The State is making a change in many of the endowed charities which are scattered all over the country. In the course of time it will be possible, not only to apply the whole of the educational endowments to the original purposes of their founders, but to combine the small endowments so as to make them effective.

THE issue of the Journal of the Association of Teachers in Technical Institutions for January contains a paper by Mr. John Wilson, the president of the association, on the relation of the technical institution to the modern university. After commenting upon the advanced character of much of the teaching carried on in technical institutions, and mentioning the creditable amount of research work published yearly by the staffs and senior students of these schools and colleges, Mr. Wilson gave some interesting statistics as to the students who graduated in science at the University of London during 1909. It appears that altogether 292 candidates were awarded the degree of B.Sc., and that 57 of these studied entirely at technical institutions, while if the students who did part of their work at a technical institution are included, the number reaches 80. Mr. Wilson also gives the numbers of registered " internal " students and " recognised " teachers in London polytechnics, and compares the total with those in the case of certain other London colleges. During the session 1908–9, the number of registered internal students in the faculty of science was:—at University College, 224; King's College, 175; East London College, 162; and at eight " recognised " polytechnics, 372. In these eight polytechnics there are 94 " recognised " teachers of arts, science, and engineering. In other words, the polytechnics have become important centres of university work. Mr. Wilson maintains that the success of even the limited recognition of London polytechnics by the University of London clearly points to the desirability of the extension of that recognition by the University and to a widely increased measure of recognition of local technical institutions by the provincial universities.

AT a meeting of the Royal Dublin Society on March 9 Prof. Senier delivered a lecture on " The University and Technical Training." From the account of the meeting in the *Irish Times* of March 10 we learn that Prof. Senier considered four types of institutions for the advancement and diffusion of learning and of its applications to society; institutions of acknowledged university rank or residential college universities, exemplified by Oxford; the research university, as seen at Berlin; the examination university, first known in Napoleon's University of Paris; and the technical research university, Charlottenburg. In England, he said, where numerous new universities have been established in recent years, the type adopted has been a combination of the German Research University and the German Technical Research University, the one or the other type predominating, according to local needs, and the whole adapted to its surroundings, particularly to the conditions of secondary education. Whatever view may be held respecting the German practice of separating these two types, as adapted to German conditions, Prof. Senier thinks that for the conditions which prevail in the British Isles the combination of the two in new universities is a wise arrangement. The two new universities in Ireland are also of this combined type, and are to be adapted to Irish educational conditions and the needs of the country. After directing attention to the influence Liebig exerted through his students in the direction of scientific research, Prof. Senier said so great is that influence that science laboratories after the model of Giessen have become the recognised attribute of science professorships throughout the world. Another advantage possessed by the German university is the character of the leaving examination of the secondary school. It corresponds to a matriculation examination, with the added knowledge acquired by about two years' university study in arts, and its acceptance by the university as evidence of sufficient knowledge for matriculation relieves the university of the practice of giving the student an examination as his first experience on entering. In Prof. Senier's opinion secondary schools should abandon all attempts to teach experimental science. To rival the work of the German universities the better organisation and coordination of the entire educational

system is necessary. Germany has built up a chemical industry with tens of millions of pounds annually through the agency of research chemists, methodically trained in technical schools. German manufacturers know the value in dividends of the services of trained research chemists; Irish and English manufacturers do not.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, February 25.—Prof. H. L. Callendar, F.R.S., president, in the chair.—Prof. J. **Perry**: Telephone circuits. The author published a paper in the Proceedings of the society in 1893 showing how voltage v and current c are attenuated along a telephone or submarine telegraph line, a line with resistance r, capacity k, inductance l, and leakance s per unit length; currents are of the form $\sin qt$. When lq/r is considerable the mathematical expressions become simple. It was pointed out that the introduction of l is of great benefit. The author now points out that k may be made negative by the use of inductance leaks to earth, and l may be made negative by the use of condensers in series with the line. To introduce l, as Mr. Pupin has done, by inductance coils at equidistant places on the line, or to introduce the other properties mentioned by placing other contrivances at equal distances, is a mathematical problem of great complexity. Contrivances placed close together have the same effect as the continuous distribution of properties, but there is considerable expense; the problem is to find how far apart the contrivances may be placed so that the effect produced shall still be beneficial. Mr. Pupin has given a rule for the spacing of his coils, but practical men dispute its accuracy; nobody has given a rule for other contrivances; the object of the author is to give an easy method of calculation which is practically correct, and can be used when the contrivance is any network or other combination of resistances, inductances, and capacities—some being leaks to earth—and it may include transformers, motors, and generators. Suppose there are contrivances at the equidistant places A, B, &c., m miles apart in a cable which has the above-mentioned properties r, k, l, and s. There is a contrivance the terminals of which are A and A_0, another the terminals of which are B and B_0; between A_0 and B there is m miles of cable. Let the currents in the line at A, A_0, and B be c, c_0, and C. Let the voltages at these points be v, v_0, and V. The assumption on which the whole method is based is that $V/C=v/c=\rho$. This is practically true everywhere in a long line except near the ends. Now whatever be the nature of the contrivance, we can calculate v_0 and c_0 from v and c. It is also known that

$$V = v_0 \cosh mn + \frac{r+lqi}{n} c_0 \sinh mn,$$

$$C = c_0 \cosh mn + \frac{n}{r+lqi} v_0 \sinh mn,$$

when

$$n = \sqrt{(r+lqi)(s+kqi)}.$$

Putting V/C or ρ equal to v/c, we have a quadratic to calculate ρ, and therefore V and C, and the problem is solved. Taking $c=\sin qt$ and calling it 1, then $v=\rho$. Whatever the contrivance may be, we find that $V=\alpha+\beta\rho$ and $C=a+b\rho$, where α, β, a, and b are given in value; they are usually unreal quantities of the form $M+Ni$, where i is $\sqrt{-1}$. Solving for ρ, and finding C, we have two answers which are reciprocals of one another. If $\frac{1}{2}(a+\beta)$ be called P, and this is very easily evaluated, then

$$C = P \pm \sqrt{P^2-1}$$

Examples of the use of the method are given, some showing that the detached contrivances produce much the same and others very different effects from what might have been expected from a study of the cable with continuous properties. It was shown that a line may have contrivances somewhat far apart which will tune it to a musical note merely, so that it acts almost like an ohmic resistance, but which will not transmit well the currents of other frequencies, and that for the commercial transmission

of speech there must be a compromise. The author laid stress upon the fact that his method of calculation could be taught to quite non-mathematical people.—Prof. C. H. **Lees** : The laws regarding the direction of thermo-electric currents enunciated by M. Thomas.—H. R. **Nettleton** : New method of determining thermal conductivity.

Mineralogical Society, March 15.—Prof. W. J. Lewis, F.R.S., in the chair.—G. W. **Grabham** : A new form of petrological microscope, with notes on the illumination of microscopic objects. The new instrument, which is of the " Dick " or " English " pattern, has a focussing substage carrying a series of condensers mounted on a triple nose-piece, each capable of being inserted in the axis of the instrument. A new explanation was given of the " Becke " or bright-line effect, especially applicable to parallel polarised light traversing mineral sections, which meet along inclined junctions.—W. F. P. **McLintock** : Datolite from the Lizard district. Datolite, which is associated with calcite, chalcopyrite, and natrolite (rare) in veins and geodes at the junction of the serpentine and hornblende schist, Parc Bean Cove, Mullion, Lizard district, Cornwall, occurs in crystals measuring up to 2 cm. along the *b* axis, and displayed fourteen forms, of which two were new. An analysis gave SiO_2, 37.45 ; CaO, 34.67 ; Fe_2O_3 and Al_2O_3, 0.57 ; B_2O_3, 21.87 ; H_2O, 5.67 ; total, 100.23.—Arthur **Russell** : Additional notes on the occurrence of zeolites in Cornwall and Devon. The occurrence of heulandite, a mineral hitherto not recorded from Cornwall, at Carrick Du Mine, St. Ives, Cornwall, was described ; also of chabazite and heulandite at the Ramsley Mine, South Tawton, Devon.—Dr. J. W. **Evans** : A modification of stereographic projection. Faces below the plane of projection are represented by the same points as parallel faces above it, upper faces being distinguished by a plus, and lower faces by a minus, sign.—Dr. J. W. **Evans** : Axes of rotatory symmetry. Coincidence is complete or codirectional when equivalent lines and their directions coincide, incomplete or contradirectional when equivalent lines coincide, but equivalent directions of uniterminal lines are opposed ; in both cases it is colinear. If a minimum rotation of $2\pi/n$ result in codirectional, contradirectional, or colinear coincidence, the axis of rotation has codirectional, contradirectional or colinear symmetry, with cyclic number *n*.—Prof. H. L. **Bowman** exhibited models illustrating space-lattices and Sohncke's point-systems.

Dublin.

Royal Dublin Society, February 22.—Mr. R. M. Barrington in the chair.—Prof. W. **Brown** : Chrome-steel magnets. Eight steels containing from 1.75 to 9.22 per cent. of chromium were tested for magnetic moment per gram, the best result being obtained with a magnet which contained about 2.5 per cent. of chromium.—W. J. **Lyons** : The distribution of mean annual rainfall over the counties of Dublin, Wicklow, Kildare, and Meath. The rainfall over this area varies from below 28 inches to probably more than 60 inches in a very marked manner, closely related to the very striking orographical features of the area. The author suggested that the recognised action of hills in inducing condensation by causing ascensional currents was not an adequate explanation of the marked increase found in the rainfall of hilly districts. He thought it probable that mountains facilitated the processes of rain development, apart from any influence on condensation.—Prof. W. F. **Barrett** : A simple form of open-scale barometer. In form this instrument resembles an air thermometer, only that it indicates variations of atmospheric pressure and is almost insensible to changes of temperature. This is accomplished by making use of a Dewar's liquid-air flask as the air receptacle, into which is sealed a quill glass tubing containing an index of a dense non-conducting liquid. The tube is open to the air at one end, and is sealed into a wider glass tube which surrounds it, and from which the air has been exhausted as completely as possible. It is found in practice that the readings correspond fairly well with those of an ordinary barometer, and as it can be made as sensitive as desired by altering the ratio of the capacities of the bulb and index tube, it is adapted for domestic use as a weather-glass, and claims to be nothing more.

Paris.

Academy of Sciences, March 14.—M. Émile Picard in the chair.—Henri and Jean **Becquerel** and H. Kamerlingh **Onnes** : The phosphorescence of uranyl salts at very low temperatures. The changes observed in the absorption spectra at temperatures down to that of liquid air have been described in a previous paper. In the present paper details of the spectra are given for the temperatures of 80° C. absolute (boiling nitrogen) and 14° C. absolute (solid hydrogen). The bands approach asymptotically a limiting position as the temperature is lowered. A very strong magnetic field (35,000 Gauss) is without influence on the spectra. Ordinary phosphorescent spectra appear to be due to the effect of traces of impurities in the phosphorescent substance ; this is not the case with uranyl salts ; the spectra appear to be due to the uranium itself. —H. **Deslandres** and P. **Idrac** : The spectrum of the comet 1910a. The arrangement of the spectrograph used is described, and the wave-lengths of the lines observed given. The bands of hydrocarbons and cyanogen were identified.—J. **Boussinesq** : The vertical propagation, at great depths, of the movement of waves by emersion in the case of a canal or basin indefinite horizontally.—MM. **Haller** and Ed. **Bauer** : The alkylation of the fatty ketones by the use of sodium amide. The decomposition of the hexa-alkylketones. Diethylketone has been methylated by sodium amide and methyl iodide, ethyl-isopropylketone, di-isopropylketone, a high boiling condensation product, and tetramethyl-ethylketone, being produced. The hexa-alkylacetones are split up by sodium amide, a trialkylmethane and trialkylacetamide arising from the reaction.—Prof. Hittorf was elected a foreign associate.—Charles **Nordmann** : The absorbing atmospheres and the intrinsic luminosities of some stars.—Jules **Baillaud**, J. **Chatelu**, and M. **Giacobini** : Observation of a minor planet at the Observatory of Paris. The traces of this planet were first noticed by Jules Baillaud on a negative of the international chart of the sky taken on March 3. Observations are tabulated for March 3, 5, 7, 8, 10, and 11.—Frédéric **Riesz** : Certain systems of functional equations and the approximation of continued functions.—L. **Remy** : The algebraic surfaces representable on that of Kummer.—H. **Larose** : The equation of telegraphists.—E. **Estanave** : The simultaneous production of stereoscopic relief and of changing aspect in the photographic image.—Pierre **Weiss** and Kamerlingh **Onnes**. The saturation intensity of magnetisation at very low temperatures. The intensities of saturation have been measured at the ordinary temperature and at the temperature of boiling hydrogen (20° C. absolute) for nickel, iron, and magnetite. The results for cobalt were not satisfactory.—Pierre **Weiss** and Kamerlingh **Onnes** : The magnetic properties of manganese, vanadium, and chromium. For these metals at the temperature of solid hydrogen (14° C. absolute) there was expected either the appearance of ferromagnetic phenomena or a paramagnetism considerably increased according to Curie's law. It was found experimentally that neither of these effects was produced, the magnetic phenomena remaining very slight. The theoretical consequences of these facts are discussed.—P. **Vaillant** : A particular case of evaporation. A study of the diffusion of the vapour arising from a liquid in a cylindrical tube the length of which was great in proportion to its diameter.—Ch. **Féry** : A new reflectometer. A hemispherical cavity is formed in a block of plane glass, and the hole exactly filled by a hemispherical block of glass of the same curvature. The drop of liquid the refractive index of which is to be measured is placed between the two blocks, and the radius of the dark ring formed by total reflection measured. From this and the corresponding radius of the dark ring when air is between the two blocks the index of refraction can be determined with an accuracy of about 0.005.—L. **Bloch** : Chemical actions and ionisation by bubbling. It is shown that the ionisation produced when gases are evolved from a liquid is the result of actions in the liquid surface.— O. **Boudouard** : The testing of metals by the study of the damping of vibratory movements.—M. **Vèzes** : The analysis of essence of turpentine by curves of miscibility. The author's results generally confirm those of M. Louise, but some differences are pointed out.—M. **Lecoq** : A colloidal solution of pure metallic arsenic. A colloidal