The Cambridge University Press has published a second edition, in two parts, of Mr. Smith's work. Evidently the book has met with the reception it deserves.

THE importance of experimental work is fully recognised in the agricultural department of the Glasgow and West of Scotland Technical College. We have before us the reports on experiments on the manuring of hay, oats, and turnips, conducted in 1893 on the Home Farm of Cleghorn Estate, near Lanark, and on about fifty other farms scattered all over the south-western counties of Scotland. Prof. R. P. Wright, who directed the experiments, must derive satisfaction from the useful conclusions to which they have led.

THE first part of Mr. J. W. Taylor's "Monograph of the Land and Fresh-water Molluscs of the British Isles," published by Messrs. Taylor Bros., Sovereign Street, Leeds, has just appeared. It would be difficult to speak too highly of the fine coloured plate which forms the frontispiece to the part, or of the 138 well-drawn illustrations in the text. These figures will be recognised by all conchologists as faithful representations of the species they personify. The work is readable, concise, and accurate, so far as it has been published, and the scientific naturalist, as well as the systematic student, will find it useful and interesting.

MR. R. L. JACK, the Government Geologist of Queensland, has issued his report of the progress of the geological survey for last year. We learn from it that the most important work of the year was the production of a geological map of the Charters Towers gold field. The first edition of this map was issued early in the present year, and Mr. Jack does not claim too much when he says that no important centre of mining industry in Australia has been so thoroughly mapped. The underground work has now been completed, and it is expected that a second edition, embodying this work, will shortly be published. With Mr. Jack's report we received a report, by Mr. W. H. Rands, on the Towalla and Marceba gold fields.

WITHIN the past few years the number of students and workers in glacial geology has greatly increased. The third edition of Prof. James Geikie's "Great Ice Age," just published by Mr. Edward Stanford, appeals therefore to a much larger class than when the previous issue appeared seventeen years ago. The work has been enlarged, and most of it has been rewritten. The mass of glacial literature that has accumulated during the last fifteen years or so, has rendered it possible for the author to treat the glacial, and interglacial, deposits of the continent much more fully than in the second edition. The phenomena of existing glacial action in Alpine and Arctic regions, and the glaciation of Scotland, have been revised in the light of recent work, and several rearrangements of matter have been made. An important addition consists of two chapters on the glacial phenomena of North America, by Prof. T. C. Chamberlin. All glacialists will welcome this authoritative account of the glacial accumulations of Canada and the United States. It increases the value of what has always been a valuable treatise.

THE additions to the Zoological Society's Gardens during the past week include a Barbary Ape (*Macacus inuus*), a Turtle Dove (*Turtur communis*), four Barbary Turtle Doves (*Turtur risorius*), four Barbary Partridges (*Caccabis petrosa*), a Crested Lark (*Alauda cristata*) from Morocco, presented by Mr. Alfred J. Gosling; a Caracal (*Felis caracal*), from South Africa, presented by Mr. J. E. Matcham; a Brown Capuchin (*Cebus fatuellus*) from Guiana, presented by Mr. T. A. Jenkins; a Common Buzzard (*Buteo vulgaris*) from Aden, presented by Captain R. Workman; a Lanner Falcon (*Falco lanarius*), captured at sea, presented by Mr. Arthur J. Elliott; a Hawks-billed Turtle (*Chelone imbricata*) from the East Indies, presented by Captain E. F. Tyacke; two Long-nosed Crocodiles (*Crocodilus cataphractes*) from West Africa, presented by Mr. J. Banks Elliott, three Rusa Deer (*Cervus hippelaphus*, ♂ ♀ ♀) from Mauritius, presented by Rear-Admiral Kennedy; two Somali Ostriches (*Struthio molybdophanes*) from Somaliland, purchased; four Plumed Ground Doves (*Geophaps plumifera*) from Australia, received in exchange.

OUR ASTRONOMICAL COLUMN.

THE SPECTRUM OF δ CEPHEI.—M. A. Belopolsky has taken a number of photographs of the spectrum of δ Cephei—a variable of short period—and determined from them the velocity of the star in the line of sight. The results obtained showed a periodic variation, and M. Belopolsky used them to find the elements of the star's orbit, in the manner described by Dr. Lehmann-Filhés in the *Astronomische Nachrichten*, No. 3242 (see NATURE, August 2, p. 327). He finds that the eccentricity of the orbit is 0·46; and the apparent semi-major axis 180,000 geographical miles (207,000 English miles). The period of the star is 5d. 9h. The maximum velocity of approach is about 2·8 statute miles per second, and of recession 3·2 miles per second. The system, as a whole, is therefore moving away from our own system. It is found that the light-minimum occurs one day before the time of periastron passage given by the computed elements of the orbit.

THE ROTATION OF VENUS.—For eight years M. Flammarion has carried on observations of the polar caps of Venus, and, in the current *Comptes-rendus*, he discusses the bearing of his results upon the question of the planet's period of rotation. It will be remembered that Schiaparelli concluded in 1890 that the rotation and revolution periods of Venus were of the same length, viz. 225 days; but later observations by Trouvelot and others have led many astronomers to doubt this interpretation, and to believe that the rotation period of the planet is not very different from that of the earth. M. Flammarion remarks that if it is conceded that the polar caps are really due to snow or ice, their very existence is against Schiaparelli's view. As the two caps are often visible at the same time, it appears that the axis of Venus is but slightly inclined to the orbit. M. Flammarion's observations of markings on the planet are not sufficient to determine the period of rotation, but they appear to indicate that it is not far removed from twenty-four hours.

THE LOWE OBSERVATORY.—A few particulars with regard to the new astronomical observatory, which has lately been erected in Southern California by Prof. T. S. C. Lowe, are given in Saturday's *Times*. The observatory is seven miles by rail north of Pasadena, and sixteen miles north-east of Los Angeles. Its altitude is about 3600 feet above the sea, and 2000 feet above the hill at the base of the mountains, which are very steep at this point. While the crest of the range rises high above the observatory and shelters it on the north, leaving, however, the North Star visible, the entire southern horizon is unobstructed, extending to the rim of a large segment of the Pacific Ocean, about 100 miles distant, on the south and west. Astronomically, it is nearly at the intersection of the 34th parallel of north latitude with the 118th meridian of longitude west of Greenwich. The new observatory is well equipped with the great 16-inch Clark reflector and other instruments which have done no able work in the Warner Observatory at Rochester under the directorship of Dr. Lewis Swift, who will now superintend the Lowe Observatory.

THE MEAN PARALLAX OF STARS.—In the *Astronomische Nachrichten*, No. 3258, Prof. Hugo Gyldén gives the results of his attempts to discover a formula connecting the parallax of a star with its magnitude and its apparent motion. The fifty-six stars which have had their parallaxes determined with a satisfactory degree of accuracy were arranged in groups according to their magnitude and according to their apparent motion. After a lengthy series of tentative formulæ, the observed values were connected within about ten per cent. by the following formula,

$$P = 0''\cdot204\, e^{-0\cdot2138m\,\Psi_m}$$

where $\Psi_m = 2 - \left(\frac{1}{e}\right)^{\frac{m}{10}}$ m is the magnitude, and P the parallax of stars exhibiting no proper motion. For stars with proper motion a term p^1 has to be added to P, the value of which tends to 0″·48 as the magnitude, and the proper motion increases. So long ago as 1872, Prof. Gyldén showed that it is justifiable to deduce the distance of a group of stars from their apparent mean brightness in all cases where the probability of a certain intensity of illuminating power is a function of this intensity alone, without depending upon position in space. And since the photometric law has been proved to be at least approximately valid in this case, it may be concluded that the brightnesses of stars reduced to the same distance are the same, on an average, for all distances which can enter into our consideration. But the most important result of the present investigation is the determination of the mean parallax of first magnitude stars reduced to the zero of apparent motion. The value for this, which is 0″·204, may be considered as identical with Peters's value of 0″·209, especially when it is borne in mind that the latter value is not reduced to zero apparent motion.

THE INSTITUTION OF MECHANICAL ENGINEERS.

ON Wednesday and Thursday evenings of last week, October 24 and 25, a general meeting of the Institution of Mechanical Engineers was held at 25 Great George Street; the President, Prof. Alexander B. W. Kennedy, occupying the chair. The two following papers were read and discussed:

"The Manufacture of Standard Screws for Machine-made Watches," by Mr. Charles J. Hewitt, of Prescot.

"Drilling Machines for Cylindrical Boiler Shells," by Mr. Samuel Dixon, of Manchester.

Mr. Hewitt's paper was of an interesting nature. He is the works manager and chief mechanic of the Lancashire Watch Factory, an establishment recently started at Prescot for the manufacture of watches on a large scale in one works. The factory system of watch production has been, as is well known, carried to a very successful issue in the United States, where the Elgin and Waltham Watch Companies annually make large numbers of excellent time-pieces wholly by machinery. As, in all cases, where highly skilled hand labour, performing intricate operations, is superseded by mechanical appliances, the machines used are of a highly organised and costly nature. In the case of the minute parts required in watch-making, this feature is very strikingly emphasised. Perhaps some of our readers may remember the exquisite little machine tools exhibited by the Waltham Watch Company, at the Inventions Exhibition, in the year 1885. These were a revelation to most English watchmakers, accustomed to the small factories and perfectly rude appliances of the British industry, in which the highest skill of the operators, due to special training from earliest youth, compensated for the lack of ingenuity displayed in the construction of the tools used. In the case of watches, as with so many other mechanical productions, the brain capital expended in the employment of construction of machines bears fruitful interest in the shape of less skilled labour required in their use. The same thing may be observed throughout the whole range of mechanical industry. The file, the hammer, and chisel are the primitive tools of the engineer, requiring simple inventive power in their inception, but great skill in their use. The planing machine, by which the same end is obtained mechanically, of producing a flat surface, as was got originally by chipping and filing, required knowledge and skill for its production, but a comparatively small amount of those qualities for its operation. The same thing is true, even to a greater extent, in the case of the still more modern machine tool, the milling machine, which is often attended by boys, possessing no mechanical knowledge whatever, during its production of finished forms such as would have required a highly skilled workman in former days.

The beautiful machines referred to by the author in his paper, examples of which were shown at the meetings, carry the same principle many steps farther. As was remarked, the machine shown for making watch-screws may be said to stand in the same relation to ordinary engineers' machine tools as costly gems to common building stones.

Mr. Hewitt commenced his description by dwelling upon the difficulties experienced by watchmakers in old times, when there was no general standard for dimensions and pitch of screws, or form of thread. Such was necessarily the case with hand-work, but a machine can be depended upon to turn out many thousands of parts exactly similar, so that a screw could be put into a watch made years previously. The advantage, naturally, is most apparent in the case of repairs and renewals. The standard of screws adopted by the Lancashire Watch Company at their Prescot Works, is that recommended by the committee of the British Association, and described in the report of 1882. It is a V-thread of $47\frac{1}{2}$ degrees, rounded top and bottom through $\frac{2}{11}$ of the height, and the pitch is directly related to the diameter of the formula $D = 6P^{\frac{6}{5}}$. In arranging the standard the first business was to make master taps, which were produced on a small screw-cutting lathe specially designed for the work, and having a corrected screw, accurate within very close limits. Taps being thus produced, screw-dies were made to the exact standard. When cut the thread requires hardening, and this causes some amount of distortion, which is corrected by grinding the threads with a soft steel lap charged with diamond dust, the operation being performed in the same lathe that cuts the thread. The die used is simply a tapped hole in the centre of a small thin disc of steel, it being an object to have as little metal as possible surrounding the hole, so as to reduce the distortion produced by hardening. Although the die is not split, the pressure exerted by the die-holder is sufficient to produce a slight modification in the diameter of the screw, and in this way the alteration caused by hardening is corrected. During the discussion this fact was questioned, but Mr. Hewitt says that the statement is absolutely correct. The machine itself is of an intricate design, as may be imagined when it is stated that perfect screws are turned out automatically from the plain rod or wire. There are four hollow spindles through which this wire is fed forward to the operating tools, which are four in number, and are carried on a revolving turret. There is also a further tool for making the slit in the screw-head for the turn-screw. It would be useless to attempt to describe the mechanism of this very ingenious lathe without the aid of elaborate drawings. Indeed, during the discussion several engineers, well skilled in mechanical appliances, confessed themselves unable to follow the train of mechanism, even with the aid of working drawings displayed on the walls of the theatre. It is enough to say that the machine will go on without any attention so long as the wire to form the screw lasts, when it stops of itself.

A short discussion followed the reading of the paper, but no fresh points were raised; the speakers, for the most part, contenting themselves with complimenting the author on the ingenuity of his design.

On the second evening of the meeting, Mr. Dixon's paper, on drilling machines for boiler shells, was read and discussed. The introduction of steel as a material for steam-boiler construction opened up a new era in that branch of industry. When iron plates only were used, a first-class boiler-shop possessed, as the chief part of its plant, simply a punching machine and a pair of rolls for bending the plates; the rest was done by handwork, and that of a highly skilled nature. Now that machinery has superseded the handicraftsman, rivetting is done by most costly and beautifully designed hydraulic apparatus, necessitating in its invention a knowledge of applied science of a high order. Flanging of the immense boiler-plates of the present day is also effected by heavy hydraulic presses. The rolls now used for bending plates have to be designed on true mechanical principles, whilst great advance has been made in drilling machinery. Thus both in the enormous boilers of our large steamships and in the diminutive mechanism of watches, we see the skilled handicraftsman being displaced by automatic machinery. It was soon found impossible to make steel boilers with the same plant that was used for the old type of iron boilers; the difference in the physical properties of the material alone demanded a change in treatment. The softer and less homogeneous iron enabled the rivet-holes to be punched, but it was found that this work done upon steel plates caused a deterioration of the metal; drilling, therefore, had to be substituted for punching. Iron plates were punched in the flat; but it was found that with steel when the holes were made in that way, they often would not go together accurately so as to take the rivets to the greatest advantage, the result being a weak joint. This did not matter so much when steam pressures were low, but with the greater demands made by the marine engineer in producing motive power economically, higher pressures had to be used, and there was no margin for loss in the line of rivetting. It therefore became customary to bend the plates and put them into shape to form the shell of the