there are still other matters to be taken into consideration. One of these, for instance, is the distance between the tuyeres at the bottom of the furnace. Mr. Cochrane confidently predicted that an alteration in this particular would effect a very important saving in Messrs. Samuelson's furnaces. The large economy actually realised by the use of brick stoves was commented upon by several speakers; but the advantage of increasing the capacity of furnaces appeared to be doubted by two very high authorities upon the subject, Mr. Edward Williams and Mr. E. Windsor Richards.

On Thursday afternoon the paper read was on the Northampton iron ore district, by Mr. W. H. Butlin. It gave an interesting description of this district, well known to travellers on the main line of the Midland Railway, in which, however, the deposits of ore have only been developed within the last thirty years. The paper also contained analyses of the ore, which is of a very variable character, and also of the limestone, slags, &c.

On Friday morning the first paper read was by Mr. John Stead of Middlesborough, on a New method for the estimation of minute quantities of carbon. The author had found that the colouring matter, which is produced by the action of dilute nitric acid upon white iron and steel, has the property of being soluble in potash and soda solutions, and that the alkaline solution has about two and a half times the depth of colour produced by the ordinary acid solutions. Hence it occurred to him that the colour-matter might be separated from the iron, as an alkaline solution, by simply adding an excess of sodium hydrate to the nitric acid solution of iron, and that the colour solution thus obtained might be used as a means of determining the amount of carbon present. This method is found to succeed well, as small a quantity as 0·03 per cent. of carbon being readily detected. The method of using it was described, and also experiments made to determine (1) the influence of heating the nitric acid solution for a longer or shorter time; (2) the effect of using an excess of nitric acid to dissolve the steel; (3) the effect on the solvent power of using a greater or less quantity of soda solution; (4) the effect of the presence of small quantities of chlorine. All these experiments proved satisfactory as regards the new process. An improved form of chromometer was also described.

The next paper was on the Production and utilisation of gaseous fuel in the iron manufacture, by Mr. W. S. Sutherland of Birmingham. It was of a somewhat discursive character, containing various suggestions, especially as to a method of making wrought iron by the converter process; but its chief object was to describe the production of a cheap form of heating gas, which the author has used largely for the welding up of boiler-flues, tubes, &c. In this process part of the fuel is burnt, as completely as possible, to carbonic acid and water, but the resulting heat is stored up partly in the remainder of the fuel and partly in regenerators, that in the regenerators being made to heat up to a sufficiently high degree a quantity of steam. This superheated steam is passed through the hot fuel, and forms with it carbonic oxide and hydrogen, which go away to be stored up and used. With this process about 55,000 cubic feet of gas is made per ton of Staffordshire coal, and at a cost of about 3*d.* per 1000 cubic feet, its heating power being about one-half that of coal gas. The author pointed out that it was most important to prevent as far as possible the formation of carbonic acid, and that for this a high temperature (say 1200° C.) was required.

The following papers were taken as read:—On Coal-washing machinery, by Mr. Fritz Baare; on the Tin-plate manufacture, by Mr. E. Trubshaw; and on Improvements in railway and tramway plant, by Mr. Albert Riche.

SCIENTIFIC SERIALS

American Journal of Science, April.—Review of De Candolle's origin of cultivated plants, with annotations on certain American species, by A. Gray and J. H. Trumbull.—Remarks on Glyptocrinus and Reteocrinus, two genera of Silurian crinoids, by C. Wachsmuth and F. Springer.—Smee battery and galvanic polarisation, by H. Hallock.—The age of the Southern Appalachians, by O. B. Elliott.—Evolution of the American trotting-horse, by W. H. Brewer.

IN the *Annalen der Physik und Chemie* for 1883, part i., Ernst Pringsheim has an elaborate paper on the theoretical and practical aspects of Crooke's radiometer. This is followed by essays on Stokes's law of fluorescence, by Ed. Hagenbach; on special cases of crystallisation, by E. Lommel; on the heat-conducting power of fluids, by L. Graetz; on the relation of specific heat in gases and vapours, by P. A. Müller; on the constant result of internal friction and galvanic conduction in relation to temperature, by L. Grossmann; and on A. Guebhard's proposed method of determining equipotential lines, by Hugo Meyer. Part ii. contains papers by O. Grotian on the power of electric conduction of some cadmium and quicksilver salts in liquid solutions; by W. C. Röntgen, on the change produced by electric power in the double fracture of quartz (continued in part iv.); by A. Kundt, on the optical character of quartz in the electric field; by H. Meyer, on the magnetising function of steel and nickle; by A. von Waltenhofen, on the history of recent dynamoelectric machines, with some remarks on the determination of the working powers of electromagnetic motors; by J. Wagner, on the tenacity of solutions of salts; by S. von Wroblewski, on the absorption of gases by fluids under high pressure; by A. Schuller, on distillation in vacuum; by K. R. Koch, on the elasticity of crystals of the regular system; by C. Bohn, on absolute masses; by E. Gerland, on the methods adopted by R. Kohlrausch in his researches in contact electricity. In part iii. papers are contributed by F. Neesen, on the specific heat of water; by E. Ketteler, on the conflicting theories of light (continued in part iv.); by W. G. Hankel, on the thermoelectric properties of helvine, mellite, pyromorphite, mimetesite, phenakite, pennine, strontianite, witherite, cerussite, titanite; by F. Niemöller, on the dependence of the electromotor power of a reversible element on the pressure exercised on its fluidity; by C. Tromme, on experimental researches in magnetism; by K. Vierordt, on sound measurement; by A. Ritter, on the constitution of gaseous bodies; by K. R. Koch, on a method of testing the micrometric screw. Part iv. contains papers by F. Kohlrausch, on the galvanic gauging of the surface coil of a wire bobbin; by C. Tromme, on electrical research; by M. Baumeister, on the experimental investigation of torsion elasticity; by E. Wiedemann, on thermochemical research; by G. Kirchhoff, on the theory of light radiation; by W. Wundt, on sound measurement.

Journal de la Physique, February.—On a spectroscope with great dispersion, by M. Cornu.—On the comparative observation of telluric and metallic lines, as a means of observing the absorbent powers of the atmosphere, by the same.—Researches on the photometric comparison of differently-coloured sources, and in particular on the comparison of different parts of the same spectrum, by MM. Macé de Lepinay and Nicati.—On electric shadows and various connected phenomena (second article), by M. Righi.

Verhandlungen der k.k. Zool.-botan Gesellschaft in Wien, 1882, Bd. xxxix. Heft 2 (March, 1883), contains:—Zoology.—Biological notes on some beetles belonging to the Dascyllidæ and Parnidæ, by Th. Beling.—On Platen's ornithological collections from Amboyna, by W. Blasius.—On a new tortoise, by J. v. Hornig.—On the genus Colias, by A. Keferstein.—On the skin glands in some larvæ, by Dr. Klemensiewicz (Plates 21 and 22).—On new Hymenoptera, by Fr. Kohl (Pl. 23).—On the Myriapods of Austrian-Hungary and Servia, by Dr. R. Latzel.—The butterfly fauna of Surinam, v., by H. B. Möschler (Plates 17 and 18).—On a new mite in the inside of the quill feathers in the hen, by Dr. C. Nörner (Plates 19 and 20).—On a collection of birds from Central Africa, sent by Dr. E. Bey, by A. v. Pelzeln.—On Pselaphidæ and Scydmænidæ, from Java, Borneo, and Central and South America, by E. Reitter.—On *Icaria scudderi*, by Dr. H. Weyenbergh.

THE *Atti* of the Roman *Accademia dei Lincei* for January and February, 1883, contains papers by E. Millosevich, on the ingress of Venus on the solar disk, December 6, 1882; by A. Lugli, on the mean variation of temperature in Italy, as affected by latitude and elevation; by A. Viola, on the relations of some physical properties of gaseous bodies under constant pressure and of constant bulk; by L. Pigorini, on barbaric stations still existing in the Emilian provinces; by Tommasi-Crudeli, on the malaria of the Tre Fontane district, which appears not to have been beneficially affected by the Eucalyptus plantations elsewhere found so efficacious; by S. Tacchini, on meteoric dust and the chemical analysis of the sands of the Sahara; by the same author, on Finlay's comet and on the new asteroid (232) discovered on February 1 by Palisa; by S. Brioschi, on the algebraic relations between the hyperelliptical functions of first order; by S. Ferrari, on the relations between the meteoric elements and some agricultural returns for the year 1880 in Italy.

THE *Rendiconti* of the *Reale Istituto Lombardo di Scienze e Lettere* for February and March, 1883, contains papers by G. Ascoli, on Irish glosses, especially those of the Ambrosian Codex; by M. E. E. Beltrami, on the theory of magnetic layers; by Z. Volta, on an unpublished drama of Luigi Ceretti; by G. A. Maggi, on the transmission of undulatory motion, and especially of luminous waves, from one isotropic medium to another; by P. F. Denza, on the observations of the transit of Venus made at the observatory of the Collegio Carlo Alberto in Moncalieri.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 12.—"The principal cause of the large errors at present existing between the positions of the Moon, deduced from Hansen's Tables and observation; and the cause of an apparent increase in the secular acceleration in the Moon's mean motion required by Hansen's Tables, or of an apparent change in the time of the Earth's rotation," by E. J. Stone, F.R.S.

The errors in the lunar theory have been traced to the effects of changes in the *unit of time* which have, apparently unconsciously, been introduced, from time to time, into astronomy with changes in the adopted data.

The argument is clearly seen by a consideration of the different expressions for the longitudes of, what may be called, the mean sun which have been adopted for the determination of the sidereal times at mean noon.

If B, H, and V denote the longitudes of the mean sun according to Bessel, Hansen, and Le Verrier, we have for 1850, January 1, Paris mean noon, $+ t$

$$B = 280^\circ\, 46'\, 36''{\cdot}12 + 1296027{\cdot}618184t + 0{\cdot}0001221805 \,.\, t^2$$
$$H = 280\; 46\; 43{\cdot}20 + 1296027{\cdot}674055t + 0{\cdot}0001106850 \,.\, t^2$$
$$V = 280\; 46\; 43{\cdot}51 + 1296027{\cdot}678400t + 0{\cdot}0001107300 \,.\, t^2.$$

In all these expressions the unit of time has been *supposed* to be a Julian year of 365·25 mean solar days. The constant differences $7''{\cdot}08$ and $7''{\cdot}39$ in $B-H$ and $B-V$ are not unimportant, for they introduce abrupt changes in the record of time; but the differences in the coefficients of t and t^2 show that the *same* unit of time cannot have been adopted in these expressions. The measure of time must be continuous; let, therefore, 1 and $(1+x)$ be the units in B and H,

$$\text{then } 1296027{\cdot}618184 \,.\, t + 0{\cdot}0001221805t^2$$
$$= 1296027{\cdot}674055t(1+x) + 0{\cdot}0001106850t^2(1+x)^2.$$

If, therefore, $n = 1296027{\cdot}674055$

$$x = -\frac{0{\cdot}055871}{n} + \frac{0{\cdot}000114955 \,.\, t}{n}$$

To reconcile B and H, therefore, x must contain a variable term. Similar remarks apply to the difference between B and V.

Now let N be the moon's mean motion referred to 1 as the unit of time, and $(N+\delta N)$ the moon's mean motion referred to $(1+x)$ as the unit of time,

then $(N+\delta N)\,(1+x) = N$,

$$\text{and } t\delta N = \frac{N}{n}\left\{ 0{\cdot}055871 \,.\, t - 0{\cdot}0000114955 \,.\, t^2 \right\}$$
$$= 0''{\cdot}747 \,.\, t - 1''{\cdot}54\left(\frac{t}{100}\right)^2.$$

But Hansen determined his mean motion of the moon so as to force an agreement between his theory and observations reduced with Bessel's unit 1; and his tables, therefore, represented the observations well for many years, whilst 1 was adopted as the unit of time; but directly the unit of time was changed by the adoption either of H or V, then the effects of the erroneous determination of the moon's mean motion by Hansen became apparent. The change of error in longitude of Hansen's Lunar Tables between 1864, when Le Verrier's Solar Tables were adopted in the *Nautical Almanac*, and 1880, amounts to more than 10″.

The effect of the change of unit is also shown in the comparison of Le Verrier's Solar Tables with observation, but of course only to about the thirteenth part of the amount shown by the Lunar Tables. The necessity of adopting some definite unit of time by fixing the constants in the expression for the longitude of the mean sun is insisted upon.]

If $L_0 + n_0t + S_0t^2$ is the expression adopted for the longitude of the mean sun, the quantities L_0, n_0, S_0, must never be changed. The correction δL, which from time to time may appear necessary to obtain the mean longitude of the sun from the longitude of the mean sun must not be allowed to change the adopted values of L_0, n_0, and S_0. The true longitude of the sun will then

$$= L_0 + n_0t + S_0t^2 + \delta L + \text{periodic terms.}$$

It would appear that speculations respecting changes in the time of rotation of the earth on its axis are at least premature until the theories have been revised with a unit of time freed from changes of adopted constants which are at present inextricably mixed up with any effects which would result from a change in the time of rotation of the earth on its axis.

The longitude of the mean sun when properly investigated, differs from the mean longitude of the sun by a secular term—

$$0''{\cdot}3113\left(\frac{t}{100}\right)^2.$$

As this difference has been usually neglected in the determination of the sidereal time at mean moon, an error of about

$$13 \times 0''{\cdot}3113 \,.\left(\frac{t}{100}\right)^2, \text{ or } 4''\left(\frac{t}{100}\right)^2$$

has been thrown upon this secular acceleration of the moon's mean motion. This accounts for the difference between Adam's theoretical value, and that deduced from eclipse observations.

Chemical Society, May 3.—Dr. W. H. Perkin, president, in the chair.—The following papers were read:—On a new oxide of tellurium, by Dr. E. Divers and M. Shimosé. When the compound of sulphur trioxide and tellurium, discovered almost simultaneously by the authors and by Weber, is treated in a vacuum, sulphur dioxide is evolved and a new oxide of tellurium is formed containing one atom of tellurium to one atom of oxygen. The decomposition takes place between 180° and 230°. The oxide is black, and quite stable at ordinary temperatures in dry air. No compound of this monoxide has yet been prepared, but in its properties it is essentially different from a mixture of tellurium and dioxide.—On tellurium sulphoxide, by Dr. Divers and M. Shimosé. The authors prepared this compound by pouring sulphur trioxide on to tellurium finely powdered and dried. It was purified from sulphur trioxide by heating to 35° and exhausting with the Sprengel pump. It is a red amorphous solid, quite stable at ordinary temperatures in sealed tubes. When heated in a vacuum to 90° it is changed into a bright fawn-coloured modification.—On a new reaction of tellurium compounds, by Dr. Divers and M. Shimosé. When sulphuric acid containing a small quantity of tellurium dioxide or sulphate in solution is poured into a hydrogen-generating apparatus, and the escaping hydrogen passed through a second portion of the telluretted sulphuric acid, a beautiful red colour, due to tellurium sulphoxide, is rapidly developed.—On a simple modification of the ordinary method for effecting the combustion of volatile liquids in Glaser's furnace with the open tube, by Watson Smith. The author causes the end of the combustion tube to project from the furnace, and volatilises the liquid by gently warming the current of gas with a Bunsen burner.—On the production of ammonia from the nitrogen of minerals, by G. Beilby. The author gives the results obtained with typical oil and coal shales when distilled (1) at a low red heat, (2) at a low red heat in a current of steam, (3) at a low red heat in a current of steam, the residual coke being afterwards subjected to the prolonged action of steam, so that a large portion of the coke is consumed and the nitrogen in it liberated as ammonia. Thus a sample of oil shale furnished by (1) 2·7 lbs. of nitrogen per ton as ammonia, by (2) 3·9 lbs., by (3) 12·0 lbs.—On the specific gravity of paraffin wax, solid, liquid, and in solution, by G. Beilby.

Zoological Society, May 1.—Prof. W. H. Flower, F.R.S., president, in the chair.—The Secretary read an extract from a letter addressed to him by Mr. W. L. Crowther, C.M.Z.S., respecting the possibility of obtaining living specimens of the Thylacine of Tasmania.—The Secretary exhibited, on behalf of Mr. H. Whitely, the skin of a Bird of Paradise (*Diphyllodes gulielmi*) from the Island of Waigiou, which was believed to be the second example of this rare species yet obtained.—The Secretary exhibited a set of Radde's international colour-scales, and explained the way in which it was intended to be used.—A