

students the methods of teaching so well introduced and so thoroughly carried out in the laboratory at South Kensington, the birth-place of the modern English school of morphological botany. It now remains for one of our competent younger botanists to prepare a course of practical instruction in the physiology of plants, introducing the experiments employed in our best laboratories; and there are signs that such a volume will meet with a hearty welcome from students of botany in this country. The importance of the subject needs no comment.

OUR BOOK SHELF.

A Chapter in the History of Meteorites. By the late Walter Flight, D.Sc., F.R.S. (London: Dulau and Co., 1887.)

THIS work, though left incomplete by the early death of its author, will be found of great service by all who are interested in meteoric studies. The first 144 pages were printed off twelve years ago, and were thus safely beyond revision. The rest of the work has been revised, and the whole has been prepared for press, by editors who, perhaps wisely, have chosen to be anonymous: their part of the task we may dismiss with the remark that it appears to have been executed with at least ordinary care. The task of the author has been to give a brief summary of the memoirs which have been published relative to meteorites since the year 1868, and thus to furnish an appendix to the work of Buchner. To collectors of meteorites such a convenient summary of memoirs, themselves scattered over a wide range of periodicals, chiefly foreign, is invaluable. There are seven plates and six woodcuts: the frontispiece is an excellent engraving of Chladni, who did so much to compel men of science to recognize the reality of meteoric falls. There is also a hand-painted picture of the wonderful meteorite of Busti, in which two minerals new to terrestrial mineralogy were discovered by Maskelyne. In an introduction there is a short sketch of the life and work of the author. Only 240 copies have been printed; the proceeds of their sale are to be added to the Flight Memorial Fund, which at present amounts to £317.

A Hand-book for Steam Users. By M. Powis Bale, M.I.M.E., A.M.I.C.E. (London: Longmans, 1887.)

MR. BALE'S little hand book supplies a want long felt by steam users. Its contents are entirely of a practical nature, and the technical terms used are very properly those of the ordinary mechanic. The book embraces the whole of the many duties of the engine-driver and fireman, and explains to them what to do, and what not to do, under varying circumstances. The arrangement of the information is simple and effective, the writer evidently knowing how to get at the understanding of those for whom the book is written.

The information and rules given are eminently practical, and will prove very useful to those steam users who do not pretend to be engineers. In the preface we are told that the author has for many years urged the necessity of a compulsory system of boiler inspection, and of granting certificates of competency to those having boilers under their charge. In this we entirely agree, and we trust the time is not far distant when Parliament will establish a system of examination similar to that of marine engineers, under the control of the Board of Trade for all who have charge of stationary boilers and engines, as well as locomotives. Michael Reynolds, the author of several books on the practical working of steam-engines, has long advocated

the introduction of certificates of competency for locomotive drivers and firemen. Their duties are as arduous and responsible as those of the marine engineer, and yet this fine class of men is entirely recruited from the lower grades employed in the locomotive running sheds and works, and their promotion generally depends on years of service on the footplate.

Students of steam and mechanical engineering will here find information which, although not generally taught in the lecture-rooms, will indicate some of the many points an ordinary engine-driver has to be thoroughly acquainted with. N. J. L.

The Encyclopædic Dictionary. Vol. VI. (Part II.) (London: Cassell and Co., 1887.)

THE special characteristic of this work is that the compilers have tried to make it combine some of the advantages of an encyclopædia with all the advantages of a dictionary. The result, upon the whole, is very satisfactory. The information given in the encyclopædic part of the work is not, of course, sufficient for students; but it will meet the wants of readers who may wish to obtain a concise and trustworthy account of any subject in which they happen to be interested. Special attention is devoted to the various branches of science, and scientific terms are very carefully defined and explained. So far as we have been able to test the volume of which this is the second part, we have found it in all respects equal to the preceding volumes.

A Treatise on the Principle of Sufficient Reason: a Psychological Theory of Reasoning, showing the Relativity of Thought to the Thinker, of Recognition to Cognition, the Identity of Presentation and Representation, of Perception and Apperception. By Mrs. P. F. Fitzgerald. (London: Thomas Laurie, 1887.)

THIS is neither a treatise nor has it anything particularly to do with the principle of the sufficient reason, or with the philosophical views mentioned in the second title. It is rather a kaleidoscope of phrases, original and otherwise, that have apparently from time to time touched the author's fancy, and are now vaguely but gratefully remembered to have once possessed a meaning for her. Quotations from Ouida, Plato, Lord Dundreary, and other philosophical authorities, are tossed together impartially, without apparent purpose except to fill 400 pages; and though some reference is made occasionally to opinions said to be held by the author, such reference is nearly always too vague to show what the opinions really are. Only the hard-hearted can find even amusement in the book.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

"Infusorial Earth."

THE following letter, addressed to the Secretary of the Royal Society, has been forwarded to us for publication:—

Foreign Office, October 27, 1887.

SIR,—I am directed by the Marquess of Salisbury to state to you, for the information of the President and Fellows of the

Royal Society, that Her Majesty's Consul-General at Christiania has reported that a considerable number of pits of "infusorial earth" containing 85 to 95 per cent. of silica are said to have been discovered in the neighbourhood of Stavanger.

Capital is being sought for the purpose of working the deposits, which are estimated to be capable of yielding 400,000 cubic metres of that rare product. It is affirmed that whilst the similar deposits at Lüneburg, in Hanover, are mixed with sand and gravel, those now discovered are so pure in quality as to be available for most purposes merely after desiccation.

As this discovery may possibly have a scientific interest as well as a commercial value, I am directed to convey the above information to the Royal Society.

I am, Sir, your most obedient humble servant,

T. V. LISTER.

The Secretary, Royal Society, Burlington House.

The Electrical Condition of the Peak of Teneriffe.

THE limited number of observations on atmospheric electricity which have been already made all point, with one exception, to a normal positive difference of potential between a point some few feet above the earth and the ground itself. The only notable exception to this law was found in some observations which were made on the Peak of Teneriffe about thirty years ago. Then it appeared that the condition of the Peak was constantly resinous or negative. These observations were, however, taken with a gold-leaf electrometer, and some doubt has been expressed as to whether the sign of the electricity was correctly obtained.

I therefore thought, when taking a short trip to Teneriffe, that it would be useful to examine this question by means of the improved electrical instruments now available.

Through the courtesy of the Meteorological Office I obtained the loan of a Thomson's portable electrometer, and, through the kindness of Mr. Whipple, received at Kew all necessary instruction in the use of the instrument, and special caution as to the possible difficulty of getting a good "earth" on sun-burnt lava. Any success the observations may have had is entirely due to his care and forethought.

I was only able to stay about a fortnight on the island, but the results obtained were so uniform that there can be no doubt as to their accuracy.

The height of the electrometer fuse was always about 5 feet 6 inches above the ground. At the Port of Orotava, at the base of the Peak, and about 50 feet above sea-level, the mean of eight sets of observations—each set usually consisting of six determinations—gave a potential of 138 volts. The highest was 193, and the lowest 98 volts. These, and all I obtained in Teneriffe, were uniformly positive.

One day I took a skirmishing expedition to the rock of Gayga, a portion of the rim of the old crater, 7100 feet above the sea. On the way up, while on the pretty uniform slope of the mountain, at 3800 feet, the potential was only + 99 volts, while on the rock itself, tension rose to 257 volts. The rock is a long sharp, narrow edge, perhaps half a mile long, with a precipitous cliff of 500 feet on one side. The rock was composed of dry lava, and I thought a little damp, but still the earth observations were not quite so accordant as usual.

A few days later, therefore, when starting for the top of the Peak, I took, as suggested by Mr. Whipple, an ordinary 66-foot iron surveyor's chain to be laid along the ground and connected with the instrument. The readings at different heights, on the way up, were as follows:—

At 5600 feet, on the slope of the mountain, 111 volts.

On the Cañadas, or rough flattish ground that forms the bottom of the old crater, at 5800 feet, 139 volts. The ground here was pumice and pumice dust, so I tried running out the chain to see if the earth-readings would be altered. There was not however the slightest change, and to show the character of the observations five out of the six earth-readings gave the same number.

At the *Estancia de los Ingleses*, 10,500 feet, situated on the slope of the main peak, the potential fell to 118 volts. The sun was setting, and dew falling so fast that the top of the electrometer box was covered with wet. There could be no doubt then of obtaining a good earth.

On the top of the Peak, 12,200 feet, the potential actually rose to no less than 549 volts. This was at 8 o'clock in the morning of October 24. The wind was blowing at the rate of about 10 miles an hour from the north-east, while the dry and wet

bulb thermometers marked 31° and 26° respectively. There was a little white frost on the ground, and the earth-readings, without the chain, were remarkably uniform, only differing by the 11-tooth of a turn of the screw.

The results of all the observations points unmistakably to the conclusion that during this month of October the electrical condition of the Peak of Teneriffe were the same as in every other part of the world. The potential was moderately positive at the same distance from the ground even at considerable altitudes, but the tension rose enormously round a sharp point, and a projecting edge of rock.

It is well known that there are very few thunderstorms in Teneriffe, though one passed near us at Orotava without affecting the indications of the electrometer. Would it not be interesting to measure the potential on the summit of a mountain like Kina Balu in Borneo, which is about the same height as the Peak of Teneriffe, but situated in the heart of the equatorial zone of the constant electrical discharge?

We had one day of very heavy rain, when possibly some negative indications might have been obtained; but I did not think it expedient to let the instrument get drenched.

But, besides obtaining these decisive electrical results, I was also very fortunate in some other observations during the short stay in Teneriffe.

We saw from the *Estancia* the shadow of the Peak at sunset gradually creep along the land and surrounding sea, and then stand up in the air like another peak rising above the horizon. This is what is so often seen from Adam's Peak in Ceylon, and from Pike's Peak in Colorado.

Then our observations confirmed not only the important discovery made by P. Smyth, that cloud is not formed at the junction of a south-west current flowing over a north-east trade, but the even more important fact that there is no such thing as the supposed simple return current from the equator. At Teneriffe, as in every other part of the world I have ever visited, the general circulation of the air is on a complicated screw system, the practical effect of which is that as you ascend, the wind always comes more and more from your left hand as you stand with your back to the wind. You do not come abruptly to a south-west wind over a north-east trade, but pass successively as you rise from the surface from north-east through south to south-west, and then probably to west, or even north-west.

I also made some very important observations on the local formation of halo-forming sky, and got an excellent photograph of the genesis of a cirrus cloud from a moist current rising over the Peak, but space will not allow me to explain the results in this place.

RALPH ABERCROMBY.

21 Chapel Street, London, November 7.

"Toeing" and "Heeling" at Golf.

I FEAR that "P. G. T.'s" reply to my letter on the above subject has left us very much in the same position as before. This is regrettable, as I hoped that further light would have been shed on this interesting mechanical problem. Before complying with the invitation to "think over the result of the impulsive rotation of the club-head," I considered it would be well to get some trustworthy observations on which to reason. With this object our professional, Mr. David Lowe, made twenty-seven tee shots with the driver, while I noted the effect. My instructions to him were, whether striking off the toe or the heel, to drive as truly as he could in the direction of an object selected for that purpose. The effects were as follows:—When the ball went off the heel of the club, the ball in its flight curved to the right, even though its direction commenced obliquely to the left; to this there was no exception. The opposite curve, or to the left, with only one exception, was produced by hitting off the toe. Care was taken to ascertain in each case the point of impact of the ball on the club-face.

I now instructed him to try and curve the ball to the left, striking with the heel of the club, or to "toe it off the heel," in "P. G. T.'s" words. This feat he was unable to perform, and he gave it as his opinion that it could not be done.

Now for my explanation of "toeing" and "heeling" in reply to the invitation of "P. G. T."

Everyone who has played golf is aware that the ball when cleanly struck leaves a round mark upon the face of a new club of about five-eighths of an inch in diameter. This is the measure of the elastic distortion that takes place in the ball by the