The new regulations of the Board of Education dealing with junior technical schools were the subject of considerable discussion, and the view was generally expressed that all forms of specialised teaching should come within the scope of the new regulations, and that all limiting conditions as to the pupil's future outlook should be entirely removed from the regulations.

Special consideration was given to that section of the report of the Royal Commission which dealt with the examination of the external student desirous of proceeding to the degrees of the University of London. It was agreed that access to the examinations of the University should continue to be, as in the past, effectively provided for with such improvements in method as experience would suggest, but that no steps should be taken which should in any way diminish in standing or importance the quality of the degree awarded to the external student, or which should impair the position of the external as compared with the internal student. It was further strongly urged that there should not be, as proposed, any exclusion of unattached students from the examinations in technology, including engineering, in view of its disastrous effect upon higher technological education, and that it was of the utmost importance that the relations hitherto subsisting between the London polytechnics and the University of London should be maintained, and the recognition of eligible teachers in these institutions be continued.

The question of the new and important regulations for the establishment of technical bursaries by the "1851" Exhibition Commissioners with a view to the assistance of eligible graduates of the universities desirous of proceeding immediately to industrial employment was fully considered, and it was agreed that the Commissioners should be asked to consider the desirability of including within the list of accepted universities other qualified technical institutions.

The very important question of compulsory continued education in respect of children who had left the elementary schools to enter into employment with a view to their further education, both vocational and general, was carefully considered

It was urged that having regard to the vast expenditure of public money, amounting now to upwards of twenty-four millions sterling per annum, and with a view to conserve the results of this expenditure, not only should "half-time" be abolished, but all regulations by means of which a child may be relieved of attendance at school before he reaches the age of fourteen, and that there should be enacted a law under which children leaving the elementary school at fourteen should be required to attend within the usual hours of labour a continuation school, which shall include in its curriculum not only vocational subjects, but such subjects of a general character as shall conduce to his effective preparation for the duties of life, and that the responsibility for the due observance of the law be laid upon the employers. It was shown that only a mere fraction of the children leaving school for employment continued their education, the figures being, for those between fourteen and seventeen years of age, only 300,000 out of a total of 2,335,000, or 13 per cent., with the result that there was a most serious economic and moral loss to the nation.

It was further shown that the German Government, realising this great loss to the German nation, had for some years established compulsory day continuation schools for children in employment throughout the empire, with most satisfactory results. There was a general consensus of approval. In the city of Berlin in 1910–11 there were 68,000 students of both sexes enrolled in continuation schools, of whom 32,000 were students in compulsory schools.

J. H. R.

ANCIENT PIGMENTS.

IN *Archaeologia*, vol. lxiv., pp. 315–35, Prof. A. P. Laurie, of the Royal Academy of Arts, presents us with the chief results of an important research on the historical and local succession of the use of "ancient pigments." His material has been drawn almost entirely from western Europe, Chinese, Persian, and Indian painting not being discussed. His conclusions, derived mainly from the optical and microchemical examination, necessarily much restricted, of valuable illuminated MSS., amplify rather than correct those of previous investigators, such as Sir Humphry Davy, Marcelin Berthelot, and other chemists of the nineteenth century, but synthetic experiments have in some cases been utilised. The story more nearly approaches completeness in some sections than in others. The lakes, for example—pink, lilac, red, crimson, and purple—have not as yet, in all cases, revealed their origin. Perhaps the series and sequence of blue pigments may be cited as a characteristic example of Dr. Laurie's fuller treatment of his subject. Of the six blues included in the early list—indigo, Egyptian-blue, the mineral azurite or chessylite, real ultramarine from lapis lazuli, blue verditer and smalt—the most interesting is without doubt Egyptian-blue. To this remarkable pigment Prof. Laurie has devoted much attention, having finally determined its composition and properties, and also the *optimum* temperature for its production (see Proc. Roy Soc., vol. lxxxix. A, pp. 418–29). Although these six pigments were not all in use everywhere and at the same time they cover the early centuries and the period between classical times and the close of the sixteenth century. Later additions to blue pigments comprise Prussian-blue, near the beginning of the eighteenth century; cobalt-blue, and artificial ultramarine in the first quarter of the nineteenth century; and cœruleum about the year 1870. This dating of pigments and of their use is of the highest importance in connection with questions as to the provenance and authencity of works of art. For full details Prof. Laurie's paper, with the annexed tables, must be consulted. A few typographical errors in this important memoir should be noted; Robertson on p. 321 should be Roberson; sulphur not silver should appear in the second line from the bottom of p. 331; and the name of the mollusc from which the Irish monks prepared the Tyrian purple employed in their illuminated MSS. is not quite accurately given in the earlier of the tables appended to the memoir. It may be suggested that this purple pigment, which is a dibromoindigotin, ought to be identifiable where its presence is suspected by means of its high content of bromine.

A. H. C.

CELLULOID AND ITS DANGERS.

THE Departmental Committee on Celluloid, appointed by the Home Secretary some fifteen months ago to consider the precautions necessary in the storage and use of this substance, has recently issued its report (Cd. 7158, 1913). From this it appears that the product accepted as "celluloid" in the report consists essentially of gelatinised nitrocellulose and camphor, the proportion of nitrocellulose usually varying from 70 to 75 per cent. in ordinary celluloid articles, and from 80 to 90 per cent. in kinematograph films. It ignites very readily, and burns with great rapidity and fierceness; moreover, in certain circumstances it may take fire without the direct application of flame. If submitted to a moderately high temperature for some time it suddenly decomposes with evolution of considerable heat and the emission of inflammable and poisonous gases

—chiefly carbon monoxide and nitric oxide, with small proportions of hydrocyanic acid. Mixed with air in suitable quantity, the evolved fumes are highly explosive; but the Committee found no evidence to confirm the opinion that celluloid itself is liable to spontaneous ignition at ordinary temperatures or is explosive in ordinary circumstances.

A number of experiments were carried out at the Government laboratory for the information of the Committee. It was found that the "fuming-off" test devised by Prof. Will was the simplest and one of the most trustworthy methods for ascertaining the relative stability of various kinds of celluloid towards heat. No definite relation between chemical composition and stability to heat could be detected, though a small proportion of mineral matter appears to have a distinct stabilising effect. Celluloid contains sufficient oxygen to support its own combustion, and once ignited will continue to burn in the absence of air; chemical fire extinguishers using carbonic acid gas are, therefore, of little use, and water alone is the best means of extinguishing the substance when burning. The Committee makes a number of recommendations as to the storage and working of celluloid, with the view of lessening the danger from fire; for these the report itself should be consulted.

WIRELESS TELEGRAPHY.[1]

WHEN Mr. Marconi first came over to England in 1896, Mr. Swinton was the means by which he was introduced to Sir William Preece, and the latter, having just then come to the conclusion that his methods of inductive and conductive telegraphy—with which he had been attempting to effect communication with lightships—were unworkable, set the Post Office to work with Mr. Marconi, Sir John Gavey having charge of the experiments. It might seem strange, as Prof. S. P. Thompson had pointed out in NATURE, that Sir William Preece missed the possibilities of Sir Oliver Lodge's Hertzian-wave experiments, but took up Mr. Marconi with practically the same system. But Sir William Preece had always been particularly sympathetic to the young, and Sir Oliver Lodge had not approached him directly.

Next, quoting from an article which Sir William Crookes contributed to *The Fortnightly Review* in 1892, Mr. Swinton showed that Sir William Crookes had in those days fully realised the possibility of telegraphy by means of Hertzian waves. He clearly described how messages might be sent in Morse alphabet by means of apparatus tuned to special wavelengths and receivable only by apparatus similarly tuned. Mr. Crookes also referred to experiments made by Prof. Hughes in 1879, where wireless signals were transmitted over several hundred yards, at which experiments he had assisted. There seems to be no doubt that Hughes discovered Hertzian waves and noted their effects some years before Hertz rediscovered them, but, unfortunately, Sir George Stokes told Hughes, apparently quite erroneously, that the results could be explained by known induction effects, and Hughes was so much discouraged that he never published anything on the matter.

Then, with reference to Sir Oliver Lodge, Mr. Swinton said that he would always regard him as the original inventor of wireless telegraphy, because Sir Oliver Lodge in his Royal Institution lecture in 1894, and later at the Oxford meeting of the British Association in the same year, had first publicly sent signals, rung bells, and deflected galvanometers over a distance by means of Hertzian waves. It had been said that Sir Oliver Lodge did not make clear the telegraphic application of his experiments, but Mr. Swinton was present at Lodge's Royal Institution lecture, and was so much impressed with the telegraphic capabilities it suggested, that he had next morning discussed with his then assistant, Mr. J. C. M. Stanton, the possibility of setting up communication between his residence in Jermyn Street and his office in Victoria Street by Lodge's method. This experiment was never tried, as they had thought that too many large buildings intervened, but preliminary experiments were made in Mr. Swinton's office, and signals on a bell were successfully transmitted and received through several walls with a large Tesla high-frequency coil used as transmitter, and as receiver a coherer consisting of a heap of tintacks. This was two years before Mr. Marconi arrived in this country, but in making these statements Mr. Swinton did not wish in any way to belittle the great work that Mr. Marconi undoubtedly accomplished in making wireless a practical and commercial success by long-continued and arduous labours.

Passing to his experiments, Mr. Swinton stated that finding a difficulty in reading wireless messages by ear, he had devoted attention to automatic recording apparatus. A simple arrangement that he had devised was to employ a sensitive or manometric flame, such as can be made exceedingly sensitive to minute sounds, the flame greatly shortening and roaring the moment the smallest sound reaches it.

Different descriptions of these flames respond more readily to sounds of different pitches, and they also can be tuned to some extent, so that different flames would discriminate between signals of different acoustical pitch even of the same electrical periodicity. All that was necessary was to place the receiving telephone in proximity to the sensitive portion of the apparatus producing the flame, and if a screen were placed in front of the latter hiding the flame when it was shortened, photographic records of Morse signals were easily obtained by throwing by means of a lens a small image of the flame when visible upon a moving strip of photographic paper. Another method of recording the signals employed by the lecturer was to arrange a quick-period mirror galvanometer with the movable portion oscillating between adjustable stops, the oscillations being recorded on a strip of moving photographic paper by projecting on the latter the reflection in the oscillating mirror of a bright point of light proceeding from a pinhole in an opaque box, containing an electric lamp.

Operating, as he did, at his own house, with a very small aërial, Mr. Swinton, in order to magnify the signals, made use of several relays of the types invented by Mr. S. G. Brown. He showed three of these relays connected in series, actuated by signals received on a temporary aërial that Messrs. Gamage had kindly erected on the roof of the Institution of Electrical Engineers. The relays operated a Kelvin siphon-recorder, as well as a loud-speaking telephone, which could be heard by everyone present. At a quarter to nine o'clock a special congratulatory message was received. This was sent by Commandant Ferrié, a vice-president of the society, from the Eiffel Tower. Not only could every signal be clearly heard throughout the Lecture Hall, but it was also received on the siphon-recorder. Further, the motions of the siphon were made visible to the audience, being optically projected on a screen with the aid of an Epidiascope, kindly lent by Messrs. Leitz and Co. The dots and dashes were easily read, both audibly and visibly, though the Admiralty in London was accidentally during part of the time sending radio-telegraphic signals, which were likewise made audible by means of the loud-speaking telephone. The message from

[1] Abstract of the presidential address delivered to the Wireless Society of London on January 21 by Mr. A. A. Campbell Swinton.