atoms which compose a chemical molecule, is contributed to the *Chemiker Zeitung* by Prof. Victor Meyer. The literature of this most interesting branch of chemical study has so rapidly accumulated since the theory of Le Bel and Van't Hoff was promulgated in the year 1874, that a concise account of the important stages of progress which have led up to the present state of our knowledge is particularly welcome. The earlier portion of the memoir is devoted to the development of the idea of the asymmetric carbon atom, and the growth of the conviction that the occurrence of isomeric compounds represented by the same constitutional formula—which differ only in their action upon polarised light, and very slightly in other physical properties, such, for instance, as the three lactic acids—could only be accounted for by the different spacial arrangement of the atoms in the molecule. The fundamental assumptions of Van't Hoff are very clearly expressed, and the possibilities of isomerism by change in the relative positions of the various groups attached at the four corners of the hypothetical carbon tetrahedron are fully illustrated. A striking example is afforded in this connection by one of the results of the brilliant researches of Emil Fischer in the sugar group, whereby we are made acquainted with no less than thirteen distinct sugars, all of which are represented by the same constitutional formulæ $CH_2OH.(CHOH)_4.CH_2OH$. The second section is devoted to the stereo-isomerism of the derivatives of ethylene, so ably worked out by Wislicenus. The simple explanation of the remarkable and long-discussed case of the isomeric acids, maleic and fumaric, upon the lines of the new theory, is referred to, and a similar explanation extended to numerous other and more complicated of the derivatives of ethylene. The third section deals with the peculiar nature of the stereo-isomerism of closed-chain compounds, such as the polymerised tri-aldehydes. It is then shown in a further section that carbon is by no means peculiar in lending itself to stereo-isomerism, but that the pentavalent nitrogen atom is likewise capable of furnishing isomers which differ structurally merely in the relative positions occupied by the five attached atoms or groups. The stereo-isomerism of nitrogen compounds is shown, however, to be largely influenced by the weight and complexity of the five attached groups. The interesting discovery of a second di-oxim of benzil by Goldschmidt in Prof. Meyer's laboratory, gave a great impulse to the study of nitrogen compounds containing the group C = N, termed oxims, and the number of stereo-isomeric oxims which have subsequently been isolated bear remarkable testimony to the use of a theory in stimulating research.

THE additions to the Zoological Society's Gardens during the past week include two Swainson's Lorikeets (*Trichoglossus novæ-hollandiæ*) from Australia, presented by Mr. John Biehl; a Chilian Conure (*Conurus smaragdinus*) from Chili, presented by Mrs. Gibney; two Eyed Lizards (*Lacerta ocellata*) twenty European Tree Frogs (*Hyla arborea*) South European, presented by Mr. T. Keen; a Madagascar Porphyrio (*Porphyrio madagascariensis*) from Madagascar, a Waxwing (*Ampelis garrulus*), two Long-tailed Tits (*Parus caudatus*) European, purchased; a Hog Deer (*Cervus porcinus*) born in the Gardens

OUR ASTRONOMICAL COLUMN.

ECLIPSE METEOROLOGY.—A very extensive series of meteorological observations was made during the total eclipse of the sun on January 1, 1889, at Willows, California. It appears that the temperature fell 6° F. from the commencement of totality to ten minutes after, while the variation of the barometer was so nearly identical with the daily fluctuation that no effect could with certainty be ascribed to the eclipse. The influence on the wind, however, was very marked, its previous velocity of twelve miles per hour being reduced almost to that of a calm. Observations with the solar radiation thermometer showed that some heat was received throughout totality. An attempt was also made to secure concerted observations of the so-called "shadow bands"—the long dark bands separated by white spaces which are seen in rapid motion on the ground and sides of buildings just before and after totality. The observations collected seem to give decisive evidence against the view that the bands are diffraction fringes in the shadow of the moon, the observed velocities being far less than that of the shadow; the fact that they were prominently seen at some stations, while at others they were hardly visible, indicates a local origin (*Ann. Harvard. Coll. Obs.* vol. xxix.).

In the same volume, Mr. Parkhurst gives an account of his photometric observations of some of the asteroids, and confirms the previous conclusion that there is a phase correction over and above that for the defect of illuminated surface, and that this correction is different for different asteroids; the idea that large errors may be introduced by rotation, however, is not confirmed. The same writer also gives the individual observations of a large number of variable stars, which furnish valuable data for the construction of light-curves.

A REMARKABLE COMETARY COLLISION.—Two striking photographs are reproduced in the February number of *Knowledge*, in illustration of an article, by Prof. E. E. Barnard, on the probable encounter of Brooks' Comet with a disturbing medium on October 21, 1893. The comet was discovered by Mr. Brooks, on October 16, but though it was kept under observation at the Lick Observatory, no phenomena of an extraordinary kind were observed until the 21st of that month. A photograph, then taken with a Willard photographic lens, presented a remarkable appearance, the tail appearing, to use Prof. Barnard's analogy, like a torch streaming in the wind. The reproductions of the photographs give the impression that the comet's tail swept into some dense medium, and was broken up by the encounter. Indeed, Prof. Barnard thinks it impossible to escape the conclusion that the tail did actually enter a disturbing medium which shattered it. This theory is supported by the photograph taken on October 22, where the tail is seen to hang in irregular cloudy masses, and a large fragment appears to be entirely separated from the main part. There is little doubt that the tail met a mass of meteoritic matter, and so had its symmetry destroyed; at any rate, this supposition must be accepted until a simpler and better one can supplant it. What we have to do, as Mr. Cowper Ranyard remarks in an article on the irregularities of comets' tails, is diligently to collect facts. The multiplication of such photographs as those obtained of Brooks' Comet, and of Swift's Comet (1892), by Prof. Barnard, will certainly revolutionise current opinion as to the development, and the types, of comets' tails.

MIRA CETI.—According to the *Companion to the Observatory*, this famous variable star will reach a maximum about the 17th inst. At the time of writing (February 3), the star is of a reddish tinge, and faintly visible to the naked eye; but, unfortunately, it is too near the sun to permit of long-continued observations on the same evening. The magnitude at maximum is very inconstant, and varies between 1·7 and 5·0 (Gore). Spectroscopic observations of the star are of the highest importance, and it is to be hoped that a satisfactory record of its phases will be secured. The general spectrum is one of Group II., but near a former maximum, Pickering photographed a number of bright lines, chiefly of hydrogen. Among the points on which information is desirable are: (1) at what phase of the variation the bright lines of hydrogen make their appearance; (2) the fluctuations in the bright flutings of carbon observed by Mr. Lockyer at the maximum of 1888 (NATURE, vol. xxxviii. p. 621).

PROPER MOTIONS OF STARS. — The recently published volume (xxv.) of the *Annals* of the Harvard College Observatory contains values for the proper motions of a large number of stars in the zone 50°—55° north, the adopted values, however, being only at present regarded as provisional. The results are derived by Prof. Rogers from the comparison of his own positions for the stars in this zone, obtained with the meridian circle, with the positions given for corresponding stars by earlier catalogues. One section of the volume gives the values of α and δ, referred to the system of the *Astronomische Gesellschaft*, for the stars included in the zone in question.

THE SYSTEM OF ALGOL.—An elaborate discussion of the inequalities in the period of Algol recently led Mr. Chandler to conclude that there is a distant dark body around which the bright star and the dark companion producing eclipses revolve in a period of 130 years (NATURE, vol. xlv. p. 446). This conclusion has been greatly strengthened by recent investigation by Mr. Searle, of the relative places of Algol and comparison stars from observations made with the meridian circle at Harvard College (*Annals*, vol. xxix. 1893). The right ascension of the star appears to be increasing in general conformity with Chandler's prediction.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE forty-seventh annual general meeting of the Institution of Mechanical Engineers was held on the evenings of Thursday and Friday of last week, in the theatre of the Institution of Civil Engineers. There were two papers down for reading, as follows:—

"Research Committee on Marine Engine Trials. Abstract of results and experiments on six steamers, and conclusions drawn therefrom in regard to the efficiency of marine engines and boilers," by Prof. T. Hudson Beare.

"Description of the Grafton High Speed Steam Engine," by Edward W. Anderson, of Erith.

The reading and discussion of Prof. Beare's paper, together with the introductory proceedings, occupied both evenings, so Mr. Anderson's paper had to be adjourned until next meeting.

Upon the members assembling on Thursday evening, the 1st inst., the President, Dr. William Anderson, took the chair. Mr. Bache, the secretary, then read the annual report of the council, by which it appeared that the Institution continues to flourish, the income and membership having increased during the past year. After the reading of the report Dr. Anderson vacated the chair, his term of office of two years having expired, and the new President, Prof. Alexander B. W. Kennedy, F.R.S., was duly installed. After the usual votes of thanks, and a few complimentary speeches, the reading of Prof. Beare's paper was proceeded with.

As our readers are aware, the Research Committee on marine engine trials of this Institution has been for some time past engaged in making trials with different steam vessels. The reports of the committee on these trials have already been referred to in our accounts of former meetings of the Institution at which they have been read. Six vessels have been experimented upon altogether since the committee was formed. These ships have consisted of channel passenger vessels and cargo boats, the committee not having had yet an opportunity of experimenting upon an important ship of the ocean liner type.

The labours of the committee have been brought to a conclusion, for the present at any rate; and the paper of Prof. Hudson Beare was intended to give a summary of the results, and afford a basis of discussion thereupon. We are at a loss how to condense within the compass of space at our disposal the mass of data dealt with by the author of the paper. Perhaps the most lasting impression on one's mind, after going through the subject, is that no general conclusions, that can be compactly expressed, are to be drawn from the trials. The conditions of work required from marine engines in ships of different classes are so various that what is paramount virtue in one case becomes an unnecessary refinement in another. Thus in the cargo boats the first consideration is economy in fuel, to which nearly every other feature in the machinery is usually sacrificed. In order to carry cargo at a rate sufficiently low to enable the shipowner to compete, the coal bill must be light, and therefore we find in these vessels boilers lightly worked and speeds low. On the other hand, vessels that have to convey passengers must be speedy, and general economy has to be sacrificed to this end, the model of the vessels themselves being formed with the same purpose in view. Perhaps we cannot do better than quote some of the elements of design of the machinery, and some of the results attained during the trials, in order to illustrate these leading facts. We will take two of the ships tried—the *Iona*, a large cargo boat, and the *Ville de Douvres*, a paddle boat carrying mails and passengers between Dover and Ostend. The *Iona* is 275 feet long, 37.3 feet wide, 27 feet 7½ inches draught, and 4430 tons displacement. Her speed on trial was 8·6 knots. The *Ville de Douvres* is 271 feet long, 29 feet wide, 9 feet draught, and 1090 tons displacement. On her trial she made 17·1 knots. It will be seen, therefore, that the cargo boat is considerably over four times the displacement, and travels at about one-half the speed of the mail boat. As both craft are approximately the same length, the additional size and weight-carrying capacity of the *Iona* is made up by her greater beam, and also by her fuller ends. The engines of the *Iona* are of the three-stage compound, popularly, but erroneously, known as triple expansion engines. As a matter of fact the *Iona's* engines are 19-expansion, the steam being expanded nineteen times in passing through the three cylinders. The *Ville de Douvres* has ordinary two-cylinder compound engines, in which the steam is expanded but 5·7 times. The horse-power required to drive the 4430 tons of the bluff-ended *Iona* through the water was but 645·4 indicated, whilst the *Ville de Douvres*, modelled for speed, required 2977 indicated horse-power to enable her to get her 17 knots. Supposing each unit of power to be obtained in both ships at an equal expenditure of fuel, the figures quoted will show the price that has to be paid for speed; but there is a further item to the debit side of the coal bill in the case of the fast ship. In order to get high speed it is very desirable, indeed necessary, that machinery should be light, and light machinery, other things being equal, means a low figure of merit in regard to fuel economy. The *Iona* works, as stated, with 19 expansions, her boiler pressure being 165 lbs. above atmosphere; whilst the *Ville de Douvres* has boilers pressed only to 105 lbs. The result of this greater expansion of steam on the part of the cargo boat's engines, and the easy way in which her boilers are worked, enables each unit of power to be obtained on a consumption of 1·46 lbs. of coal per hour; whilst the *Ville de Douvres* required 2·32 lbs. of coal for each indicated horse-power exerted for an hour.

It is easy to see from these figures, which are fairly representative, that economy and speed cannot go hand in hand; the owner must select whether he would rather travel cheaply (in fuel) or quickly.

Pursuing the investigation of this branch of the subject, we find that the total weight of the machinery of the *Iona* is 202 tons, which gives 3·1 units of power per ton weight of machinery; whilst the total weight of the machinery of the *Ville de Douvres* was 361 tons, equal to 8·2 units of power per ton weight of machinery. With regard to space occupied, the engines of the two ships are not comparable, being paddle and screw engines respectively; but in boilers we find that the net volume required for each indicated horse-power with the *Iona* was 4·15 cubic feet, and with the *Ville de Douvres* 2·09 cubic feet; thus showing that space as well as weight may be gained by the sacrifice of fuel economy. In the discussion which followed the reading of the paper, Mr. Jeremiah Head, of Middlesborough, gave some interesting figures in regard to those cargo steamers generally known as "ocean tramps." He stated that the s.s. *Westoe*, a vessel of this class, had carried 3500 tons dead weight at a speed of 9 knots, the fuel burnt being at the rate of ·64 oz. per ton per nautical mile, or about one five-hundredth of a penny. Another ship, the *Oscar II.* of 4600 tons dead weight capacity, required a consumption of half an ounce of coal per ton per mile. Still another vessel steaming at 8·9 knots showed a similar fuel economy. The figures are striking, and easily remembered: half an ounce of coal for each ton carried one nautical mile.

The boilers of both the *Iona* and the *Ville de Douvres* are of a similar type, being the ordinary return tube marine boiler, but the proportions are somewhat different. Thus in the *Iona* the proportion of total heating surface to grate surface is 75·2 per cent; in the *Ville de Douvres* it is but 31·1 per cent. This large extension of the heating surface means both a heavier and more bulky boiler, as has been shown; but in the cargo boat this sacrifice of weight and space can be profitably made in order that the fullest amount of heat from the products of combustion may be absorbed by the water in the boiler. In the *Ville de Douvres* this heat is allowed to pass off by the chimney. If we turn to the record of funnel temperatures we find this fact borne out, the escaping gases in the *Iona* being 452° F. and in the *Ville de Douvres* 910° F., as far as could be ascertained. The coal consumed on a given area of grate in the two vessels does not vary greatly, it being 22·4 lbs. per hour in the *Iona*, and 31·3 lbs. per hour in the *Ville de Douvres*. The different proportions of grate to heating surface in the two ships will, however, be