ALTHOUGH but a short time has elapsed since the discovery of the elements radium and polonium by M. and Mme. Curie, a considerable amount of work has already been done upon the properties of the rays emitted by these substances. M. Henri Becquerel has already shown that there is a fundamental difference between the rays emitted by polonium and radium, in so far as a portion of the radium rays are deviated by a magnet. In the current number of the *Comptes rendus* is a further contribution by M. Becquerel on this same subject, in which, after showing that the deviation is the same in air and *in vacuo*, by an ingenious arrangement it is shown that the rays given off by different preparations are similar in nature, differing only in intensity. The salts were placed in small leaden cups upon a sensitised plate wrapped in black paper, and isolated from each other by screens, no effect being produced upon the plate until the magnetic field was excited. In a strong field the radiation is bent down on to the plate, which, when developed, showed that the deviations were equal, although of different intensity.

THE exact value for the atomic weight of nitrogen, in spite of its importance, is still liable to some uncertainty. The mean value derived from the researches of Stas, Penny, Marignac, Pelouze and Hibbs, by methods exclusively chemical, is 14·034 (oxygen = 16); whilst the value calculated from the practically identical densities of Lord Rayleigh and Leduc is 14·006. The February number of the *Journal* of the Chemical Society contains further work on this subject by Mr. G. Dean. Silver cyanide was obtained in a state of great purity, and the ratio Ag : AgCN determined, from which the value 14·031 is deduced for the atomic weight of nitrogen, a number practically identical with the mean above quoted, 14·034. Further work is clearly necessary to explain this considerable discrepancy, nearly 0·2 per cent., between the results obtained by physical and chemical methods.

THE additions to the Zoological Society's Gardens during the past week include two Common Marmosets (*Hapale jacchus*) from South-east Brazil, presented by Mrs. Nigel Cohen; a Black-eared Marmoset (*Hapale penicillata*) from South-east Brazil, presented by Mr. Hamilton Coffey; a Rhesus Monkey (*Macacus rhesus*) from India, presented by Dr. R. Cox; a Small Hill-Mynah (*Gracula religiosa*) from Southern India, presented by Mr. W. Brindley; two Dwarf Chameleons (*Chamaeleon pumilus*) from South Africa, presented by Mr. H. Way; a Lesser White-nosed Monkey (*Cercopithecus petaurista*, ♂) from West Africa, an American Bison (*Bison americanus*, ♂) from North America, two Great Anteaters (*Myrmecophaga jubata*, ♂ ♀), a Blue-fronted Amazon (*Chrysotis aestiva*) from South America, deposited; a Hog Deer (*Cervus porcinus*, ♂) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

COMET GIACOBINI (1900*a*).—A telegram, received February 3, from the Centralstelle at Kiel, announces the observation of this comet by M. Javelle, at the Nice Observatory, in the following position:—

R.A. 2h. 57·7m. } 1900 January 31d. 7h. 3m.
Decl. −7° 55′ } Nice Mean Time.

A later telegram, received February 4, gives the following position:—

R.A. 2h. 49m. 51s. } 1900 February 3d. 7h. 25·8m.
Decl. −6° 40′ 10″ } Nice Mean Time.

Daily motion in R.A. = −2·6s.
,, ,, ,, Decl. = −25″.

The comet, when discovered, was about 2° north-east of the 4th magnitude star η Eridani, and according to its observed motion is at present following a north-westerly path through Cetus.

SECOND NEW ALGOL VARIABLE IN CYGNUS.—It is announced, in the *Astronomische Nachrichten*, No. 3614, that Madam Ceraski, of the Moscow Observatory, has detected another variable during the examination of plates taken at the Observatory by M. Blajko. From the light variation observed, it is considered to be of the Algol type. Its position is the following:—

		R.A. h. m. s.		Decl. ° ′ ″
1855·0	...	19 40 59·7	...	+32 21 6
1900·0	...	19 42 43·4	...	+32 27 34

The period is calculated to be

6d. 0h. 9·4m.;

an epoch of minimum being

1899 December 15d. 23·3h. Greenwich Mean Time.

The normal magnitude of the variable is 10, its value at the minimum being about 12.

A small chart of the neighbouring stars is given in the paper to facilitate its recognition. The star makes almost an equilateral triangle with the stars B.D. 32°·3559, and B.D. 32°·3560.

THE COMPUTATION OF OCCULTATIONS.—There is a considerable number of methods for calculating the times of occultations, and until quite recently that of Bessel was the most generally employed. In these computations, in order to obtain results accurate to some seconds of time, the values resulting from the first calculations were only taken as a first approximation and used as a basis for a second computation, which latter gave the times with greater precision. In the year 1896 Dr. Carl Stechert published a new method (*Tafeln für die Vorausberechnung der Sternbedeckungen*) which dealt directly with the apparent and not the true time of conjunction, and at the same time allowed of certain simplifications being made. Curiously enough we have received from the Director of the Observatory of Rio de Janeiro, Mr. L. Cruls, a description of a method which results in an equation similar to that obtained by Dr. Stechert, but obtained by a line of reasoning essentially different. This method, which only involves one computation, and is based on the exact knowledge of the instant of the apparent conjunction of two stars, is fully described in the publication referred to, the text being arranged in parallel columns in the Spanish and French languages. The accuracy of this method may be gauged from the results of ten computations compared with the observed values. The mean error of a single isolated observation was found to be ± 11s·5 while that of the whole of the sixteen observations (including immersions and emersions) was ± 3s. The method is accompanied by numerous tables and diagrams for facilitating the reductions of equations involved.

LIGHT CURVE OF CERASKI'S FIRST ALGOL VARIABLE.—In the *Astronomical Journal*, No. 475, Mr. J. A. Parkhurst gives the results of forty-five observations of this variable during the period 1899 June 15 to September 12. Comparisons with four neighbouring stars give the normal magnitude as 8·75, and the minimum as 11·4. Forming the light curve from the observed times and magnitudes, the epoch of an August minimum was found to agree more closely with Prof. E. C. Pickering's value (*Harv. Coll. Obs. Circular*, No. 44) than with that of Prof. Ceraski, so that the author supports Prof. Pickering's extension of the period to 4d. 13h. 45m. 2s.

REDUCTION OF STAR PHOTOGRAPHS.—Mr. A. R. Hinks, who has recently undertaken the work of stellar photography with the new photographic equatorial refractor at the Cambridge Observatory, discusses, in the *Astronomical Journal*, No. 475, the method he proposes to adopt in the reduction of the plates. The telescope is to be devoted to determinations of stellar parallax, measures of star clusters, &c., and it is important for the ultimate value of the work that the measures as published should be comparable with others obtained elsewhere. Of the many possible methods of reduction, the author considers it most advisable to adopt a system based upon that devised for the work of the Astrographic Catalogue by Prof. H. H. Turner (*Monthly Notices*, *R.A.S.*, 1894, vol. liv. p. 489). In thus publishing the measures in the rectangular co-ordinates from the plates themselves, there may be some doubt as to their being comparable with older work published in the usual spherical co-ordinates of right ascension and declination. This the author proceeds to investigate by applying the new method of reduction to Dr. Frank Schlesinger's measures of the Rutherford photographs of the Praesepe cluster. In working out the equations of condition, both the rigid least square solution and the simplification devised by Mr. Dyson are given. From the values of the residuals it appears that determinations of parallax, &c., from photographs, may with advantage be carried out entirely in rectangular co-ordinates, and the results thus published. In addition, the approximate method of solution of the equations of condition is but little inferior to the rigid least square solution. A great advantage of the adoption of this plan would be the tendency to equalise the time of obtaining and reducing the photographs.

TECHNICAL INSTRUCTION IN RELATION TO INDUSTRIAL PROGRESS.[1]

What are the new industrial conditions which we now have to meet?

We have long known of the enormous progress being made in Germany, especially in those branches of manufacture of the more scientific kinds. Thus, most of the electric plants installed throughout the continent have been made in Germany, and German firms are building practically all the large lighting and traction plants in South America. In steam engineering and in shipbuilding we know how efficient Germany has become. The phrase "made in Germany" was intended to imply that the goods so marked were not equal in quality to British made goods, but the phrase no longer carries this meaning, and it will be remembered that when the *Kaiser Wilhelm der Grosse* made a record passage from New York to Southampton, having beaten the best English record, she sailed into port with large white letters painted on her side, "MADE IN GERMANY." I was in Germany myself just as this happened, and heard the story passed round, to the great amusement of the Germans.

In South Africa the same progress has been made by the Americans, who have supplied most of the machinery used in the South African mines, and the engineers engaged there are nearly all young Americans who have received a good technical training as engineers and electricians. Again, many of the principal electric light and power plants in our own country are equipped throughout by American firms in competition with the best home companies, and erected at our very doors, notwithstanding that the American plant has to be carried so many thousand miles before it reaches its destination.

It is frequently stated that this is owing to our own firms being so full of work that they have orders two years ahead, but the question is whether England has more work than she can do, or whether the rate of production of that work is what it might be if the plant employed in our various manufactories were of a more up-to-date type. In any case it is clear that the higher grades of the metalworking trades are no longer a speciality of this country, but, on the contrary, both America and Germany can compete with us on our own ground.

But there is another direction in which, quietly but surely, a revolution is being effected in methods of manufacture, not only in engineering works of all kinds, but in many industries which have never until recently used machinery, and this revolution is being brought about by the introduction of the American Machine Tool. The characteristics of this machine tool are its high quality, its adaptability to all kinds of special work requiring automatic appliances, and the method of working the tool so as to produce with great accuracy an indefinitely large number of interchangeable parts by working to standard gauges.

To give an illustration of the way in which these changes are being brought about by the introduction of the American machine tool: A few weeks ago I visited the newly-erected machine tool factory of the Ludwig Loewe Co. in Berlin, one of the largest factories of the kind in the world, having cost, I believe, nine million marks to build and equip. The firm was founded in the first place about thirty years ago for the purpose of making sewing machines, but before it could make sewing machines it had to buy American tools with which to make them. Then after a time the American machines required to be repaired, and they had to start a small engineers' shop for the purpose of repairs, and more American tools were purchased to equip the engineers' shop. But this small engineers' shop proved so serviceable and so successful that the sewing machine trade was stopped, and the machine tool instead began to be manufactured. From this beginning a great machine tool business was gradually built up. The tools made were of the newest and most approved American patterns. The head engineer and works' foremen employed were Americans. This business has now reached such enormous dimensions that it includes not only the machine tool works above mentioned, but also Arms and Ammunition works and Electrical Appliance works, the whole employing, I am told, something like twelve thousand men.

From these works are passing out from time to time skilled men with practical experience of up-to-date machine tools, who become foremen in the various works and manufactories, and the result is that, wherever they go, they soon introduce the highest class of machine tools, and rapidly a great change takes place in the amount of business done by the firms. America, as is well-known in engineering circles, is doing an enormous trade on the continent of Europe and with England also in improved machine tools of the highest class.

We have, of course, good machine tool makers in this country, but few, if any, who have made a speciality of one single type of machine tool, as is the case in America, which tool they claim to be the most perfect of its kind, while they leave other types to other manufacturers. By thus confining themselves to one class of tool they greatly reduce the working costs of manufacture as compared with firms who make any and every class and size of tool.

A London Daily recently said, "there is no question that the commercial interests of the United States are growing by leaps and bounds. Europe is beginning to be inundated with American goods, and American firms are getting contracts at the expense of European rivals all the world over. This would not be accomplished except for the fact that American manufacturing plants are maintained by the universal use of high-class machine tools, operated by well-paid workmen, while by far the greater number of shops in this country are equipped with tools many of which are of the most antiquated type."

It is probable the German workshops, generally speaking, are in no sense better equipped than our own. In fact, we have in this country, especially in connection with our great Railway Companies, shops which are probably superior to anything else of the kind in the world, also our textile machinery is superior to that of any other country, but the Germans are waking up to the fact of their deficiencies as compared with the machine tool equipment of the general American manufacturer. They recognise that trade follows the machine tool, and the financiers of Germany appear to be encouraging the rapid introduction of a better class of machines for general works' practice. A similar tendency is at work in this country, and the result is that the industrial conditions are rapidly changing, and a new and more efficient class of men to carry on our mechanical industries is becoming more and more an absolute necessity.

What we require in order to meet these conditions successfully and to maintain our industrial position as a community of metalworkers in competition with our rivals.

It is clear from what has been already said that we need the means of securing a steady supply of skilled machinists and tool makers, with a competent knowledge of up-to-date methods of turning work out, and of the best types of machine tools; men, in fact, who are competent to become, in course of time, leading men and works' foremen.

There are, of course, works' foremen in England second to none in the world, but every one knows, who has any knowledge of works, that such men are singularly scarce, and when a vacancy occurs, extremely difficult to replace. These men are the brain of the workshop, and upon their skill depends very much of the true success of any manufacturing concern. Almost any man in the works could be more easily replaced than the skilled works' foreman.

Incompetent foremen are not only incapable of improving methods of production, but they will not encourage the introduction of new machines, which they themselves have not the ability to understand and use. Such men initiate little, and they continue to demand the same kind of tool and methods that their forefathers used. But the deficiency in the supply of

[1] Abridged from a paper on "Metal Work as a Form of Manual Instruction in Schools," read at a conference of science teachers on January 11, by Prof. W. Ripper, University College, Sheffield.