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PATENTS AND THE PUBLIC.

The Patents and Designs Act, 1907. By James Roberts and H. Fletcher Moulton. Pp. xiv+128. (London: Butterworth and Co., 1907.) Price 4*s.* net.

IN the preface to this book the authors state that it does not pretend to be a treatise on patent law, but that its object is to give assistance to the reader in the interpretation of the new enactments and to point out their practical effects. The authors have not discussed the wisdom of the many changes in the law introduced by the new Act, nor have they attempted to dogmatise on points which must necessarily, on account of the language employed in framing the new provisions, await judicial decision. They have, however, indicated where these points lie, and have directed attention to both aspects of the questions involved so as to enable persons dealing with patents to appreciate the dangers ahead.

Among the many changes to which the authors direct attention are the important alterations in the jurisdiction and powers of the Comptroller. The jurisdiction of the Comptroller as to the granting of patents has been extended by giving him the power, under section 7, to refuse a patent altogether if he is satisfied that the invention claimed has been wholly and specifically claimed in any specification published before the date of the application for the patent in question. In cases of opposition under the Act of 1883, the Comptroller had power to refuse to grant a patent if the invention had already been patented in this country, and the new Act extends this practice in opposition cases to cases coming under the official search instituted by the Act of 1902. The words "wholly and specifically claimed" would appear to indicate that it is intended to give the Comptroller power to refuse under this provision only patents for those inventions which have been described and claimed in prior specifications in substantially identical terms. This new power of the Comptroller should prove to be of considerable benefit to the industrial community in that it will tend to prevent the increase of worthless patents, of which there are such a large number in existence.

The jurisdiction of the Comptroller as to the granting of patents has been also extended by enlarging the grounds of opposition before him, for by section 11 any person may give notice of opposition on the ground that the nature of the invention or the manner in which it is to be performed is not sufficiently or fairly described and ascertained in the complete specification. Hitherto it has been the practice that a member of the public who had no special interest was not entitled to oppose the grant of a patent, but the question of what persons are entitled to be heard in opposition now becomes of greater importance, as it is only such persons as are entitled to oppose under this section who are entitled to petition for the revocation of the patent under section 26. The two distinct views which may reasonably be taken of the right to oppose under this section are fairly stated by the authors, but it is not at present clear which view will finally be adopted. This section should result in a desirable improvement of the descriptions contained in specifications, for unless the nature of the invention and the manner in which it is to be performed are sufficiently and fairly described and ascertained in the complete specification, this may be made a ground of opposition to the grant.

Two important changes in the practice of developing an invention are introduced by the new Act. Under section 16, an applicant who has put in two or more provisional specifications for inventions which are cognate or modifications one of the other may file one complete specification in respect of the whole of the applications, so that by this section an applicant may, as the authors state, "file several provisional specifications as improvements occur to him, and in the event of the Comptroller allowing them to be included in one patent, he does not risk invalidity by reason of disconformity." Under section 19 a patent of addition may be applied for in respect of any improvement in or modification of the invention for which an ordinary patent has been applied for. The advantage of introducing patents of addition is that they enable a patentee to develop his invention at less cost than would be incurred by taking out separate patents for each improvement, as no renewal fees are payable in respect of a patent of addition.

The practice on a petition for revocation of a patent has been very much altered by the new Act. Revocation of a patent may be obtained on petition to the Court as hitherto, but, in addition, the Comptroller may now revoke a patent on various grounds. In the first place, under section 26, any person who would have been entitled to oppose the grant of a patent may, within two years of the date of the patent, apply to the Comptroller for an order revoking the patent on any ground on which the grant might have been opposed; so that under this section an opponent may come in to petition for revocation, and thus subject the patentee to the annoyance of what is practically an opposition considerably after the time has expired in which an opposition could have been entered under the old procedure. Secondly, under section 27 any person may apply to the Comptroller for the revocation of a patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside the United Kingdom. The authors state that:—

"An attempt was made to attain the object of this clause by section 3 of the Act of 1902, but that section has proved practically a dead letter, partly in consequence of its ambiguity and partly because of the heavy expense it entailed on a petitioner. In the year 1906, out of 14,700 patents issued, 6500 were granted to foreigners; in the case of patents for dyes the proportion was about 95 per cent. In many cases these inventions were worked abroad exclusively, and the patented articles, or substances made by the patented processes, were imported in large quantities into this country, the British patents being used merely for the purpose of closing the market to persons other than the patentee and his licencees."

Such a state of affairs was in direct opposition to the spirit of our patent law, and as the obvious remedy

of forfeiture of the patent, on account of the importation, under which the imported articles were made was prohibited by the fifth article of the International Convention, section 27 was introduced to meet the difficulty. By this section, which will come into operation on August 28, the Comptroller will have to consider the application for revocation, and if after inquiry he is satisfied that the allegations contained in it are correct, and unless the patentee proves that the patented article or process is manufactured or carried on to an adequate extent in the United Kingdom, or gives satisfactory reasons why the article or process is not so manufactured or carried on, the Comptroller may make an order revoking the patent either forthwith or after a reasonable interval.

Much has been written lately as to the benefits to this country likely to be produced by this section, and in some cases there has been considerable exaggeration of the probable effects. But although it is almost impossible to state accurately the effects of the section until it is discussed in actual practice, there is no doubt of the fact that foreign inventors are now showing a greater desire than ever before to have their patents worked in the United Kingdom. In and about London, for instance, sites are being acquired for the erection of factories for the manufacture of articles patented by foreign inventors, while in Leicester the manufacture of machinery for making boots and shoes is being largely extended, and a factory has been leased for the manufacture of safety razors. The advertisement pages of the trade journals and of the illustrated official journal of the Patent Office also indicate the anxiety of many foreign inventors to have their patents worked in the United Kingdom in order to avoid revocation.

Perhaps the most interesting case under this section may prove to be the case of the German chemical industries. It is well known, of course, that although the inventor of the original artificial dye was Perkin, the aniline dye trade has been transferred almost entirely to Germany, the proportion of patents in dye cases granted to foreigners being in 1906 about 95 per cent. Most of these patents are under the control of a few large syndicates, and at least one of these syndicates is making active preparation for working their patents in this country. The extent to which this working will be insisted on is, at present, quite problematical, as, under the section, the Comptroller need make no order revoking the patent if the patentee gives satisfactory reasons why the article or process is not manufactured or carried on in this country. What is a satisfactory reason? Is it a satisfactory reason that the article or process can be manufactured or carried on more cheaply abroad? Is it a satisfactory reason to have advertised for someone to work the patent and to have received no offer? These and many other questions at once arise and present difficulties which can, apparently, be settled only in practice.

The authors deal with the many minor changes in the law introduced by the new Act, and, although the comments might with advantage have been more lavish, the book may be recommended as a clear and concise discussion of the new enactments.

A HISTORY OF GEOGRAPHICAL EVOLUTION.

Die Entwicklung der Kontinente und Ihrer Lebewelt ein Beitrag zur vergleichenden Erdgeschichte. By Dr. T. Arlt. Pp. xviii+730. (Leipzig: W. Engelmann, 1907.) Price 20 marks.

THE explanation of the obvious plan in the distribution of oceans and continents has long been one of the ideals of geography. Bacon insisted that one of the main duties of geographers was to solve the riddle of the geographical homologies, and at length a solution has been advanced that has made widespread progress into favour during recent years—the daring and once ridiculed tetrahedral theory of Lowthian Green. That theory, simply stated, is that hard-shelled spheroidal bodies that are contracting owing to internal shrinkage tend to become flattened on four faces; that the spheroid undergoes a tetrahedral deformation as the unshrinkable shell sags down after the contracting interior, and that this shape develops as the body thus most easily gets rid of the excess of surface. The extent of this deformation is limited in a revolving mass, as the effects of rotation oppose the deformation and tend to restore the spheroidal form. Modern developments of the tetrahedral theory attribute to this struggle between tetrahedral collapse and spheroidal recovery an alternate advance and retreat of the sea upon the land, as the ocean basins are alternately deepened and shallowed; and the occurrence of epochs of intense volcanic activity, following long intervals of quiescence, is attributed to disturbances that restore stability to the earth after a period of slow deformation has rendered the crust unstable.

The ultimate test of this theory is its agreement with the records of historical geology, and that test Dr. Arlt applies to it in the large volume of some 730 pages and an atlas of twenty-three plates. The author marshals a very varied array of evidence collected from geography, stratigraphical geology, palæontology, and geodesy. Dr. Arlt shows he has studied an enormous and varied literature, and is capable of handling petrographical, biological, and mathematical evidence.

The book begins with a brief reference to the theory of the permanence of ocean and continent which was much in vogue from 1876 to 1890. If that theory be true, the tetrahedral theory is unnecessary; for one of the astronomical theories which attribute the distribution of the continents to agencies that affected the earth in pre-geological times might be adequate. But, as Prof. G. H. Carpenter has recently remarked, "there can be no doubt that the trend of modern speculation is against the doctrine of the permanence through past ages of the great ocean basins of the present day" ("Scottish National Antarctic Expedition, Report on Scientific Results," vol. v., p. 57); and in accordance with most recent work, Dr. Arlt shortly and emphatically dismisses the theory as inconsistent with the facts. He then proceeds to state the methods of palæogeography They are the petrographic—the study of sedimentary rocks and deep-sea deposits—and the biological—the study of the existing and former distributions of animals and plants.

In the biological section the author deals mostly with the land faunas and floras; for their evidence is naturally the most significant regarding former land connections. But the marine fauna also gives weighty evidence. The writer pointed out in 1891 that the relations of the echinoid faunas of North America and Europe gave convincing evidence of a middle Cainozoic land connection across the Atlantic; and the position then indicated for the North Atlantic shores from the migrations of the sea urchins corresponds to the general position assigned to it by Dr. Arlt from the migrations of land animals. In his statement of the biogeographical evidence, Dr. Arlt follows the method of Blanford's fine address to the Geological Society in 1890. He considers the existing distribution of each group of land organisms in connection with its geological history and with the probable distribution of land and water on the earth during its development. He illustrates the land routes available for migration at successive periods in the history of a group by an ingenious series of diagrams (*e.g.* plate ii.). Dr. Arlt devotes 300 pages to a summary of our knowledge as to the geographical distribution of Cainozoic life. For the existing biological regions he adopts the division into three, and the names he uses suggest the age of the faunas and floras that inhabit them. The Holarctic region he names Kainogæa, on account of the modern character of its life; the Ethiopian and Oriental regions he groups together as Mesogæa; and for the remaining regions, including Australasia, Madagascar, and the Neotropical region, he adopts, with a modified meaning, Dr. Sclater's name, Palæogæa, as the region is characterised by ancient life.

The author then deals similarly with the distribution of Mesozoic and Palæozoic life, and the former continental unions thus proved. He quotes widely from literature, and numerous references show his indebtedness to the works of Lydekker.

The second main division of the work is geological, and here the author is largely dependent upon the work of Suess. He summarises the evidence from the various former continents, including North Atlantis, South Atlantis, Angaraland, Gondwanaland, the larger Oceania and Antarctica. He then describes the seven chief Archæan massifs, the ancient coigns of the earth, which have remained unbroken since the earliest geological times, and have guided the course of the earth-folds that formed the chief fold-mountain lines of the earth.

The section on historical geology summarises the chief geographical incidents and the characters of the life of each of the geological systems, and insists on the periodicity in the dominant phenomena. The author's conclusions, though probably right in the main, perhaps overstate the regularity of the periodicity. For instance, he divides known geological history into six cycles—the Cainozoic-Mesozoic, Upper Palæozoic, Middle Palæozoic (Lower Devonian and Silurian), Lower Palæozoic (Ordovician and Cambrian—the author, however, does not adopt the former term), the Algonkian, and the Urschiefer. Each cycle he represents as beginning with a marine transgression, followed by a period of fold-mountain formation, and then by vast eruptions of basic volcanic rocks, and each cycle closes with a Glacial period. He accepts six Glacial ages, viz. one in the lower and one at the top of the Algonkian, and others in the Upper Ordovician, Lower Devonian, Permian, and Pleistocene. The evidence for these six glaciations is not yet convincing.

Dr. Arlt traces, too, in the last pages of his work the influence of the former land distribution on the distribution of human races. He assigns the original home of mankind to the area north of the Himalaya. As land distribution at the arrival of man was in broad outlines essentially the same as now, the migrations of man, as is shown in the last of Dr. Arlt's admirable series of charts, followed the existing land lines. The woolly-haired races spread from Southern Asia into Africa and Melanesia; the stiff-haired Malays crossed oversea from Malaysia to Madagascar and the islands of the Western Pacific (the author unfortunately includes the Maoris as Malays), and the allied Mongols occupied northern Eurasia and America. The members of the author's last group, including the Indo-Germanic, Semitic and Hamitic peoples, and Dravidians, Veddas and Australians, overran southern Europe and northern Africa, while one section of it passed through the Malay Archipelago to Australia.

Dr. Arlt's work is extensive, comprehensive—the index occupies ninety-eight pages—and ambitious. Probably not one of his readers will agree with it all. The chapters are necessarily of unequal value. Among his classifications of animals, *e.g.*, that of the Echinoderms on his phylogenetic chart of that group, he adopts a now out-of-date system from von Zittel's text-book of 1883. But the work is of great value; it is original, suggestive, and, taken as a whole, we think sound. It is the fullest statement yet issued of the doctrines of a school of geological thought which appears to be making steady progress, and it shows the necessity for the combined study of palæontology, geology, and petrography in discovery of the actual history of the geography of our earth.

J. W. GREGORY.

BOTANY ON THE VOYAGE OF THE "VALDIVIA."

Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia," 1898–1899. Edited by Prof. C. Chun. Vol. ii., Part i., No. 2, Beiträge zur Kenntniss der Vegetation der Canarischen Inseln. By H. Schenck. Pp. 180; with 12 plates. Price 45 marks. Vol. ii., Part ii., No. 3. Das Indische Phytoplankton. By G. Karsten. Pp. 326; with 25 plates. Price 70 marks. (Jena: Gustav Fischer, 1907.)

THE second volume of these memoirs has been assigned to the botanical results of the *Valdivia* expedition. The first part deals with insular floras, the second with marine floras, and there will be an account of plants collected in countries visited on the

mainland. Dr. H. Schenck is responsible for the account of the Canary Islands, as he was for the previous numbers referring to the islands of Kerguelen, St. Paul, and New Amsterdam; but much of the text and a few of the illustrations are again the work of the late Prof. A. F. W. Schimper, who was botanist to the expedition. The character sketches written by Prof. Schimper bear that particularly vivid impress and breadth of view that characterise "Die Pflanzengeographie." Certainly he has a most fascinating subject, as the flora of the islands is rich in curious endemic plants.

The zones of vegetation as developed on the island of Teneriffe are fairly typical for the group. Schimper distinguishes three regions, basal, montane, and alpine. The basal region is the most extensive; here are found the weird arboreal monarch of the island, *Dracaena Draco*, the dragon's blood tree, showing at first an unbranched stem with tiers of horizontal leaves, but developing later a much-branched system; the candelabra-like *Euphorbia canariensis* and a date palm, *Phoenix Jubae*, the fruits of which provide food for birds but not for man. These are the dominant endemic species, but there are many others, succulent species of Euphorbia, Ceropegia, Echium, &c., and xerophytes characterised by a mass of thin, whip-like branches and narrow leaves, of which *Plocama pendula* furnishes a type. The proportion of endemics in the coastal vegetation is about one-third, a large number being species of Statice.

In the montane region Schimper notes particularly the laurel forest, where *Laurus canariensis, Erica arborea, Ilex canariensis,* and *Ocotea bullata* hold sway. Great interest attaches to several of these, because they are evidently closely connected with Tertiary fossil forms found in European countries. *Pinus canariensis* gives character to the landscape at 5000 feet, while higher *Spartocytisus supranubius* is almost the sole occupant of the black, stoney slopes. The volume is altogether *un embarras de richesse,* with copious illustrations, some in heliogravure, others interspersed with the text. Not the least pleasing feature is the generous manner in which Dr. Schenck has subordinated his work to that of his former colleague.

The study of phytoplankton is, for obvious reasons, a more exclusive subject, but the results given in the two volumes of text and plates are full of interest. Two earlier accounts treated of the gatherings taken in the Antarctic and Atlantic, while the plankton of the Indian Ocean is here under discussion. It was found that a definite limit to the Antarctic region could be set at Kerguelen Island. As the ship proceeded northwards the character of the plankton changed, species of Ceratium and Peridineæ generally becoming more numerous. Off Sumatra an increase of diatoms and Schizophyceæ connected with the increased food supply furnished evidence of coastal plankton mixed with the oceanic forms. Respecting vertical distribution, it was noted that in tropical waters the mass of plankton exists in the upper six hundred feet, while at twelve hundred feet living forms practically cease. The morphological details at the end of the volume include notes on diatom microspores, the formation of the rays in certain of the Peridineæ, and some life-histories. A final word of commendation must be bestowed on the volume of exceptionally fine drawings that have been skilfully reproduced.

SOME NEW CHEMICAL BOOKS.

(1) *A Systematic Introduction to Analytical Chemistry.* By A. F. Walden and B. Lambert. Pp. vi+176. (Oxford: J. Thornton and Son, 1908.) Price 3*s.* 6*d.*

(2) *Naturlehre für höhere Lehranstalten.* I. Teil. Chemie, Mineralogie, und Geologie. By Dr. F. Dannemann. Pp. viii+225. (Hanover and Leipzig: Hahnsche Buchhandlung, 1908.) Price 2.80 marks.

(3) *Organic Chemistry.* Including certain portions of Physical Chemistry for Medical, Pharmaceutical, and Biological Students. By H. D. Haskins and J. J. R. Macleod. Pp. xi+367. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd., 1907.) Price 8*s.* 6*d.* net.

(4) *Stereochemie, die Lehre von der Räumlichen Anordnung der Atome im Molekül.* By Dr. L. Mamlock. Pp. vi+152. (Leipzig: B. G. Teubner, 1907.) Price 5 marks.

(1) ALTHOUGH there is perhaps no branch of chemistry which at the present day is more stagnant than analysis (of the academic as distinguished from the technical kind), there are always to be found teachers whose interest in the subject will prompt them to publish their experiences. With this interest we have the greatest sympathy, for there is no doubt that the skill, neatness, intelligence and patience which analysis demands will always appeal to the chemist. Analysis is, in fact, his handicraft, just as much as the using of a lathe or a planing machine is that of the mechanical engineer, with this difference: that whilst the engineer may employ a mechanic to do his practical work, the chemist must always be his own analyst.

When we approach the question of the place of analysis in chemical teaching, we put the subject at once on a different plane and see it in a different perspective, for as students of chemistry are not all to be professional chemists, we have to consider analysis as merely a part of chemical teaching. There is no doubt that there has been a tendency for the subject to assume an exaggerated value. We inherited the tradition of the Stockholm Laboratory, and continued it because it adapted itself to practical examinations in chemistry. We do not believe any more than the authors "that the neglect of qualitative analysis is either necessary or desirable," but there is a great difference between learning the principles of the process and studying it as a part of the technique of the professional chemist. For the ordinary student there seems no object in discovering and identifying such uncommon combinations as meta- and pyro-phosphoric acid, fluosilicates or perchlorates. The range of practical chemistry has so increased of late that it has become more than ever imperative to restrict the study of one branch if it encroaches on the time which

could be given more usefully to another. As to the general character of the book under review, we have failed to discover anything very original in its treatment of the subject, but it seems to be a thoroughly safe and trustworthy guide.

(2) This volume (the first of two parts) is for use in Realschulen and Gymnasien. It is divided into sections. There is one on descriptive and practical chemistry which covers 100 pages, including ten pages on technical processes, one of forty pages on mineralogy, including eight on crystallography. There are about thirteen pages on geology, three pages describe experiments on vegetable physiology, and the last forty pages are devoted to object lessons on topics which range from Scheele's discovery of oxygen to the growth of coral islands. The book is well printed on good paper, illustrated by excellent drawings, and compiled with evident care. It is also, in a sense, a practical manual, the first section being interspersed with a variety of simple chemical experiments. Yet in spite of its attractive appearance it is a satisfaction to think that such a book would find no place in any school in this country. Its defect is diffuseness, especially in the latter sections. We can form a pretty clear notion of the effect of a course of this kind on an average boy or girl. They would have absorbed a number of scientific names, have formed a hurried acquaintance with different kinds of apparatus, remembered several chemical formulæ; they would describe the six crystallographic systems, and talk about sedimentary and igneous rocks; but their knowledge would be a kaleidoscopic assortment of ideas which could produce no sharp and permanent impression, and would do little to stimulate a living interest in the things about them.

Whatever shortcomings our systems of science teaching may possess, we do not set schoolboys and girls, who are old enough to study science seriously, to nibble at a scientific scrap-heap. They may do that as much as they please out of school, and perhaps the more they do it the better; but in school the process with older children must be methodical and thorough, and not superficial and diffuse, and should leave the boy or girl with a solid foundation to build upon.

(3) The authors state in their preface that "it was with the idea of presenting in the simplest manner the facts of organic and physical chemistry which have an essential bearing on medical science that the present work was written." There is no doubt that in the present state of organic chemistry a process of judicious selection for special needs is not only desirable, but imperative. Like the botanist, one has to transplant typical specimens into trim little beds where they can be examined individually without the brain becoming bewildered by an endless and varied flora. Thus the authors have emphasised those facts which have a special relation to physiology and pharmacy, and have suppressed matter which they consider of less importance, and have done it with considerable judgment. Whether they have succeeded as well with the few brief references to physical chemistry is doubtful, the space allotted being altogether inadequate for even an elementary exposition of the subject.

We would direct the authors' attention to the following errors which have been noted in glancing through the book. Amyl and ethyl nitrite are not usually described as "nitro" compounds (p. 162); no distinction is drawn between the metallic derivatives of glycol and glycollic acid, both being described as *glycolates* (pp. 142 and 166); racemic lactic acid is not indicated by "*i*," but by "*r*" (p. 169); *nitrobenzlidene* is wrongly spelt (p. 195); *purine* is not the atomic framework, but the mother-substance of the uric acid group (p. 204); there is a step missing in Traube's synthesis of uric acid (p. 201); and the formula for safrole is wrong (p. 316).

(4) This book is intended for those who are not professed chemists, but are interested in the related sciences of physics and chemistry. It is a clear and concise exposition of the subject, a sort of abridged Werner's "Lehrbuch," and will no doubt fulfil the purpose for which it was compiled. Satisfactory as the book is in many of its essential features, it reveals a curious ignorance on the part of its author of much of the recent work on stereochemistry published in this country. We have noted the following more important omissions. There is no reference to McKenzie's researches on asymmetric synthesis, or to Patterson's work on the activity of substances in solution, or to his recent paper on "Optical Superposition," or to Kipping's synthesis of optically active silicon compounds. A book which ignores, whether by accident or design, contemporary research cannot be regarded as an entirely trustworthy guide. J. B. C.

OUR BOOK SHELF.

The Animal Mind. A Text-book of Comparative Psychology. By Dr. Margaret Floy Washburn. Pp. xi+333. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1908.) Price 7*s.* net.

THIS book is the second volume of a series to be devoted to animal psychology, under the title of "The Animal Behaviour Series." The first volume—"The Dancing Mouse," by Dr. Yerkes, recently reviewed in these pages—was an exposition of the different experimental methods applicable to the investigation of the psychology of one particular animal. Miss Washburn's book likewise follows the experimental method, and aims at presenting concisely the facts and principles that have emerged as the result of the application of this method during the last ten or twenty years to the study of different forms of animal behaviour.

Starting with a general statement of the difficulties and limitations inherent in the science of comparative psychology, the author proceeds to give a somewhat brief yet penetrating and concise discussion of the problem of inferring mind from structure and function respectively. Miss Washburn's conclusion is so typical of her general attitude throughout the book that it may well be quoted here:—"We can say neither what amount of resemblance in structure to human beings, nor what speed of learning constitutes a definite mark distinguishing animals with minds from those without minds, unless we are prepared to assert that only animals which learn so fast that they must have memory ideas possess mind at all. And this would conflict with the argument from structure. For example, there is no good experimental evidence

that cats possess ideas, yet there is enough analogy between their nervous systems and our own to make it improbable that consciousness, so complex and highly developed in us, is in them wholly lacking."

There follows on this a very full and admirably lucid description of the investigation of sensory discrimination, space perception, and higher forms of consciousness in the various classes and orders of the animal kingdom—methods and results being in every case given in connection with the names of the investigators and references to their works. These references, by the way, nearly five hundred in number, are collected at the end of the book, under the heading "Bibliography," and greatly enhance the value of the book to the intending research student.

Two chapters are devoted to the consideration of the processes of learning in animals. The subject is as difficult as it is important, which perhaps justifies the author's attitude of extreme caution, apparent throughout the discussion. The account is descriptive rather than critical. For example, the conflict between the results of Thorndike and Hobhouse respectively in their experiments on cats and dogs is indeed stated but not discussed. The closing chapters on the memory idea and attention are full of interest, and really come to close quarters with the vexed question of the relation of animal to human intellect.

Psychologists will be unanimous in their gratitude to Miss Washburn for the very thorough way in which she has accomplished her task.

WILLIAM BROWN.

Natur-Urkunden. By Georg E. F. Schulz. Heft 1. Vögel. Erste Reihe. Pp. 20, with 20 plates. Heft 2. Planzen. Erste Reihe. Pp. 16, with 20 plates. Heft 3. Planzen. Zweite Reihe. Pp. 16, with 20 plates. Heft 4. Pilze. Erste Reihe. Pp. 16, with 20 plates. (Berlin: Paul Parey, 1908.) Price 1 mark for each part.

VARIOUS books on birds by Messrs. Kearton, and others on natural history, including a miniature series that has attained a wide circulation, have served to indicate how suitably photographs from the life may be utilised to illustrate books on botany and zoology. A very charming series of this kind is now being issued by Messrs. Paul Parey under the title of "Nature Records"; they are being entirely prepared as to photographs and text by Mr. G. E. F. Schulz. The volumes will deal with both branches of natural history. Of the first four, two are devoted to wild plants and a third to fungi. It will be recognised that, owing to their low growing position, size, and tendency to movement, it requires great care and skill to photograph plants as they grow. However, Mr. Schulz is not content to take his photographs under the easiest conditions, but has been at considerable pains to record special phases, such as the open flowers of *Silene noctiflora* and the rain-flecked leaves of *Aira canescens*. Among the illustrations of fungi, one of the best, representing *Boletus scaber*, shows even part of the hymenophore.

Difficult as it must have been to secure these plant photographs, some of the studies of birds in the first part must have required even greater skill and patience. There is a delightful picture of the parent tern holding a small fish while one youngster tries to gobble and the other cries lustily. The turning of the eggs in the nest is shown both for the seagull and the avocet. Altogether the volumes cannot fail to meet with the admiration of all "nature-lovers." Inasmuch as the records are taken at random, the series is intended primarily for the *dilettante*, but the author's notes are full of nature knowledge that may be recommended to teachers of nature-study and others who are not too old to learn. It is to be hoped that the early parts will have a ready sale, as in these circumstances the series will be continued.

A Pocket Handbook of Minerals. By G. Montague Butler. Pp. ix+298. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 12*s.* 6*d.* net.

EVERY student of mineralogy knows how difficult it is to acquire facility in identifying minerals off-hand. It is with the view of assisting the student, the miner, and the collector in determining his specimens that this little work has been prepared. It has no pretension to be a manual of mineralogy, even of an elementary character, but it is simply a book for the pocket, to be used as a work of ready reference. For this purpose it seems well adapted. The mineralogist finding an unknown or doubtful mineral may turn to it for assistance, much in the same way that a botanist would use his flora. Chemical and crystallographic characters are deposed from the supreme position which they usually occupy, and attention is directed rather to obvious physical characters, which in some cases appear even trivial, but are yet of diagnostic value. The most characteristic features of a mineral are emphasised by being printed in thick type so as to catch the eye. At the end is a rather ingenious scheme, forming a kind of artificial key for the identification of an unknown species. There is also a glossary, which seems to have been prepared with care.

As the book is likely to be used by the prospector, the commercial element is not ignored, and tables are introduced giving the value of metals, useful minerals, and especially gem-stones. It is notable that space for notes is left here and there in the book, a feature which, though increasing the size of the volume, is likely to be of service in the field; thus a description of moonstone in less than half-a-dozen lines occupies an entire page (p. 136). We have not noticed many printer's errors, but the name of the mineralogist who suggested the scale of hardness was Mohs, not Moh, as printed twice on p. 290.

La Lutte contre les Microbes. By Dr. Etienne Burnet. Pp. ix+318. (Paris: Librairie Armand Colin, 1908.) Price 3.50 francs.

IN this book a very readable account is given of certain diseases of microbic origin, of the parasites producing them, modes of transmission, and methods of treatment and prevention. Cancer is first dealt with, the author evidently inclining to the view that this disease is due to a micro-parasite, transmitted perhaps by food and by insect parasities, which we think is probably not the case. The statistical part of this section is a useful summary of data concerning the frequency of the disease, cancer houses and districts, &c. After cancer, tuberculosis, tetanus, sleeping sickness, intestinal infections, and small-pox and vaccinia are dealt with, and with these the author is on less debatable ground, and a good summary of our knowledge of each is given. The volume concludes with a translation of Jenner's researches on the causes and effects of cow-pox. R. T. HEWLETT.

The Farm shown to the Children by F. M. B. and A. H. Blaikie. Described by Foster Meadow. Pp. xii+91. (London and Edinburgh: T. C. and E. C. Jack.) Price 2*s.* 6*d.* net.

THIS attractive little volume contains a great deal of information about farming, expressed in a very simple manner. Its forty-eight coloured pictures are sure to please children greatly, and the book, as a whole, is well calculated to arouse an interest in agricultural pursuits.

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 intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Nature of the γ and X-Rays.

IN a previous letter to NATURE (January 23, p. 270) I gave a brief description of some experiments made by Dr. Madsen and myself on the properties of the secondary radiation due to γ rays. A fuller account is given in the Transactions of the Royal Society of South Australia, 1908, p. 1.

The experiments have been continued, and I hope that the following summary of the results will be of interest:—

(1) When γ radiation is diminished in quantity as it passes through matter, β radiation appears in its place, moving at the outset in the original direction of the γ radiation, and subsequently undergoing scattering in the ordinary manner of β rays.

(2) The penetration and therefore the speed of the β radiation thus produced increases with the penetration of the γ radiation to which it is due.

(3) The speed of the β radiation does not depend upon the nature of the atom in which it arises.

(4) In the case of radium at least, the speed of the β radiation is nearly equal to, perhaps a little less than, the speed of the normal β rays emitted by radium itself.

(5) When very hard γ rays traverse matter their absorption and therefore the production of β rays are almost independent of the atomic structure of the matter, and a density law follows. Softer rays are affected by atomic structure; they are more absorbed by heavy atoms than by light atoms for equal weights of absorbing screen. The softer the rays, the greater is this effect. Hence arises the difference in character of the logarithmic curves of absorption of different substances; heavy atoms show a rapid initial fall. Hence also when soft γ rays are used the emergence radiation from heavy atoms may be greater than from light atoms. And again, the relative extent to which the rays produce secondary radiation from different metals may be modified by passing the rays through screens, as Kleeman has shown. We do not, however, find any true selective absorption such as Kleeman suggests.

(6) If there are any secondary γ rays, the ionisation which they produce is negligible compared with that produced by the secondary β radiation, at least within a moderate distance of the radiator, say a metre in air.

All these facts can be explained very simply and directly on the neutral-pair theory; indeed, the theory guided us to the verification of most of them.

As regards (1), we have simply to suppose that the negative and positive passing united into an atom are separated if they happen to traverse a very strong field anywhere therein; the negative flies on, and the positive becomes ineffective.

The second property is also an obvious consequence of the hypothesis. The faster the γ particle is moving, the greater the initial speed of the negative.

The third is readily explainable: the electric field of the atom is merely the solvent of the bonds that connect the pair. It is not able to affect the speed of the negative set free.

The fourth may be taken to imply that the radio-active atom (say Ra C) ejects electrons at a certain speed, some of which start off in company with a positive counterpart, some without. The former constitute the γ rays, the latter the β.

The fifth would show that there are stronger fields inside heavy atoms than light ones, and that the chance of separation of the pair increases with (*a*) the strength of the field, (*b*) the time taken to cross it.

Turning now to the ether pulse hypothesis, it is convenient to consider it in two different forms, which are irreconcilable with each other.

In the first of these, both the electron and the electron's energy are supposed to be drawn from the atom, the γ ray merely pulling the trigger. This theory requires us to accept the extraordinary idea that the primary ray, though it does no more than pull the trigger, determines the direction and velocity of the shot, and it offers no explanation at all of (1) and (4) (see above). We should naturally expect the velocity of the electron to be a function of the properties of the atom from which it is drawn, as in the well-known cases of true radio-activity. Moreover, all the radio-activity of which we have certain knowledge is not to be hurried or stayed by any external agency. It is true that Prof. W. Wien (Göttingen *Nachrichten*, 1907, p. 598) has made a tentative application of a theory of Planck's, and thence derived a formula $v^2\lambda = \text{const.}$, where v is the velocity of the ejected electron, and λ the thickness of the pulse. This provides a formula, but it satisfies (2) and (3) only; moreover, it seems to me that the difficulties remain as great as ever, and that the application of Planck's theory must be unjustifiable.

Passing on to the second form of the pulse theory, we now suppose the electron itself to be drawn from the atom, but its energy from the pulse.

I understand that this view is now held by Prof. J. J. Thomson (see Camb. Phil. Soc., vol. xiv., part iv., p. 417), and it is also maintained by Mr. N. R. Campbell ("Modern Electrical Theory"). New works often take some time to reach us here, and I have only just received a copy of this admirable book, but I hope I have understood it sufficiently well to enable me to describe the position correctly.

Since the energy of a pulse, if spread over an ever-widening surface, is utterly insufficient to provide the energy required for the secondary β ray, Prof. Thomson and Mr. Campbell suggest that the pulse does not spread, but travels radially from the arrested electron along tubes of force, the latter being considered as things differentiated from the surrounding space. Prof. Thomson speaks of bundles of pulse energy travelling with the speed of light in straight lines. When a kathode particle strikes the anti-kathode, bundles dart away from the point of impact; when these impinge on atoms they drive out the electrons constituting the secondary rays. In this way the energy difficulty is explained, and possibly also the difference between the emergence and the incidence radiations. It must be remembered, however, that this difference may be very large. In the case of carbon under γ rays, the one radiation is five or six times the other. Since the secondary β ray has the same speed (nearly) as the primary kathode ray which caused the X-ray, it seems to me necessary to suppose that the arrest of the kathode particle must cause one bundle of energy of very small and invariable volume to travel out along one straight tube (and only one) connected to that particle. This causes the ejection of one electron from some atom into which it penetrates, giving all its energy to that electron. Similar arguments apply to β and γ rays. Surely it requires a very complicated structure of the æther to effect all this. I have too deep a respect for Prof. Thomson's work to say it is not possible to construct a theory on these lines, but I think I may fairly claim that the neutral-pair theory explains all the known properties of the γ rays much more simply and completely.

Perhaps I ought to add that the theory, although it may require a detachable positive electron, does not require a free positive electron.

I have scarcely mentioned the X-rays. I am glad to see that Mr. Cooksey (NATURE, April 2, p. 509) has proved the difference between emergence and incidence radiation in their case also. It can now be said, therefore, that all the properties of the γ rays as set out in the above summary hold for the X-rays also, *mutatis mutandis*.

University of Adelaide, May 5. W. H. BRAGG.

Symbols for Physical Quantities.

IT is very desirable to have a notation for the representation of physical quantities in scientific books and periodicals, which shall be the same in all languages.

The subject is under the consideration of the International Electrotechnical Commission with a view to international agreement, and committees in the different countries (in England under the chairmanship of Lord Rayleigh, O.M.)

are discussing this particular subject. They are dealing more especially with symbols for electrical and magnetic quantities, but the system might with advantage be extended to embrace all important quantities in physical science, especially as the subject is receiving the attention of most technical societies with a view to some action being taken in the matter.

There are, however, two great difficulties which arise when we try to fix upon a standard notation.

The first is the difficulty of persuading a number of writers and readers who have become accustomed to a certain symbol for a certain quantity to change it in favour of an equally large number of writers and readers who have become accustomed to another symbol. For instance, in France and Germany the letter "I" commonly represents the strength of an electric current, while in England and America "C" is more commonly used.

In the second place, there are not enough letters in the two or three alphabets at our disposal to give a distinct symbol to each quantity, without resorting to the combination of more than one letter to form a single symbol. There is a great objection to this combination of letters, because the use of subscript letters and numbers is required for distinguishing between particular quantities of the same general kind. If, for instance, C represents current, C_a might conveniently represent armature current, and C_1 the current in circuit No. 1. It would therefore not be good to take C_a to represent capacity, or any quantity other than an electric current.

There is, moreover, an objection to using letters at all to represent quantities in a universal notation, because, unless initial letters are used, there is no connection in the mind between the letter and the quantity, and the symbol is difficult to remember. We cannot always use initials, because the initial letters differ in different languages. For instance, in England "R" commonly stands for resistance, while in Germany it is more convenient to use "W" for widerstand. Moreover, the same initial occurs for a great number of different quantites. For instance, "R" might stand for resistance, reluctance, reactance, radius, &c.

One way of avoiding the above difficulties would be to create a number of new symbols which could be printed by means of type like ordinary letters, and which would represent each physical quantity in a distinctive manner.

The question, however, arises as to whether a number of entirely new symbols would be acceptable to writers, readers, and printers alike, and the sub-committee on symbols appointed by the British section of the Commission has requested the writer to place his views publicly before the profession, with the view of obtaining suggestions and criticisms as to the feasibility of such a scheme from as wide a circle as possible.

In choosing a symbol, we would try to make a very simple picture of something that reminds us of the quantity in question. For instance, ⌇ might represent temperature. If we were told that this simple outline of a thermometer represents temperature, we would have no difficulty in remembering it. Similarly, / might represent force, and the various "forces" might be derived from it; for instance, ϟ electromotive force (conventional representation of lighting), and ∩ magnetomotive force.

It is not my purpose here to say what would actually be the best form of symbol for each quantity, but it is not a difficult matter to devise very simple characters which can be written quickly, easily, and with sufficient accuracy, and can at the same time assist the memory to connect them with the quantity for which they stand.

What would the printers say to the new type? The author has taken up this matter with a very large publishing firm, and is assured by their chief expert that 200 or 300 new types would be a small matter to a modern printer, who is already accustomed to deal with many hundreds of different founts, each of which contains from 50 to 120 different symbols. He estimates that a printer in a large way of business has at his command as many as 60,000 distinct types, differing from each other either in letter, size, body, or face. The addition of 200 or 300 more would be a drop in the ocean. The size of the new type could be standardised for most purposes, and it would only be in some special case that another size would be called for.

The setting up of the formulæ with the standard size of type would be simpler than with the present system, in which subscript letters are often unnecessarily introduced. One symbol under the present system sometimes consists of four or five letters.

If it be admitted that the introduction of new symbols is advisable, the question arises, what shall the new symbols represent exactly? Shall the sign ⌇ (temp.) represent temperature in any units, or shall it represent the number of degrees of temperature, measured by some scale agreed upon, and embodied in the definition of the symbol? If the system of units employed be not prescribed, fewer symbols would be required, and the general writer who now says vaguely, "Let T equal the temperature," would find the symbol sufficient for his purpose. But from the reader's point of view there is much to say in favour of a symbol which will embody in its definition a standard system of units. Any formula expressed in such symbols would be completely self-contained, and would be an exact statement of a physical fact. Until the units employed in any formula are known, the formula expresses only half its meaning. Perhaps some slight addition to the symbol, or even to the whole formula, might be used to indicate that the standard system of units is employed. Without that addition, the symbol would have a general meaning. For instance, ⌇ might equal temperature, while ⌇ might indicate the degrees centigrade above the absolute zero. The name of the type might be the name of the physical units which it represents; for instance, for ϟ we might read "volts."

If writers, printers, and readers who have any definite views as to the best method of devising a system of symbols would communicate with the author, they might assist in solving the many difficulties which arise in connection with this matter. MILES WALKER.

The Cottage, Leicester Road,
Hale, Altrincham.

Linnæus's Authorities.

I AM happily able to throw a little light upon the question raised by Prof. Karl Pearson in NATURE of July 16 (p. 247). The citation he quotes is identical with that in the tenth edition of the "Systema Naturæ" (1756), p. 24.

"Bont. jav. 84. t. 84." will be found in Piso, "De Indiæ utriusque re naturali et medica," Amst. 1658. fol. The bastard title following the engraved title-page has towards the bottom this line:—"Iacobi Bontii, Bataviæ in majore Java novæ medici ordinarii, ..." hence, no doubt, the form employed by Linnæus. This forms the third separately paged part of the volume, and on p. 84 is a woodcut of the "Ourang Outang sive Homo silvestris," &c.

"Kœp. itin. c. 86" is doubtless "Kiöping (Nils Matson) En reesa genom Asia, ... &c. Wisingsborgh, 1667. 4to."; I am quoting from Dryander's Catalogue of Banks's Library, vol. i., p. 86.

"Dalin. orat. p. 5." is referred to in Amœn. Acad., vol. vi., p. 74 as "Dalin in oratione Acad. R. Holm. de hac:" &c. I have not verified the actual speech, but it should not be difficult to run it down in the early volumes of the Handlingar. B. DAYDON JACKSON.

Linnean Society, Burlington House, W.

Elliptical Halos.

IN Pernter's "Meteorological Optics" the explanation of haloes, based on a consideration of refraction and reflection in ice-crystals, is given at some length. In particular the elliptical halo described by Mr. Cave in NATURE of July 16 (p. 247) is shown to be a form depending on the sun's altitude. If the sun is less than 25° above the horizon, the phenomenon appears as two arcs touching the 22° halo at its highest and lowest points. For altitudes greater than 70°, it is indistinguishable from the 22° circular halo.

It would be interesting to know if Mr. Cave observed the transition from the elliptical to the circular form.

E. GOLD.

3 Devana Terrace, Cambridge, July 16.

THE FIXATION OF ATMOSPHERIC NITROGEN AS CYANAMIDE.

IN NATURE of August 30, 1906, an article was published describing the Birkeland Eyde process for the fixation of atmospheric nitrogen by electrothermic methods and the conversion of the nitric acid so ob-

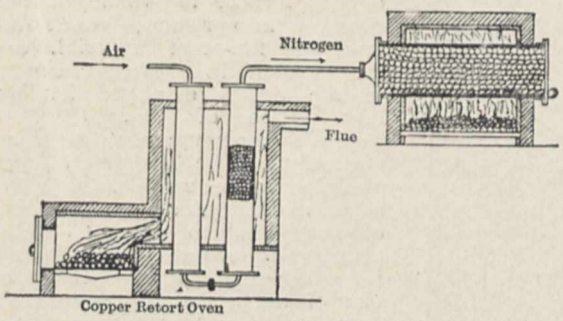

FIG. 1.—Nitrogen Absorption Retort.

tained into calcium nitrate, which is used as a fertiliser in place of Chili saltpetre. Since that date the Birkeland-Eyde works at Notodden, in Norway, have been considerably enlarged, owing to the success which met their initial efforts. The necessity of obtaining large quantities of nitrogen in a form suitable for fertilising purposes does not require to be reiterated again, because the fact that the available sources are being depleted, and the demand for nitrogen for agricultural purposes continually increases, is now universally recognised. This has led many investigators to endeavour to fix atmospheric nitrogen in some other form, which it is hoped will be more economical than that of direct oxidation in the electric arc.

The amount of Chili saltpetre exported in 1907 was 1,740,000 tons, and in order to replace this by the fixation of atmospheric nitrogen, it is necessary to employ 280,000 tons of the gas, and this is the amount which, it is calculated, is contained in the atmosphere over every nine acres of the globe. Another method

FIG. 2.—Electric Furnaces at Odda for producing Cyanamide.

of fixing nitrogen is known, and that is the formation of calcium cyanamide by the heating of calcium carbide in a stream of nitrogen obtained from the atmosphere. The researches which led to the discovery of calcium cyanamide were originally commenced by Drs. Frank and Caro in 1895, when they were endeavouring to produce cyanides by heating a mixture of calcium carbide and sodium carbonate in presence of nitrogen. The results were not very satisfactory, and therefore barium carbide was substituted, and this substance was found to absorb nitrogen with great avidity at between 700° and 800° C. It was intended to treat the barium cyanide with potassium or sodium carbonate, and thus produce the cyanides. On examination of the products produced, however, it was found that not only did barium carbide produce barium cyanide, but also a more complex compound was formed, which upon examination proved to be barium cyanamide according to the equation :—

$$BaC_2 + 2N = BaCN_2 + C.$$

The product obtained in the reaction usually contained 30 per cent. of barium cyanide and 40 per cent. of cyanamide, the remainder consisting of barium oxide and carbon. It was found, however, that the barium cyanamide and barium cyanide could easily be converted into potassium cyanide by melting with potassium carbonate as follows :—

$$Ba(CN)_2 + BaCN_2 + C + 2K_2CO_3 = 4KCN + 2BaCO_3.$$

Experiments were then taken up with calcium car-

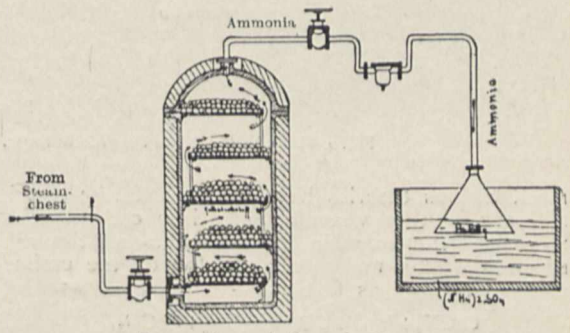

FIG. 3.—Ammonia Producing Apparatus.

bide, and investigation showed that by altering the conditions it was possible to convert the whole of the calcium carbide into cyanamide according to equation 1. Now when calcium cyanamide is decomposed by means of water, ammonia is produced thus :—

$$CaCN_2 + 3H_2O = CaCO_3 + 2(NH_3).$$

It seemed, then, that it might be possible to obtain the ammonia for purposes of fertilisation, that is to say, employ cyanamide directly as a manure, but as the reaction only takes place with water at high temperatures, agricultural authorities were inclined at first to doubt the possibility of employing this product, as it was presumed the ammonia would probably not be liberated by the moisture of the soil. However, experiments showed that the cyanamide actually does decompose in the soil, and that it acts as a source from which plants can obtain the nitrogen which they require for nutriment. The product has therefore been put upon the market under the name of "Nitrolim." Some difficulties, however, were met with, one being that the finished product often contains some quantities of calcium oxide, therefore on exposure to moist atmosphere the nitrolim in-

creased in bulk, which was objectionable for storage purposes, as the jute sacks in which it was contained burst. By, however, taking precautions to line the sacks first of all with double paper, this difficulty was got over, and also by improved methods of manufacture the amount of lime produced was lessened.

As regards the actual part played by cyanamide in the soil various theories have been put forth; *e.g.* it would appear that when brought into contact with the ground the cyanamide is first decomposed through the action of the moisture and also of the carbon dioxide in the soil as follows :—

$$CaCN_2 + H_2O + CO_2 \rightarrow H_2CN_2 + CaCO_3,$$

and the free cyanamide will then, by absorption of water, probably be further decomposed into urea,

$$H_2CN_2 + H_2O \rightarrow CO\begin{matrix}NH_2\\NH_2\end{matrix}.$$

Also the decomposition is greatly assisted by the myriads of microbes which are invariably found in cultivated soil.

Experiments have shown that calcium cyanamide is more suitable in some soils than in others, *e.g.* if the soil is in an acid state it is necessary previously to lime it. Such soils are found in high moorland and in sandy places because they are very poor in lime, and when applied to such land, cyanamide, unless lime is first added, is distinctly harmful, but with most other soils it is very satisfactory.

Nitrolim can also be mixed with other fertilisers, such as basic slag, potassium salts or superphosphate, but with this latter particular precautions have to be employed owing to the free phosphoric acid combining with the free lime in the cyanamide. This difficulty, it is stated, has now been got over. One advantage which cyanamide has over Chili saltpetre is that it is less soluble in water, and is therefore not so liable to be washed away in the drains and so lost, consequently the unchanged cyanamide which may have been left in the ground after the first harvest is readily available for the succeeding one.

FIG. 4.—Isere Va ley, Nôtre Dame de Briançon.

Cyanamide is manufactured from calcium carbide of the same quality as that which is used for illuminating purposes. The carbide as it comes from the electric furnace is ground up and charged into retorts, which are made of fire-proof material, and are mounted in a furnace similar to the retorts employed for the manufacture of gas. (Fig. 1 shows this arrangement diagrammatically.) The nitrogen is then passed over the carbide, the retort being maintained at a temperature of from 800° to 1000° C. The nitrogen is produced either by the Linde system of fractional distillation of the air or by passing air over heated copper turnings, the resulting copper oxide being reconverted to the metal by passing reducing gases over it. In the Linde process the oxygen which remains after the separation of the nitrogen is a useful bye-product. As soon as the carbide in the retorts is saturated with nitrogen—a fact which becomes evident by the controlling gas meter coming to a standstill—the calcium cyanamide is extracted in the form of a hard cake, and is cooled in vessels from which air is excluded. When cool it is ground into a fine powder and is ready for use.

During the last year a new electric furnace has been devised for heating the carbide while it is absorbing the nitrogen, and this has given such satisfaction that now all the older retorts are being replaced by the electrically heated ones. The process is cheaper, and the operating costs per furnace are lower, also the life of the retort is practically unlimited, which was not the case with the older retorts (Fig. 2 shows a number of these retorts in position.)

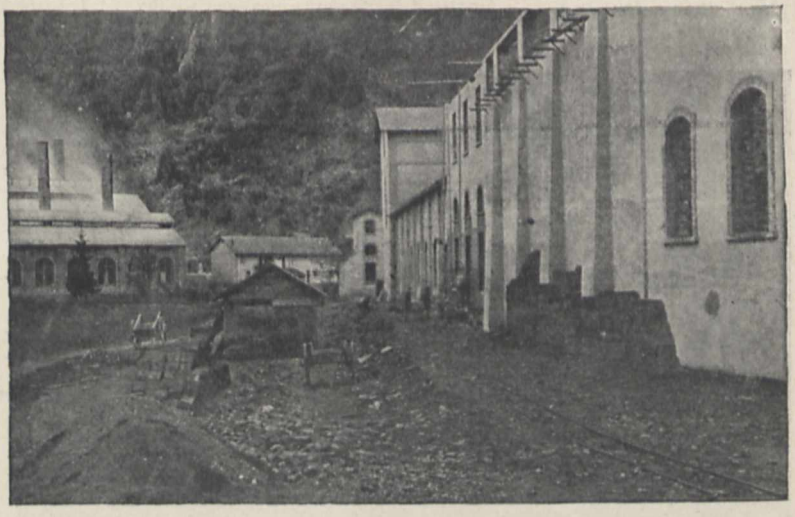

FIG. 5.—Main Buildings at Nôtre Dame de Briançon.

The yield of carbide at most works is about two

tons per kilowatt year, and two tons of carbide will absorb practically 500 kilograms of nitrogen in the form of nitrolim. A power of about $2\frac{3}{4}$ h.p. is required per year for fixing each ton of nitrogen, and in addition to this about one-third horse-power is required for the grinding and all other mechanical operations. Consequently, to produce sufficient nitrolim to take the place of all the Chili saltpetre at present consumed annually, plant developing no less than 800,000 h.p. would be required. Not only is nitrolim useful as a fertiliser, but quite a large variety of chemical products have been made by means of it. For instance, by melting it with a flux, a mixture containing 25 per cent. of potassium cyanide, which is found to work quite as efficiently for the extraction of gold and silver as the pure product, is produced. It comes on the market under the name of "Surrogate." Ammonia may be produced very readily from this product, and may be collected pure or used for making salts of ammonia. (Fig. 3 shows diagrammatically the form of plant employed.) Another product is dicyandiamide, which is being used in increasing quantities for the manufacture of organic dyes. Besides which there are urea, thiourea, ferricyanide, and a variety of other products.

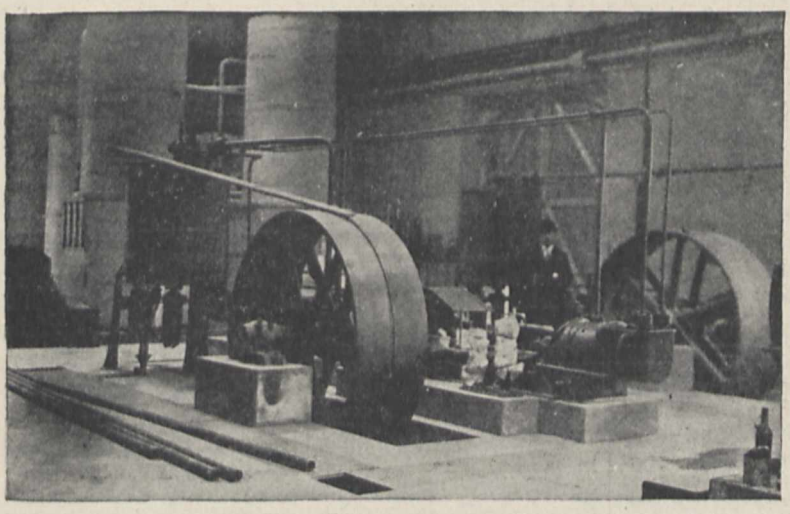

FIG. 6.—Linde Machinery.

As a commentary upon the Birkeland-Eyde process worked at Notodden, it is of interest to notice that the Cyanamide Company at Odda fix about the same quantity of nitrogen as the Birkeland-Eyde; but whereas the former employed about 25,000 kilowatts of power, the energy required by the latter company is between five and six thousand kilowatts. It would thus appear that the actual fixation is cheaper in the form of cyanamide than in that of calcium nitrate. At the end of the present year it is hoped that works having a total output of 45,000 tons of nitrogen will be in operation, and in the course of next year a correspondingly large increase in production of this product is predicted. It should be mentioned that the first plant upon an industrial scale was started about two and a half years ago, at Piano d'Orta, in Central Italy, with a yearly production of about 4000 tons of nitrolim. These works are now being increased to a capacity of 10,000 tons. Other important works are being started in Italy; the power employed is hydro-electric.

Works are being erected in Austria-Hungary, and at the present time a water-power installation, giving at least 50,000 h.p., is being erected at Almissa. In France the Société Française des Produits Azotés has installed works at Nôtre Dame de Briançon (Haute Savoie) having an output of 4000 tons, and these have been in operation for about six months. In Germany, at Westeregeln and Brühl, on the Rhine, 10,000 tons of nitrolim are being annually manufactured. It should be noticed, however, that the works at Brühl do not employ water power, but as the coal in this district is cheap, it is used in place of water power. In the United States the American Cyanamide Company are constructing works on the Canadian side of the Niagara Falls, with a capacity of from five to six thousand tons per annum, which it is hoped to enlarge later on so as to produce 40,000 tons.

The chief British enterprise is the North-Western Cyanamide Company, Ltd., which has erected works at Odda. Figs. 4 and 5 show the Isere Valley, Nôtre Dame de Briançon, and the main buildings of the cyanamide works. Fig. 6 shows the Linde machinery employed there for fractional distillation of the air.

F. M. P.

THE EDUCATION OF THE BLIND.[1]

THE jubilee year of the Institution for the Blind at Illzach-Mülhausen has been celebrated by the publication of a "Festschrift," which contains addresses and papers by Prof. Kunz and others at the congresses regarding the blind held in Frankfort in 1882, Amsterdam, 1885, Kiel, 1891, Berlin, 1898, Paris, 1900, Breslau, 1901, Halle, 1904, Leipzig, 1905, and in Rome, 1906. There is first an interesting account of the development of the Institution at Illzach since its foundation in 1856. Institutions for the blind were founded in various cities long before this date. Thus, to select from a long list of the chief cities of the world, we find one in Paris in 1784, in Liverpool (the first English institution), 1791, Edinburgh, 1793, London, 1799, Berlin, 1806, St. Petersburg, 1807, Stockholm, 1808, Dublin, 1810, Barcelona, 1820, Munich, 1826, New York, 1831, Bern, 1836, Padua, 1838, and Madrid, 1842.

The home at Illzach was at first small and modest, but it grew rapidly, and now it is one of the best equipped blind asylums. From the first its founders had in view that it was not merely to be a home for the blind, but a school in which all the elements of an ordinary education, and also of a technical education, could be taught. Nothing is more ingenious than the methods now adopted for the education of the blind, more especially by the sense of touch. Reading by raised type, or by a system of raised points so grouped as to represent numerals or letters, arithmetic, grammar, geometry, geography by raised maps, natural history by specimens of plants and animals or by anatomical models, or the outlines of plant and animal forms in bas-relief, music—theoretical, vocal, and instrumental—and gymnastics, and many technical arts are also taught, such as sewing,

1 Geschichte der Blindenanstalt zu Illzach-Mülhausen i. E. Während der ersten fünfzig Jahre ihrer Tätigkeit, ferner deutsche, französische, und italienische Kongressvorträge und Abhandlungen über das Blindenwesen, Prof. M. Kunz, Direktor der Anstalt, 1856-1906. Pp. 346. Leipzig: Wilhelm Engelmann, 1907.)

knitting, basket-making, mat-making and brush-making. Special maps and even pictures are now made for the blind. There are numerous illustrations of these in the volume. The blind children are taught to take part in plays, some of which are complicated enough to tax the powers of those having vision, and, of course, in music of all kinds, many of the blind attain to remarkable proficiency.

The second part of the work deals with the various congresses. These were largely attended, and papers were read which opened discussions on the best methods of teaching the blind. Each congress had its own speciality. Thus at Kiel, 1891, the subject was the modelling of animal forms; and at Berlin, 1898, it was the teaching of music and grammar. Even comparative grammar was taught to advanced pupils, and those interested in the relationships of languages will find much that is suggestive in the record of the Berlin conference (pp. 130–145). At the Paris conference in 1900, the important question was discussed whether blind children should be taught by blind teachers, and, if so, to what extent? There appear to have been considerable differences of opinion upon this point. The French, Belgians, and Italians made great use of blind teachers, but in Germany and other northern countries the greater part of the teaching was done by those who see, and the blind teachers were only helpers. Prof. Kunz has an important article on this question, and he has arrived substantially at the conclusion that the proportion of seeing to blind teachers should be about two to one. Many blind teachers have, however, attained wonderful skill in imparting knowledge to their unfortunate brethren, and a feeling of sympathy and subtle intuitions, related to personal experience, may to some extent account for their success.

One of the most interesting chapters in the volume is that entitled Zur Blindenphysiologie, das sogenannte "Sinnenvikariat" (p. 186). It might be called the "psycho-physik" of the blind. The results of various experimental inquiries are given, and it is shown that in the blind, taking the average of a large number above puberty, all the other senses are capable of more delicate perceptions than in those who can see. As might be expected, the sense of touch is highly developed. This is of great importance, as it enables the blind to use with accuracy the Braille method of designating letters by various patterns of points, which are sometimes sharp and of varying size, sometimes wedge-shaped, and sometimes the marks consist of thin vertical and horizontal lines, either single or meeting at various angles. An address by Prof. Kuntz at Halle, in 1904, gives much information as to the spread over the world of the methods of teaching the blind. This is followed by an interesting description, with numerous illustrations, of the many forms of type suitable for reading, for arithmetic, and for music, and nothing could show more clearly the delicacy of the sense of touch acquired by the blind during their education than an inspection of these curious patterns. Dr. Javal, the eminent Parisian ophthalmologist, contributes an interesting chapter on some physiological features of the blind.

There is an elaborate paper bearing on the perception of the direction of sound by the blind, and the acuteness with which they perceive the nearness and often the nature of objects by reflection of sound-waves. The whole subject has been investigated with the greatest care. It is interesting to find a translation into modern Greek by Fräulein Irene Lascaridi (a teacher in the Asylum for the Blind in Athens) of Prof. Kunz's paper on the physiology of the blind, Περὶ τῆς Φυσιολογίας τῶν Τυφλῶν. Several examples of raised type and maps are shown at the end of the volume. The book is not only worthy as a "Festschrift," as it contains all that can at present be written upon the subject of the education of the blind, but it will be an enduring monument to the zeal, devotion, and learning of Prof. M. Kunz, who has devoted his life to the interests of those who are deprived of one of the most important of the senses.

JOHN G. MCKENDRICK.

CATALOGUE OF DOUBLE STARS.[1]

PROF. G. W. HOUGH, director of the Dearborn Observatory, while observing with the 18½-inch refractor, discovered 648 double stars. These stars consist of close pairs and of pairs where the companion is very faint; they are, therefore, difficult to measure, and may be regarded as of the same class as those discovered by Prof. Burnham. But whereas the Burnham stars have been fairly well observed and yield a good percentage of binaries, the Hough stars have been very little observed, and they yield few interesting pairs.

Prof. Doolittle, of the Flower Observatory, has done good work in collecting these 648 stars in one catalogue, and arranging this catalogue in a form which leaves nothing to be desired. The stars are not entered according to the Hough number, but in order of right ascension, and the meridian catalogue name is added; but to facilitate reference, a list of the stars is given in order of the Hough number, with the page in the catalogue on which the star appears.

In addition to his own measures, made at the Flower Observatory of the University of Pennsylvania, Prof. Doolittle gives measures by other observers, which unfortunately are few. From the Astronomer Royal's report and from the Greenwich results published in the Monthly Notices of the R.A.S., we gather that the Greenwich observers have been at work on the Hough stars, and it seems a pity that more of these measures could not be included. It may be that Prof. Doolittle experienced difficulties in publication which retarded the appearance of his catalogue. This would make it seem of later date than it really is, and would also explain the phrase in the introduction—"Mr. Burnham's new general catalogue, when it is published," &c. The general catalogue has been with us since August last.

The right ascensions and declinations are given for 1880. This, in a catalogue of 1908, means that the right ascensions are practically 1½ m. wrong to start with, and the declinations sometimes 8′ or 9′ out, thus necessitating the application of precession corrections by everyone using the work, whereas if the places had been given for 1910 they would have been useful for many years.

Prof. Doolittle began systematic work in 1901, and the catalogue he has produced is an important piece of work well carried out, and the printing is very good, the few errors being easily rectified. But owing somewhat to the uninteresting character of the Hough stars, he has had little beyond the actual catalogue itself to repay him for his labour. With the exception of Hough 212, and possibly two others, there is no object in the whole catalogue of any remarkable interest at present; and the paragraph on p. 10 of Prof. Doolittle's introduction must evidently be read in the light of the well-known characteristics of the Hough stars. In this paragraph he gives thirty pairs as being *clearly binary systems in rather rapid motion.*

Astonishment at the large number was increased on an analysis of the thirty. From the notes in the

[1] "Catalogue and Re-measurement of the 648 Double Stars discovered by Prof. G. W. Hough." Publications of the University of Pennsylvania, Astronomical Series, vol. iii., part iii. Pp. 176. (Pennsylvania, 1907.)

body of the work, *i.e.* in Prof. Doolittle's own words, we find these consist of two pairs in which there is no evidence of motion; five pairs in which change is doubtful; five pairs in which some change is probable; seven pairs where the change is less than 1°·0 per annum; six pairs where the change is just over 1°·0 per annum; two pairs where it is approximately 2°·0 per annum; two pairs fairly rapid binaries; one pair, Hough 212, with a period of 5·7 years.

The last five only can be brought under the above phrase.

There are two rather serious errors in identification: Hough 198 should be B.D.+16°.4896, not WB (2)xxiii.195, the declination of which is 42°, not 16°; Hough 507 should be WB(2)iv.151, declination 37°, not WB(2)iv.154, declination 32°.

NOTES.

WE regret to see the announcement of the death on July 20 of Mr. Arthur Lister, F.R.S., distinguished particularly for his researches on the Mycetozoa. Mr. Lister was seventy-eight years of age, and was elected a Fellow of the Royal Society in 1898.

SIR JOHN BANKS, first president of the Royal Academy of Medicine, Ireland, and a leading authority on mental diseases, died on July 16 at ninety-seven years of age.

THE eighth meeting of the Association of Economic Biologists will be held at Edinburgh on Tuesday, Wednesday, and Thursday, July 28, 29, and 30, under the presidency of Mr. A. E. Shipley, F.R.S., who will deliver a presidential address "On Rats and their Parasites" on July 28.

WE learn from the Journal of the Meteorological Society of Japan that the death of H.I.H. Prince Yamashina occurred on May 2 at thirty-one years of age. The late Prince had deep interest in meteorology and allied sciences. On his own account he established the Mount Tsukuba meteorological observatory and two base stations in 1901, and published a series of "Ergebnisse der meteorologischen Beobachtungen auf dem Tsukubasan." He made several valuable researches in meteorology and seismology, and designed a number of excellent instruments.

DR. LUDWIG MOND, F.R.S., has offered to the Reale Accademia dei Lincei a biennial international prize of 400*l.*, to be called the Stanislao Cannizzaro prize, for chemistry and physical chemistry. The amount necessary for providing the prize, together with taxes and expenses, is to be given by the donor in the form of Italian Consols, while the conditions of award have been placed in the hands of the president of the Academy, in consultation with Dr. Mond and Senator Cannizzaro.

THE Paris correspondent of the *Times* states that a Society of the Observatories of Mont Blanc has just been regularly constituted, with a board of directors largely chosen from the Academy of Sciences, for the more systematic continuation of the work begun by the late M. Janssen and M. Vallot. The society has decided to place the Vallot and Janssen observatories under the direction of M. Vallot. With this object the latter has given his establishment to the society just formed—a purely scientific association—which appeals for members and funds. The secretary is Comte de La Baume-Pluvinel, 9 Rue de La Baume, Paris.

WE are informed that the optical illusion observed by Dr. T. Terada, Tokyo, and described on p. 255 of our last number, has been previously observed and described. In the Proc. Roy. Soc., Edin., 1878–79, there is an account of some experiments on this illusion. Like Dr. Terada, the writer first observed it after looking at moving water, but in his case it was a quickly flowing stream; on afterwards looking at the gravel bank a stream of gravel seemed to flow slowly through it in a direction the opposite of that of the water. A number of experiments are described in the paper referred to on the effect of looking at rotating discs with black and white radii, and moving bands of paper with cross-lines, the eyes being afterwards directed to a mottled surface on which the reverse movements referred to appeared. These spectra were shown to be entirely stopped when a straight line was drawn across the surface.

AN international exhibition and congress of the applications of electricity will be held on September 14–20 at Marseilles. The object of the congress is the consideration of the technical, commercial, and administrative problems which have arisen in recent years. These questions will be treated in reports prepared by well-known authorities, and the reports will be submitted to the congress for discussion, and published subsequently. The business of the meeting will be transacted in nine sections dealing with, respectively, the framing of regulations; the construction and protection of electric wiring; technical and commercial workings; lighting and domestic applications; applications to industry, mines, traction, and agriculture; electro-chemistry and electro-metallurgy; telegraphy and telephony; instruction and measurements; and applications to hygiene and medicine. Numerous papers, none of which, we understand, is the work of a British authority, will be discussed in each section. Prof. Maurice Lévy will be the president of the congress. There are four general secretaries, MM. Armagnat, Chaumat, and Dusaugey, and Prof. Zimmern, who may be addressed at 63 Boulevard Haussmann, Paris.

COMMANDER PEARY departed on July 17 from Sydney, Nova Scotia, on the *Roosevelt*, on his voyage to the North Pole. A *Times* correspondent reports that Commander Peary has summarised the main features of his programme thus: First, the utilisation of the Smith Sound route, the advantages of which are a land base 100 miles nearer the Pole than is to be found at any other point of the entire periphery of the Arctic Ocean, a long stretch of coast-line upon which to return, and a safe and (to Commander Peary) well-known line of retreat in the event of any mishap to the ship, independently of assistance. Secondly, the selection of a winter base which commands a wider range of the central polar sea and its surrounding coasts than any other base in the Arctic regions. Cape Sheridan is practically equidistant from Crocker Land, from the remaining unknown portion of the north-east coast of Greenland, and from Peary's "Nearest the Pole" of 1906. Thirdly, the use of sledges and Esquimaux dogs. "Man and the Esquimaux dog," Commander Peary observes, "are the only two machines capable of such adjustment as to meet the wide demands and contingencies of Arctic travel. Airships, motor-cars, trained Polar bears, &c., are all premature, except as a means of attracting public attention." Fourthly, the use of the Whale Sound Esquimaux for the rank and file of the sledge party.

THE president of the Local Government Board has authorised for the current year the following researches in connection with the annual grant voted by Parliament in aid of scientific investigations concerning the causes and processes of disease:—(1) A further inquiry by Dr. M. H. Gordon into the character and differential tests for the

micro-organisms found in the throats of patients suffering from scarlet fever. (2) An investigation of protracted and recurrent infection in diphtheria. This will be undertaken by Dr. Theodore Thomson and Dr. C. J. Thomas. The bacteriological part of the investigation will be undertaken by the Lister Institute. (3) An investigation of protracted and recurrent infection in enteric fever. This will be undertaken by Dr. Theodore Thomson, in conjunction with Dr. Hedingham, of the Lister Institute. (4) Investigations by Dr. W. G. Savage into the presence of paratyphoid bacilli in man, the differentiation of streptococci in goats, and the bacteriological measurement of pollution of milk. (5) A statement of the results of the bacteriological examination of more than 7,000 samples of milk from different parts of the country, made by Prof. Delépine. (6) An investigation into flies as carriers of disease, by Dr. Copeman,, F.R.S., with the co-operation of Prof. Nuttall, F.R.S. (7) An inquiry into the condition of flock beddings, by Dr. Farrer. The bacteriology and biology of bedding (especially in relation to vermin), which will be undertaken in connection with this inquiry, will be superintended by Prof. Nuttall. (8) A statistical inquiry into the social incidence of disease will also be begun, the prevalence of varicose veins and of hernia under different social conditions forming the first subject of inquiry under this head. This will be undertaken by Dr. Basil Cook. Announcements of further investigations for the current year will be made at a later date.

THE Fourth International Fishery Congress will be held under the presidency of Dr. Hermon C. Bumpus at Washington, D.C., U.S.A., on September 22–26, to deliberate on important matters relating to fishing and fish culture, and to submit propositions for the benefit of the fisheries to Governments and to State, provincial, and local authorities. The congress will be organised and conducted in conformity with the decisions for the regulation of the international fishery congresses decreed in Paris in 1900. The membership will consist of Government, State, and provincial representatives, delegates from home and foreign societies, corporations, invited persons, and persons who express a wish to take part in it. In response to invitations from the United States Government, twelve national Governments have signified already their intention to be represented officially, and delegates have been appointed by the governors of many of the States of the United States. Very few nations have indicated formally their inability to participate officially, and the congress promises to be really representative in character. Among the important subjects to be discussed may be mentioned: commercial fisheries; matters affecting fishermen and the fishing population; legislation and regulations relative to fishing, fish culture, pollution of waters, and obstruction of waters; international matters affecting fisheries; aquiculture; acclimatisation; fishways and fish ladders; biological investigation of the waters and their inhabitants; diseases and parasites of fishes, crustaceans, molluscs, and other water animals; and angling and sport fishing. Suitable arrangements will be made for the entertainment and instruction of the members in Washington and at the other places visited, and an opportunity will be given for visits to places of general interest. All communications and inquiries before September 20 should be addressed to Dr. Hugh M. Smith, the secretary-general of the congress, Bureau of Fisheries, Washington, D.C.

THE morphology and physiology of the gephyreans of the family Priapulidæ are discussed by Mr. L. A. Moltschanov in a paper published in the June issue of the Bulletin of the Imperial Academy of St. Petersburg. The author regards the genus Priapuloides as intermediate between Priapulus and Halicryptus.

RICHARD CAREW (1555–1620) forms the subject of the second instalment of "Early British Ornithologists," by Mr. W. H. Mullens, now being published in *British Birds*. In connection with this we may perhaps be permitted to direct attention to the inconvenience of that title as the designation of a serial. In quoting we refer, for instance, to Mullens, *British Birds*, vol. ii., p. 42, while we should in like manner refer to Yarrell, *British Birds*, vol. i., p. 10. Who is to know in such cases whether it is to the serial or to a separate work that the quotation refers?

A SECOND report on the copepod crustaceans of the Irish Atlantic slope, by Mr. G. P. Farran, has just been issued in "Scientific Investigations, Irish Fisheries," for 1906, No. ii. The list given is mainly the result of a number of deep-water tow-nettings taken in 1904–5, and may be regarded in the main as a contribution to our knowledge of the plankton of the zone between 600 and 1000 fathoms. No. viii. of the same issue is devoted to reports concerning the obstacles to the ascent of young eels up the Irish rivers and the illegal capture of the fry.

THE Royal Scottish Museum has issued a general guide-book to the collections, at the price of one penny. Considering that it comprises only 63 pages and includes the artistic, ethnographical, natural history, and technical collections, the notices of each group are necessarily of the briefest. Although the type of the main text is small—too small, we think, for a number of persons who ought to avail themselves of the guide—the "catch-words" are printed in heavy block type well calculated to attract the attention of the reader.

WE are indebted to Mr. L. M. Lambe for a copy of a paper from the first volume of the third series of the Transactions of the Royal Society of Canada on the remains of a new type of crocodile from the Cretaceous formation of the Judith river. This crocodile, for which the barbarous name *Leidyosuchus canadensis* is suggested, is a broad-nosed form recalling Diplocynodon, but with the splenial included in the short mandibular symphysis, as in some of the Goniopholididæ. Possibly it may be a direct descendant of the latter—an idea supported by the fact that several members of the Judith river fauna present a Jurassic *facies*.

THE ninetieth volume of the *Zeitschrift für wissenschaftliche Zoologie* is published in a single issue of 677 pages. with 43 plates, of which several are coloured. All the eighteen papers are devoted to invertebrates. Among these. special reference may be made to one by Mr. F. Blochmann on the taxonomy and geographical distribution of brachiopods. The paper is illustrated with a large map, in colour, showing the distribution of Liothyrina, a genus most numerously represented in the neighbourhood of the Gulf of Mexico on the one side of the Atlantic, and the Spanish and north-west African coast, together with the Mediterranean, on the other. This distribution seems to confirm the theory of the existence until comparatively recently of a belt of shallow water across the mid-Atlantic. Further, the distribution of this and other genera indicates, in the author's opinion, the existence during Tertiary times of a communication between the Atlantic and the Indian Ocean by way of the isthmus of Suez.

THE results of a number of experiments with regard to the inheritance of colour and the head-crest in canaries

undertaken at the Carnegie Institution of Washington are recorded by Mr. C. B. Davenport in publication No. 95 of that body, the report being illustrated with three coloured plates. After referring in some detail to the introduction and cult of the canary as a cage-bird, the author observes that in some respects this species, owing to the comparatively short time it has been under the influence of domestication, is better adapted for investigations of this nature than animals which have been longer subject to human influence. As regards colour, it appears that the domesticated yellow breeds are derived from the original "green" breed by the loss of the black, and that it consequently carries a mottling factor which leads to the production of mottled hybrids when crossing takes place with a pigmented canary or a finch. Although such hybrids do not display a fixed pattern, the degree of their mottling is heritable. Further, the principle of localisation of the unit of complex plumage-colour must be recognised, as is exemplified by the restriction of a red patch to the sides of the face in hybrid canary-goldfinches.

On the occasion of succeeding to the presidency of the Royal Microscopical Society for the second time, Lord Avebury delivered an address on seeds, with special reference to British plants. The president confined himself to a synopsis of the forms occurring in the British dicotyledonous orders and indicated the biological significance of the various devices met with. The paper is printed in the June number of the society's journal.

From Messrs. Gallenkamp and Co., London, a new catalogue of museum jars and window aquarium apparatus has been received. It also contains an illustrated list of Smedley's models. The models of Palæozoic seeds and cones, which are on view in the Hall of Science at the Franco-British Exhibition, have met with the universal approbation of botanists; the models of cryptogamic plants, flowers and seeds, and of invertebrates, are less generally known. They are all modelled in hard wax on a rigid foundation.

The editorial article in the June number of *Tropical Life* deals with the arrangements made for insurance against gales, hurricanes, and earthquakes as applicable to Jamaica and other West Indian islands. These permit of the insurance of such crops as limes, cocoa, and cocoanut-trees. Cotton can be specially insured against damage during the hurricane months July to October. In the same journal Mr. F. T. Crawley discusses the value of manures for lands planted with sugar-canes. With reference to the experience of planters in the Hawaiian islands, it is stated that fertilisers containing ammonia, phosphoric acid and potash are found to lead to an increased proportion of sucrose.

Having for twenty years pursued the study of the resinous substances found in plants, Dr. A. Tschirch laid before the Chemical Society of Switzerland, in response to its invitation, a paper treating of the chemistry and biology of plant secretions, with special reference to the resins. The author classifies the resinous substances according to the various products that are associated with the pure resin, and distinguishes *tannol resine, resinol resine,* and *harzsaüre,* also such extraneous substances as ethereal oils, gums, &c. With reference to their systematic value, it is observed that while the orders Dipterocarpaceæ, Burseraceæ and others are characterised by definite groups of resins, other resins occur in plants quite unrelated. But it is suggested that for distinguishing between certain resin-producing species, chemical tests based on the secretions might be devised. The lecture has been published in pamphlet form.

The results of an expedition in the Atlas Mountains of Morocco, made by M. Louis Gentil in 1906–7, are given in *La Géographie* for March. From the data obtained, a valuable map has been drawn up, indicating the main geological features of the High Atlas Mountains from the west coast to the region of Demnat. In an article accompanying the map, M. Gentil discusses the various difficulties encountered in obtaining accurate observations, and emphasises the utility of geological methods in mountain exploration. Information has been obtained of the hitherto little-known regions of Ounila, Anr'mer, Sous, and Siroua, the characteristic geological structure of the last being especially noticed. In an orographical sketch of Morocco, the regions of the High Atlas, Middle Atlas, and Anti-Atlas are distinguished, and the main features shown on a map.

Mr. W. H. Wheeler has prepared a paper on the physical characteristics, tides, currents, and fisheries of the North Sea (J. D. Potter, 145 Minories). In the first section an account is given of the pre-Glacial condition of the North Sea, the main features being a deep fiord in the north branching out of the Atlantic, a large estuary south of the Wash, and an isthmus joining England to the Continent. In the post-Glacial period the mouth of the fiord between Durham and Yorkshire became blocked up, sandbanks were formed, and the channel which now forms the Strait of Dover was scooped out. This section of the paper includes also a description of the Dogger Bank, and illustrations of the depression of the land on the east coast of England and in the Low Countries. The making of new land by the deposit of glacial drift covered by alluvium is discussed, examples being drawn from the coasts of Belgium and Holland. The opposite effect of erosion is observed along the English coasts. An account is given of the Orkney and Shetland Islands, and the east coasts of Scotland and England are described in detail. The progress of the tidal wave in the North Sea is traced, velocities and range of the tides being given, with a table showing the effect of winds on the tides. As the result of experiments made by the Fishery Board of Scotland, the general drift of the surface currents in the North Sea was shown to be southerly down the coasts of England and Scotland, then south-east round the Dogger Bank, and, finally, east-north-east to the Skager-rack. Statistics of the fishing industry are given in the section dealing with this subject.

The first application of the Kimberley method of diamond washing to the concentration of alluvial tin is described by Mr. H. D. Griffiths in the *Mining Journal* of July 11. The new method has been adopted at Kuils River tin mines, Cape Colony, and has given such exceptional results as regards efficiency and economy that the sluicing methods formerly in use on the property have now been discarded.

The British Fire Prevention Committee has issued a red book (No. 127) on fire tests with fire extinguishers. The series of tests with the "Diamond" dry powder extinguisher showed that hand powder fire extinguishers, as a class, if applied with skill, can often be usefully employed in the incipient stages of small fires. The various tests undertaken with petrol point to the conclusion that, with a volatile liquid of this nature giving off a highly inflammable vapour, the powder extinguisher is only efficient when the area of the fire is small or

narrow. The efficiency of powder extinguishers depends materially on the closeness of range, the position of the operator's shoulder, and on a certain knack or dexterity in handling the appliance. The action of powder extinguishers would appear to be largely mechanical.

WE have received from the Deutschen Gesellschaft zur Bekämpfung des Strassenstaubes a pamphlet of thirty-five pages, in which Colonel Layriz has compiled from the scattered notes in technical journals a report on the methods at present in use to obviate the dust nuisance on roads. The data collected tend to show that efficacious methods are now available for obviating the formation of dust in densely populated cities and in the vicinity of summer resorts, but that the unavoidable cost renders it impossible to apply such methods, except by degrees, so as to make country high-roads free from dust.

THE June number of the Journal of the Franklin Institute is of special interest to metallurgists. Mr. E. A. Custer has a copiously illustrated article describing the casting of pipes in permanent moulds that the hottest iron attainable from the cupola does not destroy. The method is one deserving careful attention, for it has long been the dream of every foundryman whose trade requires a large number of duplicate castings to make such castings in moulds that would not merely survive the process, but would also produce castings that would be marketable and be easily machined. Mr. G. B. Heckel reviews the methods in use for protecting iron and steel against corrosion, and Mr. H. P. Cochrane discusses engineering practice as applied to the handling of fuel at power stations.

NUMEROUS attempts have been made to obtain ammonia from peat, but the difficulties of dealing with a substance which often contains 90 per cent. of water have hitherto proved insuperable, and none of the methods has survived the experimental stage. We have received an account of the Woltereck process, stated by the inventor to have overcome successfully all these difficulties. The peat is slowly decomposed at a regulated temperature by means of a blast of air charged with water vapour, and forms "paraffin tars," acetic acid, and ammonia. These pass successively through a scrubber to remove tar, an alkali tower containing a hot solution of caustic soda or milk of lime to absorb the acetic acid, and finally through an acid tower, where the ammonia is taken up by sulphuric acid. The tar on distillation yields a wax said to be worth 4*l*. a ton; the acetate is to be utilised for preparing either acetic acid or acetone. The ash of the peat is a saleable manure, and contains potash, lime, and phosphoric acid. It is estimated that the cost of producing the sulphate of ammonia will not be more than 5*l*. 8*s*. per ton, and, as the present market price is 12*l*., a considerable profit is anticipated.

THE officiating director-general of observatories (Mr. J. H. Field) has issued a memorandum, dated June 9, on the meteorological conditions prevailing in the Indian monsoon region before the advance of the south-west monsoon of 1908, with an estimate of the probable distribution of the monsoon rainfall. Account is taken, as usual, of the recent conditions over a wide area, including parts of Australia, Africa, Siberia, and South America, and all the available data have been analysed by the method developed by Dr. Walker and described by him in his forecast for last year. The result indicates, *inter alia*, that the total rainfall for the whole of India during the period from June to September will probably be nearly normal or in slight defect.

WE have received part ii., vol. xx., of the Memoirs of the Indian Meteorological Department, containing kite observations made by Mr. J. H. Field at Belgaum (Bombay Presidency) during the pre-monsoon and monsoon periods in 1906, in continuation of those begun at Karachi in 1905 (published in part i.). One series was made in May, in which month the normal weather is dry and hot; the records, which are diagrammatically shown, indicated no marked increase in wind velocity up to 1300 metres, the maximum height reached. Temperature gradients were strong, by day always considerably above the adiabatic rate for unsaturated air. Comparatively humid air extended on different days to a height of 600–1100 metres; above it exceedingly dry air was met with. The other series was made in August and September, when the weather was comparatively cool, with frequent rain, especially in September. The wind velocity was, on the whole, nearly uniform up to the maximum height reached, 2500 metres. The temperature gradients were considerably smaller than in May and, except near the surface, always below the adiabatic rate. The upper limit of humid air had risen by about 1000 metres since May.

WITH reference to the article on recent developments in electric lamps which appeared in our issue of June 25, we are informed by the General Electric Co. that the statement to the effect that tungsten lamps for high voltages, 200 and above, have not yet been commercially introduced is not correct, as they have had these lamps on the market since the commencement of April. This firm is now in a position to deliver Osram and Wolfram lamps up to 260 volts pressure in 50 and 100 candle-power sizes and lamps for 100 to 130 volts in 25, 30, 50, and 100 candle-power sizes. In addition to this, 25-volt lamps are made for 10, 16, and 25 candle-power, and there is a large demand for this type of lamp for private plants and for alternating-current circuits where advantage can be taken of the possibility of transforming down the voltage. The company sends us two very well arranged catalogues setting out the advantages and possibilities of these lamps.

VOL. v. of Contributions from the Jefferson Physical Laboratory of Harvard University consists of reprints of ten papers by the staff and students which appeared in the Proceedings of the American Academy, the *Physical Review*, &c., during the year 1907. Of those not already noticed in these pages may be mentioned a paper by Mr. G. W. Pierce on "Crystal Rectifiers for Electric Currents and Electric Oscillations," part i., in which the author follows up and explains the fact recently discovered by General Dunwoody that a crystalline mass of carborundum between two electrodes will act as a receiver for electric waves when used either with or without a cell in series with it. This property is shown to be due to carborundum not following Ohm's law, but conducting better for high than for low voltages. It thus falls into line with other detectors of electric waves investigated by Profs. Braun and Strientz. The author is not yet prepared to advance any theory as to the cause of the phenomenon, but considers that there is sufficient evidence to show that it is not of thermoelectric origin.

MERCURY has usually been regarded as completely insoluble in water and other solvents. It has, however, a definite vapour pressure, although a very low one at ordinary temperatures, and since no gas is completely insoluble in water, it appeared not improbable that this vapour should prove to be slightly soluble in water. This question is dealt with by Mr. A. Christoff in the current number of the *Zeitschrift für physikalische Chemie* (June

30), the experiments described being conceived with much ingenuity. The reducing action of mercury upon a solution of gold chloride was relied upon for detecting the extremely minute amounts of mercury involved, great care being taken to eliminate disturbing influences. The solvent action of water, benzene, nitrobenzene, and alcohol on mercury is clearly proved, and it was also shown that the effects observed could not be attributed to the formation of an oxide or hydroxide of mercury.

THE *Bio-Chemical Journal* for June (iii., No. 5) is mainly occupied with papers by Prof. P. W. Latham on the synthesis of protein. Taking the results of Schutzenberger, obtained by the hydrolytic decomposition of egg-albumin with baryta, the author analyses them and attempts to reconstruct a formula for albumin.

A THIRD edition of "Determination of Radicles in Carbon Compounds," by Profs. H. Meyer and J. Bishop Tingle, has been published by Messrs. John Wiley and Sons, of New York. Messrs. Chapman and Hall, Ltd., publish the book in this country at the price of 5*s*. 6*d*. net. The new matter, running to fifty-five pages, has been placed at the end of the volume in the form of an appendix, and copious cross-references have been provided.

WE have received a copy of a new periodical devoted to scientific subjects, and entitled the *Scientific Monthly*, an illustrated journal of science. There are contributions dealing with electrical, astronomical, chemical, and microscopical subjects, and numerous notes on scientific questions of current interest. The articles are of a general informative character and are illustrated. The magazine, the price of which is 3*d*., is published by Mr. Arthur N. Kemp, 26 Shaftesbury Avenue, London.

WE have received from Mr. Bernard Quaritch, of Grafton Street, New Bond Street, London, W., copies of two of his July catalogues of books. One deals with Oriental history, languages, and literature, and includes works on Oriental art and natural history; the other gives particulars of a large number of books printed during the fifteenth and sixteenth centuries, and is the first part of an illustrated catalogue to be completed in about three parts. The first part, now issued, contains some sixty facsimiles, and comprises examples of xylography in the Low Countries and Italy, and typography in Germany.

OUR ASTRONOMICAL COLUMN.

THE LICK OBSERVATORY ECLIPSE EXPEDITION, JANUARY, 1908.—A very interesting account of the work done, and the preliminary results obtained, by the Lick Observatory-Crocker eclipse expedition to Flint Island, written by Dr. Sebastian Albrecht, appears in No. 3, vol. ii., of the Journal of the Royal Astronomical Society of Canada (pp. 115–131, May–June).

After explaining the importance of the several items in the programme prepared, and describing the various instruments, Dr. Albrecht gives an illustrated description of the eclipse-camp site, and tells of the difficulties overcome in transporting and setting up the several instruments. Errors in the ephemeris-positions of the moon led to totality commencing 27 secs. earlier than predicted, and the observed times of beginning and ending of the total phase were 9h. 22m. 20s. and 9h. 26m. 12s. G.M.T.

The equipment included a coronagraph of 40-ft. focal length, pointed directly at the eclipsed sun, and intended to photograph the details of the inner corona, a shorter instrument for photographing the coronal extensions, several spectrographs, including one with quartz lenses and prisms, two sets of four cameras for seeking any intra-mercurial planet that may exist, polarigraphs, a photometer, and Prof. Abbot's bolometric apparatus.

The photographs taken with the 40-ft. camera show about thirty streamers extending to a distance of more than one solar diameter, and about half that number extending to 1½ diameters; excellent negatives, eight in number, were obtained with the smaller coronagraph. Four good negatives, on which the linear dispersion is such that from λ 3700 to λ 5300 is thirteen inches, were obtained with the large moving-plate spectrograph, and on the one taken at the end of totality there are hundreds of bright lines, the study of which should afford a wealth of information concerning the structure and composition of the sun's higher atmosphere. From one of the smaller-scale spectrograms the wave-length of the green corona line has been determined as 5301·4. Both on these and on the spectrograms obtained with the quartz spectrograph, the shifting of the great intensity of the continuous spectrum towards the red indicates the lower temperature of the corona as compared with that of the photosphere. About twenty-five sharp lines are shown on the coronal spectrograms taken with the quartz instrument, two of which appear to be new. Dr. Perrine's examination of the photographs taken leads to the conclusion that no intra-mercurial planet of sufficient magnitude to account for the Mercury perturbation anomalies exists. Two of the photographs illustrating Dr. Albrecht's article are of the corona.

THE APPROACHING RETURN OF HALLEY'S COMET.—*Popular Astronomy* for May contains an article of general interest on Halley's comet, written by Prof. H. C. Wilson. After describing the comet's appearance at various returns since 1066, the writer compares the approximate elements, reduced to the equinox of 1910, of the orbit at the recorded apparitions from 451 A.D. onwards, and shows that those for 1910 indicate similar conditions to those obtaining in 1066, when the comet was an object of remarkable grandeur. At present the comet appears to be just beyond the orbit of Jupiter, which it should traverse about March 1, 1909, and may possibly be discovered photographically during the coming winter.

THE ORBIT OF ALGOL.—No. 5, vol. i., of the Publications of the Allegheny Observatory is devoted to a discussion of the orbit of Algol, based on observations made in 1906 and 1907 with the Mellon spectrograph; the measurable portion of the spectra extends from λ 3925 to λ 4750, and is 21 mm. in length. In this region eight lines, due respectively to Ca, He, H, Si, and Mg were selected for measurement by Dr. Schlesinger, and were measured by him and Dr. Curtiss independently, adjusted wave-lengths being employed by the latter observer. An apparent change of velocity (about −10 km.) between the observations of 1906 and those of 1907 may be due, possibly, to a change of camera lens, but it is not impossible that it is a real change in the star such as was suspected by Belopolsky. The elements and the light-curve obtained by each observer are given, and the results indicate that the light minimum lags about one and a half or two hours behind the time demanded by the velocity determinations.

THE PATH OF THE MINOR PLANET (279) THULE.—An exhaustive mathematical discussion of the orbit of the minor planet (279) Thule, by Dr. A. Wedemeyer, occupies the fifty-six pages of No. 2, vol. xxxi., of the *Archiv der deutschen Seewarte*. The special perturbations are determined by Oppolzer's method and tabulated, and the corrections derived are applied for each observed opposition of the planet from 1888 to 1906.

AN AMATEUR'S MERIDIAN INSTRUMENT.—In the July number of the *Bulletin de la Société astronomique de France* M. E. Soulié describes a simple and inexpensive apparatus which enables amateur observers to determine the meridian with very fair exactitude. It consists of a flat plate of heavy material, so supported that it hangs vertically like a plumb-line. Using the plane of this sheet to direct the line of sight, the plate is oriented to Polaris some minutes before ζ Ursæ Majoris, or δ Cassiopeiæ, crosses the sight-line. By fine adjustments, the instant when Polaris and one of these stars, preferably the latter, are in the plane of the plate together is noted, and then the plate is made to follow Polaris for exactly six minutes. At the end of this interval it is in the meridian, and may afterwards be used to observe transits or to determine local noon, &c.

GEOLOGICAL WORK IN THE UNITED STATES.

THE work of the Geological Survey of the United States is in many regions also geographical. Bulletin No. 307 (1906), by Henry Gannett, is thus a useful "Manual of Topographic Methods," reviewing in its eighty-six pages "the most approved methods of surveying as applied to the production of topographic maps." Those of us who have used the American maps on the scale of 1 : 62,500 may have wondered at the selection of this figure in place of our 1 : 63,360, or 1 inch to one mile. It is here clear, however, that the American scale is a convenient deduction from 1 : 250,000, which is employed for the maps of large areas, and which furnishes a scale of practically four miles to an inch. The thick Bulletin No. 299, by Mr. Jas. McCormick, is a second edition of the "Geographic Dictionary of Alaska," and includes 9300 names, as against 6300 published in 1902, numbers that afford "a rough indication of Alaskan growth."

FIG. 1.—Weathering of Madison (Carboniferous) Limestone, Tongue River Canyon, Bighorn Mountains.

Mr. N. H. Darton's "Geology of the Bighorn Mountains" (Professional Paper No. 51, 1906) is a fascinating description, very handsomely illustrated, of a region in Wyoming that has come into notice as a summer resort. There are few areas more calculated to convert the ordinary man into a keen stratigraphical geologist. Huge sections can be read off on the mountain-sides, and Cambrian, Ordovician, Carboniferous, Triassic, Jurassic, and Cretaceous deposits are represented. The Cretaceous system closes with fresh-water stages some 9000 feet thick, containing coal-seams in the upper layers, which correspond with the type of strata usually known as Laramie. Prof. R. D. Salisbury (pp. 71–90) describes the glacial geology, largely from material gathered by Messrs. Blackwelder and Bastin. Two Glacial epochs are traceable, and diminutive glaciers belonging to the later one still remain in the great chain of pre-Cambrian granite, rising 12,000 feet above the sea (see Plates xxix., xxxvi., &c.). It is claimed that glacial erosion has deepened some of the valleys by at least 700 feet. A glacial and a geological map accompany the memoir, in a pocket at the end, in accordance with the convenient plan now adopted by the United States Survey.

West of the Bighorn Mountains stretches the Bighorn Basin, on an average 5000 feet above the sea. Its geology and water-supply have been described by Mr. C. A. Fisher (Professional Paper No. 53, 1906). The basin is formed by a broad synclinal of the older strata, and its floor is occupied by Laramie beds, unconformably covered by the Eocene Wasatch clays and sandstones, as is well shown in Plate x. The ranges on the west divide this basin from the Yellowstone Park, and hot springs and geyser-deposits occur within the area now described.

Mr. N. H. Darton, the author of the memoir on the Bighorn Mountains, also describes the Arkansas Valley in eastern Colorado (Professional Paper No. 52, 1906). This is a dry region, where artesian water, held up in the Dakota sandstone, is of great economic importance, and the coloured map forming Plate xxvi. shows, by contour-lines, the altitude of the top of the sandstone above sea-level, whether exposed at the surface or concealed. The uplift of the Rocky Mountains in this region followed on the fresh-water Laramie epoch, and the rivers began to form flood-plains, and to carve out the main features of the topography in the western hills, as far back as Eocene times (p. 49). The flat alluvial fan of Miocene age attains in itself a thickness of 1000 feet.

Mr. A. C. Veatch's memoir on northern Louisiana and southern Arkansas (Professional Paper No. 46, 1906) covers a vast region, where the streams pour down from the "wolds" on the Texas and Arkansas border into the great alluvial valley of the Mississippi, which is rich in "ox-bows," on the east. The characteristic Cretaceous, Eocene, and Oligocene fossils are well illustrated, and marine conditions remained in this area until a very gradual tilting up of the north and a lowering of the coast-region set in at the opening of Miocene times (p. 44). The low mounds of fine loam, 20 feet to 100 feet across and 3 feet to 5 feet high, which dot the fluviatile plains of the Louisiana and Texas coast, provide a very interesting discussion (p. 55). They are not forming under exist-

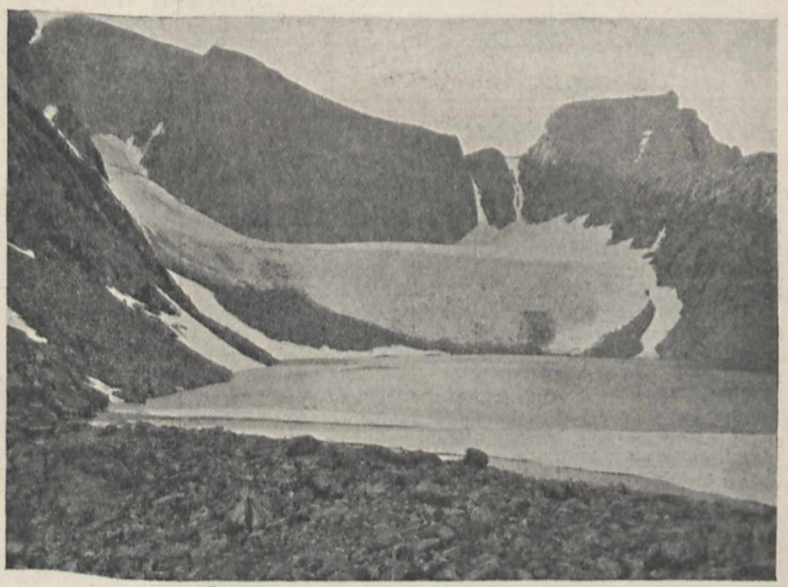

FIG. 2.—Residual Glacier in cirque, Cloud Peak, Bighorn Mountains.

ing conditions, and may have been due to ancient wind-action, or even to termite ants, which subsequently passed away in the face of climatic changes. Some 250 pages of the paper are devoted to the underground water-supply of the region, and various methods of well-drilling are described and illustrated.

Bulletin No. 298 contains a record of deep wells drilled during 1905, particulars of which are collected by the Survey, while geological advice is freely given to well-sinkers who ask for it, and the difficulties likely to be encountered are pointed out. Bulletins Nos. 279, 286, 304, 317, and 318 (1906–7) deal with various coal and oil districts. Indications of underground structure are given on the maps, and in No. 318 transparent sheets with contours are supplied, to be laid over the ordinary maps, and indicating the depth at which a particular oil-bearing bed may be encountered. No. 320, by Messrs. S. F. Emmons and Irving (1907), contains important additions to what has been previously published on the ores of Leadville, Colorado; the Downton district serves as the particular instance. Waters originating during the cooling of igneous masses are here put into a prominent place as ore-bearers (p. 66), though at Leadville the concentration of ore "in exceptionally rich bodies has come about through the agency of surface waters" (p. 72). Bulletin No. 297, by Mr. M. R. Campbell (1906), treats of another asset of Colorado, the Yampa coalfield, north-west of Leadville, where the coals are in the Montana stage of the Upper Cretaceous strata. Mountain-building processes have converted much of this "sub-bituminous" coal into coal of a higher grade, while metamorphism by igneous intrusions has given rise in parts to anthracite. Mr. Darton, in the Bighorn memoir mentioned above, describes coals, including a 7-feet seam, still higher in the Cretaceous system to the north of Yampa.

Bulletins No. 303 (S. Nevada, 1907) and No. 295 (Yukon-Tanana, Alaska, 1906) are concerned with gold-mining; the topographical map in the latter is regarded as the most important feature, and similar sheets are being rapidly pushed forward on the 1 : 250,000 scale.

Petrographers and chemists will be grateful to the Survey for Bulletin No. 305 (1907), by Mr. W. F. Hillebrand, on "The Analysis of Silicate and Carbonate Rocks." This will take the place of the well-known No. 176. Attention is given to the question of porosity (p. 38), which is so important a factor in building-stones, and the rocks composed of carbonates are now for the first time specially considered. Mr. T. N. Dale describes (No. 313, 1907) the "Granites of Maine," the foundation of a very important industry. The striking sheet-structure of granite is discussed (p. 30), and stress is laid on its possible origin by compressive strain. Dark knots in the granite due to segregation are distinguished from the inclusions that also occur (p. 50). Examples of the use of the granite in carved work are shown in the illustrations. Messrs. Emerson and Perry (Bulletin No. 311, 1907) describe the "Green Schists and Associated Granites and Porphyries of Rhode Island." Interesting features of contact-metamorphism occur, including the brecciation of a micro-granite by a later granite magma, and the production of interstitial films of biotite and magnetite between some of the closely adjacent fragments (p. 68). Explosive action at the top of the dome seems to have blended this breccia with a true Carboniferous conglomerate at the surface. A new locality for riebeckite is here given (p. 53).

The only palæontological bulletin received by us is No. 292 (1906), by Mr. R. S. Bassler, on "The Bryozoan Fauna of the Rochester Shale." This shale is a member of the Niagaran series (Silurian, *i.e.* Upper Silurian), and is well displayed in the Niagara gorge. The conditions of its deposition seem to have been admirably suited for bryozoan life, and types abound which are not represented conspicuously in contemporary American strata elsewhere. As "compared with the Ordovician types, the noticeable features are the predominance of the Cryptostomata and the decline of the Trepostomata" (p. 2). The author (p. 8) asks English workers to undertake a comparison of the Rochester bryozoa with those which have "received but little study" in the Buildwas beds of the Wenlock series. The thirty-one excellent plates in this bulletin will prove helpful to anyone who will accept this friendly challenge. Even our Carboniferous bryozoa have been much neglected during the last quarter of a century.

Before we pass to the surveys of separate States, we must mention Mr. Weeks's continuation of the "Bibliography and Index of N. American Geology and Mineralogy" (Bulletin No. 301), which covers all work done from 1901–5 inclusive.

The Wisconsin Geological and Natural History Survey sends us three bound Bulletins. No. xv. is on the "Clays of Wisconsin," by Dr. H. Ries (1906), and treats of the characters of clays in general from an economic point of view, as well as giving details of those worked within the State. Tests of clays and bricks have been made for this report. On p. 213, in an appendix on "Molding Sands," we note a formula for determining the pore-space of a sand which would give far too low a result. "Grains" should, we presume, read "grams" in this passage, and we take it that the formula intended is $100(Vd-W)/Vd$, if a percentage is required.

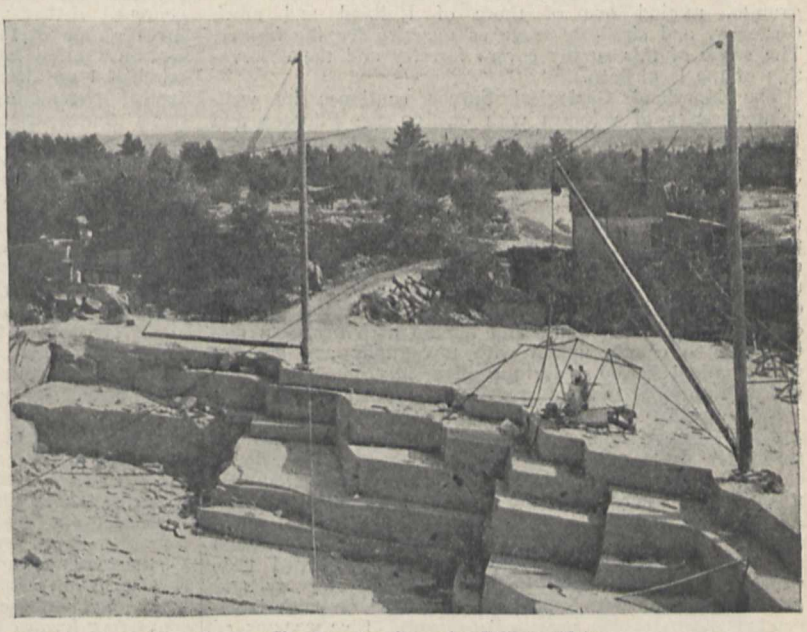

FIG. 3.—Sheet-structure in granite, Sullivan, Maine.

Bulletin No. xvi. is a volume of nearly 700 pages, with folded maps, by Mr. S. Weidman, on the "Geology of North Central Wisconsin" (1907). About 75 per cent. of the area is occupied by intrusive igneous rocks, which are fully described, and which have sometimes been crushed and converted into schists. The troctolites and nepheline-syenites will attract petrographers, and there are interesting intermixtures of granites and diorites (Plates xxii. and xxiii., for example), and gneissose "nepheline-pegmatites," the banding in which is due to original flow. On p. 308 the new variety of pyrochlore, called marignacite, is described. The account of the glacial features of the area is prefaced by a general sketch of North American glaciation, and the full and admirably illustrated chapters on the surface-configuration ought to interest every educated

dweller in the State. References, however, are required throughout this volume from the illustrations to the text. Bulletin No. xvii. is on the "Abandoned Shore-lines of Eastern Wisconsin," by Mr. J. W. Goldthwait (1907), and is a study of the development and passing away of the lakes and lake-extensions associated with later Glacial times. The evidences of warping in the shore-terraces through earth-movement are of special interest. Mr. E. C. Harder has contributed a study of the relations of streams and joint-systems to the Bulletins of the University of Wisconsin (No. 138, 1906), in which the south-western area of the State is dealt with. The maps, however, do not at once carry conviction, owing to the obvious influence of large topographic features on the courses of many of the smaller streams.

The Iowa Geological Survey issued its fourteenth annual report (for 1905) in 1906, a thick volume giving much information on the economic and general geology of the State. The descriptions, fully illustrated, are published county by county, and the stratigraphy concerns Ordovician and Silurian rocks especially. Next in interest to these come the glacial drifts, often overlain by loess of the usual problematic origin. The value of this loess as a soil-provider is justly dwelt on on p. 393. The huge boulders from northern Minnesota and Wisconsin, often of red granite, remind one of those of Holland and north Germany, and similarly serve as quarries for the farmer. The scope of this survey covers forestry and the observation of the local flora.

The Maryland Geological Survey continues its well-printed series of volumes with one on the Pliocene and Pleistocene deposits (1906), one on Calvert County (1907), and one on St. Mary's County (1907). In the county volumes we again note how geological surveys in the United States tend to become natural history surveys, with the view of the application of all branches of observation to local education and the local industries. This is a return, and we venture to think a welcome one, towards the broad and wholesome "statistical surveys" of the eighteenth and early nineteenth centuries; and surely the climate, plant-associations, and human activities of a district are so closely united with topography and geology that a united survey under one scientific department seems the only rational way of studying a political division. A certain amount of repetition, even in diagrams and illustrations, is, of course, inevitable, if each county is separately dealt with, but local knowledge is no doubt enlarged by such a system. The palæontological studies given in the Pliocene volume show that so-called "pure" science is in no danger of being eclipsed. The superficial deposits of Maryland (called "surficial" in the memoir) are "the last of a long series of unconsolidated beds which began to be deposited in Lower Cretaceous and possibly Jurassic time, and have continued on with interruptions down to the present" (p. 136). Five systems of terraces are traced in the coastal plain, the highest being the oldest. These are uplifted terraces of marine deposition, and represent the seaward edges of submarine platforms, successively constructed out of the products of coast-erosion and of materials swept by currents against the shore (p. 108). It is interestingly urged that "the Atlantic seaboard has been repeatedly elevated when loaded and depressed when lightened" (p. 137).

The domes of folding in Maryland, its Upper Devonian fauna, its climate, and the historical origin of its counties are dealt with in the Johns Hopkins University Circular, "Notes from the Geological Laboratory" (July, 1907). The work of the University, the State Survey, and the general United States Geological Survey seem happily combined (p. 2) in the interests of research.

Dr. J. A. Udden publishes in the Bulletin of the University of Texas, No. 93. 1907, an account of the "Geology of the Chisos Country, Texas," which is of the more value since the Geological Survey of that State has been discontinued.

Lastly, workers in Silurian fields will be interested in Mr. E. M. Kindle's paper on the "Occurrence of the Silurian Fauna in Western America" (*Amer. Journ. Sci.*, vol. xxv., February, p. 125). "Silurian" is used in the restricted sense now common in England, and beds of this age are traced in the Wasatch Mountains of Utah and Alaska. *Conchidium Knightii* is large and abundant on Kuiu Id. in S.E. Alaska, though not hitherto known from the United States. Another old acquaintance, *Pentamerus oblongus*, is abundant in the Utah fauna.

G. A. J. C.

THE ROYAL SANITARY INSTITUTE.

THE annual congress of the Royal Sanitary Institute was held at Cardiff last week. Many interesting papers were read, and several useful discussions were arranged. A large proportion of the papers fittingly dealt with practical and demonstrative matters arising out of the duties and work of sanitary and educational authorities and the officials who serve them. There was a dearth of original contributions of a scientific nature, but those contributions which appear to call for special reference are the following:—

Dr. W. G. Savage read a paper upon "The Examination of Sausages and their Hygienic Preparation." While sausages are usually composed of good meat, finely minced and mixed with flour, spices, and flavouring agents, such as salt, pepper, and sage, there are no definite guiding standards in this country either as to their composition, the presence and amount of preservatives, or their bacterial content. Hitherto there does not appear to have been any investigation dealing with the bacteria of sausages, and Dr. Savage has recently examined twelve different samples, purchased on the open market, in order to see how far typical excretal organisms are present in them. Most of the sausages examined were quite recently made, and the results show that *Bacillus Coli* of definite excretal type were always present in large numbers, whereas the ordinary musculature, bread, and other constituents of sausages in their pure state do not contain *B. Coli*. Although this bacillus is the distinctive organism of excreta, and the fact of its presence in considerable numbers in sausages is not a nice matter to contemplate, it must be realised that the bacillus referred to is found in the intestines and given off from the dejecta of animals generally. These and other facts referred to by Dr. Savage call for the framing of some standard by which the purity and wholesomeness of these articles of food can be judged.

An instructive paper was presented by Mr. H. Percy Boulnois upon "The Utilisation of Residuals from Refuse Destructors," and two other papers were contributed to the congress upon the same subject. The amount of refuse produced in a town in this country is about a quarter of a ton per head of population per annum, and after this has been cremated in a destructor, the residual clinker represents from 25 to 33 per cent. of the refuse burnt. Of the many methods which have been devised for utilising this material, reference was made to a very recent method which involves the use of the lightning dust crusher for converting furnace clinker into the form of poudrette. The lightning dust crusher consists of a comparatively small steel case containing four or six steel hammers, each weighing about 50 lb. The axle on which these hammers hang is rotated by machinery at the rate of about 1000 revolutions per minute. The machine can be fed at the rate of four tons an hour, and the poudrette escaping finds a market, as a manure, at 2*s.* 3*d.* per ton. It is quite inoffensive to the smell, and recently Mr. H. J. Coles, the surveyor of Market Harborough, has, by mixing the poudrette with tarry compounds, made very serviceable fuel briquettes, with a calorific value amounting to one-third that of the best coal.

Mr. Reginald Brown had some experiences to offer with reference to "The Surface Treatment of Roads in Relation to Dust Laying." He recommended the use of oil-tar, which is a by-product of the manufacture of gas from oil, and varies in its composition according to the temperature of production, the nature of the retort or producing plant, and of the oil used. The lack of uniformity in composition, however, does not seriously affect its suitability for road treatment. From extended experience it has been found that four dressings are required for each watering season, and that on an average one gallon will cover ten superficial yards. The cost of "surfacing" a road with oil-tar averages one penny for four dressings (no grit being required for covering), and this works out

at 58*l.* 13*s.* 4*d.* per mile per watering season, a figure which contrasts favourably with the cost of tar painting and approximates very closely to that of watering. In some instances the material is applied hot, but Mr. Brown has used it upon all the streets of the Southall-Norwood Urban District in the cold state by means of an ordinary watering cart, with excellent results. The appearance of the road treated with oil-tar is that of a newly-laid wood pavement, and the odour given off is similar. It is his opinion that the use of both coal-tar and oil-tar will become pretty general, the use of oil-tar being adopted where it can be obtained, and coal-tar where oil-tar is not manufactured. The employment of "akonia," calcium chloride, "halmite," and "pulvicide" is also considered in the paper. But oil-tar is shown to possess certain advantages, more especially of economy, over other methods.

Mr. W. D. Scott-Moncrieff contributed a paper upon "Some Recent Experiments on the Biolysis of Sewage." The immediate objects of his investigation were to discover what periods of hydrolysis gave a sufficient standard of purification with measured conditions of flow, and the experiments are claimed to have shown, for the first time, not only the behaviour of the sewage in varying circumstances of sojourn, &c., in the septic tank, but also to what extent a well-matured filter working under proper conditions is capable of dealing with the polluting organic matters under widely varying conditions, as regards different periods of hydrolysis. It should be noted, however, that the author points out that the results he has obtained are strictly confined to the special conditions that produced them, and that they do not justify any generalisations.

A noteworthy paper upon "The Limit of School Children's Capacity for Attention" was read by Prof. W. Phillips. After referring to the various experimental inquiries into this question, which have involved the use of various forms of Mosso's ergograph, or fatigue recorder, and Griesbach's æsthesiometer, and many experiments designed to test the rate of deterioration in mental work done at different times of the day and on different days of the week, Prof. Phillips discussed the useful results which all this work has led to. His conclusions are as follows:—

(1) The various tests seem to agree on one point, viz., that during an ordinary school session children can maintain a more even degree of attention, if one or two intervals of rest are included. Where two of ten minutes each can be arranged, more advantage is gained than from one of twenty minutes. (2) The tests seem to agree, too, in showing that a child's attention wanes more rapidly in the afternoon than in the morning. Therefore those teachers who have been accustomed to place the less taxing subjects of instruction in the afternoon seem justified. (3) The various branches of mathematics seem, *ceteris paribus*, to make a greater demand on the attention than most other subjects. This result has long ago been anticipated by those teachers who place mathematics early in the morning session. (4) Gymnastics is not of necessity a mentally recuperative subject, some of the tests proving that children were often tired after a lesson in it. (5) In connection with the discussion of the extent of the fatigue caused by gymnastics, it soon becomes obvious that the results do not depend on the nature of the exercise alone, but also on the teacher. If the latter is a strict disciplinarian, the fatigue may be of a pronounced character. (6) It is clear that attention depends on numerous factors, such as the age, health, and nutrition of the child, the temperature and ventilation of the class-room, &c. But above all it depends on the child's training and education.

RECENT METEOROLOGICAL PUBLICATIONS.

THE report of the second Norwegian Arctic Expedition of 1898–1902,[1] edited by Dr. H. Mohn and published at the expense of the Fridtjof Nansen fund for the advancement of science, forms a valuable addition to the meteorology of a little-known region of the earth's surface.

[1] Report of the Second Norwegian Arctic Expedition in the *Fram*, 1898–1902. No. 4. Meteorology. By H. Mohn. (Kristiania: Published by Videnskabs-Selskabet i Kristiania, 1907.)

The *Fram* left Christiania on June 24, 1898, and sailed, *via* Godhavn, Upernivik, Foulkefjord, and Cocked Hat, to the first winter quarters, which were reached in September. As the methods of observation were different when the ship was anchored from when she was under way, the results are given separately, and as those obtained at the winter quarters are most complete they are given in part i.

The positions of these winter quarters and the length of stay at each are shown in the following table:—

Place	Lat. N.	Long. W.	Duration of stay.
Rice Strait ...	78° 45·7′	74° 56·5′	1898, Sept. 19 to 1899, July 24
Havnefjord ...	76 29·4	84 3·7	1899, Oct. 23 to 1900, Aug. 9
Gaasefjord I. ...	76 48·9	88 39·5	1900, Sept. 18 to 1901, Aug. 12
,, II. ...	76 39·8	88 38·3	1901, Sept. 6 to 1902, July 21

The interval August 12 to September 6, 1901, was spent sailing about in the Gaasefjord.

Up to June, 1899, Dr. Johan Svendsen—the physician of the expedition—who had taken part in the examining and comparing of the instruments before they left Norway, was the meteorologist-in-chief, but his lamented death in that month robbed the expedition of his further invaluable services.

The pressure observations were made with the same barometer—a Kew standard Adie 850—throughout, and readings were taken every two hours from midnight to midnight. A small number of records were, from one cause and another, omitted, but the gaps have been filled in by the interpolation of readings from a Richard barograph. In the tables the values, reduced to standard temperature, barometer, gravity, and sea-level, are given for the bi-hourly readings each day; daily and monthly means, and the monthly means for each even hour, are also shown. The mean pressures for the months exhibit a regular annual period, with a chief maximum in March, a secondary maximum in November, a principal minimum in August, and a secondary minimum in January. The range of pressure is 11·8 mm., and the yearly mean pressure for the whole region is 761·40 mm. Other tables summarise the lowest and highest pressures recorded, and the differences between the mean highest and mean lowest pressures in each month are given. The oscillation of pressure is shown to be greatest in February and least in August, greatest in winter, least in summer.

Owing to the rolling of the *Fram* only a few of the thermometers came back safely to Norway, but there is sufficient evidence on which to base the discussion of errors. The reduced values for temperature are tabulated in much the same form as those for pressure, and the summaries show that during the "dark season" (November, December, January), when the sun remains below the horizon, the diurnal variation vanishes entirely. The daily range of temperature shows an annual period with a maximum (3°·47 C.) in April; during the three summer months it is practically stationary at 1°·7 C. to 1°·8 C. The respective effects of clear and overcast skies on the temperatures recorded are shown very clearly (p. 113). With a "clear sky" in the months October to January, the daily minimum occurs in the day hours and the maximum at night, but with an "overcast sky" the ordinary daily period obtains in every month. Dr. Mohn suggests that the investigation of air temperatures in the Arctic and Antarctic regions deserves greater attention, the final results of which would probably throw considerable light on the question of radiation from and to the earth in the lower atmosphere.

The lowest temperature recorded by the expedition (−51°·3 C.) was obtained on January 20, 1901, a year that was marked by unusually low temperatures, and the highest (13°·3 C.) was recorded on July 9, 1902; thus the absolute range becomes 64°·6. In the mean there are about thirty-four days per annum when the temperature falls below −40°; February is marked by exceptionally high maximum temperatures, especially in 1900.

The other meteorological factors, wind, storms, clouds, precipitation, &c., are dealt with by Dr. Mohn in a similarly comprehensive fashion, but enough has been said to show that in this volume we have data of unique value which should prove of great service in current meteorology. The work has obviously been done with conscientious care and thoroughness; the only pity is that the period for which observations are available is so brief.

Another recent addition to meteorological science appears as a Harvard publication,[1] and deals with the observations made at Arequipa during the years 1892–5. Earlier observations were made at Arequipa during 1888–90, and the results appeared in vol. xxxix. of the Annals. The work was resumed in 1891, but as the records thereof are incomplete none earlier than those of 1892 has been included in the present publication.

The area dealt with in this volume differs, of course, in most respects from that treated by Dr. Mohn, the latitude of Arequipa being 16° 22′ 28″ S., but the same careful observation and full discussion are common to the two volumes. The Arequipa station is a rather peculiar one, inasmuch as it is situated at an altitude of 8040 feet above sea-level, although only 350 feet above the plaza of Arequipa city, some two miles distant. Several peaks some 20,000 feet in height lie within ten to twenty miles of the station, and have been usefully employed in the estimation of the heights and extents of clouds. The results and summaries are given in a series of twenty-four tables, and are too comprehensive in detail and suggestion to be dealt with at length here, but one or two side issues may be noted.

In taking pressure observations, both mercurial barometers and a barograph were employed, and it was noticed that the latter gave a diurnal range consistently smaller than that given by the mercurial barometer; these differences are to be discussed, at length, in a subsequent publication. Barometer readings were taken at 8 a.m., 2 p.m., and 8 p.m.

Similarly, a smaller daily range was indicated by the thermograph than by the thermometer, and the former shows a distinct lag, particularly noticeable at the 8 a.m. readings.

The records of cloudiness were obtained with a sunshine recorder between 6 a.m. and 6 p.m. during the period January, 1892, to June, 1893, but for dates after that the hourly means for sunshine recorder and pole-star recorder are given, thus including the twenty-four hours of each day. The results with the latter instrument agree with eye-observations, but, owing to the sensitiveness of the blue paper employed, the sunshine recorder gives exaggerated values for the clearness of the sky; the character of the cloud was indicated by the numbers 1 to 5, 1 representing thin and 5 representing dense cloud, and it seems probable that only clouds of characters 3 to 5 were registered by this instrument.

W. E. ROLSTON.

THE AMERICAN ASSOCIATION OF MUSEUMS.[2]

FOLLOWING the example of the museums of the United Kingdom, the officials of similar institutions in the United States have inaugurated a movement which is to be known as "The American Association of Museums." It has been organised with that attention to detail and breadth of view which specially belong to our American cousins, giving full promise of successful development. The pioneer work was carried out by Dr. W. J. Holland, director of the Carnegie Museum, Pittsburg, Pa, who issued invitations to the heads of a number of the leading museums of America, and others likely to be interested in the formation of such an association, to attend a preliminary meeting to be held at the American Museum of Natural History, Central Park, New York, on May 15, 1906. A cordial response was made to this invitation, more than seventy delegates attending, while nearly fifty others signified by letter their adhesion to the scheme. Practically all phases of museum work were represented from every State in the Union. Dr. Hermon C. Bumpus was elected president, with Dr. George A. Dorsey, Field Museum of Natural History, Chicago, as secretary. Officers were appointed, and a committee of organisation was authorised to draw up a constitution. This is mainly based on that of the Museums Association established in England nineteen years ago, with one essential difference, for while the English association is primarily one of institutions, the full members being museums, with associate members to include individuals interested in museums, the American association consists of active, associate, sustaining, and honorary members. The active members consist of persons actively engaged in the work of museums, and they alone are eligible to hold office. Sustaining members are museums, with the right to vote through the chief executive officer. Associate members need not be engaged in the work of museums, and they have no vote.

Various papers on practical museum subjects were read at this meeting, but they are not published in this volume, which only gives the general proceedings and titles of the papers submitted. Six life members, 135 active members, and twenty-six sustaining members were enrolled, which shows how heartily the scheme has been accepted, while a strong financial position was at once assured, the subscriptions amounting to 592 dollars, and after deducting the necessary expenses the substantial balance of 472 dollars remained.

By invitation of the trustees of the Carnegie Museum the second annual meeting was held at the Carnegie Institute, Pittsburg, Pa, on June 4–6, 1907, and the present volume is chiefly occupied with the papers read at that meeting. Dr. Holland gave a concise but amply descriptive account of the purpose of the Carnegie Institute, which shows that in America Mr. Carnegie realises the equal importance of museums with libraries in the scheme of general knowledge and human progression, and does not there restrict his generous impulses to the latter institutions as he does in our country. About sixty members were present at this second conference, when various resolutions affecting the status and future work of the association were discussed, the principal one relating to the form in which the proceedings should be published. There were three suggestions made:—(1) that the papers should be published in one of the American scientific journals; (2) the issue of a separate annual volume; (3) a periodical of their own at more frequent intervals dealing with museum subjects generally. The latter suggestion appeared to find most favour, though there were two important difficulties raised, viz. the cost and the selection of an editor willing to undertake the work. The question of cost showed great divergence of view, from less than 1000 dollars to many thousands. The same difference of opinion prevailed in the English Museums Association when they started their *Museums Journal* seven years ago with only about 100*l.* in hand, but experience has shown that the increased income from it has more than covered the cost. Speaking from an intimate personal acquaintance with the editorial work of that journal, we would strongly advise no American curator to undertake similar work lightly.

The titles of the papers will show the wide scope of museum work, and how wisely the association has confined itself to the subjects within its legitimate province. We suggest that a table of contents at the beginning of future volumes would greatly facilitate reference and add to the use of the volume. Mr. Henry L. Ward submitted papers on "The Labelling in Museums," "The Aims of Museums," with special reference to his own museum at Milwaukee, and "The Exhibition of Large Groups in Museums." Dr. Benjamin Ives Gilman, of the Museum of Fine Arts, Boston, dealt with "The Triple Aim of Museums of Fine Art" in his customary comprehensive manner. The other papers published include:—"Some Instructive Methods of Bird Installation," by Frank C. Baker; "A New Method of Mounting Ethnographical Objects," by Dr. E. S. Morse; "Installation of Swinging Frames," by W. M. R. French; "Museum Records," by Paul M. Rea; "The Evolution of Museums," by F. A. Lucas; "The Work of a Children's Museum," by Miss Anna B. Gallup, and other contributions on museum administration and management, many of the papers being well illustrated. There is also an interesting plate of the Diplodocus, with the members of the association gathered about it.

E. HOWARTH.

[1] "Harvard College Observatory Annals," vol. xlix., part i. Peruvian Meteorology, by Solon I. Bailey. Observations made at the Arequipa station, 1892–5.

[2] Proceedings of the American Association of Museums, vol. i. (Pittsburg, Pa, 1908.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

EDINBURGH.—Prof. J. Walker, F.R.S., has been elected to the chair of chemistry in the University in succession to Prof. A. Crum Brown, F.R.S.

LIVERPOOL.—Prof. Salvin-Moore has resigned the directorship of the Liverpool Cancer Research Committee, and accordingly vacates the professorship of experimental cytology in the University on September 30.

A VOLUME about Canada in Sir C. P. Lucas's "Historical Geography of the British Colonies" will be published shortly by the Oxford University Press. The author, Prof. H. E. Egerton, confines himself to history. Mr. J. D. Rogers, who wrote "Australasia" for the same series, will deal with the geography of Canada in another part.

THE following appointments have been made at University College, London:—Mr. H. M. Hobart to the newly-created lectureship in electrical design; Dr. A. W. Stewart to the lectureship in stereochemistry for the session 1908–9; Mr. G. C. Mathison to the Sharpey research scholarship in physiology; Mr. W. F. Stanton to be demonstrator in the department of applied mathematics; and Mr. H. S. Bion to be demonstrator in the department of geology.

THE Association of Technical Institutions held its summer meeting on July 17 at the Franco-British Exhibition. The chair was taken by Sir Horace Plunkett and Dr. Friedel, head of the Information Bureau of French Education, who gave an address on the French educational system. Dr. Friedel said that the most interesting development of higher education in France is that at the Universities pupils can get special instruction in their various technical pursuits, including agriculture and watch-making, so that technological education now goes from the elementary stage right up to the University. Municipalities do a great deal for their Universities; they give money, found chairs, build laboratories, and endow all kinds of institutions connected with the Universities. Perhaps the time will come, he said, when English towns will do more than they do at present in that direction. Sir Philip Magnus also spoke.

SOCIETIES AND ACADEMIES.

LONDON.

Mineralogical Society, June 16.—Prof. H. A. Miers F.R.S., president, in the chair.—A nickel-iron alloy (Fe_5Ni_3) common to the meteoric iron of Youndegin and the meteoric stone of Zomba: L. **Fletcher.** In the case of the Zomba meteoric stone, the gradual increase of nickel in the residue after repeated extraction of the nickel-iron with mercuric ammonium chloride was previously attributed to rusting. It is now explained by the presence in the nickel-iron of a component not easily affected by the mercuric solution and containing 38·50 per cent. of nickel. This component is identical with the "tænite," containing about the same percentage of nickel, which was separated from the Youndegin iron by its insolubility in dilute hydrochloric acid.—Kaolinisation and other changes in West of England rocks: F. H. **Butler.** The author pointed out that the gaseous emanations of a granitic magma, which are carried upwards and discharged externally, gradually bring about considerable pneumatolytic changes. Notable among these are increased vesicularity in the quartz of the peripheral part of granitic intrusions and their offsets, the elvans, also the assumption by that mineral of the idiomorphic form, and the production of tourmaline. The occurrence of tourmaline in rocks exemplifying various stages in metasomatism indicates long-continued supply of boron compounds from abysmal regions. The primary, usually brown, tourmaline in the altered acidic rocks is commonly found to have been eroded, doubtless owing to alkalinity of the kaolinising solution, before dekaolinisation and the consequent formation of acicular schorl ushered in a final deposition of quartz. The view of Prof. Vogt and other authorities that kaolinisation was effected by the rise of solutions of carbon dioxide from among calciferous rocks receives support from the occurrence of calcium sulphate in underground waters and of numerous calcium compounds in mineral veins and lodes. The unchanged condition of some topaziferous granite is one of various indications that the action of hydrofluoric acid on rocks has been low down rather than superficial. It or hydrofluosilicic acid appears to have played a part in the following sequence of events in the west of England:—(1) Decomposition of deep-seated calcite-bearing rocks, and consequent kaolinisation of neighbouring granite by evolved carbon dioxide; (2) local and variable dekaolinisation, fluorisation, and tourmalinisation of china-clay rock and china-stone by borated waters carrying dissolved fluor-spar, resulting in the formation of schorlaceous rocks and greisen. (3) Lastly, supply to the metasomatised rocks of tinstone and wolfram from solution, and then of silica. The author concluded with a brief summary of facts subversive of the popular notion that the kaolin of commerce is the result of subaërial action upon granite.—Schwartzembergite, and the drawing of light-figures: G. F. Herbert **Smith.** The author described the crystals occurring on three specimens in the British Museum, the locality being San Rafael, Chili. They are formed of four low pyramids, above and below, eight in all, with nearly square contour, the angle from the centre averaging 20°, with range 15°–25°, and simulate tetragonal symmetry; steep pyramids are occasionally present also. The mean refraction is 2·350. The optical characters are remarkable; through each pyramid face appears in convergent light a biaxial interference-figure ($2E=16°$) with negative birefringence, the axial plane being parallel to the edge of the contour, but through intermediate sectors appears another biaxial interference-figure with larger angle ($2E=33°$), the axial plane being in this case radial; the number of different directions of single refraction in the crystal is, however, only four. The pyramids give with pin-hole object a continuous band of light. Since there was no well-defined image from which to measure, it was necessary to draw these figures direct on to a projection. The author described a camera-lucida attachment for the goniometer which would allow of the preparation of projections of different sizes and of the relative variation required by the distortion in a projection.—The chemical composition of seligmannite: G. T. **Prior.** The results of two analyses show that this new mineral from the Binnenthal is a sulph-arsenite of copper and lead ($PbCuAsS_3$) corresponding to the sulph-antimonite, bournonite, with which it is crystallographically similar.

DUBLIN.

Royal Dublin Society, June 16.—Prof. Sydney Young, F.R.S., in the chair.—On the quantitative spark spectra of titanium, uranium, and vanadium: Dr. J. H. **Pollok.** Tables were given showing the rate of disappearance of the various lines of the spectra of each element on dilution, and reproductions of the spectra were shown in which the most characteristic and persistent groups of lines were marked. A second paper, "On the Spectrographic Analysis of a Sample of Commercial Thallium," illustrated the most convenient method of using quantitative spectra for the identification of small quantities of impurities in metals or minerals.—The secondary β radiation excited by γ rays: F. E. **Hackett.** The method used was to measure the ionisation produced by the β radiation emitted from the back of a plate when γ rays were incident on the front, care being taken that the intensity of the γ rays issuing from the different plates was the same. The plates were thick enough to absorb the β rays present in the incident pencil, so that the secondary radiation measured was due solely to γ rays. For substances of atomic weight less than 130, the secondary radiation measured in this way is almost constant, and equal to 70 on the scale used. For higher atomic weights the secondary radiation increases, reaching the value of 100 for lead and 120 for uranium. The paper contains a theoretical discussion of the subject, deducing the radiating power per unit volume and per atom of the substances examined when subjected to the same intensity of γ rays. The paper also contains some measurements of the penetrating power of the secondary rays.—The occurrence of deposits of unbroken marine shells at high levels on the Curraun Peninsula, co. Mayo: T. E. **Gordon** and Prof. A. F. **Dixon.** The authors described several deposits of unbroken marine shells

occurring in relatively enormous numbers at the foot of cliff-like terraces of the Old Red Sandstone, lying mostly in recesses beneath overhanging rocks or deep in narrow clefts. The shells were found at heights of 100, 300, and 700 feet above sea-level. The unbroken condition of the shells, their enormous number, their presence in deep, horizontal, narrow rock clefts, and the fact that they were found so far as half a mile from the sea coast, high on the side of a barren mountain, led the authors to the conclusion that their presence was not due to human agency or to birds. The appearances suggest that the shells, which are all of littoral species, were left behind on a rocky coast by a receding sea. In spite of the geological difficulties of such a suggestion, the authors had no other to offer.—Curious water-worn markings on rocks at Doughbeg, co. Mayo: T. E. **Gordon** and Prof. A. F. **Dixon.** Rounded and horse-shoe shaped markings regarded by the authors as due to the action of water containing sand or grit pouring down a smooth, sloping rock surface on which were a number of projecting pieces of vein quartz.—Dry rot of the potato tuber: Dr. G. H. **Pethybridge** and E. H. **Bowers.** The authors dealt with a case in which the dry-rot fungus *Fusarium Solani* was the cause of considerable trouble. Inoculation experiments were carried out with this fungus (including a pure culture of it) which show that it is a true parasite.—An investigation of the connection between band and line spectra of the same metallic elements: Prof. W. N. **Hartley.**

PARIS.

Academy of Sciences, July 13.—M. Bouchard in the chair.—Notice on Alphonse Peron, correspondant of the Academy, whose death occurred at Auxerre, July 2, 1908: M. **Douvillé.**—A hypothesis by means of which the variations of the radius vector of the sun can be obtained, without necessitating the consideration of the sun's apparent diameters: J. **Boussinesq.**—The lava from the recent eruption of Etna: A. **Lacroix.** Details are given of the petrographical study of different lavas: three chemical analyses of products of different origin show very slight differences.—A hæmogregarian from *Morelia spilotis*: A. **Laveran.** A description of an organism apparently identical with *H. Shattocki*, with ten diagrams showing various stages of development.—The action of metallic oxides on the primary alcohols: the case of irreducible oxides: Paul **Sabatier** and A. **Mailhe.**—The oxides MnO, SnO, and CdO give hydrogen and the aldehyde at 340° to 350° C., but the action is less rapid than with reduced copper. The blue oxide of tungsten and the oxides of aluminium and thorium give ethylene and water. Many oxides (chromium, silica, titanium, zinc, &c.) act catalytically in both ways, aldehyde, hydrogen, ethylene, and water being produced.—The partial eclipse of the sun of June 28, 1908, observed at the Observatory of Ebra (Spain): M. **Cirera.** The actinometric observations were hindered by clouds, which rendered uncertain the determination of the time of the first contact.—The eclipse of the sun of June 28, 1908, observed at the University of Strasburg: Robert **Jonckheere.** The observations of the times of the first and second contacts were satisfactory.—Observation of the partial eclipse of the sun of June 28, 1908, at the Observatory of Bordeaux: F. **Courty.**—The history of lunar relief: P. **Puiseux.**—Certain systems of differential equations: Edmond **Maillet.**—Canonical products of infinite genus: Arnaud **Denjoy.**—Positive electrons: Jean **Becquerel.** In a previous note the author has described certain phenomena which appear to indicate the existence of positive electrons. In the present paper other possible explanations are examined in detail, but found to be experimentally untenable; the hypothesis of the formation of positive electrons thus remains the best available to explain the observed phenomena.—Remarks on a note by M. Tissot, "On the Use of Detectors sensitive to Electrical Oscillations, based on Thermoelectric Phenomena": Edouard **Branly.**—The mechanism of synthesis of rings containing nitrogen.—The action of ethyl pyruvate upon paratoluidine: L. J. **Simon.**—Sparteine. The conversion of *iso*sparteine into α-methylsparteine: Amand **Valeur.**—Researches on some acid sulphates of potassium: L. **Arzalier.**—Osmotic pressure and the Brownian movement: Jacques **Duclaux.**—The physico-chemical analysis of wines: Paul **Dutoit** and Marcel **Duboux.** The determination of the sulphates, total acidity, and tanning materials of a wine can be done in an hour by measuring the changes in the electrical conductivity caused by the gradual addition of baryta solution.—The stigma-bearing nucleus and pollinisation in *Saxe-Gothea conspicua*: A. **Tison.**—The influence of the concentration of solutions of some sugars on respiration in plants: A. **Maige** and G. **Nicolas.**—The grafting of some varieties of beans: Lucien **Daniel.**—The mechanism of the distribution of products possessing smell in the plant: Eug. **Charabot** and G. **Lalone.**—The chemical study of the ripening of *Lycopersicum esculentum* (tomato): F. M. **Albahary.** As the tomato ripens, the amounts of organic acids, sugar, starch, and nitrogenous materials other than proteids increase, whilst the proteids and cellulose diminish.—The influence of amyl nitrite on the red globules of the blood: Gr. **Flavu.**—The *rôle* of the malic acid fermentation in vinification: A. **Rosenstiehl.**—The physiological *rôle* of the leucocytic granulations: M. **Kollmann.**—The discovery of fossil plants in the volcanic earths of Aubrac: Ant. **Lauby.**

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