

rich crimson as the sun sank behind the lofty range of mountains west of the Albert Nyanza, and, contrasted with the deep green foliage of the river banks, the scene was striking. But by far the most superb sight was the fall itself under the light of a full moon that night. For the identification of the rock specimens from the falls, consisting of biotite gneiss, mica schist, garnetiferous mica schist, and quartz, I have to thank Mr. G. T. Prior, of the Natural History Section of the British Museum.

C. STEUART BETTON.

#### THE MANUFACTURE AND USES OF SODIUM.

THE manufacture and uses of metallic sodium is the subject of an interesting article by Mr. James D. Darling in the January number of the *Journal* of the Franklin Institute, from which we take the following facts.

melting point ( $800^{\circ}\text{C.}$ ) of the chloride and to its corrosive action when in the molten state.

The process introduced by Mr. Darling involves the electrolysis of sodium nitrate with the liberation of sodium and of nitrogen peroxide, which is then converted into nitric acid.

The decomposition cell consists of a cast-iron pot set in a brick furnace. At the bottom of the pot is a 6-inch layer of refractory insulating material, and on this rests a cup 30 inches high, 16 inches outside diameter, with walls 4 inches thick. This cup is made of two sheets of perforated steel, between which is a mixture of ground deadburned magnesite and Portland cement which has been mixed with water and allowed to set hard. The space between the cup and the pot is filled with sodium nitrate (M.P.  $313^{\circ}\text{C.}$ ) and the cup itself with melted caustic soda (M.P.  $320^{\circ}\text{C.}$ ). The cast-iron pot acts as the anode, and 5 per cent. of the current is advantageously shunted through the metal walls of the cup. The kathode consists of a short length of 4-inch

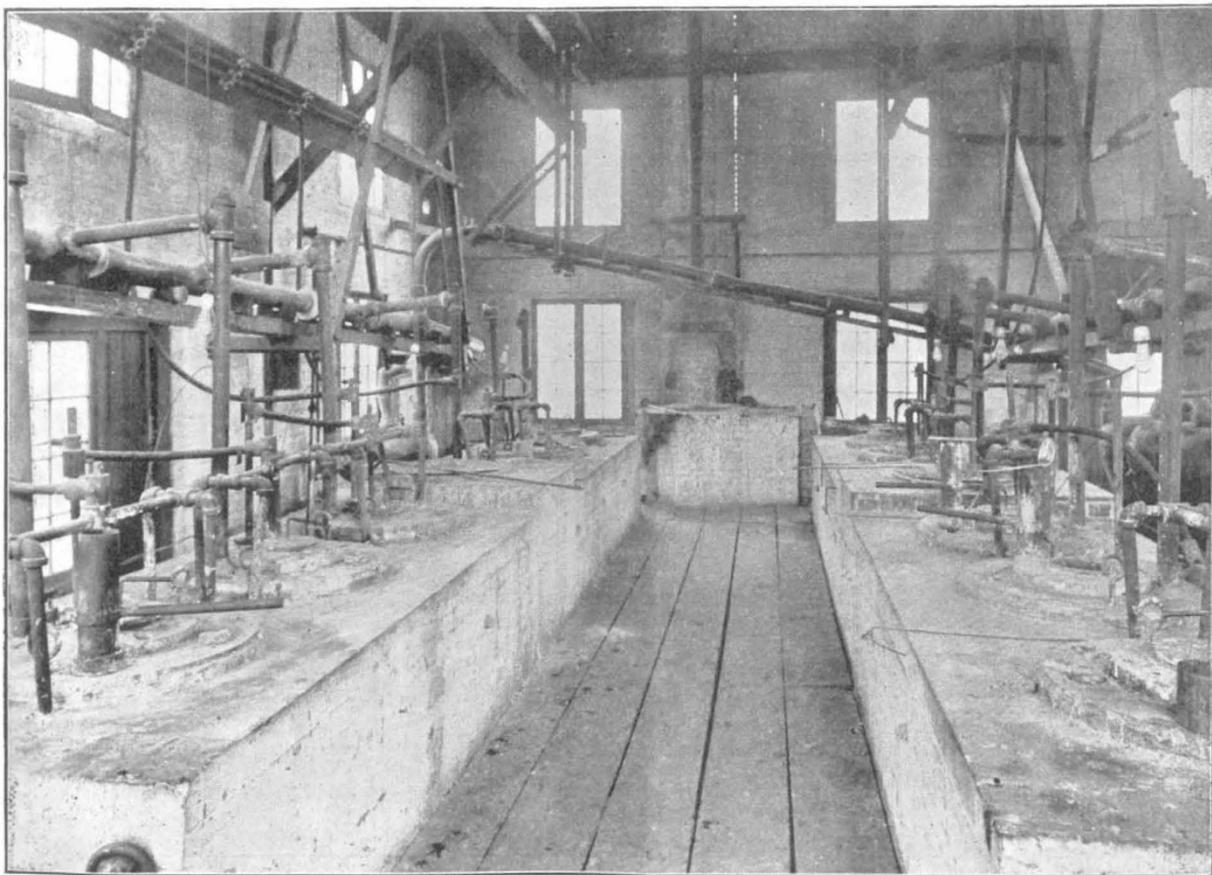


FIG. 1.—General View of Sodium Furnaces.

From the time of its isolation in 1801 until 1858, the cost of sodium was exceedingly high. In 1858, Deville perfected the process of manufacture by heating sodium carbonate, chalk and coal in an iron retort and condensing the sodium vapour thus produced. The price then fell from 2000 francs to 10 francs per kilo. No further important advance in the manufacture was made until the late Mr. Castner took up the subject, and after using with great advantage a modification of Deville's process in which carbon was replaced by a compound of carbon and iron and carbonate of soda by caustic soda, he succeeded in 1890 in making Davy's original method available on the large scale, that is to say, the method of decomposing fused caustic soda by the electric current. Most of the sodium used to-day is made by this process.

Attempts to make sodium from its cheapest compound, the chloride, have so far been unsuccessful, owing chiefly to the high

wrought-iron pipe reaching nearly to the bottom of the cup. Each furnace takes a current of about 400 amperes at an average E.M.F. of 15 volts, and external heat is used only when starting up or when changing the cups, which have a life of 425 to 450 hours. When the current is passed, nitrogen peroxide and oxygen are liberated at the anode and escape through a hole in the cover of the pot. Sodium is liberated at the kathode, and rises to the top of the cup, where at intervals of an hour it is dipped off with a spoon and preserved under mineral oil.

The aim of this new process is to decompose sodium nitrate in such a way that the sodium is liberated in a medium which will not oxidise it, and to get the nitrogen peroxide for the manufacture of nitric acid. How this is done will be evident from the description just given; the sodium ions of the fused nitrate travel through the walls of the porous cup to the fused caustic soda; they act upon the caustic soda until it is converted

(probably) into the monoxide, hydrogen being liberated, and when this is once achieved the following sodium ions form metallic sodium at the cathode. The use of two electrolytes with a common cation enables the sodium to be liberated in such a way as to escape oxidation by the fused nitrate. It is obvious that the only substance used up is the nitrate. Fig. 1 gives a general view of the sodium furnaces.

The nitrogen peroxide and oxygen evolved at the anode are conducted by earthenware pipes to a number of Woulff's bottles, connected together and containing water. The arrangement is shown in Fig. 2. The action of  $\text{NO}_2$  on water is as follows:— $3\text{NO}_2 + \text{H}_2\text{O} = 2\text{HNO}_3 + \text{NO}$ . The NO takes up more oxygen to form  $\text{NO}_2$  and more nitric acid is produced. If very strong acid is required, a system of absorbing towers is used.

Sodium is now used on the large scale for making sodium peroxide and sodium cyanide. The peroxide is made by burning

Mr. Darling states that he has devised a new method of preparing cyanides in which he avoids using so much sodium in the metallic state.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Considerable changes will be introduced into the examination for Mathematical Honours, Moderations, by a scheme which comes into effect in 1904. The main features of this scheme are (1) the legalising of the use of the infinitesimal calculus in answering questions on mechanics; (2) the abolition of restrictions on the freedom of choice of method, analytical or synthetic, in the treatment of geometry; (3) the introduction of the elements of analytical solid geometry.

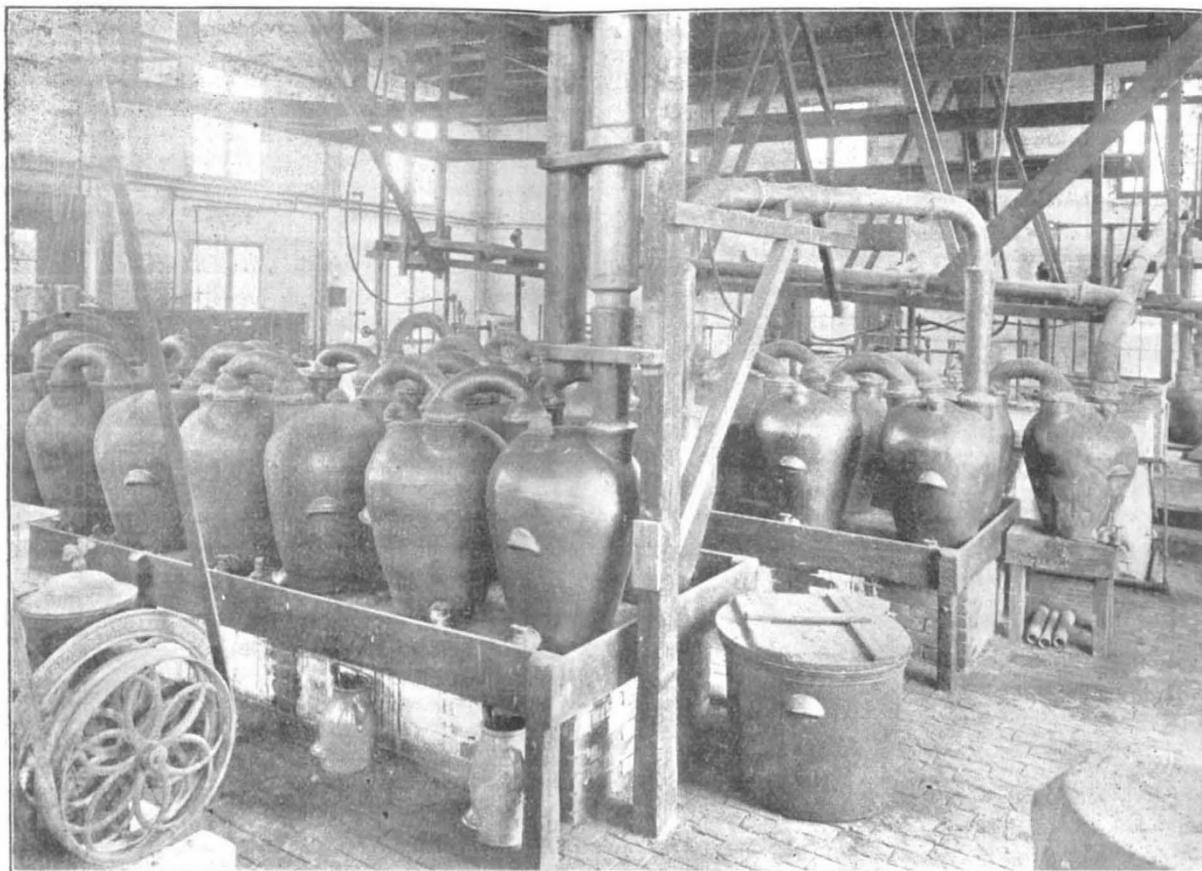


FIG. 2.—Apparatus for converting Nitric Oxide into Nitric Acid.

sodium in an excess of dry air free from  $\text{CO}_2$  in an externally heated retort. It is a valuable oxidising and bleaching agent, replacing the most costly hydrogen peroxide.

Sodium is used in making cyanides by Erlenmeyer's process, in which the metal is heated with potassium ferrocyanide,  $\text{K}_4\text{FeC}_6\text{N}_6 + 2\text{Na} = 4\text{KCN} + 2\text{NaCN} + \text{Fe}$ . Potassium carbonate is usually added so as to make the percentage of CN in the mixture equivalent to that of pure KCN.

Another method of using sodium in the manufacture of cyanides is to make sodamide by heating the metal in ammonia gas,  $\text{Na} + \text{NH}_3 = \text{NaNH}_2 + \text{H}$ . The sodamide may then be heated with carbon,  $\text{NaNH}_2 + \text{C} = \text{NaCN} + \text{H}_2$ . or, according to another process, it may be made to first form a cyanamide,  $2\text{NaNH}_2 + \text{C} = \text{Na}_2\text{N}_2\text{C} + 2\text{H}_2$ . The cyanamide is then treated with more carbon at a higher temperature,  $\text{Na}_2\text{N}_2\text{C} + \text{C} = 2\text{NaCN}$ .

CAMBRIDGE.—The following are the speeches delivered by the Public Orator, Dr. Sandys, on June 10, in presenting for the degree of Doctor in Science *honoris causa* (1) Sir Harry Hamilton Johnston, G.C.M.G., K.C.B., Special Commissioner for the Uganda Protectorate, and (2) Dr. A. W. Rücker, F.R.S., Principal of the University of London:—

"Semper aliquid novi Africam adferre" etiam inter antiquos dicebatur. In Africa nuper ab hoc viro, ne plura commemorem, camelopardalis speciem novam repertam esse constat. Idem Africae in regione septentrionali, occidentali, orientali, Africa etiam in media, patriae personam summa cum dignitate gessit; Africae montes, flumina, lacus exploravit; exploratos et pingendi et scribendi arte eximia ante oculos nostros posuit. Quid dicam de libris illis, quorum in uno Livingstonii vitam egregie narravit; in alio colonias omnes ab Europae gentibus in Africam deductas luculenter descripsit; in alio denique Afrorum