

A clear account is given in the initial paragraphs of the method of observations and the instruments used, but not too much space is devoted to these details, so that the reader is soon brought to the first difficulty which occurred in the working out of the observations. It was necessary, in order to reduce them to a common epoch, to take account of secular variations. This might most easily have been done by choosing as observing stations the same places at which the magnetic elements had been determined in a previous survey, but in attempting to carry this out it was found that the changes which had taken place in their surroundings made it impracticable to observe at most of the old stations. Some other method of reduction had therefore to be adopted. Empirical expressions were found for the magnetic elements in terms of longitude and latitude similar to those deduced by Prof. Knott for the previous survey. A comparison of the two expressions gave the secular variation. The results of all the observations for each station are given in the report. The reduction of the observations to sea level is always to some extent arbitrary. The process employed in the present case, where use is made of relations given by the theory of the potential between the radial variation of the horizontal components and the horizontal variation of vertical force, is an improvement on the more empirical methods which have sometimes been adopted.

A further application of the potential theory may serve as an important check on the accuracy of the observations. If a potential exists, the rate of variation of the northerly force towards the west must be equal to the rate of variation of the westerly force towards the north. If this relation does not hold, the earth's magnetism cannot be completely represented by a potential, and this would mean that vertical electric currents traverse the earth's surface. The authors of the present survey calculate the intensities of these vertical currents, but rightly do not attach much importance to them. They are much greater than observations on atmospheric electricity allow us to contemplate as possible. We may therefore take the calculated values of these currents to be indications of the extent of uncertainty in the observations.

We must refer the reader to the original for the discussion of local disturbances, but cannot avoid directing attention to one passage, which seems to indicate some kind of misapprehension on the part of the author.

"It is often erroneously believed," he says, "that the expansibility of the earth's magnetic potential in negative powers of the radius vector is a proof that the source of action is inside the earth."

In a preceding sentence the writer connects his supposed error with the fact that "inasmuch as the surface integral of the force over the earth vanishes, the so-called seat of action may be placed either inside or outside."

In this passage the author seems to doubt a well-established theorem which is quite independent of the question whether the surface integral of normal force when taken over the whole surface of the earth has a finite value or not.

To put the matter plainly: If the magnetic forces at all points of the surface of a sphere can be represented in terms of a potential which is expressed as a series of spherical harmonics proceeding by negative powers of the radius vector, then there are no magnets or electric currents outside the sphere. If the passage quoted is intended to deny the truth of this proposition, the author is guilty of a heresy which he does not justify either by his hydrokinetic analogy or by his reference to one of Lord Kelvin's papers. It should be said, however, that in other parts of his volume the author seems to adopt Gauss's reasoning as to the discrimination between outside and inside effects by spherical harmonic analysis. It may be, therefore, that the apparent meaning of the passage is not the one which it was intended to convey. It is of some importance to avoid misunderstanding on so important a matter, and it is for this reason that I feel compelled to direct attention to the only criticism which can fairly be raised with regard to a very meritorious and heavy piece of work.

May other countries follow this example of Japanese enterprise, and may, especially in English colonies, scientific men receive such help from their Governments as will enable them to keep pace with foreign nations in the successful prosecution of similar work. It is not the enterprise or the knowledge which is wanting, but the material assistance and the official recognition that a certain duty is imposed on each country to take its share in the working out of geophysical problems. ARTHUR SCHUSTER.

THE TECHNOLOGY OF THE VEGETABLE FIBRES.

The Spinning and Twisting of Long Vegetable Fibres (Flax, Hemp, Jute, Tow, and Ramie). By Herbert R. Carter. Pp. xvi+360. (London: Chas. Griffin and Co., Ltd., 1904.) Price 10s. net.

WORKS written for the textile industries may be divided into three classes, viz. descriptive works of a more or less technical and practical character, educational works leading students up to an appreciation of the difficulties to be faced, and works which combine the descriptive and educational but which too frequently meet the requirements of neither manager nor student. The work under consideration meets the requirements of the mill manager or advanced student in a manner perhaps more than satisfactory. On the other hand, to place such a work as this in the hands of the elementary student would be anything but satisfactory, rather suppressing than developing that genuine interest without which it is impossible for the student to make true progress in his studies. In its particular line, however, we must highly commend the work as representing up-to-date practice in most of the sections of the textile industries of which it treats.

The work is really arranged in four sections, the first three chapters being devoted to general particulars respecting the fibres in question, chapters iv. to xv. dealing with the mechanical processes necessary for the formation of the said materials into satisfactory yarns, chapters xvi. and xvii. referring to

miscellaneous processes, such as the manufacture of threads, twines, cords, and ropes, while chapters xviii. to xxi. treat on general mill management, arrangement, and engineering.

In the first section, very interesting and useful particulars are supplied respecting the fibres and their marketing, the only difficulty being the grasping of the multitude of details here given. Had these details been represented by maps illustrating (a) area of growth, (b) area of manufacture, (c) area of distribution and use of the fibres in question, with graphical illustrations of quantities, &c., the facts presented would have been vastly more interesting and useful. This method, we believe, is employed in the textile museums of certain of our northern technical colleges.

The author wisely remarks in his preface that were it not for the similarity in the processes necessary for the preparation and spinning of many of the fibres here treated, it would be impossible to bring the work within reasonable limits. The similarity in treatment is certainly marked, and practically leads the author throughout to the employment of the "comparative method." Thus, in the first preparation of ramie, the hand and the chemical or mechanical methods are naturally compared with reference to quality of result and price, this latter necessarily involving the question of native hand-labour *versus* European machine-labour. Then the difference between ramie and flax is naturally noted, and so on.

The comparative method would naturally arrange itself under some six heads:—(1) methods of dealing with the fibres in the raw state commercially; (2) methods of preparing, that is, of cleaning for the subsequent mechanical operations; (3) ultimate length, diameter, colour, &c., of the fibres; (4) the conditions for preparation of the fibres as necessarily deciding the types of machines required; (5) the types of machines for each quality of fibre; (6) value of resultant thread or fabric as revealed by scientific and "use" tests.

This is approximately the grouping employed. The greater proportion of the book is devoted to the mechanical side, and it must be recognised that this is just, as in many cases not only has the machine taken the place of the hand method, but actually does what would be impossible without mechanical aid. Perhaps one of the most interesting comparisons in the book is that afforded by chapters xii. and xiii., in which dry, semi-dry, and wet methods of spinning are successively dealt with.

The section dealing with threads, twines, ropes, &c., is chiefly interesting as introducing machines which are practically unknown in the ordinary textile industries. It very often happens that principles developed in one industry would be of great value in another were they known; in this way the present work may indirectly be of considerable use to industries other than those specially dealt with.

Chapter xviii. deals in an interesting manner with the mechanical department, including the hackle setting, wood turning, fluting, oils, and oiling; this is certainly a useful chapter for the ordinary mill

manager. Chapters xix., xx., and xxi., however, in our opinion, are somewhat out of place, it being impossible satisfactorily to consider modern mill construction, boilers and engines, steam and water power, and electric power transmission in the fifty-six pages devoted to this subject. Mere statement, usually very excellent, is all that is possible. We would, however, question the advice given respecting electric lighting in factories. There is a marked tendency to revert to incandescent gas lighting, not only on account of the expense, but also on account of the light value.

The work is not only to be commended to those engaged in the particular trades in question, but also to those engaged in the allied textile industries, as such questions as the position of the nip of the rollers in relation to the spindle and with reference to length of fibre, the varieties of gills employed, Combe's expansion pulley and quick change motion in place of the cones in cone drawing frames, &c., constitute interesting mechanical arrangements which may be of marked value in these allied industries.

The work is illustrated by 161 figures, usually of a most interesting type. The general arrangement is certainly such as will commend itself to the mill manager, who will naturally wish to refer to the work under conditions requiring speed and accuracy.

ALDRED F. BARKER.

ENGLISH ESTATE FORESTRY.

English Estate Forestry. By A. C. Forbes. Pp. xi+332. (London: Edward Arnold, 1904.) Price 12s. 6d. net.

AS the title suggests, the book is intended for the instruction of English foresters. In the preface, the author states that he feels,

"probably in common with many practical foresters, that English forestry is sufficiently distinct from Continental, or even Scotch forestry to entitle it to be regarded as a separate subject."

The author further emphasises this point in his chapter on thinning and pruning, where he seems to hint that all the mistakes and failures in English sylviculture, about the middle of the nineteenth century, were due to the bad influence of Scotch forestry and Scotch foresters, who, according to Mr. Forbes, were imported into England about that time, bringing with them their mistaken ideas of thinning and pruning, to the detriment of English forestry.

The following extract from the preface gives the author's own views regarding the book:—

"This book is intended to be suggestive rather than instructive to the practical forester. There is little in its pages but what he already knows, and possibly a great deal with which he will not agree. But as a more or less faithful record of individual experience it is offered as a small contribution to forestry literature, which, if it does not enrich, it will not, it is hoped, disgrace."

The concluding paragraph of the preface states "that this book is not, nor does it make a pretence of being, a text-book. The intelligent reader, therefore, who discovers that it does not contain a planter's