the distribution of the stresses; from the results of these the author deduces that the extensometer measurements on the outer surfaces of the cover-plates of a riveted joint are sufficient for the determination of the mean stresses in the plates, and that the partition of the load among the rivets may be determined from such measurements. All the experiments tend to show that friction does not play an important part, but further experiments are necessary on this point. Experiments on a number of specimens having a single line of rivets gave results in close agreement with the theoretical considerations. An empirical rule for the value of K is given for joints similar to the experimental specimens. We can commend a careful study of this important article to any who are interested in riveted joints.

THE *Journal of Anatomy and Physiology*, founded by the late Sir William Turner in 1866, will in future appear under the title *Journal of Anatomy*, and will be the official organ of the Anatomical Society of Great Britain and Ireland. In the preface to the first part of the fifty-first volume Prof. R. Howden, president of the society, remarks that until the year 1878 the journal was the organ of the two sciences, anatomy and physiology. In that year the *Journal of Physiology* was established, and thereafter physiological papers became few and far between in the joint journal, and finally ceased to appear. It has therefore been deemed advisable to drop the words "and Physiology" from the title. The editors of the *Journal of Anatomy* are Profs. A. Macalister, A. Thomson, A. Keith, and A. Robinson.

THE catalogue of publishers' remainders just issued by Mr. H. J. Glaisher, 55 Wigmore Street, W., is full of interest. The works offered for sale at greatly reduced prices are new unless otherwise stated, and cover a wide field. Very many of the books deal with scientific subjects. Among them we notice:—Newton's "A Dictionary of Birds"; Galton's "Memories of my Life"; Spence's "Notes of a Botanist on the Amazon and Andes"; Mill's "The Siege of the South Pole"; Clerke's "The System of the Stars" and "A Popular History of Astronomy"; Cooke's "Introduction to the Study of Fungi," "British Edible Fungi," and "Handbook to British Hepaticæ"; Smith's "The Life of Sir Joseph Banks"; Bonhote's "Birds of Britain"; Amundsen's "The North-West Passage"; "The Angler's Library," five vols.; Gadow's "Through Southern Mexico"; Scherren's "The Zoological Society of London." The catalogue should appeal to readers of NATURE in search of standard works at low prices.

ON a previous occasion the attention of readers was directed to the excellence of the pads of "Acribo" sectional paper supplied by Mr. W. H. Harling, 47 Finsbury Pavement, E.C. He is now able to provide the paper printed on linen bank in three scales, and in this strong form the popularity of such a convenient, accurate, and British-made product should be increased.

OUR ASTRONOMICAL COLUMN.

THE ZODIACAL LIGHT.—Mr. Denning writes us that displays of this light were surprisingly intense on the mornings of December 4 and 5. He has observed it on many hundreds of occasions, both at the morning and evening apparitions, but never remembers to have seen it more conspicuous. It stretched upwards from about E. by S., and its fainter limits were just traceable to the stars Regulus and γ Leonis in the Sickle of Leo. It was best seen at about 5.40 a.m., and as Regulus passed the meridian at Bristol at 5.23 and 5.19 on the mornings mentioned, the light must have extended over a considerable arc.

A NEW COMET.—A telegram from Prof. Pickering, received through the Centralstelle at Copenhagen on November 26, announces the discovery of a new comet by the Rev. Joel Metcalf on November 21. At Greenwich time 13h. 36·9m. on that day the R.A. of the comet was 3h. 38m., and the N.P.D. 71° 27′. No indication of the brightness or motion of the comet is given. The above position is located about 5° south of the Pleiades, which are now visible throughout the night.

THE SEARCH FOR A TRANSNEPTUNIAN PLANET.—Notwithstanding the failure of nearly half a century's systematic search for a planet beyond Neptune, M. A. Borelly, of the Marseilles Observatory, is still hopeful that such a planet may be discovered. The comet-seeker which he has mainly employed in his work on small planets has permitted the observation of stars down to the 12th magnitude, and M. Borelly is now inclined to think that the planet sought for must be of less brightness than this. He believes it possible, however, that the planet might be detected with the aid of the photographic chart of the heavens, which includes stars as faint as the 14th magnitude. If the period of the planet be a little more than double that of Neptune its motion would only be 1° per annum, or about 10″ per day, so that the short exposures which suffice to show the motion of planets between Mars and Jupiter would not be effective. The occurrence of what may be called Transneptunian comets, including the comets of 1532, 1661, 1862 (III.), 1843 (I.), 1880 (I.), 1882 (II.), is regarded as an argument in favour of the existence of planets outside the orbit of Neptune (*Jour. des Observateurs*, vol. i., No. 12).

SOLAR PROMINENCES IN 1916.—Admirable records of solar prominences are now being obtained under the direction of Mr. Evershed at Kodaikanal, and prompt publication of the results is a commendable feature of the work carried on. In view of the more satisfactory data relating to position angles, heights, and areas which are obtainable from the spectroheliograph photographs, the visual observations are now practically confined to displacements of the hydrogen lines and to metallic prominences. A summary of the observations for the first half of the present year is given in Kodaikanal Bulletin No. 52. Compared with the previous six months, there was a decrease of 22·6 per cent. in areas and an increase of 26·1 per cent. in the number of prominences, the average area per prominence having diminished by about one-third. The areas show a slight preponderance on the eastern, and the numbers a slight preponderance on the western, limb. Metallic prominences were observed in greater number than during the preceding half-year, and there was also a large increase in the number of displacements of the hydrogen lines observed at the limb. In observations on the disc 305 reversals of the C line, 34 darkenings of the D_3 line, and 103 displacements were recorded; there was a large preponderance of displacements towards the red. Absorption markings in H_α, attributed to prominences projected on the disc, were photographed on 147 days; the daily number was the same as for the previous period, but there was a diminution in area.

ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held on Thursday last, November 30, when the report of the council was presented, and Sir J. J. Thomson delivered his presidential address, which included the following statement of the scientific work of this year's medallists:—

Sir James Dewar, F.R.S. (Copley Medal).

The scientific work of Sir James Dewar covers a wide field. By applying his ingenuity to problems of practical and theoretical importance, he has obtained results which have contributed largely to modern progress in physics. His early work dealt with organic chemistry, the nature and properties of the picoline and quinoline bases, and he investigated the properties of Graham's hydrogenium. He made a study of the explosion of gaseous compounds, and he was associated with Sir Frederick Abel in the introduction of cordite. Experiments on electro-photometry at one time engaged his attention, and he carried through some researches on the physiological and chemical efficiency of light. In conjunction with Prof. Liveing he published many results of spectroscopic investigations, and afterwards devoted considerable time to the spectroscopic examination of the various gaseous constituents separated from the atmosphere.

Sir James Dewar's best-known recent work is connected with low temperatures and the liquefaction of gases. His introduction of the vacuum flask and his discovery of the power of gaseous absorption of charcoal at low temperatures rendered possible his investigation of the properties of many liquefied gases. He was the first to succeed in solidifying hydrogen. Helium was then the only gas which had resisted liquefaction. Sir James Dewar foretold how this refractory gas might be obtained in liquid form, and the efficacy of the method was verified by Dr. H. Kamerlingh Onnes, who, in 1908, obtained liquid helium, and reached the lowest known temperature (about 3° abs.). Sir James Dewar's experiments in calorimetry and the electrical resistance of metal at low temperatures have opened a wide field of research.

Prof. William Henry Bragg, F.R.S. (Rumford Medal).

Prof. Bragg has been continuously engaged since 1904 in researches into the nature and properties of the rays from radio-active bodies of other ionising radiations. Using new methods in the study of the ionisation of gases by α rays which greatly simplified the experimental conditions, he investigated the distribution of the ions produced along the path of an α particle through a gas. These experiments threw an entirely new light on the nature of the absorption of α rays by matter, and proved that the α rays resulting from each radio-active transformation have a definite characteristic range, depending on the initial velocity. These investigations (in which he was assisted by Kleeman) formed one of the most important advances in our knowledge of the properties of these rays since their discovery.

Prof. Bragg also made important contributions to our knowledge of the nature and properties of β rays and kathode rays, and especially of their relation to γ rays and Röntgen rays. He attacked the problem of the nature of the process of ionisation by X-rays and γ rays and put forward the view, now generally accepted, that the ionisation is entirely secondary and due to the corpuscular rays produced by the primary radiations. His Bakerian lecture (1915) contains an investigation on the reflection of X-rays from crystals, which has led to most important and novel results.

Dr. John Scott Haldane, F.R.S. (Royal Medal).

Dr. Haldane is awarded a Royal medal on account of the important contributions he has made to physiology, especially on the subject of respiration. His study of the conditions of combination of carbon monoxide with hæmoglobin have been fruitful in many directions. They led him to the investigation of gas explosions in coal mines, which has had important results in the saving of life in mines. They also led to the discovery of methods for the determination of the oxygen tension in the blood and of the total volume of the circulating blood in man, which have had wide clinical applications.

Dr. Haldane has also studied the effect of high temperatures under varying conditions of moisture on the human body, and was the first to lay down the definite conditions under which it is possible to withstand or to work in high temperatures. The greater number of his papers, and those of his pupils, refer to the conditions of activity of the respiratory centre. He was the first to demonstrate beyond dispute the all-important part played by the tension of carbonic acid in the blood in the regulation of the respiratory movements, and to elucidate the chemical self-steering mechanism by means of which the pulmonary ventilation is adjusted to the respiratory needs of the body and to the activities of the animal. The knowledge obtained in these researches has enabled him to lay down the conditions which must be observed for the preservation of life among divers, and to elucidate the phenomena of mountain sickness and of acclimatisation to high altitudes.

Prof. Hector Munro Macdonald, F.R.S. (Royal Medal).

A Royal medal is awarded to Prof. H. M. Macdonald on the ground of his contributions to mathematical physics. Prof. Macdonald has been engaged continuously in original research for the last twenty-five years, and in that time has produced many notable memoirs and one remarkable book ("Electric Waves," Cambridge, 1902). His work extends over a wide range: hydrodynamics, elasticity, electricity, and optics, and branches of pure mathematical analysis which have applications to these subjects, especially the theory of Bessel's functions. Among the papers of more distinctly physical character, perhaps the most important are the series of papers treating of the theory of diffraction, and especially the diffraction of electric waves by a large spherical obstacle, a problem which is of especial importance in connection with the theory of the transmission over the earth's surface of the waves utilised in wireless telegraphy. He was the first mathematician to attack this problem, and also the first to obtain the correct solution. The interval between the first attack and the final conclusion was about eleven years (1903–14), and the discussion which took place in the meantime attracted contributions from some of the most eminent mathematicians of the day, including such authorities as Lord Rayleigh and the late Henri Poincaré.

Henri Louis le Chatelier, For. Mem. R.S. (Davy Medal).

M. le Chatelier, successor to Moissan at the Sorbonne, is the most distinguished living French chemist. His name will always remain associated with important discoveries in several divisions of chemistry. In co-operation with M. Mallard, he was the author of an elaborate investigation on the ignition and explosion of gaseous mixtures, in which several principles of fundamental importance were established. As the result of much investigation he introduced the le Chatelier thermo-couple, and inaugurated a new period in the measurement of high temperatures. M. le Chatelier was one of the pioneers of micrometallography, and one of the first to introduce exact methods and clear ideas into the science of industrial silicates. His views on the relation of science to industry and on the teaching of chemistry, which command great attention in France, are exemplified in his highly original book "Le Carbone."

Prof. Yves Delage (Darwin Medal).

Prof. Delage is a member of the Institute, professor in the faculty of science in the University of Paris, and director of the Zoological Station at Roscoff. He is well known for his biological and zoological writings, especially for his great work, "L'Hérédité et les Grands Problèmes de la Biologie Générale," and his important "Traité de Zoologie Concrète" (the latter published in conjunction with Prof. Hérouard).

Prof. Delage's original memoirs include a very important work on the development of sponges ("Embryogénie des Eponges; développement postlarvaire des Eponges silicieuses et fibreuses marines et d'eau douce," *Arch. Zool. Expér.* (2), x., No. 3, pp. 345–98).

M. Jean Gaston Darboux (Sylvester Medal).

Professeur de géométrie supérieure à la faculté des sciences de Paris since April, 1881. Secrétaire perpétuel de l'Académie des Sciences pour les Sciences Mathématiques since May, 1900. Author of "Leçons sur la Théorie Générale des Surfaces" (four volumes), "Leçons sur les Systèmes Orthogoneux," and of many individual papers dealing with kinematics, theory of partial differential equations, planetary theory, the principles of infinitesimal geometry, functions of a real variable, and numerous other subjects. He is one of the most distinguished of contemporary French mathematicians, and has been honoured by nearly every academy in Europe.

Prof. Elihu Thomson (Hughes Medal).

Prof. Elihu Thomson, of Lynn, Massachusetts, has long been a leading man in the technical applications of electricity in the United States. In the early 'seventies, when teaching in Philadelphia, he was one of the pioneers of electric arc lighting, and invented numerous pieces of electric apparatus. In 1887 he discovered, experimentally, the repulsion experienced by masses and sheets of conducting metal when placed in an alternating magnetic field. Following up this matter, he devised an alternating-current motor, for some years the only one of its kind. He is the inventor also of the process of electric welding which bears his name, and has made valuable investigations into the production of high-frequency discharges and oscillations.

The following are among the subjects referred to in the report of the council of the society:—

The late Lieut. H. G. J. Moseley, killed in action, bequeathed to the society the whole of his estate, to be applied to the furtherance of experimental research in pathology, physics, physiology, chemistry, or other branches of science, but not in pure mathematics, astronomy, or any branch of science which aims merely at describing, cataloguing, or systematising. The value of this bequest has not yet been fully ascertained. Under the will of the late Prof. Meldola the society will eventually receive a legacy of 500*l.*

The council has decided that in present circumstances it is not desirable that the Central Bureau should undertake any work pledging the society to publication of the International Catalogue beyond the fourteenth issue. The Committee of the Privy Council for Scientific and Industrial Research has made a grant of 425*l.* to the catalogue on condition of an equal sum being provided from private sources for the purpose of assisting the society to keep this important scientific undertaking in being. Sir Charles Parsons guaranteed the collection of this second sum of 425*l.*, and thus secured the contribution from the Treasury. At the request of Dr. Walcott, secretary to the Smithsonian Institution, Washington, the Carnegie Corporation of New York made a grant to the institution of 6000 dollars (1253*l.* 18*s.* 4*d.*) for the International Catalogue. Sir Charles Parsons has collected 1088*l.* in private subscriptions, and, by himself subscribing 1909*l.*, made up the sum available from all these sources to 8500*l.* 18*s.* 4*d.* It is believed that this sum will enable the catalogue to be published to the end of the fourteenth issue without the necessity of asking for further assistance.

In June last, at the request of the President of the Board of Agriculture and Fisheries, the president and council appointed a committee to consider and report upon the bionomics and economic importance of grain-infesting insects, with especial reference to imported grain, the committee consisting of the treasurer (chairman), Prof. V. H. Blackman, Prof. A. Dendy, Prof. Stanley Gardiner, Mr. W. B. Hardy, Prof. R. Newstead, with Mr. J. H. Durrant (of the British Museum), Mr. J. C. F. Fryer (representing the Board of Agriculture), and Mr. Oswald E. Robinson (president of the Incorporated National Association of British and Irish Millers). This committee has been at work for some time on the important subject referred to it, and has appointed a small sub-committee which is engaged upon the necessary investigations and has recently presented a progress report.

Under regulations for the administration of the recruiting schemes adopted by the Government last year the Board of Trade included a provision that analytical, consulting, and research chemists were not allowed to be called up for service with the colours without the consent of the Royal Society. The Military Service Act which became law last March embodied a list of certified occupations, including that of analytical, consulting, and research chemists, "if recommended for exemption by the Royal Society." These provisions have led to a large number of applications being made to the Royal Society by persons claiming to come within the category of chemists above described, and the consideration of these claims has given, and continues to give, rise to a large amount of labour and difficulty.

The Sectional War Committees mentioned in the last report of the council have continued their labours, and several of them have been actively engaged throughout the past year in consultation with the departments of Government concerned.

The classified lists for the War Register referred to in the last report of council have been completed so far as possible, printed, and placed in the hands of the naval and military authorities. In addition, a register of scientifically trained men available for work in connection with the war, covering roughly the period between the issue of Lord Derby's scheme and the passing of the first Military Service Act, has been compiled, and arranged in the form of a card index, which has been placed at the disposition of Government departments and freely consulted.

Owing to the special test work undertaken, and the large number of special investigations carried out for the Admiralty, the War Office, and the Ministry of Munitions, the work of the National Physical Laboratory has greatly increased during the past year, and it has been necessary temporarily to make considerable additions to the staff. In the last report of the council reference was made to the steps which had been taken before the war to secure more adequate support from the Government for the work of the laboratory, and while it is clear that during the war every effort must be given to war work, it is necessary that a scheme, to come into effect as conditions become normal, should be devised to enable the laboratory to take its place in the general plan of industrial research.

Several of the senior members of the staff have been seconded for service in Government departments, and their responsibilities at the laboratory have had to be assumed, to a great extent, by the younger men. Since the formation of the Ministry of Munitions the direc-

tor of the laboratory has acted as adviser in physics to the Ministry. He has also acted as chairman of the Instruments Committee of the Munitions Inventions Department, and has served on a number of committees of the Ministry of Munitions, the Munitions Inventions Department, and the Board of Invention and Research.

Large additions have been made during the year to the laboratory buildings owing to the growth of the work. Early in the year an urgent request was made by the Admiralty and the War Office for an extension of the aeronautics research. This required the provision of two or three additional wind-channels, with increased accommodation for model-making and similar purposes. Authorisation to proceed was immediately given by the Treasury, and the necessary building and constructional work was undertaken by the Office of Works. The new building contains two wind-channels, a 7-ft. and a 4-ft., with pattern-makers' shop, generator-room, offices, etc. An addition to the metrology building, to provide additional accommodation for the work of gauge-testing, has also recently been erected by the Office of Works, while other buildings have been provided for temporary purposes.

CHEMISTRY AT THE BRITISH ASSOCIATION.

THE work of Section B (Chemistry) at the recent meeting of the British Association at Newcastle-upon-Tyne differed somewhat from that of previous years in that it was concerned mainly with two subjects—coal and fuel economy, and the future of the British chemical industries. As the first of these important topics will be dealt with separately, the following brief account of the sectional proceedings will refer chiefly to the second of the subjects of discussion.

"The Future of the Synthetic Chemical Industry in Great Britain" was the subject of a paper by Mr. F. H. Carr, in which the question of training chemists for this branch of the industry was considered at some length. Mr. Carr does not profess to be an educationist, and that is perhaps the reason why he gave his interesting views on the education of chemists to Section B rather than adding them to the fascinations of the programme of Section L.

The essence of the educational scheme proposed by Mr. Carr is the establishment of technological colleges with a course of two years, the college itself being practically a business concern for the manufacture of fine chemicals. Students who did not qualify in successive stages would be liable to dismissal, and a daily attendance of eight hours with but short holidays would be demanded.

As the colleges would have practically the equipment of a works, the student would learn to look at chemical processes from the point of view of cost of materials, yield of finished product, and value of the time and labour, heat and power expended on any particular operation, while at the same time he would become familiar with the ordinary plant found in actual factories.

To impart this training a staff with thorough works experience would be needed, and it is unfortunately not very clear how such a staff could be got together, for such men would most likely be better off financially in works, and might perhaps have little taste for teaching. The college buildings and equipment would be provided by Government, while chemical manufacturers should supply the endowment.

This scheme might be expected to produce technically and scientifically trained men suitable as departmental managers, but the equally important trained operative must also be considered. Here Mr. Carr regrets the absence of an apprenticeship system, and feels the loss of the old mechanics' institutes. For the present, training will have to be carried out in the factory, but he suggests that there should be compulsory continuation of education until eighteen years of age, more latitude being given to schools to suit particular industries of the district, and more differentiation at the age of thirteen in the training of boys of different aptitudes and tastes.

Mr. Rintoul, in a paper on the "Preparation of Chemicals for Laboratory Use," described the work being carried on by Nobel's at Ardeer for producing pure reagents and materials hitherto chiefly obtained from Germany.

Dealing with the subject in a more general way, Mr. Rintoul was of the opinion that much of the research work for the preparation of such chemicals need not necessarily be carried out in technical laboratories, as much of it was well suited to university conditions. It would indeed afford an opportunity for bringing chemical industries and universities in contact, for instead of producing many papers of perhaps somewhat doubtful value, the university laboratories might produce authoritative statements on new or comparative methods for the preparation of compounds, information on which is at present either lacking or inaccurate. Most of the raw materials required could be obtained in the British Empire, and he deplored the fact of our dependence on Germany for supplies of pure materials the manufacture of which would be of educational value, and at the same time of importance in the industry.

A paper by Mr. C. M. Whittaker on the "British Coal-Tar Colour Industry in Peace and in War" gave a summary of the work already carried out, mainly by British Dyes, Ltd., to supply colours for all kinds of dye purposes, ranging from typewriter ribbons to khaki cloth. An immense amount of work has been done, and many colours are now made in this country in huge quantities for war purposes, and all credit is due to the firms concerned. The paper conveyed, no doubt rightly, the impression that every soldier and sailor, whether hale or wounded, was a living memorial to the industry of chemists concerned with the British coal-tar colour industry. Many people have perhaps not appreciated this aspect of the war.

Apart from the discussions on coal and fuel economy, the three papers above briefly reviewed constituted the *pièce de résistance* of the meetings of the Chemical Section, but there were also a few short papers of considerable interest which must just be mentioned.

Dr. J. E. Stead contributed three short papers on (*a*) the oxidation of nickel steel; (*b*) the reduction of solid nickel and copper oxides by solid iron; (*c*) the disruptive effect of carbon monoxide at 400° to 500° C. on wrought-iron. These papers, all of interest to metallurgists, have been the subject of a discussion at the Iron and Steel Institute.

Prof. W. M. Thornton gave an account of his stepped ignition in gases, and after reading the paper illustrated it experimentally. A short discussion on the paper showed that there was considerable divergence of opinion as to the real explanation of the phenomena observed and shown by Prof. Thornton.

Dr. J. A. Smythe contributed a note, illustrated by experiment, on a "Modified Chlorination Process." He showed how calcium chloride acted as a catalyst for the chlorination of ethylene and other hydrocarbons.

In conclusion it should be mentioned that throughout the meeting there was open an exhibition of British-made chemicals and apparatus, which showed what steps have already been made to replace goods in this line of enemy origin.