Wentzel), following the views of Smekal and of Rubinovicz. The table given includes some lines predicted from the theory but not yet observed.—M. Vuillaume and A. Boutaric: The photometry of sources of light constituted by black bodies at different temperatures.—R. Mesny: The generation of polyphase oscillations of high frequency by electronic tubes.—André Charriou: The separation of ferric oxide and alumina from magnesia by the method of nitrates.—M. Picon: The action of sodammonium on hexamethylenetetramine, tetramethyldiaminomethane, and ethylideneethylimine. Sodammonium, in liquid ammonia, is without action on hexamethylenetetramine at the ordinary temperature. The imine $\text{CH}_3 \cdot \text{CH} : \text{N} \cdot \text{C}_2\text{H}_5$, derived from acetaldehyde and ethylamine, is attacked by sodammonium giving diethyldiaminobutane.—Pereira de Sousa: The basic rocks of the nepheline syenite massif of the "Serra de Monchique."—Paul Lemoine and A. Pinard: The mode of contact of the chalk and pisolithic limestone at Meulan-Gaillon (Seine-et-Oise). The limestone has filled irregular pockets in the chalk, and a section of one such pocket is given.—Mlle. F. Brepson: The rôle of the phenomena of solifluxion in the model of the region of Saulieu (Morvan). The formation of ponds and lakes in this district cannot be explained as being due to the erosion of streams, nor is there any evidence of glacial action, and it is suggested that earth slides may have been the cause of this formation. The products of granite disintegration imbibe water freely and have a tendency to slip down the steep slopes, forming ridges known as *videaux*. Examples of these phenomena in the neighbourhood of Saulieu are given, and this is considered to afford an explanation of the large number of small lakes in the district.—J. Lacoste: New radiogoniometric observations of atmospherics. An application of wireless telegraphy to the prediction of storms.—René Souèges: The embryogeny of the Carophyllaceæ. The first stages in the development of the embryo of *Sagina procumbens*.—Marcel Mirande: The relation existing between the relative acidity of the tissues and the presence of anthocyanine in the scales of lily bulbs exposed to light.—André Guillaume: Study of the limits of vegetation in the north and east of France. A study of the conditions limiting certain plants to certain areas. Meteorological, geological, physical, and palæontological influences are discussed, the effect of climate being the most important.—Med. Gard: The withering of young walnut trees in 1922. In the spring of this year there were heavy losses in young walnut trees. This does not appear to have been due to disease, as was at first suspected, but is attributed by the author to autumnal frosts.—G. Vernet: The rôle of calcium chloride in the coagulation of the latex of *Hevea Brasiliensis*. The addition of solutions of calcium

chloride to the latex of *Hevea* increases the rapidity of the coagulation and also the total weight of rubber obtained. The causes of these results are discussed.—**Émile F. Terroine** and **H. Barthélemy**: Avitaminosis and inanition. Two views of the action of vitamins have been put forward, one regarding these substances as indispensable for nutrition, the other as affecting the secreting power of glands and the diastatic properties of the digestive juices. According to the latter view, the nerve troubles and death resulting from feeding on polished rice are due to starvation caused by the inability of the intestine to assimilate the food. The authors use as a test for death by starvation the percentage of fats and lipid substances in the animal, and find that in cases of avitaminosis neither the nerve troubles nor death can be wholly attributable to inanition.—**M. Marage**: Phonation and telephonic audition. The author's results are in agreement with those of Fletcher, although the methods employed are absolutely different.—**A. Policard**: The working of the adipose tissue. Researches on the nuchal gland of rodents.—**M. Vila**: Separation of the globulins of horse serum. The globulins are removed from the diluted serum by treatment with three volumes of cooled acetone, and these can be separated into fractions by treatment with dilute hydrochloric acid.—**Y. Manouelian** and **Jules Viala**: A case of hydrophobia in a lioness.—**René Zivy**: An unpublished method of preparing vaccine. Sterilisation is produced by repeated freezing at -18° C. and thawing. Pneumococcus was the most readily sterilised (two freezings), while enterococcus, the most resistant, required six.—**Marcel Leger** and **A. Baur**: Healthy carriers of the plague bacillus. A proof that negroes in Senegal, quite free from any clinical signs of plague, carried the Yersin bacillus and could act as plague carriers.

SHEFFIELD.

Society of Glass Technology (York Meeting), October 18.—**Prof. W. E. S. Turner**, president, in the chair.—**J. A. Knowles**: Processes and methods of medieval glass painting. Medieval window glass differs from modern glass in that whereas the ancient material was a potassium-calcium-silicate, modern glass is a soda-lime glass. The northern school of glass-painting situated at York in the middle ages obtained glass from the northern Continental glass-making districts of Hesse and other Rhenish provinces. The London school drew it from Lorraine, Burgundy, and Normandy. The uncoloured glass used in the north was much whiter than that employed in the south, probably due to the use of English-made white glass from the works at Chiddingfold. The present-day glass maker can produce colours with a certainty and in a far greater range of tints than the medieval craftsmen could. With the exception of the red or "ruby" glass, the medieval coloured glasses were those which were most easily produced. Being made from native oxides which contained other metals as impurities, the resulting colours were not pure or always harmonised. The colours such as red, blue, and green were contained in the glass itself, but details such as the face, folds of drapery, and ornamental work were painted on with a brown vitrifiable pigment, formed of a metallic oxide such as red oxide of iron or black oxide of copper, mixed with a soft glass known as "flux." In the kiln the flux melted before the glass itself, and attached the black oxide to the surface.—**H. J. Powell**: Modern developments in the making of stained and painted glass. The substance of much medieval window glass decays though many pieces of ancient Roman glass are

sound. Some medieval glass has become partly or wholly opaque, and crumbles to powder. The most defective glass belongs to the fourteenth century. All the forms of decay originate from the excessive proportion of alkali in the glass mixture which causes the glass to be hygroscopic.

WASHINGTON, D.C.

National Academy of Sciences (Proc., Vol. 8, No. 10, October 1922).—**H. Blumberg**: New properties of all real functions. Descriptive and metric properties of planar sets and real single-valued functions of two real variables, with some generalisations, are discussed.—**C. N. Moore**: Generalised limits in general analysis. A proof is given of a generalisation of a theorem in the theory of divergent series.—**Martha Bunting**: Preliminary note on *Tetramitus*, a stage in the life cycle of a coprozoic amoeba. Coprozoic amoebæ in cæcal material from a rat were cultivated on an artificial medium. Amoebæ containing at least one large contractile vacuole emerge from cysts, commonly spherical, the walls of which apparently dissolve. Prior to division, the amoeba becomes homogeneously refractive ("gel" state). After division, individuals may become amoebæ or develop flagellæ. The flagellate form is thought to be identical with *Tetramitus nostratus* Perty; it reproduces by longitudinal fission after passing through a "gel" state. Eventually the amoeboid form is reassembled. Reproduction of both forms appears to be indefinite but the amoebæ finally encyst.—**Raymond Pearl** and **T. J. Le Blanc**: Further note on the age index of a population. The numerical index of the age distribution of a population previously proposed by Pearl has been used successfully employing six to eight age groups covering the life span. Statistics from the 1915 census of Iowa show that it is also trustworthy, using only three age groups; there is high correlation between the values of the index for coarse and fine age groupings.—**A. A. Noyes** and **H. A. Wilson**: Thermal ionisation of gaseous elements at high temperatures; a confirmation of the Saha theory. It has been shown that the conductivity of flames into which salt solutions are sprayed is (a) independent of the acidic constituent of the salt; and (b) changes with the concentration of the salt in accordance with the equilibrium constant obtained when the substance, its ions and electrons, as represented by the equation $M = M^+ + E^-$, are regarded as perfect gases. Substantially, the whole conductivity is due to the electrons present. From (b) relative values for the ionisation constants of five alkali elements are calculated; the series is closely parallel to that obtained from thermodynamical equations utilising ionisation potentials as employed by Saha.—**E. H. Hall**: An electron theory of electric conduction in metals. It is assumed that an ion is formed from a metal atom by loss of an electron from the outer shell, leaving a pit in the ion which renders it unsymmetrical. An imposed electric field turns the ions so that the pits move as a positive charge would do, giving the effect of an electric current. Ohm's law can be justified, and an explanation is offered of the variation of metallic resistance with temperature. Rise of temperature probably directly increases resistance rapidly, while the increased number of ions produced tends to reduce it.—**C. Barus**: Static deflection, logarithmic decrement and first semi-period of the vacuum gravitation needle. These three quantities are similar time functions with a period of one day; they are largest in the morning and least at night. Static deflection and logarithmic decrement appear to be nearly proportional, while the latter and the first semi-period also form a definite curve.