Sorghum vulgare and the consequent production of prussic acid by this plant, have led to the examination by J. C. Brunnich,* Chemist to the Agricultural Department, Brisbane, of the varieties of this plant grown in Queensland, which have been long known to be poisonous to cattle under certain conditions, although the nature and origin of the poison had not been discovered. Brunnich has now determined the amounts of hydrocyanic acid produced when weighed quantities of the plants grown under different conditions are crushed with water. The results thus obtained confirm those already recorded by the authors in the case of sorghum grown in Egypt, and show that the amount of cyanogenetic glucoside contained in the stem and leaves of the plant increases until the seeds are ripe, after which it rapidly diminishes until the glucoside finally disappears. Brunnich finds that cultivation of sorghum on land heavily manured with sodium nitrate leads to an increased production of the cyanogenetic glucoside in the stem and leaves.

"The Differential Invariants of Space." By Professor A. R. Forsyth, Sc.D., LL.D., F.R.S. Received June 18,—Read June 18, 1903.

(Abstract.)

The memoir is devoted to the consideration of the differential invariants of ordinary space and of a surface or surfaces in that space; they are the functions of the fundamental magnitudes of space and of quantities connected with the surface or surfaces which remain unaltered in value through all changes of the independent variables of position.

The method used arises through the obviously natural development of the method used for the corresponding investigations concerned with a surface and with curves upon the surface, which formed the subject of an earlier memoir by the author. The partial differential equations, characteristic of the invariance, are formed, and then the most general solution of these equations is constructed. At a certain stage in the latter process, the equations then remaining unsolved can be transformed, so that they become the invariants and the contravariants of a set of simultaneous ternary forms. The results of the latter theory are then used to complete the solution of the equations.

The main part of the memoir is devoted to obtaining the invariants; and the explicit expressions of the invariants, up to the third order inclusive as associated with a single surface, are given. Further,

* 'Trans. Chem. Soc.,' 1903.

those which are associated with two surfaces are obtained up to the second order inclusive. The necessary calculations are laborious. In the case of the invariants, which are actually of the third order, only the results are stated; they were obtained by solving fifty-seven simultaneous partial differential equations.

It is known from Lamé's investigations that there are six equations characteristic of the fundamental magnitudes when the independent variables are the parameters of a triply-orthogonal system of surfaces. Cayley proved that there are similarly six equations when the independent variables are the parameters of three families of surfaces not orthogonal to one another. These six equations, as formed by Cayley, arise in the course of the construction of the invariants of the third order.

In the later part of the memoir, the invariants up to the second order inclusive are geometrically interpreted. Those of the third order have not yet been similarly interpreted; geometrical considerations are adduced to show that, when the significance of these invariants is established, two new fundamental equations among the quantities connected with a surface will be found to exist.

"The Ultra-violet Spectrum of Radium." By Sir WILLIAM CROOKES, F.R.S. Received August 1, 1903.

[PLATES 16—18.]

The spectrum of radium has been examined and the wave-lengths of many of its lines given by several observers, amongst whom I may include Exner and Haschek,* Berndt,† Demarçay,‡ and Runge.§

Between these observers, however, there are great discrepancies, lines given by one being absent in other lists, and the wave-lengths even of strong lines varying between wide limits. Being in possession of perhaps the purest radium hitherto employed for spectrum work, I have used some of it in photographing its ultra-violet spectrum. The negatives so obtained have enabled me to get measurements from which the wave-lengths of the lines have been calculated with an accuracy only limited by the accuracy of the iron lines used as standards.

* Franz Exner and E. Haschek, 'Wien Akad. Sitzber.,' vol. 110, July, 1901; 'Chem. News,' vol. 86, p. 247.

† G. Berndt, 'Physikalische Zeitschrift,' 2 Jahrg., No. 12; 'Chem. News,' vol. 83, p. 77.

‡ Demarçay, 'Comptes Rendus,' vol. 129, p. 716; vol. 131, p. 258.

§ C. Runge, 'Astrophysical Journal,' vol. 12, p. 1.