Calendar of Industrial Pioneers.

April 20, 1821. Franz Karl Achard died. — Descended from a French protestant family, Achard was born in Berlin, worked at chemistry with Marggraf and became director of the physical department of the Berlin Academy of Sciences. He was a pioneer in the production of sugar from beetroot and in 1801 erected a sugar factory.

April 21, 1819. Oliver Evans died. — Born in Newport, Delaware, in 1755, Evans became a practical miller. He was the author of numerous improvements in milling, and his system was adopted both in America and Europe. He also experimented with high-pressure steam ; in 1803 he began building steam engines, and the same year constructed a self-propelling dredging machine.

April 21, 1889. Robert Stirling Newall died. — The inventor in 1840 of iron wire ropes, Newall established works at Gateshead and became famous as a maker of submarine telegraph cables. The first successful cable between Dover and Calais was made by him in 1851, and he constructed half of the first Atlantic cable. He was also known as an astronomer, and presented one of his large telescopes to the University of Cambridge.

April 22, 1833. Richard Trevithick died. — One of the greatest engineers and the most fertile inventors of his day, Trevithick, like Evans, turned his attention to the use of high-pressure steam, constructed double-acting high-pressure engines, and between 1797 and 1808 made important experiments with locomotives. The son of a manager of a mine, Trevithick became chief engineer of some of the mines in Cornwall. In 1813 he erected some of his engines in Peru, where he resided about ten years.

April 22, 1864. Joseph Gilbert Totten died. — Trained as a military engineer at the West Point Academy, Totten rose to be colonel of the Corps of Engineers of the United States, and became known for his researches on the strength of materials and allied subjects, his work on the lighthouse board, and his investigation of New York harbour.

April 23, 1897. Adam Hilger died. — The founder of a firm of scientific instrument makers, Hilger was a native of Darmstadt. After being trained as a mechanical engineer he worked under Ertel in Munich and under Lerebours in Paris and about 1870 came to England. A few years later he set up in business for himself at Islington, becoming well known as a constructor of instruments for celestial spectroscopy.

April 25, 1840. Sir Robert Seppings died. — Master Shipwright at Chatham Dockyard, and then from 1813 to 1832 Surveyor of the Navy, Seppings introduced improved methods of docking and undocking ships, and was the inventor of the system of diagonally bracing and trussing the frame timbers of ships, an innovation of the first importance. He gave an account of his improvements to the Royal Society and was awarded the Copley medal.

April 26, 1893. Edward Alfred Cowper died. — An apprentice of John Braithwaite, Cowper afterwards worked with Fox and Henderson, and was employed on the buildings for the Great Exhibition of 1851. He then became a consulting engineer and was known for his work in connection with the development of the compound steam engine, his invention of the regenerative hot blast stove, and the introduction in 1868 of the modern bicycle wheel with wire-spoke suspension. In 1880 he was elected President of the Institution of Mechanical Engineers.

E. C. S.

Societies and Academies.

LONDON.

Royal Society, April 6.—Sir Charles Sherrington, president, in the chair.—F. E. **Smith** : On an electro-magnetic method for the measurement of the horizontal intensity of the earth's magnetic field. A Helmholtz-Gaugain arrangement of coils consisting of two interwoven helices of bare copper wire wound in spiral grooves in a marble cylinder are mounted on each side of the centre. Each coil is of 30 cm. radius, of six turns, and of $1\frac{2}{3}$ mm. pitch. The cylinder is mounted on a non-magnetic base, and can be rotated about a vertical axis. The magnet at the centre is 1 cm. long and about 6 sq. mm. in cross-section ; it is supported on a V of aluminium foil by a fine quartz fibre, to which is attached a reflecting mirror and a damping vane. The magnet is easily removed from its support, and a copper wire of equal weight substituted. The axial magnetic field due to the current in the coils is made slightly greater than " H," and its component in the magnetic meridian opposes H. By adjustment of the angle a between the axis of the cylinder and the direction of magnetic north, the indicator magnet is caused to set at right angles to the meridian. When torsion is eliminated, $H = Fi \cos a$, where F is constant of coil system and i is current. A determination of H occupies less than 4 minutes. The probable error, including that due to uncertainty of the value of the current, measured by a current balance, is about ± 4 in 100,000.—G. I. **Taylor** : Stability of a viscous liquid contained between two rotating cylinders. Steady motion of viscous liquid between two concentric rotating cylinders is unstable for symmetrical disturbances, provided the velocity of the system is greater than a certain value, and the ratio of angular velocities of the cylinders is less than the reciprocal of the square of the ratio of their radii, or is negative. The type of instability is periodic along the length of the cylinders, consisting of vortices enclosed in partitions rectangular in section, and they rotate alternately in opposite directions. When the cylinders rotate in the same direction each vortex extends across the space between the cylinders. The length occupied by each vortex is equal to the thickness of fluid between them. When the cylinders rotate in opposite directions, two systems of vortices rotating as though geared together appear. Some criteria for stability in approximate form suitable for numerical computation have been obtained.— T. H. **Havelock** : Dispersion formulæ and the polarisation of scattered light ; with application to hydrogen. Simple types of dispersion formulæ are considered when the medium consists of anisotropic molecules distributed at random and having an axis of symmetry. A formula for the corresponding ratio of the intensities of the two polarised components of light scattered at right angles, when the primary light is unpolarised, is given. The case of hydrogen is examined numerically and the ratio of the intensities agrees substantially with Lord Rayleigh's experimental value.—G. R. **Goldsbrough** : The cause of Encke's division in Saturn's ring. A satellite will, from its inclined path alone, produce one new division in the ring system. If the satellite be Mimas, a narrow division closely corresponding to Encke's division is produced. Similarly, Enceladus should produce a division in Ring B, but it would be almost unobservable.—C. **Spearman** : Correlation between arrays in a table of correlations. Correlations between arrays are expressed as functions of the independent variable elements entering into the main variables. When only one element is common

to any different variables, then the correlation between every two parallel arrays amounts to plus or minus unity. The converse is also true. The correlational coefficients considered are derived from product moments and the proofs do not assume any " normal " frequency distributions.—W. L. **Balls** : Apparatus for determining the standard deviation mechanically. The apparatus is related to the " Harp " Harmonic Analyser, similarly utilising separately loaded strings to deflect a yoke upon which they all converge. The design of the yoke has been modified to make the readings quantitative, and each string is loaded in proportion to the square of its deviation from the zero position. A template representing the frequency curve under examination is inserted behind the loaded strings, and the movement of an optical lever gives the " sum of the squares of the deviations." The reading is then transferred to a monograph to complete the calculation. The values obtained are correct to within 5 per cent.

Association of Economic Biologists, March 31.— Prof. E. B. Poulton, president, in the chair.— W. Lawrence **Balls** : The advantages and disadvantages of team work in economic biology. An attempt to enunciate certain principles governing the increasing development of team work between different scientific workers and sciences, particularly on the industrial and economic side. Minor principles : (1) the team leader must administrate research, and not merely administrate ; (2) the " scientific management " of scientific research must be considered ; (3) every new problem needs a new method. Of major principles, apart from the self-evident essential of sincerity, two are enunciated : (1) The specialist in an applied science must be a " jack-of-all-trades " ; (2) the scientific worker's code of " individualism in effort and credit ; communism in results " must not be contravened.—F. **Kidd** : Problems of fruit storage. The uses of fruit storage in commerce were described and an outline given of the amounts of fruit imported into this country as compared with what is grown ourselves. Apples, more particularly, were dealt with as one of the most important crops and our backward position in relation to other countries with regard to apple storage pointed out. An account was given of experiments carried out to test the efficacy of gas storage, a cheaper method than cold storage, the possibility of which was first suggested by purely scientific work carried out by the author on the effect of carbon dioxide and oxygen upon germination and growth. Finally, the author dealt with a series of recent experiments upon the respiration of apples during their storage life after gathering. At each of three temperatures tested, $2 \cdot 5^\circ$ C., 10° C., and $22 \cdot 5^\circ$ C., the rate of respiration changes with age in similar manner, first rising, then falling. The age changes in the respiration curves are, however, not related to the amount of respiration. Apparently, while the respiration rate has a temperature relation of $1 : 2 \cdot 5 : 8$, the age factor has a temperature relation of the order of $1 : 4 : 30$, and consequently at analogous points on the age respiration curves more carbon dioxide has been produced at $2 \cdot 5^\circ$ C. than at 10° C. or $22 \cdot 5^\circ$ C.

Zoological Society, April 4.—Prof. E. W. MacBride, vice-president, in the chair.—R. H. **Burne** : The recessus orbitalis in flat fishes.—L. T. **Hogben** : The influence of pituitary gland in inducing metamorphosis of the Axolotl.—J. T. **Cunningham** : Mendelian experiments on fowls. III. Production of dominant pile colour.—M. **Khalil** : A revision of the nematode parasites of elephants, with a description of four new species.

Linnean Society, April 6.—Mr. H. W. Monckton, vice-president, in the chair.—A. B. **Rendle** : A seedling of the red horse-chestnut (*Æsculus rubicunda*) in which a new terminal bud had been developed to replace the original shoot springing from the seed. The original main shoot, broken some distance below the plumule, was covered after a few days by a new growth which developed into a new terminal bud. The new bud resembled a normal terminal bud the outer leaves of which are imperfect.—L. A. **Borradaile** : The mouth-parts of the shore crab, *Carcinus mænas*. Each of the paired appendages plays a distinct part in manipulating the food. The circulation of the water in the gill-chamber follows a definite course dictated by the arrangement of the organs. The maxillipeds of the third pair of appendages function in feeding, as an operculum, and as cleaning organs.—C. **Turner** : The life-history of *Staurastrum Dickiei*, var. *parallelum* (Nordst.). The contents of the spores of this desmid were, at first, of an oily character. During later stages four nuclei were visible ; this apparently indicates that conjugation resulted in a diploid nucleus, and that a reduction division occurred inside the spore before the discharge of its contents. Germination results in the formation of four, three, two, or one desmid only, usually accompanied by an atrophied nucleus in the surrounding protoplasm when the smaller numbers are formed. Conjugation is usually of the normal type, and the zygospores are produced between the two desmids ; a conjugation tube was seen in one instance only. The conjugating desmids were asymmetrically placed and the protoplasmic contents indicate a slight differentiation of the sexes. The conjugation of a four-rayed with a three-rayed form is not infrequent, and a four-rayed form may occasionally be seen associated with the three-rayed embryonic desmids in the protoplasm discharged from the same spore, when germination takes place. The vegetative division often occurs by the development of a single circular bulging cell between the two semicells. The contents may divide, or an hour-glass constriction may cause the ultimate formation of two desmids.

PARIS.

Academy of Sciences, March 13.—M. Emile Bertin in the chair.—M. **Hamy** : A property of photographic emulsions and the registration of stars during total eclipses of the Sun in view of the verification of the Einstein effect. It has been found that a short exposure of a photographic plate to light of very feeble intensity, short of producing fogging, increases the sensibility of the plate, so that a plate which just shows a fifth magnitude star before this treatment shows a seventh magnitude star after the preliminary exposure, the time being the same in both cases. The bearing of this on the photography of stars round the Sun during a total eclipse is discussed.—C. **Guichard** : Networks which are harmonic to one C.L. congruence and conjugate to another C.L. congruence.—J. **Andrade** : The mechanical problems of regulating springs in chronometers.— C. **Nicolle** and E. **Conseil** : Preventive vaccination by the digestive tract in man. Experiments on voluntary subjects (Europeans) showed that the dead cultures of organisms secured immunisation in man against Mediterranean fever and dysentery. In the latter, owing to the danger of subcutaneous inoculation, the use of a digestive vaccine offers great advantages.—M. **Lecat** : Abnormal caylians and bicaylians.—K. **Popoff** : The general equation of the elliptic type.—E. **Cartan** : Generalised space and the theory of relativity.—E. **Bompiani** : The geometry of curved spaces and the energy tensor of

Einstein.—M. **Frontad** : Logoids of slipping of soil.—E. **Fichot** : The sense of rotation of cotidal lines round amphidromic points.—M. **Siegbahn** : The degree of exactitude of Bragg's law for the X-rays. Exact measurements have shown that calcite gives a small deviation from Bragg's theory, the differences although small being systematic. M. Dauvillier has recently suggested that the deviation was due to the complexity of the Ka_1 line used in the measurements ; but the result is the same for the line a_2, which according to M. Dauvillier is simple.—E. **Gleditsch** and B. **Samdahl** : The atomic weight of chlorine in an ancient mineral, Balme apatite.—J. **Durand** : The thermal treatment of some cast irons. Heating to 900° C. and slow cooling increased the proportion of graphite and diminished the resistance to breaking. Tempering in oil from 900° C. and repeating to 650° C. increased the breaking load.—M. **Charriou** : The separation of ferric oxide and alumina from lime by the nitrate method.—H. **Gault** and T. **Salomon** : The a-alkyl levulinic acids.—E. **Decarrière** : The *rôle* of gaseous impurities in the catalytic oxidation of ammonia. Extremely minute proportions of hydrogen phosphide (0·2 parts per million) poison the platinum catalyst in this oxidation, but the simultaneous presence of acetylene and hydrogen sulphide, especially the latter, partially neutralises the poisonous action of the phosphorus compound.—E. **Grandmougin** : The acyl and alkyl leucoindigos.—C. **Jacob** : Eruptive rocks of the intermediate series in North Annam and in Tonkin.—P. **Corbin** : Some sections on the eastern edge of the Vercors-massif.—L. **Guillaume** : Tertiary and existing Turritella : evolution and migrations.—P. **Lesage** : The determination of the germinative faculty other than by the actual germination of the seeds. A. Němec and F. Duchon have recently described a method based on the evolution of oxygen by the action of hydrogen peroxide on the diastase of the seed as the only method available for testing the vitality of the seed other than actual germination tests. The author directs attention to a method described by him in 1911 and 1917 based on the colour imparted to dilute solutions of potash by the seeds. This gives a definite result in four hours.—J. **Bouget** and A. D. **de Virville** : The influence of the meteorology of the year 1921 on the reddening and fall of leaves.—R. **Poisson** : Histogenesis of the flight muscles in Ranatra, Nepa (*N. cimicoides* and *N. maculatus*).—G. **Bourguignon** : Modification of the chronaxy of the skeleton muscles and their nerves by the repercussion of the lesion of the neurones with which they are functionally associated.—A. **Lumière** and H. **Couturier** : Traumatic shock.—C. **Levaditi** and S. **Nicolau** : The embryonic leaflets in relation with the affinities of the vaccine virus.—E. **Fernbach** and G. **Rullier** : The action of an artificial gastric juice on tubercular pulmonary granulations of the guinea-pig.

Academy of Sciences, March 20.—M. Emile Bertin in the chair.—A. **Haller** and Mme. **Ramart-Lucas** : New distinctive characters of the three propanol-a-camphocarbonolides melting at 141°, 117°-118°, and 89°-90° C. respectively.—G. **Mittag-Leffler** : Cauchy's theorem on the integral of a function between imaginary limits.—C. **Sauvageau** and G. **Denigès** : Remarks on the efflorescences of *Rhodymenia palmata*. The presence of a xylane in these algæ. The pentosane extracted by the method of Mme. Swartz from *R. palmata* gives xylose on hydrolysis and hence is a xylane. This is the first case of the extraction of this substance from an alga.—J. **Drach** : The determination of the differential equations of the second order integrable by quadrature.—G. **Julia** : The trans-

formation of rational substitutions into linear substitutions.—M. **Stoïlow** : The definite integral and the measurement of *ensembles*.—J. **Ubach** : Observations of the partial eclipse of the sun of October 21, 1921, made at Buenos Ayres (Argentine Republic).—F. **Michaud** : A micromanometer with sensibility capable of regulation.—A. **Guillemet** : A new objective shutter for taking aerial photographs with apparatus with long focus.—V. **Henri** : The absorption spectrum of benzine vapour and the fundamental magnitudes of the benzine molecule. The absorption spectrum of benzine vapour has been measured at pressures between 0·01 and 65 mm. The ultra-violet spectrum can be represented very exactly by a formula derived from Bohr's theory, and consists of four series of superposed bands. The results show that the molecule of benzine is a very symmetrical structure, the movements of which obey the simple laws deduced for diatomic molecules.—F. W. **Klingstedt** : The ultra-violet absorption of phenol in different solvents. The absorption spectrum of phenol in solution depends on the nature of the solvent. Comparing with the spectrum of the vapour, one type of solvent (carbon tetrachloride and ether) produces only a displacement and enlargement of the bands. The second group of solvents (methyl and ethyl alcohol, and water) change the absorption spectrum completely. The spectrum of pure liquid and solid phenol is intermediate between the two preceding types.—C. **Chéveneau** : An optical method for the determination of the reciprocal solubility of slightly miscible liquids. The method is based on the use of a hollow prism divided into several compartments. The differences of the refractive indices of the two liquids are taken directly, independently of the temperature. The case of aniline and water is given and the results compared with the gravimetric method.—G. **Guilbert** : The observation of clouds and the prediction of weather.—H. **Joly** : The existence of phenomena of horizontal displacements of large amplitude at the eastern extremity of the Iberian chain, near Montalban (province of Téruel, Spain).—H. **Coupin** : Determination of the optimum of humidity of the external medium in the Oscillaria.—A. **de Puymaly** : The reproduction of Vaucheria by amœboid zoospores.—G. **Tanret** : The chemical composition of ergot of Diss (*Ampelodesmos tenax*) and the ergot of oats. Since the closing of the Russian frontiers ergot of rye has become extremely scarce, and the possibility of obtaining ergot from other Graminaceæ is of immediate interest. Of the two plants mentioned, oats only would appear to contain sufficient of the active principle to be of practical service. From one kilogram of Algerian oats 1·8 gram of crude and 0·8 gram of pure crystallised ergotinine was isolated.—C. J. **Gravier** : The relations between the Crustacean and the sponge in the sponges carrying Cirripedes.