outweigh 4 to 1 its injurious ones. Instead of being persecuted the bird should, therefore, receive protection.

CORNWALL is to be congratulated upon the success of the efforts its Technical Instruction Committee are making for the benefit of fishermen, through Mr. J. T. Cunningham, the County lecturer on fishery subjects. The report of the executive committee for fisheries for the year 1897-98, is almost entirely devoted to a valuable statement by Mr. Cunningham on records of sea fishing and sea temperature, experiments on oyster culture and lobster rearing, fish and net curing, and other matters concerning the science and handicraft of sea fisheries. Among the interesting items referred to in his report, is the fact that at the beginning of every season male crabs are always more numerous in the pots than females. Their number increases gradually till May or June, when it gradually diminishes; while the number of females taken does not reach its maximum till June or July, and then they are twice as numerous as the males, and they usually continue to be more abundant than the males until the end of the season. On the other hand, practically the same number of male lobsters are caught as female. The observations of surface temperature, made in connection with these fisheries, are of great service in indicating the influence of temperature upon the number of fish taken in various months. With regard to lobster rearing, Mr. Cunningham reports that important and gratifying success has been obtained, and much precise knowledge has been gained concerning the particular details of treatment on which the life and death of the larvae depend. His observations have convinced him that the opinion that swimming lobster larvae in the sea capture and feed upon other swimming creatures, especially other small swimming crustaceans, is wrong. He holds that lobster larvae are, like the adults, carrion feeders, and are not in the habit of pursuing or capturing live food at all.

MESSRS. DUCKWORTH announce for publication "A Glossary of Botanical Terms," by Mr. B. Daydon Jackson; and a "Text-book of Agricultural Botany," by Mr. J. Percival.

MESSRS. J. M. DENT AND CO. announce that after the December number *Natural Science* will be published by Mr. Young J. Pentland, of Edinburgh, who has acquired all future rights.

MESSRS. W. WESLEY AND SON have just issued a new Catalogue (No. 132 of their Natural History and Scientific Book Circular), giving a descriptive and classified list of 1500 books and pamphlets on the natural history of Great Britain and Ireland. The arrangement of works under the names of the English counties, Wales, Scotland and Ireland, will be of service to collectors of local fauna and flora.

THE following new editions of works already reviewed in NATURE have been received:—The third edition of Prof. Grenville Cole's "Aids in Practical Geology" (London: Charles Griffin and Co.) The work has been completely revised and enlarged; many additions of practical service to the geologist have been made, and all important factors of geological progress since 1893, when the second edition appeared, have been taken into consideration.—Messrs. Slingo and Brookes's well-known volume on "Electrical Engineering for Electric Light Artisans and Students" has been published in a revised and enlarged edition by Messrs. Longmans, Green, and Co. The work now occupies 780 pages, and it provides students with sound information concerning direct and simple alternating currents, the machinery and apparatus connected therewith, and their most important applications.—The tenth edition of Mr. C. Haughton Gill's "Chemistry for Schools" (Edward Stanford) has been published. Dr. D. Hamilton Jackson is responsible for the revision of the book and the additions made to bring it into line with the new regulations in chemistry for the London University Matriculation Examination.—The second edition, revised and enlarged, of Dr. Lassar-Cohn's "Chemistry in Daily Life," translated by Mr. M. M. Pattison Muir, has been published by Messrs. H. Grevel and Co.

THE additions to the Zoological Society's Gardens during the past week include two Pumas (*Felis concolor*, ♂ ♀) from the Argentine Republic, presented by Mr. Ernest Gibson; a Hamster (*Cricetus frumentarius*), European, two Bennett's Wallabies (*Macropus bennetti*) from Tasmania, a Gentoo Penguin (*Pygosceles taeniatus*) from the Falkland Islands, a Gold Pheasant (*Thaumalea picta*, ♀) from China, two Elephantine Tortoises (*Testudo elephantina*) from the Aldabra Islands, deposited; two Japanese Deer (*Cervus sika*, ♂ ♂) from Japan, received in exchange; an Axis Deer (*Cervus axis*, ♀), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE LEONIDS.—Unfortunately for observers in the neighbourhood of London, a fog more or less continuously hung over their heads on the nights of Sunday, Monday and Tuesday, and rendered observations of the expected meteor shower impossible. Observers at the Solar Physics Observatory, South Kensington, were only able to observe two or three meteors during these nights. One of special brilliance, on the night of Monday, at 10.48 G.M.T., shot across the sky from east to west, its paths extending at least 45 degrees. This was undoubtedly a fine Leonid; but its path could not be traced, as fog and cloud hid the stars from view.

Mr. R. H. Scott informs us that the meteorological reporter at Jersey (Mr. Fisher, at St. Aubin's) has reported to the Meteorological Office that a meteor shower was observed there at 10 p.m. on Monday.

From a New York telegram, published in one of the daily papers, we gather that the shower was observed in America on the night of the 14th, but it did not attain the expected brilliancy. Prof. Young is said to describe the shower observed as faint, while at the Lick Observatory the meteors were said to be small and not marked by extraordinary brilliancy.

A GLOBE FOR METEOR OBSERVERS.—Every observer, who has plotted the trails of meteors on star charts, knows that errors of projection arise which are due to the difficulty of plotting accurately the whole length of the trail. If the points of beginning and end of the visible trail be mentally noted and marked off on a star chart, then the line joining these two points does not represent the actual trail of the meteor, in consequence of the fact that the path in the heavens is on a sphere, and that on the chart is on a plane. To avoid such discrepancies it is always better to use a celestial globe, when this difficulty is eliminated. The ordinary celestial globe is, however, not well adapted for recording meteor observations, as it must be illuminated from the outside by a lamp, as the observer is in the open air.

A globe arranged especially for use when such observations are being made, recently invented by M. Pietro Maffi, is described in the French journal *Cosmos*, and should be found very serviceable. It consists of a glass hollow sphere mounted on two vertical supports, and capable of adjustment as regards latitude. The outer surface is marked with the brighter stars of each constellation and the Milky Way, and there is also means of obtaining directly the right ascension and declination of any point on the globe. The inside contains two small electric lamps in connection with accumulators in the stand, so that the whole surface of the sphere with the constellations may be seen clearly. Directly a meteor is seen its path can be plotted, and when note is taken of its exact position a wet sponge is all that is necessary to erase it.

The globe and stand, as it appears in the illustration accompanying the article, seems rather elaborate; but there is apparently no reason why a more simple and cheaper form should not be made, for its use then would be more widely distributed.

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EPHEMERIDES OF COMETS AND PLANETS.—Many readers of this column will be very glad to know that from the beginning of next year it will not be necessary to turn up back numbers of the *Astr. Nach.* to find the ephemerides of comets and planets for observational purposes. Prof. H. Kreutz tells us (*Astr. Nach.*, No. 3527) that he has been asked from several sides to supply this information separately; that is, in addition to that published in the numbers of that journal, and he has made the following arrangements. Those who are subscribers to that journal may, by paying an additional sum of ten marks yearly, obtain such information, provided that notice of such requirement is given directly, and applications are sufficient in number to indicate a decided want in this respect. We hope that many of our readers will think fit to take advantage of this very useful change.

We may mention that it would be a good opportunity for keeping to one system of publication, and that the Right Ascensions, for instance, might always be given in time, and not in degrees, as is often the case.

THE NEBULOUS REGION ROUND 37 CYGNI.—Although there may be countless nebulae in the heavens symmetrical in form, there are others which seem to have absolutely no sense of regularity. Such a nebulous region is that comprised between 20h. 51m. 24s. and 21h. 0m. 43s. in Right Ascension, and in Declination between +42° 56′·5 and +44° 51′ (epoch 1900). An excellent reproduction of the greater part of this region appears in *Knowledge* for November, and is taken from a fine negative obtained by Dr. Isaac Roberts in October 1896. A careful study of the photographic appearance of this large cosmical mass shows, as Dr. Roberts remarks, several indications of fission, as well as evidence of *loci* of vortical disturbance in different regions; but, for the main part, irregularity is the striking feature. In his description of this nebulous region, Dr. Roberts brings up the question of the connection between the stars apparently immersed in the nebulous mass and the nebula itself. In regular, such as spiral, nebulae, Dr. Roberts had previously come to the conclusion that many of the stars immersed are not stars, as we are generally acquainted with, but star-like condensations, the result of condensations in the nebula itself. In the irregular nebula in question, in which the whole surface area of this cloud of nebulosity is covered with stars, ranging from the ninth to the seventeenth magnitude, very few of the stars can be pronounced "as being actually involved in, and forming part of, the nebulosity." Dr. Roberts' evidence for assuming that those what he terms "apparently finished stars" are between us and the nebulosity is, in his own words, as follows:—"If the stars were beyond the nebulosity their photo-discs would on the negative appear less bright, and their margins be more or less nebulous; whereas only those stars which appear involved in the nebulosity present these appearances. Of course, it is a fair subject for argument that those nebulous stars which appear to be involved in the nebulosity are not so in reality, but seem thus because they are beyond it in our line of sight. But this argument is much weakened, if not entirely destroyed, when we find on examination of the negative that those faint, star-like condensations are not only nebulous themselves, but they follow the curvatures found in various parts of the nebulosity; thus we are driven to infer that the stars are the nearer bodies to us, and that the nebulosity lies beyond the stars."

WOLSINGHAM OBSERVATORY CIRCULAR, No. 48.—Mr. T. E. Espin in this circular informs us that a star, magnitude 8·4, Type IV., not in B.D. was found on November 13 in Right Ascension 4h. 19m. 49s., Declination + 39° 32′ (55). The star in the Andromeda Nebula was seen on November 10, closely following the nucleus. The one found in 1886 was preceding.

THE EXTRACTION OF NICKEL FROM ITS ORES BY THE MOND PROCESS.[1]

THE Mond process marked an entirely new departure in metallurgical practice and in the principles which had hitherto guided it. It depended on the remarkable property possessed by nickel of forming a volatile compound with carbon-monoxide, from which metallic nickel might be released if the gaseous compound was heated to 180° C.

The methods hitherto employed for extracting the metal from its ores involved concentrating the nickel either as a sulphide (matte or regulus), or as arsenide (speise), followed by either dry or wet treatment; and the metal had to be refined, mainly with a view to separate it from associated carbon.

In 1889 Dr. Ludwig Mond, in collaboration with Dr. Carl Langer, had been engaged upon a method for eliminating the carbon-monoxide from gases containing hydrogen. They had been guided by the observation that finely-divided nickel removed carbon from carbon-monoxide at a temperature of 350° C., converting it into carbon-dioxide, whereas the dissociation of carbon-monoxide by heat alone, according to Victor Meyer and Carl Langer, remained incomplete at the high temperature of 1690° C. The experiments were carried out in conjunction with Dr. Friedrich Quincke; finely-divided nickel, formed by reducing nickel oxide at 350° C. by hydrogen, being treated with pure carbon-monoxide in a glass tube at varying temperatures. The gas escaping from the apparatus was ignited, and while the tube containing the nickel was cooling, the flame became luminous, and increased in luminosity as the temperature sank below 100° C. Metallic spots were deposited on a cold plate of porcelain held in this luminous flame, and on heating the tube through which the gas was escaping a metallic mirror was obtained, while the luminosity of the flame disappeared. These metallic deposits were found to be pure nickel. Nickel carbonyl was then isolated in a liquid state, and it was possible to produce it with facility in any desired quantity. It could be readily distilled without decomposition, but on being heated to 150° C., the vapour was completely dissociated, pure carbon-monoxide being obtained and the nickel being deposited in a dense metallic film upon the sides of the vessel.

No other metals which were submitted to investigation showed indications of combining directly with carbon-monoxide except iron. The discovery that in a mixture of metals only nickel and iron would form volatile compounds with carbon-monoxide, and that they could, therefore, be separated from the other metals, induced Dr. Mond to arrange experiments with ores containing nickel, cobalt, iron and copper, such as "kupfer-nickel" and "pyrrhotine." The experiments afforded such promising results that apparatus of considerable size, though still within the limits of the resources of a laboratory, was set up, and in it several pounds of ore could be treated with carbon-monoxide. The principal nickel ores which were metallurgically treated contained the nickel in combination with arsenic and sulphur, besides other metals and gangue. These ores had first to be submitted to calcination, in order that the nickel might be present in the form of oxide, and to drive off, as far as practicable, the arsenic, sulphur, and other volatile bodies. The resulting oxide of nickel was treated with reducing gases, such as water-gas or producer-gas, in order to convert the oxide of nickel into finely divided metallic nickel, and the material containing it was cooled to about 50° C., and was treated with carbon-monoxide.

In 1892 an experimental plant on a large scale had been erected at Smethwick, near Birminghan. The process began with "Bessemerised" matte; it ended with the market product, commercial nickel. The Bessemerised matte proceeded to the first operation of dead roasting, after which the matte contained 35 per cent. of nickel, 42 per cent. of copper, and about 2 per cent. of iron. It then passed to the second operation for the extraction of part of the copper (about two-fifths) by sulphuric acid, the copper being sold as crystallised sulphate of copper. The residue from this process contained about 51 per cent. of nickel, and it passed to the third operation for reducing the nickel. Incidentally, the remaining copper was reduced to the metallic state, care being taken to avoid reducing the iron. This was effected in a tower provided with shelves, over which mechanical rabbles passed, the reducing agent being the hydrogen contained in water-gas. The temperature did not exceed 300° C., and should be kept lower when much iron was present. From this tower the ore was conveyed continuously to the fourth operation of volatilisation, in which part of the nickel was taken off by carbon-monoxide and formed the compound nickel carbonyl. The formation of this volatile compound was effected in a tower similar to the reducing tower, but the temperature was much lower, and did not exceed 100° C. From the volatiliser, the ore was returned

[1] Abstract of paper read at the Institution of Civil Engineers, on November 8, by Prof. W. C. Roberts-Austen, C.B., F.R.S.

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