

which is in connection with the pendulum. The shaft is completely rotated round its axis once in twenty-four hours, and this diurnal motion is communicated to the bobbins of paper belonging to the different registering instruments. The paper on these bobbins is unrolled with a different velocity for each instrument.

The instrument for registering variations of atmospheric pressure is shown at B, in Fig. 1. The marking needle records the movements of the mercury in the lower branch of a Gay-Lussac barometer having a very large cistern.

For recording variations of temperature, metallic reservoirs on the Bourdon system are employed, and for humidity a hair or Saussure's hygrometer is used. The velocity and direction of the wind are registered by a new arrangement devised by M. Richard, the principle being as follows:—A cylinder, carrying a certain number of cogs, arranged helically on its surface, is connected with a Robinson's anemometer, and acts by means of the cogs on an equal number of pens, each of which is lifted up in succession and made to mark the drum of paper so long as the cog acts upon it. For registering direction, the apparatus is provided with eight separate pens for the eight principal directions of the wind. For velocity, the cylinder carries ten cogs, which act successively on ten pens. Each pen is geared during one-tenth of a complete rotation of the cylinder, and, knowing the rate of movement of the cylinder, the velocity of the wind may be found from the length of the traces made by the different pens.

The descriptions beneath the accompanying illustrations, for which we are indebted to *La Nature*, tell the use of the different parts of the instrument. In spite of the many precautions which have been taken, Dr. Janssen recognises that the instrument is more or less tentative in character. But the question of long-period meteorographs for meteorological stations at high altitudes is so important that the result of the experiment will be awaited with great interest.

NORTH AMERICAN MOTHS.¹

MANY works on North American butterflies, and on some groups of moths also, have been published of late years, but the important family of the Noctuidæ has hitherto been much neglected. A great deal has been done in this direction, it is true, but the information is scattered broadcast through periodicals, and but little has been attempted to systematise it, the only existing guide being Grote's "List of North American Moths," which is limited to names of species, without even references to where they are described.

But to work at a group of insects without the aid of catalogues and monographs, is like attempting to study a language without the help of a grammar and dictionary. In the work before us, Prof. Smith has amply fulfilled the latter necessity, as far as regards the family of moths of which he treats. The Noctuidæ may be considered the most extensive family of the larger moths. We have 300 species in England, and Staudinger's last "Catalogue of the Lepidoptera of Europe, North Africa, Asia Minor, Siberia, and Labrador," published in 1871, enumerates 1040 species for those countries, and many have been added since; and although Prof. Smith does not number the North American species, an examination of his index yields upwards of 3000 species; and even after making the largest deductions for generic names and synonyms (per-

haps too large an allowance), we may still fairly conclude that the Nearctic fauna considerably outnumbered the Palearctic in this family, though it is not the case in the butterflies.

Prof. Smith has been accumulating materials for a monograph of the North American Noctuidæ for the last ten years. During the course of his studies, he visited London, and made a special study of the important series of type-specimens in the British Museum, which includes a large proportion of those described by Guenée, Walker, and Grote. Consequently he has been able to clear up a good deal of hitherto doubtful synonymy. He has also visited several of the more important museums on the continent, and of course the principal collections in North America had previously been examined by him; therefore his work is not a mere compilation (though even in this case it would have been of great value), but it represents a large amount of original study.

A rather important question discussed by Prof. Smith in his preface, is that of "types." He remarks:—"Dr. Hayden holds that every specimen named by an author of a species described by himself is a type. Mr. Morrison was yet more liberal, and marked as 'type' a number of specimens of species described by Mr. Grote, having presumably compared them with the actual type. Mr. Grote's practice seems to have been to mark all specimens before him when writing his original description, as 'type,' and I think Mr. Grote is right." Our own opinion is that greater precision is necessary, and that no specimen can be considered a type which was not before an author when he drew up his description. Even so, he should always label one individual specimen, which he considers to represent his species best, as "type," and, properly speaking, there cannot be more than two such "types" of a species, male and female. The remainder of the series should be regarded not as "types," but as "co-types," and specimens which are afterwards compared and considered to agree with them, whether compared by the author of the species himself, or by some other person, should simply be labelled "compared with type." Too much precaution cannot be exerted in these matters. Among other subjects noticed in the preface, are the contents of the various collections consulted by Prof. Smith, the dates of Hübner's works (in which he hardly seems to us to be fully acquainted with the published information), and explanations respecting the manner in which he has arranged the details of his book, in quoting references and localities, &c. All the species contained in the United States National Museum at Washington are marked with an asterisk. A useful index to authors and works cited follows the preface, and the general index, which closes the volume, fills twenty-six pages of small print in double columns.

Great differences of opinion exist between Prof. Smith and other American and European entomologists respecting the classification of the Noctuidæ, and sometimes also respecting the identification of various species cited. This is unavoidable, and in no way interferes with the value of his work. In most cases, Prof. Smith indicates where the type specimens of each species are to be found, and frequently adds valuable notes on identification and variation. Transformations are omitted, owing to the late Mr. Harry Edwards having issued a complete catalogue of the early stages of North American Lepidoptera (*Bulletin* No. 35 of the National Museum).

In conclusion, we may venture to express a hope that it may not be very long before Prof. Smith's promised "Monograph of North American Noctuidæ" is ready to see the light. A catalogue is good, but a monograph is better, and we shall be very pleased to see a work of such magnitude and importance carried to a successful conclusion.

W. F. KIRBY.

¹ *Bulletin* of the United States National Museum, No. 44. A Catalogue, bibliographical and synonymical, of the Species of Moths of the Lepidopterous Superfamily Noctuidæ, found in Boreal America, with critical notes by Dr. John E. Smith, Professor of Entomology in Rutgers College. (Washington, 1893.)