

to the bombardment of an electric discharge are, as Sir William Crookes has taught us, beautifully phosphorescent. I have here in this tube some thin crystalline plates of artificial ruby; they become beautifully phosphorescent when the current from the induction coil is passed through the tube, and by the kindness of Sir William Crookes I can show you some true rubies treated in a similar way. The behaviour of the artificial rubies in the vacuum tube is not quite as brilliant as that of the natural ones, but hitherto no special attention has been devoted to their preparation; they are simply thin plates broken from a large crystalline mass of slag such as that on the table. I may add that this variety of corundum produced by the burning of aluminium is very hard, and may be used, not only for the same purposes as ordinary corundum, but for lining the crucible in which the operations are conducted, so that the product of combustion takes its place in conducting the process. My warmest thanks are due to Dr. Goldschmidt for lending me the beautiful specimens on the table, and to Mr. W. H. Merrett for his aid in conducting the experiments.

I have set before you the considerations respecting the use of metals as fuel simply as they appear to flow. I trust that the adoption of the title of this lecture has been justified by the evidence given as to the possibility of using metals as fuel in the strictest sense of the word. It is well to be accurate on this point because we are told that the first known appearance of the word "fuel" in the English language occurs in a poem (*Coeur de Lion*, 15th century), and seems to have been a misinterpretation of the old French word *fouaille*, and was adopted in the belief that sustenance for the body and food for the flames are synonymous. Widening our view of metals by grouping them with fuels will be acceptable because fire and flame powerfully appeal to our thoughts. We "kindle" enthusiasm, and add "fuel" to the fire of ambition, in fact we constantly use fire, flame and fuel as similes, and any prospect of extending their use to us as such by enlisting metals in the service will be welcome. An early Italian metallurgist, Vanoccio Biringuccio, might not have thought so, for I find that, writing in the sixteenth century, he quaintly devotes the last chapter of a work on metallurgy to "Fires which burn and leave no ashes."¹ In this chapter he appeals to envy, hatred, malice and other products of a kindled imagination, and traces their analogies to fuel and flame, but he speedily takes leave of his readers in alarm at the prospect such a treatment of the subject presents.

The burning of aluminium as fuel gives us sapphires and rubies in the place of ashes, and metallic fuel is burnt, not by the air above, but by the oxygen derived from the earth beneath, as it occurs in the red and yellow oxides to which our rocks and cliffs owe their colour and their beauty.

AGRICULTURAL EXPERIMENTS.

A NUMBER of reports on agricultural experiments conducted by provincial colleges have reached us, of which the most comprehensive is that issued by the Agricultural Department of the Durham College of Science. Most of the field-work that this report deals with was planned and started by Prof. Middleton's predecessor, and the results are becoming more valuable each year. It is a report that should be in the hands of every one that is interested in agricultural progress, though no one need expect to find it light reading.

In the north of England, as in many other parts of the country, the turnip crop suffers severely from finger and toe, and the work of the Durham College of Science is throwing much fresh light on this subject. Hitherto the disease has chiefly been combated by the application of large dressings of slaked lime applied a year or less before it was intended to grow a cruciferous crop. In this way the fungus and its spores are destroyed more or less effectively, but at a larger cost than agriculture can now well bear. It appeared, however, that if lime can get rid of the disease when the substance is applied only a short time before the crop that the fungus affects is to be grown, the clearance of the soil will be much more effectual—or will be accomplished at less outlay—if the trouble is attacked at its fountainhead, namely, directly after an infected crop has been grown. With this object in view, a field that had grown a much-diseased crop

¹ "De la Pirotechnia," 1540, p. 167. (Venice). "Del fuo:ho che consuma et non succenero."

in 1896 was divided into five plots in the autumn of that year, one of the plots being soon afterwards treated with 2½ tons per acre of ordinary burned lime, while another plot did not receive its dressing till the autumn of 1899. Following the four-course shift the field was again under turnips in 1900, with the following result per acre:—

	Weight of roots		Percentage	
	Sound	Diseased	Diseased and destroyed	Sound
	Tons	cwt.		
No lime	13	18	41·6	58·4
Lime applied, Feb. 1897...	20	11	10·1	89·9
" " Nov. 1899...	15	12	29·2	70·8

The above figures hardly put the case so strongly as they might, for whereas when the roots were diseased to the extent of 41·6 per cent. and 29·2 per cent., such roots were practically valueless, the infected roots were far from the putrescent stage when the percentage of disease was 10·1.

The now well-known Cockle Park experiments on "manuring for mutton" are described at length in the above report, and are popularly presented in a circular issued by the Northumberland County Council. In this circular the results for each plot are shown by a diagrammatic sheep, the sections of whose body represent (a) the growth due to the soil in its unimproved condition; (b) the growth induced by manurial treatment; and (c) the portion of such growth as is needed to cover the manurial outlay. So far a large dressing of basic slag applied four years ago, and not repeated, has proved most effective; whereas the lowest place is taken by a moderate dressing of lime. A corresponding circular deals with the experiments on turnip manuring.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

A WELL-ARRANGED calendar of the Merchant Venturers' Technical College, Bristol, showing the courses of work to be taken in the forthcoming session and the facilities for study, has been received. At the end of each syllabus a useful list of books of reference is given, in addition to the usual list of text-books. We assume that the reference books recommended are to be found in the school library, or on the laboratory bookshelf.

A VACATION course of lectures and observations connected with nature study, for teachers in rural schools, was opened at the Harper-Adams Agricultural College, Newport, Salop, on August 1 with an address by the principal, Mr. P. Hedworth Foulkes. The primary object of nature teaching is, he pointed out, to encourage and promote in children the power of observation, so that when the school days are over the pupil is in full and complete sympathy with natural knowledge, and takes an intelligent interest in it. The course has been arranged to help teachers who are desirous of cultivating this spirit of observation and inquiry in their pupils.

PROF. W. J. ASHLEY, now one of the professors of economics in the Harvard University, Cambridge, Massachusetts, has been appointed to the first or organising chair of the future faculty of commerce in the University of Birmingham. Prof. Ashley was a Brackenbury scholar at Balliol College, Oxford, and obtained a first in history in 1881, followed by a fellowship of Lincoln College. For three years he was college tutor in Oxford, lecturing in large classes in economics and history. Towards the end of the eighties he was called to a chair of economics at Toronto, and after a short time the staff of Harvard University went out of the ordinary course to enable provision to be made among them for him, and there he has occupied the chair of economic history since 1892, the chair of economics itself being held by Prof. Taussig. It is understood to be the wish of the council and senate of the University of Birmingham that the professor should devote his first year to investigation and consolidation of ideas, in consultation with men of business in this and other countries,