torical, and general information concerning the island, compiled from official and other trustworthy records by Mr. S. P. Musson and Mr. T. Lawrence Roxburgh.

WE have received the first number of a new journal published at Oporto, and entitled *Annaes de Sciencias Naturaes*. The articles are mostly written in Portuguese, and among them we notice one on the flora of Oporto, and another on the birds of Portugal, as well as numerous notes on natural science matters.

MESSRS. MACMILLAN AND CO. have issued the thirty-first volume of the "Statesman's Year-Book," edited by Mr. J. Scott Keltie. The statistics have been well revised, and renewed in cases where recent information rendered such a course desirable. These changes, and the many additions that have been made, bring the volume in touch with current topics and maintain its character as an indispensable work of reference on all statistical and historical matters relating to the States of the world.

SEVERAL new crystallised compounds of hydroxylamine with the chlorides and sulphates of cobalt and manganese have been isolated by Dr. Feldt in the laboratory of the University of Berlin. The chlorides are analogous to the salts containing zinc, cadmium, and barium described some few years ago by Crismer, being constituted upon the type $RCl_2.2NH_2OH$. The sulphates, however, only contain one molecular equivalent of hydroxylamine, but contain two molecules of water of crystallisation. The compound $CoCl_2.2NH_2OH$ is obtained by digesting in a flask through which a current of hydrogen is passing, and which is heated by a water bath, an alcoholic solution of cobaltous chloride with four molecular equivalents of hydroxylamine hydrochloride and a few cubic centimetres of an alcoholic solution of free hydroxylamine. Air requires to be excluded, as brown subsidiary products are otherwise produced. The liquid after a short time deposits the new compound in beautiful rose-coloured acicular crystals, which are fairly stable, and may be preserved for months out of contact with the air. They detonate somewhat violently, however, when heated, owing to sudden decomposition. The manganese salt $MnCl_2.2NH_2OH$ may be similarly obtained, and is more stable than the cobaltous compound. It explodes at 160°. The sulphates cannot be prepared in alcoholic solution, owing to the sparing solubility of the constituent sulphates in alcohol. By employing aqueous solutions salts of a similar nature are obtained, but with the difference of composition above mentioned. Both the salts $CoSO_4.NH_2OH.2H_2O$ and $MnSO_4.NH_2OH.2H_2O$ are similar in appearance to the chlorides, and are considerably more stable in their nature. The most interesting of Dr. Feldt's preparations, however, is a salt $CoCl_3.6NH_2OH$, analogous to the well-known luteo-cobalt-ammonium chloride. When aqueous or alcoholic solutions of cobaltous chloride and hydroxylamine are mixed in contact with air, the rose-coloured precipitate rapidly darkens, taking up oxygen in all probability to form the compound $CoOCl.2NH_2OH$. If this substance is suspended in strongly cooled alcohol, and a similarly cooled alcoholic solution of hydrochloric acid is allowed to fall slowly in, a dark green liquid is produced, which eventually deposits a yellow crystalline powder. This precipitate dissolves readily in dilute aqueous hydrochloric acid, and the solution yields on evaporation the luteo-salt in large, well-formed, bronze-coloured crystals belonging to the monoclinic system. This somewhat remarkable compound is a particularly stable substance, which yields a crystalline precipitate of the corresponding oxalate, $Co_2(C_2O_4)_3.12NH_2OH$, upon the addition of ammonium oxalate solution. Full details of the work are contributed to the *Berichte*.

THE publisher of "Der Botanische Garten zu Buitenzorg auf Java," and "Eine Botanische Tropenreise, Indo-malayische Vegetationsbilder und Reiseskizzen," noticed in these columns last week, is W. Engelmann, of Leipzig.

THE additions to the Zoological Society's Gardens during the past week include a Diana Monkey (*Cercopithecus diana* ♀) from West Africa, presented by Miss L. D. Summerbell; a Wild Cat (*Felis catus* ♀) from Inverness-shire, presented by Mrs. Ellice; two Collared Peccaries (*Dicotyles tajaçu* ♀ ♀); a Globose Curassow (*Crax globicera* ♂) from British Honduras, presented by H.C. Sir Alfred Molony, K.C.M.G.; two Cape Bucephalus (*Bucephalus capensis*); a Cape Viper (*Causus rhombeatus*) from South Africa, presented by Mr. J. E. Matcham; two Crossed Snakes (*Psammophis crucifer*); a Smooth-bellied Snake (*Homalosoma lutrix*); a Rhomb-marked Snake (*Psammophylax rhombeatus*) from South Africa, presented by Messrs. H. M. and C. Beddington; a Crossed Snake (*Psammophis crucifer*); a Hoary Snake (*Coronella cana*); a Puff Adder (*Vipera arietans*) from South Africa, deposited.

OUR ASTRONOMICAL COLUMN.

COMET-SPECTRA AS AFFECTED BY WIDTH OF SLIT.—The unaccountable differences between the spectrum of burning or electrically glowing carbon and the carbon bands observed in comets are successfully explained by Prof. H. Kayser in the *Astronomische Nachrichten*. The chief differences observed between the cometary and terrestrial spectra are the following:—The carbon flutings in the laboratory have a bright edge on the red side, which in the comet spectrum is displaced towards the red. But the maximum of luminosity in the latter is more refrangible than the bright edge in the former. Whereas in the true carbon spectrum the first fluting is the brightest, in cometary spectra the second has often appeared brighter than the first. It is suggested that all these anomalies are due to the fact that in astronomical spectroscopy the slit cannot be closed so far as in the laboratory, when the objects observed are as faint as comets usually are. If we suppose the true spectrum to be that produced by a very narrow slit, we may reproduce the impure cometary spectrum by sliding a wide slit along the true spectrum, and adding up for every position the strips of the true spectrum covered by the slit. We shall thus obtain the portion of the impure spectrum corresponding to the centre of the slit. When the wide slit encounters a band with a bright edge towards the red, it will at once begin to indicate a brightness, which will gradually increase until the slit is completely filled with light. The maximum will then have been obtained, and we see that it does not correspond to the bright edge, but to a line within it. Thus the first two anomalies are accounted for. Finally, if the slit is so wide that it comprehends two carbon bands at the same time, the maximum will not be obtained when the first or the second band occupies its centre, but when the first is just leaving and the third just entering. This accounts for the third anomaly. The experiment may be easily performed in the laboratory, by observing the arc spectra of calcium or iron. On widening the slit the line spectra of these elements show the same positions for the widened lines, but the carbon bands are diffused towards the red, and their maxima are displaced towards the violet.

THE ASTIGMATISM OF ROWLAND'S CONCAVE GRATINGS.—The astigmatism of the Rowland concave grating gives to this form of spectroscope the advantage of showing no dust lines along the spectrum, and of broadening out the spectrum of a star or a small electric spark into a band; but the same property makes it unsuitable for the simultaneous observation of two spectra by the usual method of illuminating one part of the slit with one source of light, and the other part with another source. By a special device, Prof. Rowland has no difficulty in obtaining photographic comparison spectra, but his method only holds good for photography. In a recent pamphlet by Dr. J. L. Sirks (Amsterdam: Johannes Müller), however, it is shown that a slight modification of the ordinary method will enable the desired comparison to be made, at least in the first and second order spectra. The comparison prism, or equivalent arrangement for introducing a second source of light, needs only to be placed some distance from the slit, at a point de-

termined by the intersection of the line joining the slit and the grating, with a line drawn through the focus at a tangent to the circle having its centre in the middle of the line joining the grating with the focus. It is further suggested that the special qualities of a Rowland grating which are due to its astigmatism may be imparted to a "dioptric" spectroscope by giving a slight convex spherical curvature to one of the prisms, so that the instrument becomes slightly astigmatic.

THE INSTITUTION OF NAVAL ARCHITECTS.

LAST week the Institution of Naval Architects held their annual spring meeting, under the chairmanship of Admiral Sir John Dalrymple Hay, one of the Vice-Presidents of the institution, the President, Lord Brassey, being absent abroad. There was an unusually strong list of papers; perhaps almost too strong, for it was impossible to do justice to the sixteen contributions, to say nothing of the formal proceedings and the chairman's address, within the limited space of a three days meeting. Some of the papers might have been referred back to the authors with advantage, notably the two long contributions, one on the detachable ram, and the other on the comparative merits of the cylindrical and water-tube boilers.

The following is a list of the papers on the agenda:—(1) "The qualities and performances of recent first-class battleships," by W. H. White, C.B., Assistant-Controller of the Navy, and Director of Naval Construction; (2) "The amplitude of rolling on non-synchronous waves," by Emile Bertin, Directeur de l'Ecole d'Application Maritime, Paris; (3) "The stresses on a ship due to rolling," by Prof. A. G. Greenhill, Royal Artillery College, Woolwich; (4) "On Leclert's theorem," by Prof. A. G. Greenhill; (5) "Recent experiments in armour," by Charles E. Ellis, Managing Director of John Brown and Co., Limited, Sheffield; (6) "The detachable ram, or the submarine gun as a substitute for the ram," by Captain W. H. Jaques, late U.S. Navy; (7) "Leaves from a laboratory note-book: (*a*) some points affecting the combustion of fuel in marine boilers: (*b*) the spontaneous heating of coal," by Prof. V. B. Lewes, Royal Naval College, Greenwich; (8) "The circulation of water in Thornycroft water-tube boilers," by J. I. Thornycroft; (9) "On water-tube boilers," by J. T. Milton, Chief Engineer Surveyor Lloyd's Registry of Shipping; (10) "On the comparative merits of the cylindrical and water-tube boilers for ocean steamships," by James Howden; (11) "Further investigations on the vibration of steamers," by Otto Schlick; (12) "On the relation between stress and strain in the structure of vessels," by T. C. Read and G. Stanbury, assistants to the Chief Surveyor Lloyd's Registry of Shipping; (13) "Steam pressure losses in marine engines," by C. E. Stromeyer, Engineer Surveyor Lloyd's Registry of Shipping; (15) "Experience with triple expansion engines at reduced pressures," by D. Croll; (16) "Fluid pressure reversing gear," by David Joy.

M. Bertin's paper and Prof. Greenhill's second paper were taken as read.

Mr. White's contribution had been looked forward to with some interest, as it was anticipated that a somewhat lively discussion would ensue between the constructors of the Admiralty and naval officers on the question of the rolling of the *Resolution*, a subject dealt with by the author. Although the admirals mustered in some force, the discussion was of a very quiet nature, and the general opinion was that the *Resolution* and her sister-ships are perfectly safe vessels, and quite as well designed in regard to rolling capabilities as the tried battle-ships which have preceded them. That this fact could be shown by scientific reasoning was known beforehand to those acquainted with the elements of design of the ships, and having sufficient technical knowledge to draw conclusions from the premises. Nevertheless the doubts raised by the fact that the *Resolution* had put back to port after encountering a heavy storm in the Bay of Biscay, and the certainly extravagant newspaper reports of the occurrence were an unpleasant feature, especially as they appeared to be shared by a certain number of naval officers. It is well, therefore, that the discussion took place, and the matter has been set at rest. Mr. White's was a very long contribution, far too long for us to attempt even to abstract it here; but it was none too long for the patience of the meeting, as it was full of suggestive matter from beginning to end. The author dealt in a masterly way with the questions, in relation to battle-ships, of draught and trim, stability, metacentric height, curves of statical stability, period of oscillation, bilge keels, behaviour at sea, the behaviour of the *Resolution* in December 1893, performances under steam, manœuvring powers, relative size and cost of *Royal Sovereign* class, and the *Centurion* and *Barfleur* class. Unfavourable comments have been made on the *Royal Sovereign* class—the eight battle-ships of the Hamilton programme, of which the *Resolution* is one—because they have rolled heavily when small vessels have been comparatively steady. This, of course, is a circumstance for which the laws of nature are responsible rather than the designers of the ship; for however talented a naval architect may be, he cannot destroy natural laws, but can only seek to work so that they may be on his side, rather than fly in their face. To this end the constructor attempts to dispose dimensions and weights so that the natural period of oscillation of the ship may not synchronise with the period of waves more commonly encountered. A fair metacentric height is, of course, necessary in order that the ship may have stability, but an unduly large metacentric height tends to lessen the period of oscillation, and thus brings the period of the ship more nearly into harmony with that of waves ordinarily occurring. In fact, excessive stiffness produces undue motion amongst waves, whilst a very steady comfortable vessel might be one in danger of turning over under very small impulses. These facts are well known, of course, to those accustomed to the design of vessels, but they apparently are not fully grasped by many of those who go to sea in ships, to judge by the correspondence called forth by the *Resolution* incident. After the discussion that has been called forth by that incident, and the instruction given in connection with it, a hope may be expressed that "stability" and "steadiness" will not always be taken to accompany each other. The metacentric height of the *Royal Sovereign* class of the barbette type is $3\frac{1}{2}$ feet, and past experience has shown that an excellent combination of stiffness and steadiness has been obtained with metacentric heights varying from $2\frac{3}{4}$ to $3\frac{1}{2}$ feet. It may be taken for granted that it is desirable to give vessels a long period in order to gain steadiness, and with these big vessels the metacentre could be higher than in smaller craft, and, under extreme conditions of lading, the *Royal Sovereign* class could have as great a height as 4 feet without unduly impairing their prospect of steadiness, whilst of course the stiffness would be great. It is worthy of note that the inclining experiments made with the *Royal Sovereign* showed the calculated centre of gravity to be but $1\frac{3}{4}$ inches above the actual position; a result which speaks well for the care with which designs are got out at Whitehall. The period of oscillation of the *Royal Sovereign* with normal weights and $3\frac{1}{2}$ feet metacentric height, is about eight seconds. This accords with the period of battleships which have acquired good reputations for steadiness in times past. Most of the latter ships, Mr. White tells us, have smaller metacentric heights, but they are also inferior in weight and moment of inertia; the latter, it must be remembered, having an important influence on the period of oscillation. Mr. White did not think it necessary to explain to a professional audience the manner in which rolling depends on the agreement between the period of the ship and the period of the wave, a fact that must be apparent to anyone who considers how a child's swing may be caused to oscillate through a wide range by small impulses applied at the right moment. Apparently the *Resolution* fell in with a sea, on the memorable occasion in the Bay of Biscay, which tilted her from side to side just as she herself was inclined to roll, whilst the little torpedo gun-boat *Gleaner*, which accompanied her, and made so much better weather of it, was not "fitted" by the big sea. In more moderate and more ordinary weather the relative conditions might have been reversed. In any case, it is as well to repeat, the *Resolution* at her greatest angle of roll had an ample margin of stability, and there was no reason to fear for the ship, although it was doubtless remarkably uncomfortable on board, and the captain exercised a wise discretion in coming back, having, as he did, an entirely untrained crew under him.

The paper by M. Emile Bertin treats with the subject of rolling of ships from a mathematical stand-point, carrying on the investigation of the question from a point where it was left by the late Prof. Jenkins, in a paper wherein he investigated the maximum effect which takes place at the extreme angle of roll. The author extends the theory to the effect at any intermediate part of the oscillation, and to the case in which the angle of maximum-righting moment may be less than a right angle. The difficulty of exact measurement of rolling is shown by the paper; a fact also well illustrated by Mr. White in the previous