thrives, would, if the forest were rooted up and the soil limed at considerable expense, only yield a rental of 12*s.* an acre as farm-land. Evidently here we have a district where forestry is more productive than agriculture, and where planting might be extended; and the same may be said of the large area of heather land above the Bagshot Sands in Surrey, Berkshire, and Hampshire, which might all be stocked with conifers were sensible measures adopted to stop the progress of the annual heath fires.

When it is remembered that we import 70,000 tons of pit-props every year, chiefly from the cluster pine forests near Bordeaux, and that in the Belgian Ardennes, at a distance of 80 miles from the coal mines, 40-year old Scotch pine, used for pit-wood, can be sold standing for £55 per acre, exclusive of the value of thinnings, which would pay for the cost of producing and tending the forests, and this means an annual profit of 16*s.* an acre, including an allowance for compound interest at 3 per cent., there can be no reason why we should not grow our own pit-props on waste land unsuitable for agriculture.

Many farms on heavy land are at present either going out of cultivation or paying very badly, and as an example of the successful forest treatment of similar land on the London clay, the Princes Coverts, near Esher, in Surrey, may be cited.

Leopold of Saxe Coburg, the consort of our Princess Charlotte, and afterwards King of the Belgians, about seventy years ago united several small woodland areas, by planting up the land of two farms, in which they were situated, with hazel and ash coppice and oak standards. The present extent of the coverts is 868 acres, and their yield, after deducting all costs of management, amounts to at least 16*s.* an acre per annum, and probably more; but Messrs. Clutton, the agents of the Crown lands, in which these woods are at present included, might supply the correct figures. The coppice is felled every ten years, and yields supports for fruit and ornamental trees, bean- and pea-sticks, clothes-props, kindling fuel, &c., which are largely in demand for gardens, orchards, and laundries around London; while the oaks, which in seventy years attain a girth of about five feet, are readily sold standing at 1*s.* 6*d.* and 2*s.* a cubic foot, according to quality.

Whilst, however, the work of planting up our waste lands must necessarily be chiefly left to private agency, the State should bring the Crown forests into a high state of productiveness, and render them examples of good forest management. Forestry is eminently a practical business, and when a landowner wishes to plant, he should be able to see the ideal way of dealing with different localities on economic principles in our Crown forests. This at present is far from being the case. Very large sums of public money were spent in planting up the Crown forests in 1813–25, when there was a fear of our running short of timber for the Navy. It is true that our Navy now depends on teak and iron, rather than on oak and pine; but oak and pine are still valuable commodities, and the present condition of the Crown plantations, made about seventy-five years ago, is certainly not satisfactory, owing to the want of underwood, and the excessive nature of the thinnings to which they have been subjected. Over an extensive area in the New Forest the Scotch pine mosses have been allowed to outgrow the oaks they were intended to shelter temporarily. The fact is, a forester is wanted at the head of our Crown forests, who will see, among other things, that they are properly underplanted, and that all blanks are restocked; but in order to do this successfully, the rabbits, which now swarm in some of the woods, must be kept down. This was not the case twenty years ago; but their increase of late has been prodigious, and they not only eat every natural seedling which appears, but also threaten the existence of the older trees by barking them in the winter.

It should be noted that the Crown forests are managed by the State, and their proceeds go into the Treasury, but that the sporting rights in some of them are vested in the Crown. Surely the Royal sportsmen might be contented with a moderate number of rabbits, and with pheasants, which do no injury to the woods, and not require the enormous multiplication of rabbits, which no continental prince would suffer in his forests.

It may be objected that by treating our Crown forests for economic forestry, as is the case with the Crown woodlands in other European countries, we should introduce uniformity, and spoil much of their picturesqueness. There are, however, 5000 acres in Epping Forest, 4000 in Windsor Park, and extensive tracts in the New Forest, which might be reserved for the lovers of the picturesque, and even then 100,000 acres might be found n the Crown forests which could be made into models o f good forest management, which are at present not to be found anywhere in Britain. W. R. FISHER.

NOTES.

IT is stated that the Emperor of Austria has just made a graceful recognition of the important services which the Geological Survey of India has rendered to science, by the presentation of gold medals to the two senior members of the Survey, Dr. W. King and Mr. C. L. Griesbach. Surely for the Emperor of Austria we should read Empress of India.

THE next annual meeting of the Museums Association is to be held in Dublin, beginning on the 26th of June, and lasting four days. Dr. Valentine Ball, C.B., F.R.S., is the President-elect, and a strong local committee has been formed, with Dr. R. F. Scharff and T. H. Longfield as honorary secretaries. There will be a reception of the members on Tuesday, June 26, at the Zoological Gardens, and on the following Thursday an excursion will be made to the Wicklow Mountains. Last year's meeting o f the Association in London, under the presidency of Sir William H. Flower, resulted in the accretion of a considerable number of new members, and the Association has now become a strong and successful body.

THE sixty-sixth annual meeting of German scientific and medical men will be held this year at Vienna, from 24th to 30th September. This function is still more all-embracing than the British Association, maintaining as it does the true brotherhood of natural and physical sciences with the branches of medicine. If all accounts be true which we hear of the section work at the recent Medical Congress in Rome, the best-meant efforts at organisation may sometimes fall short of their mark at a very large meeting. But no city knows better than Vienna how to entertain and, at the same time, to keep work going on smoothly. Active preparations have already been begun for the September meeting, and the programme of arrangements will be issued in the beginning of July.

A COMMISSION, nominated by the physical section of the Amsterdam Society for the Advancement of Physics and Medicine, and consisting of Profs. Gunning, van't Hoff, Polak, van Deventer, and Lobry de Bruyn, has made arrangements for the celebration of the centenary of the death of Lavoisier on May 8. Prof. Gunning will deliver a commemorative address, and Dr. van Deventer will describe the apparatus of the Dutch physicist van Marum, by means of which he has repeated the experiments of Lavoisier on combustion. The apparatus, constructed like Lavoisier's, but improved by van Marum, are contained in the museum of Teyler's Society at Harlem. Some of the works, portraits, and letters of the French investigator will also be exhibited at the coming celebration.

AT the end of last week a series of severe earthquake disturbances passed over Greece, causing great destruction of property and loss of life. A sharp shock was felt at Athens about seven o'clock on April 20. It appeared to pass from west to east, and lasted for about half a minute. The shock was also felt throughout the kingdom, though with less severity in the Peloponnesus than in Northern Greece, while Zante and the other Ionian Islands appear to have escaped injury. Thebes was almost completely wrecked by the first disturbance, and a second shock, which took place at six o'clock on Saturday morning, completed the destruction. Shocks were also felt at Athens on Saturday morning, but no very serious casualties have occurred there. The district that has felt the effects of the disturbance most severely is that lying between Thebes, Livadia, Atalanti, and Chalcis. According to the reports, the intensity of the shocks diminished in proportion to the distance from this centre. The villages round Atalanti have suffered terribly, Larymni, Proskina, Malesina, Martino, and Pelli being left in ruins. In the town of Chalcis, also, the earthquake has effected considerable damage. A violent shock was felt there at noon on Sunday, and caused great devastation. There is some uncertainty as to the number of persons killed by the effects of the earthquakes. The official estimate gives the number of lives lost as about 200, but other reports make it as many as 300. Tremors continue to be felt at Athens and other places, but no great shock has been reported since that which visited the districts of Chalcis and Atalanti on Sunday.

THE Royal Geographical Society has awarded its gold medals for the current session to Captain H. Bower, for his remarkable journey across Tibet from west to east, and to M. Elisée Reclus, on the completion of his great work on comparative geography, entitled "Nouvelle Geographie Universelle." The minor awards were given as follows:—The Murchison grant to Captain Joseph Wiggins, for his services in opening up the Kara Sea route to Siberia; the Back grant to Captain H. J. Snow, for his surveys of the Kurile Islands; the Gill Memorial to Mr. J. E. Ferguson, a native of Sierra Leone, for his elucidation of the geography of the Gold Coast interior; and the Cuthbert Peek grant to Dr. J. W. Gregory, in recognition of his journey to Lake Baringo and Mount Kenia. The Duke of York has consented to become Honorary President of the Society. Dr. H. Mohn (Norway), Mr. Frederic Jeppe (Transvaal Republic), and Mr. Justin Winsor (United States) were elected honorary corresponding members.

THE philosophical faculty of the University of Göttingen has offered two prizes—the first of 3400 marks, and the second of 680 marks—for the best investigations of the solubility of mixed crystals. At present this question is of especial interest, as according to van't Hoff's hypothesis a mixed crystal may be regarded as a solution in a solid solvent. By an application of the thermodynamical equations of Willard Gibbs, Roozeboom has also studied the conditions of equilibrium of mixed crystals when in contact with their saturated solutions. These considerations lead to a result which may be stated as follows:—If a substance A form a mixed crystal with another substance, when the mixed crystal is in contact with its saturated solution, the ratio of the concentration of A in the mixed crystal to its concentration in the saturated solution should be the same, no matter what the absolute value of the concentration may be, provided the molecular weight of A in the mixed crystal and in the saturated solution is the same. Measurements of the solubility of mixed crystals will therefore test the validity of the above theoretical views, and may lead to a method of estimating the molecular weights of substances in the solid state. Competitors must send in their results, written in German, Latin, French, or English, to the Dean of the Faculty by August 31, 1896. The awards are to be announced in March 1897.

THE international character of the Naples Zoological Station shows each year increasingly. Great Britain is at present represented by Mr. Riches for Cambridge, Dr. Günther and Mr. H. Vernon for Oxford, and Mr. Moore for the British Association. Germany maintains two tables, and keeps them both occupied. Among those present at Naples now are Prof. His of Leipzig, Prof. Ludwig of Bonn, Prof. Ewald of Strasburg, Dr. Klaatsch and Baron v. Uexküll of Heidelberg. Austria-Hungary's three tables are occupied by two physiologists of Vienna, Dr. Beer and Dr. Fuchs, and Prof. Klein, botanist, from Buda-Pest. The ten Italian tables are occupied all the year round. Russia has sent Dr. Golenkin, Prof. Ognew, and Miss Perejaslewzewa from Moscow. Switzerland, Holland, and Belgium maintain one table each, and Dr. Staehelin (Basel), Dr. Schmidt (Utrecht), and Prof. Heymans (Ghent) occupy them. It is said that Roumania will join the other nations this spring, taking a table and sending Prof. Sihleanu from Bucharest, and that negotiations are pending with Bulgaria. The contract with Spain will probably be renewed this year; indeed, nearly every State in Europe—France and the Scandinavian kingdoms excepted—is represented at Naples. A striking feature this year is the great number of Americans. Some years ago, no relations having then been established between the Zoological Station and the United States authorities, Major. Alex. H. Davis, of Syracuse, New York, instituted a table for his countrymen, but the demand becoming greater, a movement was set on foot among American naturalists asking the Smithsonian Institute to take a table, while at the same time Prof. Agassiz proposed the like to the authorities of Harvard College. The development of interest in the work is shown by the fact that not only are these tables continuously occupied by Americans, but that Major Davis has again stepped forward to take another to meet the urgent demand, and that Prof. Dohrn has consented to place provisionally one or two others at the disposal of American students who wished to work at the Naples Station this year. It is not improbable that, in the near future, California and Japan, representing respectively the eastern and western shores of the Pacific, may have their delegates working side by side in the famous "Stazione." It may then fairly claim to have girdled the world with the far-reaching influence of its aims and its methods. Of that imitation which is "the sincerest flattery" there has been no lack. Other and excellent stations have come into being; others still are projected, all doubtless, in varying degree, to serve for purposes of use; but as first exemplar, as foremost in equipment, as incomparably richest in its intimacy of association with the chief biologists of our time, and, above all, in its international comprehensiveness and representation, the Naples Station is now, and bids fair long to remain unchallenged, the universal clearing-house of the world's biological science.

THE death is announced of M. G. Salet, of the Paris Sorbonne.

M. GRIMAUX, Professor of Chemistry at the École Polytechnique, has been elected a member of the Paris Academy of Sciences, in the place of the late M. Frémy.

DR. W. A. TILDEN, F.R.S., Professor of Chemistry in the Mason College, Birmingham, has been appointed Dr. T. E. Thorpe's successor at the Royal College of Science.

Mr. W. ESSON, F.R.S., has been appointed Deputy Savilian Professor of Geometry at Oxford, the continued illness of Prof. Sylvester having rendered him unable to perform the statutory duties of his office.

THREE research scholarships, each of the value of £250, and open only to British subjects, have been instituted by the Grocers' Company "as an encouragement to the making of exact researches into the causes and prevention of important diseases."

THE University College of Liverpool has a generous friend in Mr. George Holt, who has recently offered £10,000 to the Council for the endowment of a chair of pathology in the Medical School. The only endowed chair hitherto possessed by the school is that of physiology, which was also a gift from Mr. Holt.

THE *Chemist and Druggist* says that the herbarium of the late Isaac C. Martindale, of Philadelphia, comprising over 200,000 different plants and ferns gathered from every country in the world, and valued at ten thousand dollars, has been presented to the Philadelphia College of Pharmacy. The herbarium was bought from the heirs of the late proprietor by Mr. Howard B. French and Messrs. Smith, Kline, and French jointly, and given to the College by these gentlemen.

THE agricultural correspondent of the *Times* points out that the appointment of an official agrostologist to the Department of Agriculture at Washington is an event of exceptional interest, for it involves a recognition of the primary importance of the grasses in the rural economy of the nation. The duties of the United States agrostologist will include the identification of grasses and the investigation of forage plants, the preparation of monographs on grasses, and the conduct of various inquiries into grasses and forage plants. The gentleman who has been selected to fill the post is Prof. Frank L. Scribner. He has already filled the position of chief of the section of vegetable pathology in the Agricultural Department at Washington, and has recently been Director of the Tennessee Agricultural Experiment Station.

THE recent operations in Epping Forest have given rise to a large amount of correspondence in the daily papers, all the writers, with one or two exceptions, being opposed to the thinning of the timber and to the other improvements being effected by the Conservators. The Epping Forest Committee of the Corporation of London have so far met the public view of their proceedings as to promise that further operations shall be suspended till a select committee of experts have gone over the ground and reported upon the matter. Without prejudicing the decision of this committee, it may fairly be stated that the newspaper correspondents have given a most exaggerated account of the number of trees felled. In the meantime, the Essex Field Club has convened a meeting for Saturday, April 28, to examine the districts under discussion, and to give an opportunity for the ventilation of the whole question of the Forest management. The meeting will be conducted by the verderers, Sir T. Fowell Buxton and Mr. E. N. Buxton, Prof. Meldola, F.R.S., who as first president of the Club has in these columns expressed his views on the question (vol. xxvii. p. 447), and Prof. C. Stewart, the President of the Linnean Society. Mr. Angus D. Webster, a well-known expert in forest matters, who is now manager of woods to the Duke of Bedford, will be present at the meeting, and many other authorities are expected to take part in the proceedings.

THE Romanes lecture for 1894 will be delivered by Prof. Weismann, at the Sheldonian Theatre, Oxford, on Wednesday, May 2, at 2.15 p.m.

DR. JOHN HOPKINSON, F.R.S., will deliver the "James Forrest" lecture at the Institution of Civil Engineers, on Thursday, May 3, at 8 p.m., his subject being "The Relation of Mathematics to Engineering."

A COURSE of five lectures on "Geographical Distribution" will be delivered by Mr. F. E. Beddard, F.R.S., in the Lecture Room in the Zoological Society's Gardens, Regent's Park, on Saturdays at 4 p.m., commencing Saturday, May 19.

ON Thursday, May 3, Prof. Dewar will deliver the first of a course of lectures at the Royal Institution, on "The Solid and Liquid States of Matter"; on Saturday, May 5, Captain Abney delivers the first of the Tyndall Lectures on "Colour Vision," and on Tuesday, May 1, Prof. Judd begins a course of lectures on "Rubies."

DURING the present term, Prof. Clifton is lecturing at Oxford on the optical properties of crystals; Messrs. W. W. Fisher and Watts on inorganic and organic chemistry respectively; Prof. A. H. Green on field geology and applied geology; Prof. Ray Lankester on the Mammalia; Prof. Burdon Sanderson on the special senses; and Prof. Vines continues his advanced course in botany. Dr. Tylor lectures on the races of mankind, as classified by language, civilisation, and history; and Mr. H. Balfour on the progress in the arts of mankind, particularly as illustrated by the Pitt-Rivers collection. Numerous supplementary lectures by demonstrators and others are announced in all the departments.

THE programme of the meeting of the Iron and Steel Institute, to be held at the Institution of Civil Engineers on May 2 and 3, has been issued. Mr. Windsor Richards will preside and deliver an address. Prof. J. O. Arnold will read a paper on the "Physical Influence of certain Elements upon Iron"; Mr. William Hawdon will describe a new departure in the construction of blast furnaces; and Mr. Jeremiah Head will point out the growing importance of Scandinavia as a source of iron ore supply. Mr. D. Selby-Bigge will discuss the uses of electricity in the way of replacing steam and other motors in the iron and steel industries. Mr. G. J. Snelus will explain a new French process—a Bessemer process on a small scale. A paper on the relations between the chemical constitution and ultimate strength of steel will be read by Mr. W. R. Webster; and Mr. J. E. Stead and Mr. H. K. Bamber will speak, the former on the microscopic examination of iron and steel, and the latter on the analysis of steel.

La Nature credits Mr. J. Lancaster, an American ornithologist, with the assertion that he has seen frigate-birds flying continuously for seven days. According to his observations, the birds do not get fatigued even after staying such a long time in the air; in fact, not only can the frigate-bird maintain itself in the air almost without moving its wings, but it can travel with a velocity of 160 kilometres per hour with very little exertion. Though the albatross has usually a greater breadth of wing than the frigate-bird, it can only sustain itself in the air four or five days.

THE Roman villa at Llantwit-Major has been described, and the remains figured, by General Pitt-Rivers. In the *Western Mail* of Monday last, Mr. John Storrie says that he has visited a Roman villa at Ely, near Cardiff, and found that the wall plaster is painted with exactly the same patterns as that of the villa at Llantwit. There is other evidence that both villas were erected by the same workmen. Mr. Storrie also found relics not only of the pre-historic village, but of palæolithic man, thus indicating that the district examined may have been a settlement of man continuously from the time of the palæolithic men of the river gravels, then the marsh dwellers, then the Romans, and that it was only deserted when the present village of Ely took its rise probably during the early Norman period.

THE fourth trip of H.M.S. *Jackal*, for physical observations in the northern part of the North Sea, takes place next week,

completing the quarterly observations for one year undertaken by the Fishery Board for Scotland, in association with the researches simultaneously carried out by Prof. Krümmel of Kiel, and Prof. Pettersson of Stockholm. Mr. H. N. Dickson has had charge of the observations at sea, and will present a comprehensive report to the Fishery Board in the course of this year. While the trip of August 1893 was very successful, those of November 1893 and February 1894 were unfortunate as regards weather, the *Jackal* encountering the full force of the two most violent storms of the winter on these occasions, and being thus unable to complete the full programme of work.

IN consequence of the break-down of the proposed expedition (under Dr. Stein) to Ellesmere Land, efforts are being made in this country and in Sweden to ensure that an adequate search is made by whalers, or by a special expedition, for the missing Swedish naturalists, Björling and Kalstennius, and the Newfoundlanders who were in their company. It will be remembered that the young Swedes set out from St. John's, in 1892, in a small schooner, the *Ripple*, the wreck of which was discovered last summer on the Carey Islands. The survivors intended to make for the Eskimo settlement on Ellesmere Land, where they hoped to be rescued. It is just possible that they may survive, and prompt action is needed to make up for the time lost in trusting to the intentions of the American expedition. Mr. Clements R. Markham has opened a subscription list at the Royal Geographical Society, 1, Savile Row, where a considerable sum has already been received.

THE expedition of the German Cameroons Government, under Baron von Uechtritz, to delimit the Hinterland of the Cameroons has, according to a private letter of its scientific member, Dr. Passarge, published in Dr. Danckelman's *Mittheilungen*, had more than a political object. It proceeded up the Benue to Yola, and after being well received by the Sultan, left for the east, and reached Garua in the autumn of last year, where, in company with the French mission, the boundary line between French and German territory was settled, and access to Lake Chad from the south behind the Cameroons insured to the French Congo territory east of the Shari. Dr. Passarge has made the most complete geological survey of the Benue that has yet been attempted, and his observations throw much light on the geology of the Western Sudan generally.

THE May number of the *Geographical Journal* announces two new expeditions into Africa of more than ordinary scientific interest. Dr. Donaldson Smith, an American traveller who has already had some experience in Somaliland, is to make another effort to force a way from the north coast of Somaliland to the Lake Rudolph region. The expedition will probably start in May. Mr. R. T. Coryndon, well known as a hunter and collector in South Africa, is on his way, *viâ* the Cape and Lakes Nyasa and Tanganyika, to the eastern edge of the great Congo forest, where he intends to make a permanent camp, from which natural history collecting may be carried on for a year or more. Both explorers are trained in the use of surveying instruments, and if all goes well, the results obtained cannot fail to be of the greatest interest and value.

A SERIES of long, nearly parallel lakes, lying in Central New York State, has been investigated by Mr. Ralph S. Tarr (*Bull. Geol. Soc. Amer.* vol. v. pp. 339–356, 1894). Several of these lakes, known as Finger lakes, and notably lakes Cayuga and Seneca, are extremely long compared with their width. With the exception of one or two minute ones, they all drain northwards and eventually enter Lake Ontario through the Oswego or through the Genesee river. Mr. Tarr gives reasons for believing that "Lake Cayuga, and presumably other of the Finger lakes, is situated in a rock-basin with a maximum depth of approximately 435 feet. The nature of the proof is that the pre-glacial tributaries to this valley are found to be rock-enclosed, and that their lowest points are above the present lake surface." There appear to be various reasons why a rock-basin should be constructed with comparative ease in the region discussed. Mr. Tarr finds that the course of the pre-glacial Cayuga was northward, and probably tributary to a river which drained at least one of the great lakes, Ontario. And as the tributaries of Cayuga river seem to prove the rock-basin origin of Lake Cayuga, it is argued that the Cayuga river tributary to the Ontario stream indicates that Lake Ontario is also a rock-basin.

KIRCHHOFF'S law connecting the absorptive and emissive powers of substances has been tested for glass by G. B. Rizzo, who has communicated his results to the *Accademia di Torino*. Kirchhoff's law states that any substance absorbs those rays which it is capable of emitting at the same temperature, and that the emissive and absorptive powers are, under similar conditions, numerically proportional. The glass tested had been coloured blue by means of oxide of cobalt. It was heated to a red heat in a Bunsen flame, and placed in front of the slit of a spectroscope in which a bolometer was substituted for the telescope. The absorptive power was measured by comparing the intensity of the continuous spectrum given out by an Auer lamp with that of the absorption spectrum due to the glass, and the emissive power was determined by noting the effect of the spectrum of the hot glass alone upon the bolometer. The results show that while the emissive power decreases nearly uniformly between the wave-lengths 685 and 580, the absorptive power shows decided maxima in the red, yellow, and green, which show no relation whatever to the emissive power. It must therefore be concluded that Kirchhoff's law does not hold good for this and similar cases.

AT a recent meeting of the *Accademia dei Lincei*, Prof. Riccò drew attention to the difference of time between the seismometer records of Zante and Catania during the first four months of last year, and communicated some important conclusions regarding the mode of propagation of earthquake shocks between the two places. The distance between the stations is 515 km. (320 miles), and the difference in time between the four earthquake shocks originating at Zante ranged from 4 min. 20 sec. to 7 min. 30 sec., and gave a mean velocity of 1439 m. per second. This velocity, curiously enough, nearly coincides with the velocity of sound in water. This means that the shock was not propagated along the bottom of the Ionian Sea—in which case it would have travelled with a speed of something between 2000 and 4000 m. per second—but was transmitted by the water to Sicily. The circumstance that no shock was propagated through the ground, Prof. Riccò attributes to the probability that the ground to the east of the Etna district is discontinuous and much broken up.

IN a paper communicated to the R. Accademia delle Scienze dell'Istituto di Bologna, Prof. Augusto Righi gives a description of a very sensitive idiostatic electrometer which he has constructed. The essential part of the instrument consists of a thin aluminium disc about 9 c.m. in diameter, having a hole 1 c.m. in diameter at the centre, and also two sector-shaped windows. A light aluminium needle, of the usual shape employed in quadrant electrometers, is suspended above this disc by a bifilar suspension, and carries a thin platinum wire which dips into a vessel containing sulphuric acid. Two metal discs, pierced with central holes, are placed one above the needle, and the other below the disc with the windows. These two discs are generally placed in metallic connection with the conducting case which surrounds the instrument, and they form one plate of a con-

denser, the other consisting of the middle disc and the needle. If a difference of potential exists between these two systems of conductors, then the needle will be deflected, the deflection being approximately proportional to the square of the difference of potential. The sensitiveness of the instrument can be varied by altering the distance between the upper and lower discs and the middle one, or by placing the lower disc in metallic communication with the needle and middle disc, instead of having it connected with the upper disc. With a scale at a distance of five metres a deflection of one millimetre corresponds to 0·14 volts. On account of the deflection being proportional to the square of the difference of potential the sensitiveness increases with the deflection, so that when the instrument is employed in measuring a difference of potential of three volts, one millimetre of the scale corresponds to a change of potential of 0·0033 volts.

IN No. 7 of the pamphlets which the Physical Laboratory of the University of Leyden is issuing under the direction of Prof. Kamerlingh Onnes, there is an interesting paper by Dr. L. H. Siertsema on the magnetic rotatory dispersion of oxygen. In most substances the magnetic rotatory dispersion approximately, at any rate, follows the law that governs natural rotation, viz. that the rotation varies inversely as the square of the wave-length. In strongly magnetic bodies, such as solutions of iron salts, the dispersion is much greater; according to Becquerel the rotation being proportional to the fourth power of the wave-length. Oxygen seems to be an exception, for while Becquerel thought he obtained a small dispersion, more recently Kundt and Röntgen obtained no dispersion. The arrangement of the apparatus employed by the author resembles that used by Kundt and Röntgen. The gas under high pressure is enclosed with a polariser and analyser in a long tube, and the rotation is obtained by fixing one end of the tube and turning the other, so that torsion is given to the tube. The tube lies in a long magnetising coil containing 3600 turns, and through which a current of 70 amperes is passed. Some preliminary experiments, made with commercial oxygen at a pressure of about 100 atmospheres, have shown that, contrary to the result given by Becquerel, Verdet's constant for oxygen decreases regularly with increasing wave-lengths, and that for violet it is twice as large as for red.

AT a recent meeting of the Kaiserliche Akademie der Wissenschaften of Vienna, Prof. Klemencic read a paper on the magnetisation of iron and nickel wires by rapid electrical oscillations. From the amount of heat developed in a wire of a magnetic material traversed by electrical oscillations the author calculates, by means of the formula given by Lord Rayleigh and Stefen, the value of μ (the permeability). The heat developed in the wire under observation was determined by means of a thermoelectric couple, and was compared with the heat developed in a non-magnetic wire under similar circumstances. The following are some of the values obtained for μ:—Soft iron 118; steel wire, soft 106, hard 115; Bessemer steel, soft 77, hard 74; nickel 27. These values agree very well with those obtained by Lord Rayleigh and Bauer for very feeble magnetising forces. The results obtained by these observers show that for certain values of the magnetising force the permeability is constant, and that it afterwards rapidly increases. Now the results obtained by the author show that over the range he is employing μ has a constant value. This fact may be explained either by supposing that the magnetising forces employed are so small that we are dealing with that part of the curve where μ is constant, or that, although the magnetising forces are much greater than those to which the former supposition limits us, the magnetisation is unable to follow the rapid changes in the magnetising force, so that the magnetisation never reaches that part of the curve where μ is variable and has very much greater values. A rough estimation has shown that, at least on the surface of the wire and at the commencement of the oscillations, the magnetising force exceeds more than a hundredfold the maximum limit within which μ is constant. Thus in these experiments there must exist a time lag in the magnetisation which must not be confused with the hysteresis. It would also appear that Bauer and Lord Rayleigh's results which refer to longitudinal magnetisation, also apply to circular magnetisation.

THAT it is easy to find microbes in the soil capable of assimilating atmospheric nitrogen, if culture media devoid of all combined nitrogen are employed, was pointed out by M. Winogradsky last summer, and in a recent number of the *Comptes Rendus* an account is given of important progress made by him in this most interesting subject. By progressive cultivation of a mixture of microbes derived from soil, in a nutritive liquid from which all traces of combined nitrogen were carefully excluded, Winogradsky reduced the varieties present to three bacilli, of which one was finally separated out and discovered to be endowed with this function of assimilating atmospheric nitrogen. This organism is strictly anaërobic, and will not grow in either broth or gelatine. It ferments glucose, producing butyric, acetic, and carbonic acid, and hydrogen. The amount of atmospheric nitrogen assimilated is proportional to the quantity of glucose contained in the culture material, and which undergoes decomposition in the presence of this bacillus. Winogradsky concludes his paper by suggesting that this phenomenon of the fixation of atmospheric nitrogen may be due to the union within the living protoplasm of the microbial cell, of atmospheric nitrogen and nascent hydrogen, resulting in the synthesis of ammonia.

A CATALOGUE of second-hand books, including many rare and scarce volumes on scientific matters, has been issued by Messrs. E. George and Son, Booksellers, Whitechapel Road.

A REPORT upon the work of the City and Guilds of London Institute during 1893 has just been issued, and it affords satisfactory evidence of the advance of technical education, both in London and the provinces. A fact well worth recording is that the Salters' Company have recently offered to found, in connection with the Institute, a studentship or fellowship of the annual value of £150, to be awarded for the encouragement of higher research in chemistry in its relation to manufactures. A scheme of regulations for the award and tenure of this studentship is being drawn up, and the Council of the Institute hope that the action of the Company may result in increased cultivation of original research, and a consequent important advance in the application of chemistry to manufacturing industries. The report shows that the withdrawal of payment on the results of examinations in technology at centres outside the metropolis has had little or no effect in diminishing the number of candidates presenting themselves. It is pointed out that this is partly due to the pecuniary assistance which County Councils are now able to give for the furtherance of technical education, and partly to the recognised value of the certificates granted by the Institute in connection with these examinations.

WE have received a copy of Luke Howard's treatise "On the Modifications of the Clouds" (London, 1803), which has been issued by Dr. G. Hellmann as No. 3 of the reprints of important and rare works relating to meteorology and terrestrial magnetism. The first edition of this work is very scarce. The paper was first presented to the Askesian Society in the winter of 1802–3, and printed in vols. xvi. and xvii. of the *Philosophical Magazine*. It was the first successful attempt at cloud nomenclature, and up to the present time has formed the

basis of all classifications. Many attempts of improving it have from time to time been made, but the problem of obtaining a more perfect nomenclature still remains, to a great extent, unsolved. When such an accomplished bibliographer as Dr. Hellmann undertakes the reproduction of a work, we may be sure that he will tell us all that can be known about it, and few persons can read his introductory remarks without learning something. Comparatively few copies appear to have been reprinted from the *Philosophical Magazine*, and Dr. Hellmann points out that the first part of the text was set up afresh, as some of the lines do not exactly agree ; also, that some small omissions were made in the separate copies of 1803 which have been added to this new edition. In 1832 a second edition was issued without plates; but in 1849 L. Howard appears to have drawn a new set of cloud pictures, and these, although not considered to be equal to the first, were included in the third edition, published in 1865. Many other details of great interest are given by Dr. Hellmann, to which we cannot now refer. We may mention that the plates only are actual *facsimiles*, while the type of the text is as nearly as possible like that of the original work.

THE additions to the Zoological Society's Gardens during the past week include a Slow Loris (*Nycticebus tardigradus*) from Malacca, presented by Captain Spalding ; two Sooty Mangabeys (*Cercocebus fuliginosus*, ♀ ♀), an African Civet Cat (*Viverra civetta*), two Royal Pythons (*Python regius*) from West Africa, presented by the Rev. Canon J. Taylor Smith ; two Crested Porcupines (*Hystrix cristata*) from South Africa, presented by Mr. Adrian Vander Byl ; a Water Vole (*Arvicola amphibius*) British, presented by Colonel L'Estrange ; a Buzzard *Buteo vulgaris*) British, presented by Colonel C. B. Rashleigh ; a Raven (*Corvus corax*) British, presented by Miss P. L. Graham ; two Pin-tailed Sand Grouse (*Pterocles alchata*, ♂ ♀) South European, a Black Gallinule (*Limnocorax niger*) from East Africa, two —— Moorhens (*Gallinula* sp. inc.) from Madagascar, presented by Mr. H. H. Sharland ; four Swainson's Francolins (*Francolinus swainsoni*), a Delalande's Lizard (*Nucras delalandii*), a Rough-keeled Snake (*Dasypeltis scabra*) from South Africa, presented by Mr. J. E. Matcham ; a Chimpanzee (*Anthropopithecus troglodytes*, ♂) from West Africa, a Lioness (*Felis leo*) from India, deposited ; a Chimpanzee (*Anthropopithecus troglodytes*, ♀) from West Africa, a White-backed Trumpeter (*Psophia leucoptera*), a Short-tailed Parrot (*Pachynus brachyurus*) from the Upper Amazons, a Blackish Sternothere (*Sternothærus subniger*) from Madagascar, purchased ; two Barbary Wild Sheep (*Ovis tragelaphus*, ♀ ♀) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

FOUR NEW VARIABLE STARS.—Prof. E. C. Pickering announces (*Astr. Nach.* 3225) that four new variable stars have been discovered by Mrs. Fleming from the presence of bright hydrogen lines in photographs of their spectra taken in connection with the Henry Draper Memorial. The first of these is a star in the constellation Sculptor, having the co-ordinates R.A. oh. 10·4m. Decl. – 32° 36′. The range of variability of this star is from magnitude 6·5 or 6·6 to 10·0, and the period 366 days. The second star is Arg.Oeltz 16121, in Scorpius, its exact position being R.A. 16h. 50·3m. Decl. – 30° 26′. The range of variability is from 7·3 to 11·6 magnitude, and the period is 278 days. The star B.D. + 1°·3417, in the constellation Ophiuchus (R.A. 17h. 14·5m. Decl. + 1° 37′) is the third of the variables discovered, the range in this case being from magnitude 8·5 to 12·5, and the period 348·4 days. The fourth star is B.D. + 4°·4250, in the constellation Aquila (R.A. 19h. 46·5m. Decl. + 4° 13′). Its period is about a year, and at the last maximum on August 12, 1893, its photographic magnitude was 9·5. At a minimum it becomes fainter than the twelfth magnitude.

SPEED OF PERCEPTION OF STARS.—When working at the Etna Observatory during a high wind, Prof. Riccò noticed how the pole star and its companion appeared to change their mutual distance at every vibration of the telescope. The phenomenon was not observed on the following night, which was calm, but could be reproduced by shaking the telescope. The pole star appeared in every case to move more rapidly than its companion. This observation has been communicated to the *Società degli Spettroscopisti Italiani*, and connected with Prof. Schaeberle's investigation of the difference of personal equation between bright and faint stars observed in transit. Schaeberle estimated the apparent retardation of faint stars at 0·02 sec. per magnitude. Prof. Riccò proposes to redetermine this by measurements of stellar distances by the micrometer as compared with the transit instrument. That the colour may have a determining influence is shown by the fact that when a spectrum is displaced rapidly at right angles to its length, the more refrangible portions appear to lag behind.

ELEMENTS AND EPHEMERIS OF GALE'S COMET (*b* 1894).—The following elements and ephemeris are given in a supplement to *Astronomische Nachrichten*, No. 3225 :—

T = 1894 April 13·75 G.M.T.

$\omega = 324^\circ\ 19'$
$\Omega = 206^\circ\ 15'$ } Mean Eq. 1894·0.
$i = 87^\circ\ 15'$
$q = 0{\cdot}9849$

Ephemeris for Greenwich Midnight.

1894.	R.A.	P.D.
April 26 ...	101° 38′ ...	124° 23′
30 ...	115 22 ...	109 31

The comet is increasing in brightness, and on April 30 it will be 6·05 times brighter than at the time of discovery.

A MISTAKEN COMETARY DISCOVERY.—From a note by Prof. Krueger in *Astronomische Nachrichten*, No. 3224, it appears that the object seen by Mr. Holmes on April 9, and afterwards announced as a new comet, is really the nebula No. 6503 in the New General Catalogue.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE meeting of the Institution of Mechanical Engineers was held last week in the theatre of the Institution of Civil Engineers, on Thursday and Friday evenings, April 19 and 20. The chair was taken by the President, Prof. Alexander B. W. Kennedy, F.R.S. Two papers were read at the meeting : the first, "On the Grafton High Speed Engine," by Mr. E. W. Anderson ; and the second, "On Fluid Pressure Reversing Gear," by Mr. David Joy. The President's address was, however, the chief feature of the meeting, and to this we shall mainly confine our report, more especially as it would be difficult to give an adequate description of the mechanical devices upon which the two papers were founded without somewhat elaborate illustrations.

After the usual formal proceedings, Prof. Kennedy read his address. It had been expected that in consequence of the leading part the President has recently taken in the development of electrical engineering that the address would deal largely with that subject, and in this respect the result proved to be in accordance with general expectation. The address pointed out that practical electrical problems divided themselves into three main sections, in which electrical energy is used, respectively : firstly, for lighting; secondly, for power; and thirdly, for physico-chemical processes. The third section, which relates to the deposition of metals, the reduction of chemical compounds, &c., was one in which the President had not had experience, but he had no doubt that there was a great future before it. In this section he also included the application of electricity to heating, and said it was to be hoped that there being so many competent workers engaged in the study of this subject, success would soon attend their efforts. The commercial problem of producing the heat sufficiently cheaply to allow of its general use was yet to be overcome. Remembering, however, that something like 95 per cent. of all the energy that goes to incandescent lamps appears only as heat and not as light, there would seem to be an ample opening here for another "thermal storage"