sodium is to take place. The preliminary heating takes about half an hour, and the actual distillation about an hour and a half.

The lid of the crucible, to which is attached the condensing arrangement consisting of an iron pipe dipping into an iron box, is fixed in the furnace; it has a convex rim which makes a joint with the grooved top of the crucible, with the assistance of a little powdered lime. The crucibles are raised and lowered by means of hydraulic power, the work of removing a crucible from the furnace and replacing it by another being done with great rapidity.

The reaction which takes place may be represented by the formula—

$$6NaHO + FeC_2 = 2Na_2CO_3 + 6H + Fe + 2Na.$$

This formula is made up in reality of several taking place *pari passu*. The main point is that it clearly expresses the final result. It will be observed that no carbonic oxide is given off, and the difficulties already referred to, caused by the presence of that gas, are got rid of. The iron is recovered, and used over and over again by coking it with fresh tar.

It is unnecessary to refer here to the arrangements for the production of the double chloride of aluminium and its reduction by sodium, as no special novelty is claimed for them.

Mr. Castner has shown great technical skill in devising the plant used throughout the works, and they are in every way a great advance on anything of the kind attempted before.

A novel feature is that hydrochloric acid, for the manufacture of the double chloride, is obtained direct by means of pipes from Messrs. Chance's glass-works, which are contiguous, and the carbonate of soda resulting from the operation in which sodium is produced is similarly conveyed to Messrs. Chance's, to be there purified and crystallized.

The estimated possible output of these works is stated to be 500 pounds of aluminium and 1500 pounds of sodium per day. The cost of manufacture of aluminium has hitherto been between 30*s*. and 40*s*. per pound. By Castner's process it is stated that it can be produced at 15*s*. That this is so there is but little reason to doubt; and it is a substantial and important reduction, which will enable aluminium to be used much more largely than has hitherto been possible. Still, before it can be very largely used, the price will have to be further considerably brought down; and it is much to be hoped that Mr. Castner's success will stimulate him and others to work with this end in view.

THE QUEEN'S JUBILEE PRIZE ESSAY OF THE ROYAL BOTANIC SOCIETY OF LONDON.

PROBABLY the last of the Jubilee productions has seen the light by the appearance of an article in the Quarterly Record of the Royal Botanic Society of London for the three months ending March last under the title of "Fifty Years of Economic Botany." The article in question forms the essay to which the Council of the Royal Botanic Society has awarded its gold medal and a purse of fifty guineas. The author is Mr. John W. Ellis, L.R.C.P. It needs only a casual glance to discover how deficient this short essay is, not only in consequence of the numerous omissions of very important plants and products, but also on account of the imperfect information given under many of the headings. Thus the writer tells his readers that China grass and rhea are two distinct fibres furnished by allied plants, the former by *Bœhmeria nivea* and the latter by *B. tenacissima*, while the fact is that China grass and rhea are one and the same thing, *B. tenacissima* being a synonym of *B. nivea*. In a casual reference to "Moong" fibre the author is apparently quite ignorant of the fact that its botanical source is *Saccharum munja*, Roxb. New Zealand flax (*Phormium tenax*) is introduced under textiles, but why is not apparent, for the author concludes his paragraph as follows—"Not having been introduced during the period to which this essay refers, any further mention of this interesting fibre—for which it has frequently been attempted to find a place in the British market—is unnecessary." Why "gun cotton and its derivatives" should occupy a special chapter it is difficult to say, seeing that this explosive substance is not a direct product of the vegetable kingdom; the author however apparently looks upon it as a much more important vegetable product than the species of cinchona, the ipecacuanha, coca, jalap, or the multitude of new drugs that have occupied such a prominent place in men's minds for the last twenty years. The success that has attended the acclimatisation of the cinchonas in our Indian possessions, whither they were introduced some twenty or thirty years since, when there was a great fear lest the supply of bark from South America should fail because of the great demand, and the consequent reduction in the price of quinine from a guinea to its present price of two shillings per ounce, are facts of sufficient importance, one would think, to be noted in any record of the progress of useful plants. And the same might also be said with regard to *Erythroxylon Coca*, considering to what purpose cocaine is now being put, but the author—a member of the medical profession—has apparently a wholesome dread of drugs, and for once has ignored all consideration of them. He seems to have been content to consult very old books for his facts throughout and to have completely passed over modern authorities; consequently his statements are both antiquated and incorrect.

The old name of *Siphonia elastica* is quoted for the Para rubber plant instead of the now better known name of *Hevea brasiliensis*. Balata is referred to *Sapota Mullcri* instead of *Mimusops globosa*, and we read that Mr. Jenman's report on the Balata Forests of British Guiana issued in 1885 "will probably assist in developing a demand for this material," while the fact is that balata has been going down in the estimation of manufacturers since that date in consequence of it having been found not to be durable when exposed to the air; manufactured articles made from it cracked on the surface, and the inner portion lost its tenacity, so that some manufacturers have given up its use entirely. The Dika plant of W. Trop. Africa, which has long been identified with the Simarubeous plant (*Irvingia Barteri*), is referred to under the very old name of *Mangifera Gabonensis*, a genus belonging to the natural order Anacardiaceæ. Again carapa or croupee oil of West Africa is said to be obtained from the seeds of *Carapa guineensis* and crab oil of British Guiana from *Carapa guianensis*. These two were combined by Prof. Oliver under *C. guyanensis* in the "Flora of Tropical Africa" so far back as 1868.

These are only a few illustrations of the general untrustworthiness of the essay, the circulation of which, it is hoped, will not be large.

THE ZODIACAL LIGHT.

FROM the days of Cassini a connection between the zodiacal light and sun-spots has been suggested. In some recent discussions it is denied. But, so far as I am able to discover, the long series of observations by Heiss and Weber, extending from 1847 to 1883, afford the first opportunity to attack the question.

The result is in the diagram before you. The broken line represents Wolf's well-known series of relative sun-spot numbers, the jagged full line the mean elongations

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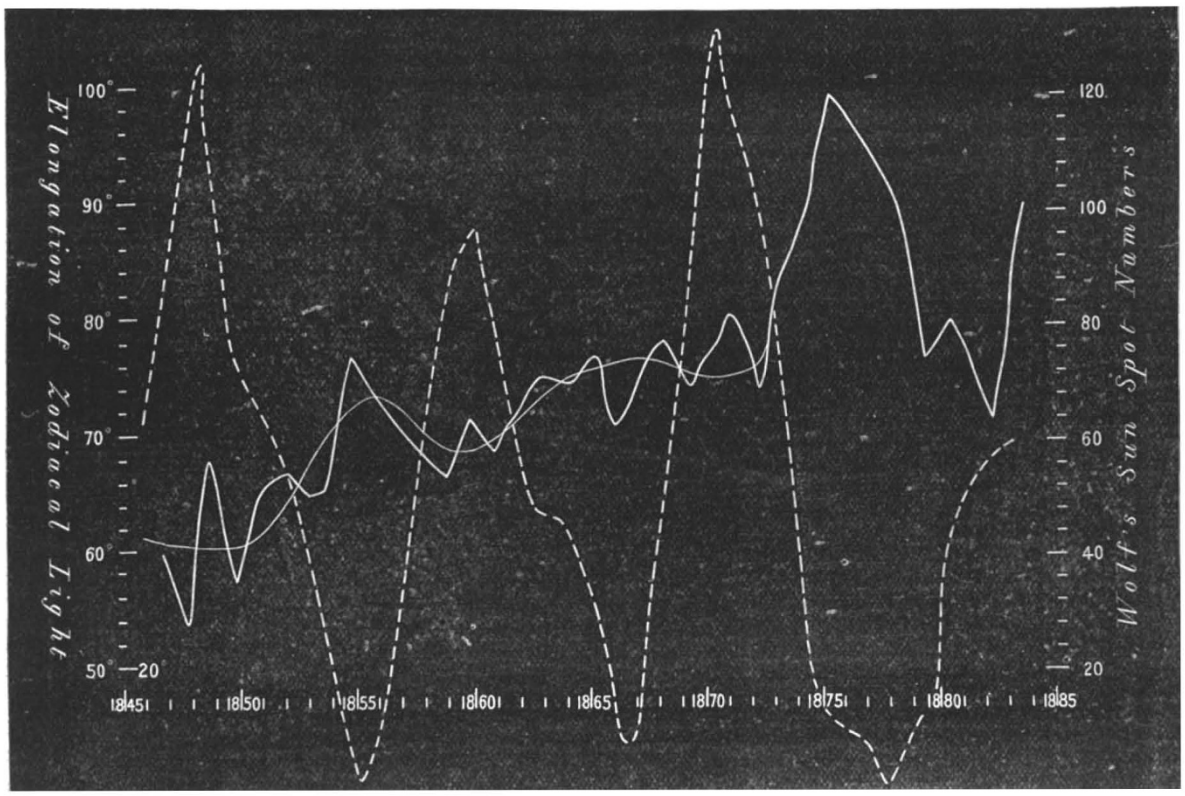
of the apparent apex of the zodiacal light from the sun. It will be seen that each sun-spot minimum corresponds with a maximum of the zodiacal light, and each sun-spot maximum with a minimum of the zodiacal light. The minimum in 1870 must be considered as masked by the forces tending to produce the enormous maximum of 1876. It will be noticed, too, that when the sun-spot phenomena are more extensive, as in 1850 and 1870, the following zodiacal light phenomena are also more extensive; where the sun-spot phenomena are less, as in 1860, the following zodiacal light phenomena are less extensive; and *per contra*, when the zodiacal light phenomena are extensive, as in 1880, the sun-spot phenomena are less extensive. As far as this series goes, the correlation seems to be complete.

We may gain some insight into the relation by tabulating the various spectroscopic observations in their order in the sun-spot cycle. Thus we have Lias, for four years during the rise in the sun-spot period, observing only a faint continuous spectrum; Respighi and Lockyer, just after sun-spot maximum, one bright line; Vogel, the same; Smyth, Secchi, Pringle, about the same date, no spectrum, or only a continuous spectrum; Tacchini, possibly a bright line; Wright, three years after maximum, generally only a continuous spectrum,—three times a bright line; Burton, fourth year after sun-spot maximum, continuous spectrum; generally a bright line; Arcimis, five years after sun-spot maximum, continuous spectrum and *two* bright lines (1480 K and 2270 K). It would seem, therefore, that the zodiacal light is more gaseous at sun-spot minimum, and only slightly, if at all gaseous, at and near sun-spot maximum.



Comparison of zodiacal light elongations with Wolf's relative sun-spot numbers.

The same story is told by the disturbances suffered by Encke's comet.[1]

We would consider, therefore, the zodiacal light a locus of condensation.

One may notice, too, that the light appears, in common with the frequency of auroræ and the diurnal range of the declination-needle, to be affected by a disturbance of longer period. But for the present we must restrain ourselves from the connections with terrestrial and cosmical physics with which the matter teems, and ask—what is the principal object of this communication—that those who are not observing will observe, and that those who have, or know of the places of concealment of, any observations, will kindly call them to our attention.

Baltimore, Md. O. T. SHERMAN.

[1] *Gould's Astronomical Journal.*

CHEMISTRY AT THE BRITISH ASSOCIATION.

IT was hardly to be expected that the proceedings of the Chemical Section of the British Association would be as remarkable at Bath as at Manchester. Nevertheless, at Bath some interesting discussions took place, and some valuable papers were read.

The President's Address was listened to with great interest, and formed a fitting introduction to the discussion, which afterwards took place, on the teaching of chemistry.

In the "Report of the Committee on the Action of Light on the Hydracids, in Presence of Oxygen," read by Dr. Richardson, some experiments were described, in continuation of those read before the Association last

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