Calendar of Industrial Pioneers.

November 12, 1902. William Henry Barlow died.—Appointed principal engineer of the Midland Railway in 1844, when thirty-two years of age, Barlow laid out the line from London to Bedford and was responsible for St. Pancras Station. He was also concerned with the Clifton Suspension Bridge, the second Tay Bridge, and the Forth Bridge. He was widely known for his scientific investigations of arches and beams, and in 1868 was made one of the committee appointed to investigate the applicability of steel to structures. He was a vice-president of the Royal Society, and in 1879–80 president of the Institution of Civil Engineers.

November 13, 1903. Josiah Vavasseur died.—One of the chief ordnance engineers of last century, Vavasseur invented in 1866 the copper rotating ring or band for projectiles of breech-loading guns, and subsequently did important work on the construction of built-up steel guns and on hydraulic mountings. In the Vavasseur mounting of 1877, the recoil was for the first time scientifically controlled by hydraulic buffers having a uniform resistance. The London Ordnance Works which he founded was in 1883 merged in those of Armstrong's at Elswick.

November 14, 1830. Henry Bell died.—The foremost pioneer of the steamboat in Europe, Bell, who was born at Torphichen, Linlithgowshire, on April 7, 1767, was apprenticed as a stone mason but afterwards became a shipwright and builder. In 1808 he became proprietor of a hotel and baths at Helensburgh on the Clyde and in 1811 ordered the *Comet*. In August 1812 this little craft began running between Glasgow and Greenock, and from this dates the beginning of steam navigation in Europe. The vessel was wrecked in 1820, but the engine was salved and is preserved in the Science Museum at South Kensington.

November 14, 1905. Robert Whitehead died.—The inventor of the automobile torpedo, Whitehead made his first torpedo in 1866 while holding a position in an engineering works at Fiume. Taken up first in 1868 by the Austrian Navy, experiments were carried out at Sheerness in 1870 and soon afterwards the torpedo was adopted by the British and other Governments.

November 15, 1839. William Murdock died.—Known principally for his discovery of lighting by coal gas and as the originator of a great industry, which in Great Britain alone consumes some 22,000,000 tons of coal per annum, Murdock was for many years the right-hand man of Boulton and Watt. He was first employed by them in 1777, and was sent to Cornwall to erect steam engines. In his house at Redruth in 1784 he experimented with a small locomotive and in 1792 lighted his house by gas. He was also a pioneer in the transmission of power by compressed air.

November 16, 1911. Engelbert Arnold died.—A notable contributor to the literature of electrical engineering, Arnold, after studying at Zürich, engaged in practical work in Russia. For a short time he was engineer to the Oerlikon works in Switzerland and from 1894 to 1911 held a chair at the Institute of Technology at Karlsruhe.

November 18, 1814. William Jessop died.—Trained as a civil engineer under Smeaton, Jessop was employed on some of the English canals, completed the West India Docks and constructed a railway in Surrey which was the first opened to the public in the South of England. E. C. S.

Societies and Academies.

LONDON.

Royal Society, November 2.—Sir Charles Sherrington, president, in the chair.—Lord **Rayleigh**: Polarisation of the light scattered by mercury vapour near the resonance periodicity. White light scattered at right angles by dense mercury vapour is to a first approximation completely polarised. Ultra-violet radiation of the mercury spectrum line $\lambda 2536$, when examined immediately it enters mercury vapour in an exhausted vessel at room temperature, gives a scattered radiation which is slightly though definitely polarised. This polarisation has been observed to increase as the beam is filtered by penetration of a considerable depth of vapour. After penetration of 27·5 cm. of vapour the weaker polarised image had 60 per cent. only of the intensity of the stronger one, instead of 90 per cent. as at first. The radiation removed by the filtration appears to lie within a spectral range of about 1/100 Ångstrom.—G. P. **Thomson**: The scattering of hydrogen positive rays and the existence of a powerful field of force in the hydrogen molecule. At a pressure of less than 1/100 mm., hydrogen positive rays of 10,000 volts mean energy suffer considerable small-angle scattering in a distance of 15 cm. This scattering is 10-20 times greater than would be expected on theoretical grounds. There must, therefore, be a field of force in the hydrogen molecule at distances of the order of 10^{-8} from a nucleus which is much stronger than would be expected from the inverse square law. A subsidiary experiment throws great doubt on Glimme and Koenigsberger's "Stossstrahlen."—H. D. **Smyth**: A new method for studying ionizing potentials. Positive ray analysis is used to study the ions produced in a gas or vapour by the impact of slow-speed electrons of known energy. This requires that the density of gas be considerable where the energy of the impacting electrons is known, and as small as possible where the energy conditions are not known. In the case of mercury such a localisation of vapour density was obtained by using a unidirectional molecular stream similar to that employed in a mercury diffusion pump. Ions were produced by electrons from a hot filament, and after acceleration by a large electric field were analysed by a magnetic field. In this way the values of m/e were determined approximately. The experiments on mercury indicate the formation of doubly charged ions at 19 ± 2 volts. The series relations of the enhanced spectrum of mercury are not known, but analogy with zinc and cadmium suggests an estimate in agreement with the above value. The conclusion is that the double ions formed at this voltage are the result of two impacts. Experiments at higher voltages indicate formation by single impacts. More highly charged ions were present in such small quantities as to make their identification uncertain even at voltages as high as five hundred. It was also impossible to identify a singly charged diatomic molecule.—I. **Backhurst**: Variation of the intensity of reflected X-radiation with the temperature of the crystal. General agreement only is found with the theories of C. G. Darwin and P. Debye. Aluminium: Very marked decrease in intensity was observed with rise of temperature, and fair agreement with P. Debye's theory obtained for the (100) and (222) spectra. Carborundum: A special furnace was constructed for temperatures up to 960° C. and no deterioration of the crystal was observed. The decrease in intensity with rise of temperature was

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much greater for the higher-order spectra, and different curves were obtained for the K α (333) and K β (333) spectra. Graphite: Only for the cleavage-plane reflection was it possible to obtain a definite temperature-intensity curve, and for the direction perpendicular to this plane an unusually high coefficient of expansion was measured. Diamond: No decrease in intensity was found that could be measured with certainty, and a very small thermal agitation would be expected on account of the diamond structure's great strength. Ruby and sapphire: An anomalous effect was observed, since the decrease of intensity of the (111) spectra was greater than that of the (222). This may be completely explained by assuming that the atoms of the aluminium pair remain in contact and do not share in the expansion of the lattice.—S. **Datta**: The absorption spectrum of potassium vapour. The principal series lines up to $m=42$ have been observed as absorption lines and their wave-lengths accurately measured. The series equation shows satisfactory agreement between the observed and the calculated values, with the exception of deviations for the last few lines, for which a possible explanation has been given. The first seven members of the series have been resolved into their components. Besides the absorption of the lines of the principal series, new lines have been found to be absorbed at higher pressures, which seem to have no correspondence with the known lines in the emission spectrum. The combination lines $1s$–$2d$ and $1s$–$3d$ have been found to be absorbed, the first as a pair, confirming the presence of a satellite to the lines of the diffuse series. Their appearance in the absorption spectrum gives distinct evidence of contradiction of the selection principle.—K. R. **Ramanathan**: The molecular scattering of light in vapours and in liquids and its relation to the opalescence observed in the critical state. Three instances of light scattering by homogeneous media are known—opalescence near critical point, scattering of light by gases, and scattering of light by liquids. Experiments on scattering of light by ether, in vapour and liquid phases, at different temperatures from 33° C. up to critical temperature 193·6° and in gaseous phase from 193·6° to 217°, give results in accord with the Einstein-Smoluchowski formula and not with the Rayleigh law. The Einstein-Smoluchowski formula is inapplicable in *immediate neighbourhood* of critical point. The scattered light is markedly less blue here. Following the theoretical work of Ornstein and Zernike, from maximum value of intensity of scattered light the value of ϵ, radius of action of ether molecule, is deduced to be $4{\cdot}6\times10^{-7}$ cm. Light scattered at right angles to incident beam is imperfectly polarised; ratio of weak component to strong is throughout nearly 1·2 per cent., in case of vapour, while in case of liquids, ratio is 8 per cent. at ordinary temperatures, remaining constant till about 120° and then falling off to about 1·2 per cent. at critical point. There is no change of imperfection of polarisation on passing through critical point. Correction due to this in the expression for intensity of scattered light is given.

PARIS.

Academy of Sciences, October 16.—M. Albin Haller in the chair.—The president announced the death of F. P. A. Barbier, correspondant for the section of chemistry.—Maurice **Hamy**: The calculation of a double integral which occurs in the theory of the diffraction of solar images by a rectangular slit.—An. **Bilimovitch**: The lines of inertia on a surface.—Ed. **Le Danois**: The hydrology of the North Atlantic. It is considered that the name Gulf Stream should be restricted to the return current from the equatorial region. The variations in temperature and salinity of the surface water are due to a seasonal phenomenon and not to ramifications of the Gulf current.—C. **Raveau**: Demonstration of Fresnel's law of æther drift, without reference to the relativity of time and space.—André **Guilbert**: The calculation of the attraction of electro-magnets.—Maurice **Curie**: The refractive indices of the phosphorescent sulphides. The refractice indices of phosphorescent sulphides of calcium, strontium, barium, and zinc have been measured directly by the observation under the microscope of particles of the sulphides in a transparent homogeneous liquid of the same refractive index. The values found differ considerably from the square root of the dielectric capacity and lend no support to the theory of P. Lénard.—L. J. **Simon** and L. **Zivy**: The neutralisation of tartaric acid by potash in presence of the chlorides of the alkaline earths. In the presence of calcium (or barium) chloride, the titration of tartaric acid requires the same volume of caustic potash solution for neutralisation with either methyl orange or phenolphthallin as indicator.—Albert **Perrier** and B. **de Mandrot**: The elasticity and symmetry of quartz at high temperatures. Flat plates were cut from quartz crystals in four directions: along the binary and ternary axes, then in two directions normal to the binary axis. The quartz plates were worked with optical precision and the flexures caused by a load at the centre determined for temperatures ranging from 18° C. to 1140° C. There is a rapid change in the value of Young's modulus at 576° C., a rise of 1° increasing the modulus to three times its value. Aimé **Azam**: The origin and process of formation of the soils at the Hague.—Jean **Mascart**: The proportion of successes in weather prediction. The question as to what constitutes a successful weather prediction is discussed, and it is pointed out that many predictions are too vaguely drawn and cover too many possibilities. If the forecast is drawn in precise terms, weather prediction may be considered satisfactory if the proportion of successes is more than 60 per cent.—P. **Bugnon**: The systematic position of the Euphorbiaceæ. J. **Beauverie**: The "critical period of wheat."—L. **Blaringhem**: A sterile hybrid of spelt and rye.—Adrien Davy **de Virville** and Fernand **Obaton**: Observations and experiments on ephemeral flowers. Light has no action on the opening or closing of the corolla in ephemeral flowers, and hygrometric state has a very slight influence. The temperature is the main factor in these movements.—Marc **Bridel** and Mlle. Marie **Braecke**: Rhinanthine and aucubine. Rhinanthine is impure aucubine. Rhinanthine was extracted by Ludwig from the seeds of *Rhinanthus Crista-galli*, and aucubine was discovered by Bourquelot and Hérissey in the seeds of *Aucuba japonica*. Rhinanthine is regarded by the authors as a mixture of saccharose and aucubine, and experimental data are given in support of this view.—Fred **Vlès**: The variations of the hydrogen ion concentration in the neighbourhood of eggs undergoing division.—J. **Legendre**: The trophic rôle of birds as regards the culicines. Further studies on the part played by domestic animals and birds in the protection of man against insects (Culex, Stegomyia).—Paul **Wintrebert**: Movement without nerve and nervous movement of the embryos of Raia.—A. **Gruvel**: Two species of lobster from the coasts of Indo-China.—J. **Dumas** and D. **Combiesco**: Dysenteric intoxication of the rabbit and cholera intoxication of the guinea-pig by ingestion of soluble dysenteric and cholera toxins.

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