

many telegraph administrations which would be benefited by its clear practical character. But it is not immaculate. The chief defect of the book is the absence of recognition of what has been done elsewhere and the negation of existing literature dealing with the same subject. Mr. Latimer Clark's book on "Electrical Measurement" (published in 1868) was written especially for use in India. His "Electrical Tables and Formulæ," written in conjunction with Mr. Sabine and published in 1871, contains nearly all that is known of testing. Culley's "Handbook," first published in 1866, has run through six editions. Hoskier's "Guide to Electric Testing" was published in 1873, and has reached a second edition. Preece and Sivewright's "Text-book of Telegraphy" was published in 1876, and has also reached a second edition. Kempe's "Handbook of Electric Testing" (a most useful and valuable little work) was also published in 1876. Papers by Fleeming Jenkin, Siemens, F. C. Webb, Hockin, Heaviside, &c., are scattered everywhere; yet the impression left on the mind after perusing Mr. Schwendler's book is that, according to him, there is but one system of testing, and that is to be found in India; and there is but one book on the subject, and here it is!

OUR BOOK SHELF

A Physical, Historical, Political, and Descriptive Geography. By Keith Johnston, F.R.G.S. Maps and Illustrations. (London: Stanford, 1880.)

THIS work is in every way creditable to its unfortunate young author, who, our readers may remember, succumbed some months ago to the hardships of African travel while leading an expedition from the West Coast towards Lake Tanganyika. Mr. Johnston has not sought to enter into that minute and often painful detail with which we are familiar in most text-books of geography. His object has been to record in each of the great departments of geography the results of the latest research, leaving it to the teacher or to special text-books to fill up with details. After a brief sketch of some of the main points in mathematical geography, a clear and sufficiently full sketch of historical geography is given, treating not merely of the progress of discovery, but of the various movements of peoples and nations which have led up to the political divisions of the earth as they are at present; this we think a useful introduction of scientific method into history. Then follows a section on physical geography, in which the most trustworthy results of research in the various departments of this subject are stated with clearness and accuracy. The remaining two-thirds of the work is devoted to the special geography of the various continents and countries—their physical features, natural history, products, industries, peoples, and political and social conditions. The same method is followed throughout of dwelling only upon the important features. The work is amply illustrated by useful and beautifully executed maps, and is one of the best general handbooks of geography that we know.

Zeitschrift für das chemische Grossgewerbe. iv. Jahrgang. Von Jul. Post. Fortgesetzt von Arthur Lehmann. (Berlin: Oppenheim, 1880.)

WE have already had occasion to draw attention to the merits of this publication, and the present issue of the work is in no way inferior to its predecessors. It constitutes a complete compendium of the progress of chemical technology during the past year, and as such must be of great service to our manufacturers. The various articles are contributed by acknowledged authorities, and the whole is preceded by a short review indicating the more

striking improvements which have been introduced into the chemical arts since the publication of the last issue of the work.

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 ensure the appearance even of communications containing interesting and novel facts.]

The Lesser Spotted Woodpecker

I HAVE had an opportunity lately of observing closely the habits of the Lesser Spotted Woodpecker (*Picus minor*) as regards the very peculiar sound which it makes upon trees by the action of its bill.

It is quite certain that this habit has nothing whatever to do with the quest for food. The bird selects one particular spot upon the trunk or bough of a tree, which spot is naturally sonorous from the wood being more or less hollowed by decay. The bird returns to this precise spot continually during the day and produces the sound by striking the wood on the spot with its bill, the stroke being repeated with a rapidity which is really incomprehensible; for it quite eludes the eye. It is effected by a vibratory motion of the head; but the vibrations are so quick that the action looks like a single stroke. After short pauses this stroke is again and again renewed, sometimes for several minutes together. During each interval the woodpecker looks round it and below it with evident delight and with an apparent challenge of admiration. The beautiful crimson crest is more or less erected.

The whole performance evidently takes the place of the vernal song in other birds; and so far as I know it is the only case among the feathered tribes in which vocal is replaced by instrumental music.

The nest does not appear to be in the same tree; but similar spots are selected on several trees in the neighbourhood, and as the sound is very loud and is heard a long way off, the hen bird when sitting is serenaded from different directions.

I have not seen or heard any attempt to vary the note produced by variations either in the strength or in the rapidity of the stroke, or by changing the point of percussion; but I have observed that the note varies more or less with the tree on which it is produced.

During about six weeks the performance has been frequent every day, and early in the mornings during part of this time it was almost constant. Of late it has been discontinued. In all probability this is parallel to the well-known fact that singing birds cease to sing after the eggs are hatched.

This instrumental substitute for singing among the woodpeckers is extremely curious.

ARGYLL

May 29

Mr. Preston on Vortex Atoms

SOME passages in an article in NATURE, vol. xxii. p. 56, on Sir William Thomson's theory of vortex atoms, seem to show that the author, Mr. Preston, has not perfectly apprehended the nature of vortex motion. On p. 57 he says that "the rotating portion" of the liquid "therefore glides smoothly over the incompressible liquid that surrounds it like a pipe." From this it appears that the vortically-moving fluid is conceived by him as slipping with reference to the rest of the fluid. This is, however, an incorrect view of the nature of the motion. If there be an infinite mass of fluid, then the stable existence of a vortex filament at any part necessitates motion throughout the whole, and there is, at the surface bounding the filament, no discontinuity of the kind apparently conceived by Mr. Preston.

Two vortices exercise very remarkable influences on one another, which are due to the irrotational motion of the parts of the fluid outside the vortices.

The existence of surfaces of finite slip in the hydrodynamics of an ideal perfect fluid is not precluded by any quality attributed to the fluid, but I do not think that the behaviour of vortices bounded by surfaces of slipping has been hitherto treated by any mathematician

It does not seem likely, however, that the investigation would lead to interesting physical results, because this kind of motion is essentially dynamically unstable.

Towards the end of the same article there occurs the following passage:—

"The old idea that a ship (or more correctly a totally immersed body, such as a fish) encountered a mysterious resistance in addition to the mere friction of the molecules on its sides, is now known to have been a pure delusion."

This statement appears to me either erroneous or very misleading. The resistances to the motion of a ship have been classified under three heads, viz., wave-making resistance, eddy-making resistance, and surface-friction.¹ For a totally-immersed body the wave-making resistance is non-existent, but Mr. Preston would appear only to take notice of the last of the three. Now whilst for a body with "fair lines," such as a fish, the eddy-making resistance may be small, yet if the lines are not fair it may be very large. Thus a fish leaves scarcely any wake, whilst an oar leaves a very great amount of disturbance.

Helmholtz, Kirchhoff,² and Lord Rayleigh³ have made some interesting hydrodynamical investigations on the resistance suffered by a vane exposed to a current, on the hypothesis that in the wake of the vane there is dead water, separated from the moving water by surfaces of finite slip.

It has been already noticed that such a motion is dynamically unstable, but there is in many respects a remarkable accordance between the resistance as determined by this theory and that found experimentally,⁴ so that it seems probable that the actual stable motion of flow, with eddies in the wake, does not differ very much from the theoretically unstable motion, with dead water in the wake. It will be noticed that this theory of resistance, which gives approximate results for bodies with very bad lines, such as flat vanes, actually entirely neglects surface-friction, to which Mr. Preston's statement would seem to refer the whole resistance.

G. H. DARWIN

Trinity College, Cambridge, May 27

The Inevitable Test for Aurora

IN reference to Prof. Piazzi Smyth's courteous criticism of our communication to the Royal Society on the aurora borealis, we regret that we are unable to say whether the critical citron line, to which he directs attention, was present or not in the spectra of the electric discharges in atmospheric air from which we deduced the probable heights of auroral displays. The experiments quoted were made without reference to the aurora, and this particular line was consequently not sought for, nor indeed have many measurements been made of the spectra of discharges in atmospheric air, on account of the time required and consequent great consumption of the life of the battery which such observations entail.

WARREN DE LA RUE

73, Portland Place, W., May 29 HUGO MÜLLER

Cloud Classification

THERE is a proverbial objection to "looking a gift-horse in the mouth," and M. Poëy's Cloud Book is such a valuable addition to the scanty literature on the subject that it would be highly ungracious to make captious objections to his views. On the other hand, M. Poëy, when he differs from others, puts forward his views with such fairness and courtesy that I believe he would be the last man to deprecate full discussion.

Allow me then to put in a plea for certain old public servants, that they should neither be cashiered altogether, nor transported to strange regions, without full examination into their character and their merits.

First, then, for the *stratus*.

M. Poëy—happy man!—has carried on his observations under tropical skies and in the clear atmosphere of Paris. Had his lot been cast on the clays and gravels of the London basin I venture to think that he would have regarded the "stratus" with more respect, if with no increase of affection. He would have had frequent opportunities of observing it—at times resting entirely on the ground,⁵ at others rising with a clearly

defined lower and upper {surface, a few feet (or even inches) from the earth, cutting the taller trees in a horizontal line, leaving their tops and bottoms free, and then being gradually dissipated, to be absorbed in the warmer air or to form *cumuli* at a higher elevation. He could hardly have failed to recognise it as a clear and distinct variety of *cloud*, the lowest in altitude of all the family, but none the less a member of it. If every cloud which has contact with our baser earth is to be cashiered on that account, what will become of M. Poëy's own *cumulus* on Plate XV.? Every mountaineer knows to his cost that if he happens to be on the mountain where such a *cumulus* is resting, he will be enveloped in a fog undistinguishable from what he finds on the Thames marshes.

Whether, on the other hand, it is desirable to use the term "stratus" for clouds in a totally different sky-region, which differ both in their origin and their nature from the true "stratus," is a question too long to be fully discussed here.

Next with regard to the *nimbus*.

M. Poëy's view appears to be that Howard's term applies to an isolated shower-cloud, and is unsuitable for a rain-cloud over-spreading the sky. After careful reading of M. Poëy's remarks on the "pallium," and comparing them with Howard's description of the "nimbus," I entirely fail to see where lies sufficient difference to consign the "nimbus" to oblivion; and I can only imagine that M. Poëy has taken his idea² of what Howard meant almost entirely from the illustration, without noticing that Howard first describes the forming and behaviour of the cloud overhead in words curiously similar to those which Poëy himself uses for his "pallium," and then says, "But we see the nature of this process more perfectly in viewing a distant shower in profile." This clearly shows that the illustration was only chosen as the easiest form in which the cloud, *vel nubium congeries*, could be depicted, while the context guards completely against the name being limited to an isolated shower-cloud.

It would occupy too much space to place the descriptions of the two *savants* side by side, but I think that any one who will take the trouble to read the two together can hardly fail to see that Howard's "nimbus" fulfils all that Poëy describes as the rain-discharging cloud, including the upper "veil,"² or pallium of cirrus, the lower "sheet,"³ or "pallium" of cumulus, and the "lower clouds arriving from the windward," which "move under this sheet and are successively lost in it" (Howard, p. 11; compare Poëy, Plate XII.). In fact, to use an expression frequently employed in the discussion of patents, you can take the description of the one inventor and "read it on to" the drawing of the other, or *vice versa*.

M. Poëy's term "pallium" is certainly expressive, and will probably make itself a home in cloud terminology; but it appears after all only to mean that a certain modification over-spreads the whole or a large part of the sky (compare Howard, p. 11), and does not by any means cover that combination of clouds which produces rain ("nimbus.")

I must leave it to a future time or to other pens to discuss the merits of the "cumulo-stratus," and pass on to examine shortly M. Poëy's views about the "cumulus." The Rev. W. C. Ley, in his review of M. Poëy's work, in your pages, has already pointed out the illogical nature of the author's repeated remark that the "cumulus" only exists in the horizon, forgetting that a cloud which is on the horizon of one place must be in the zenith of another. Now I venture to suggest that this curiously-distorted mental view affects M. Poëy's classification far more than appears at first sight. If clouds are considered not objectively according to their whole form and structure, but subjectively as they present themselves to an individual observer, we naturally need new modifications as the clouds are viewed in different positions. Are not many of the clouds which M. Poëy calls "fracto-cumulus" simply "cumuli" viewed from beneath? Just as (to borrow a simile from Mr. Ley) an elm-tree seen from beneath presents a spreading, ragged edge, and shows the blue sky through its interstices, whereas on the horizon it appears compact, rounded, and sharply defined.

May I add a practical suggestion as to the popular terms proposed by M. Poëy on p. 39? These terms are put forward as an alternative to the scientific Latin names, for the use of *non-scientific observers*, who may be of great service in collecting information at out-stations where no trained meteorologist is at hand. It is therefore all-important that they should be as short,

¹ See Poëy, p. 33.

² "At a greater altitude a thin light veil," &c., Howard, p. 11, and again, "superne cirrata," p. 4.

³ "The lower clouds . . . form one uniform sheet," p. 11.

¹ Froude, *Proc. of Roy. Inst.*, December, 1876.

² "Math. Vorlesungen," 21st and 22nd lectures.

³ *Phil. Mag.*, December, 1876.

⁴ In particular Lord Rayleigh's investigation throws light on the theory of the balanced rudder.

⁵ Howard's Essay says, "its inferior surface commonly" (not "invariably" or "necessarily") "rests on the earth or water." P. 7, Edit. 1868.