

paper entitled "The Measurement of Boiler Deformations." The author described a novel and ingenious method of ascertaining the deformation and corresponding stress by means of a mirror attached to the point on the shell to be examined and a telescope sighted on to the mirror, the reflected reading of a graduated scale being observed and the angular deflection thereby ascertained.

WE learn from a note in the *Builder* for January 13 that M. Knauth, in reporting on the settlement in Strassburg Cathedral, states that the chief cause is the defective condition of the foundations beneath the north tower. The foundations consist of two walls running north to south and east to west, and are constructed of rubble and cement on argillaceous soil, in which some timber piles had been driven. The piles are badly decayed, and the interior pillar of the tower is said to be virtually unsupported for a length of 2 metres, as a layer of vegetable earth is interposed between the foundations and the base of the pillar. Like many fabrics of the same class in this and other countries, Strassburg Cathedral was built in different epochs, one result being that the foundations have now to carry loads greater than those contemplated by the original designer. This point is illustrated by the statement that the present foundation load is upwards of 25 tons per square foot. The remedy proposed is the underpinning of all defective foundations.

A BLUE-BOOK has just been issued giving account of the engine trials at the National Physical Laboratory for the award of the prize of 1000*l.* offered by Mr. Patrick Y. Alexander. These trials form the subject of an article in *Engineering* for January 13, from which we gather that six engines were entered, but only three arrived before the date fixed. These were:—(1) the Wolseley Tool and Motor-car Company, Birmingham; (2) Messrs. Humber; and (3) the Aster Engineering Company, Wembley Park (entered by Green's Motor Patents Syndicate). Not one of these engines was able to fulfil the conditions of the test fully. The first was pulled up by a leak in the copper oil pipe leading from the pump to the oil well, a defect which led to other mishaps. The Humber motor ran steadily at 37 brake-horse-power at 1224 revolutions per minute for 11½ hours, and then stopped suddenly with one of the cylinders broken off and two connecting rods buckled. The Green engine was more fortunate. It had to stop for a new sparking plug, and then ran, making approximately 31.5 brake-horse-power at 1213 revolutions per minute, until the completion of the twenty-four hours' run. In a special test of seven minutes, the motor developed 36.4 brake-horse-power at 1390 revolutions per minute. The prize has not been awarded, but we understand that the donor has generously presented a cheque for 200*l.* to the makers of the Green engine, which came nearest to the conditions of award.

MESSRS. J. AND A. CHURCHILL have just ready for publication a new edition of another volume of "Allen's Commercial Organic Analysis." It is vol. iv. under the new arrangement, and has been rewritten under the editorship of Mr. W. A. Davis and Mr. S. S. Sadtler.

MESSRS. WILLIAMS AND NORGATE announce for early publication a translation into English of Prof. Wilhelm Ostwald's work entitled "Natural Philosophy." This work, the translation of which will be revised by the author, gives a *résumé* of modern natural philosophy, based not upon metaphysics, but upon the sciences; and it aims at providing a complete synthesis of the results of the specialisation of last century.

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OUR ASTRONOMICAL COLUMN.

NOVA LACERTÆ.—A brief note in No. 4464 of the *Astronomische Nachrichten* announces that Prof. Max Wolf has found a twelfth- or thirteenth-magnitude star in the position of Nova Lacertæ on plates taken some years ago at the Königstuhl Observatory. The previous presence of a faint object does not, of course, necessarily preclude the star discovered by Mr. Espin from being of the "novæ" type, although in most cases the pre-existence of matter in the identical position is assumed rather than demonstrated; before the catastrophe which produces the extraordinary outburst of light, the object is usually too faint to be detected on our photographs.

More precise spectrum observations than those yet published will permit us to determine whether the outburst was of the catastrophic nature which produces typical "novæ" or whether it is simply a case of a peculiar variable; up to the present, the unfavourable English skies, combined with the faintness of the object, have prevented definitive observations. Seven or eight bright lines have been observed at the Cambridge Observatory, and it is worthy of note that they have not the broad appearance of lines seen in the spectra of novæ.

It is to be regretted that the "nova" was not discovered earlier, for we understand that Prof. Pickering has found images of it, on plates taken about the end of November, 1910, showing it to be of approximately the same photographic magnitude (about 5.0) as the star 9 Lacertæ shown on the chart which we gave in last week's issue; on December 30, 1910, its magnitude was about 7.0. Referring to these facts, at the Newcastle Astronomical Society, Mr. Espin pointed out that for some three weeks the star was visible to the naked eye, yet no one observed it. It was not visible on the Harvard plates on November 19, so that its rise to the fifth magnitude must have been rapid. Mr. Espin suggests that these observations conclusively prove the object to be a real nova. A plate taken at Harvard in December, 1887, although it shows faint stars, shows no trace of the nova.

Mr. Bellamy estimated the visual magnitude on January 2 as 7.5, and recorded the colour as orange. It will probably be found, as with other novæ, that there is a certain difference between the photographic and visual magnitudes, due to the presence of radiations visually inert, and this is suggested by the fact, stated by the Astronomer Royal, that the photographs taken at Greenwich show the image of the nova to be different in appearance from the other star images shown on the same plates.

THE ORBITS OF SEVERAL SPECTROSCOPIC BINARIES.—Nos. 5-8, vol. ii., of the Publications of the Allegheny Observatory contain the discussions of the orbits of various spectroscopic binaries under investigation at the observatory.

In No. 5 Mr. R. H. Baker discusses the measures of the spectrum of 30 H. Ursæ Majoris as shown on fifty plates taken with the Mellon spectrograph in 1908-10. He finds that the observations are not so well satisfied by the preliminary curve computed on the assumption of simple elliptic motion, but the agreement is improved by the introduction of a secondary oscillation. As there is no trace of the secondary component on any of the plates, the resulting orbit must be accepted as preliminary; the period is 11.5832 days.

Thirty spectrograms of 57 Cygni are discussed by the same observer in No. 6 of the Publications. These were taken in 1909, and a comparison of the results with earlier ones secured in 1903 establishes the period as 2.8546 days. The orbits of both primary and secondary components are given separately and then combined, and it appears that the masses are not very different.

Mr. Baker also reverts to the discussion of θ Aquilæ, in No. 7, which, from a comparison of observations made by M. Deslandres in 1901-2 with later ones made in 1907-8 by Mr. Baker, appeared to have a variable period. The latter observer now finds that the two observations of 1901 are probably erroneous, and that the period of θ Aquilæ (17.1245 days) is constant. The orbit as published is derived from single-prism plates, where the lines are confused, and can be only an approximation to the true elements; the star is bright enough, however, for

three-prism spectrographs, which would separate the lines and enable better elements to be derived.

In No. 8 Mr. F. C. Jordan discusses the orbit of π Andromedæ from measures of 111 plates taken with the Mellon spectrograph between August, 1907, and October, 1909, and derives a period of 143.67 days. A point of special interest is that this binary is a helium star with a long period, and it has been shown that helium binaries are sharply divided into long and short periods. The latter are generally less than one month, whilst the shortest of the former class is 116 days. The increase of eccentricity with period is also notable, the mean periods for the two groups being 8.38 and 147.1 days, whilst the corresponding mean eccentricities are 0.19 and 0.41 respectively. π Andromedæ is a notable example, the eccentricity of its orbit being 0.58. The point is a very striking one, but the data are, as yet, too meagre to warrant speculation concerning its possible significance.

THE DISCOVERY OF KEPLER'S LAWS.—The history of Kepler's labours in working out his three laws of planetary motions is interestingly told by M. Bigourdan in No. 23 of the *Revue générale des Sciences*. Refused as a divine, Kepler pursued his study of mathematics, and was appointed professor at Gratz in 1594, then being twenty-three years of age. But in 1599 he was, as a Protestant, expelled from Styria, and accepted a post under Tycho Brahe. For a number of years he endeavoured to fit Tycho Brahe's wonderfully accurate observations into the geocentric system which the latter upheld, but without success, for there was always a residual error in latitude of 8' or 9', and this amount Kepler believed to be impossible in such careful observations. Then, after the master's death, he worked away at the heliocentric idea, and succeeded, eventually, in discovering the laws which are the basis of our knowledge of orbital motions. In his paper M. Bigourdan introduces many other points of interest concerning Kepler's life and methods.

BRIGHT BOLIDES.—The apparitions of several bright bolides during the latter part of 1910 are recorded in Nos. 37-38 of the *Gazette astronomique* by M. Birkenstock, director of the Bureau Central Météorique. One, recorded by several observers at different stations, appeared about 8.45 (C.E.T.) on August 19, and, as seen at Novi, was about three-quarters the size of the full moon; it then split into two parts, each half the size of the moon, and, leaving a train, disappeared after a flight which lasted three seconds. Other bolides were recorded on September 9 and 23, and October 8.

THE ASTROGRAPHIC CATALOGUE, CATANIA ZONES.—We have received part i., vol. vii., of the Catania astrographic catalogue, giving the positions of 8855 stars. These have been determined from fifteen plates covering the region 0h. to 3h. in R.A., and $+52^\circ$ to $+54^\circ$ in declination; excluding repetitions, the net number of new positions is 7872. Tables for the geometrical corrections for zone $+53^\circ$, with their arguments, and ten-year precession constants up to the year 2000, are also given.

CONFERENCES OF MATHEMATICAL TEACHERS AND OF PUBLIC SCHOOL SCIENCE MASTERS.

THE annual meeting of the Mathematical Association was held at the London Day Training College on January 11, and the science masters met in the same building on January 11 and 12. The officials of the college and of the respective associations made admirable arrangements, which conduced to the success of the gatherings both from the working and the social aspects.

Prof. H. H. Turner presided at the mathematical meetings, and in his address gave a historical *résumé* of the recent advance of "the astronomical regiment" under the leadership of Pickering, Stratton, Perrine, Melotte, and Cowell. He described the discoveries of the new satellites of Saturn and Jupiter, and the revelations into the past of planets which resulted from an examination of the orbits of these satellites. The members present, mostly teachers in schools, were greatly interested in the "news from the front" of the mathematical army. The

annual report showed a large increase in membership and an expansion of the *Mathematical Gazette*.

Mr. G. Goodwill read a paper on the teaching of elementary mechanics, in which he recommended that dynamics should precede statics, and that the idea of change of velocity should be treated as a basal concept necessary for a proper approach to the subject. He showed an extremely simple ballistic pendulum used for measurements of change of momentum. By abandoning the usual uniplanar arrangement, he has at once simplified the exercises and tangibly increased their didactic value.

Canon J. M. Wilson described two fragments of ancient geometrical treatises found in the Worcester Cathedral Library. The first was written by Gerbert, who became Pope Sylvester II. in 979. At that time Euclid was known only to the Moors, and Gerbert failed in his attempt to enter the University of Granada. The second fragment dated from the early part of the twelfth century, and was written by a monk of Bath named Adelhard or Æthelhard. He succeeded in learning Arabic and entering the Universities of Granada, Cordova, and Seville by professing to be a Mohammedan. The fragment discovered by Canon Wilson proved to be part of a translation of Euclid from the Arabic into Latin. This translation was used in all the schools of Europe until 1583, when Euclid's own Greek text became known.

Mr. A. W. Siddons presented an important report by the Mathematical Association Committee "On the Teaching of Algebra and Trigonometry" (published by Bell and Sons, price 3d.). The report dealt with the function of algebra in the school curriculum for boys who were not likely to specialise in mathematics, and aimed particularly at giving teachers opportunity to develop with their pupils mathematical ideas of great educational value—ideas drawn from mechanics, mensuration, solid geometry, infinitesimal calculus, and more especially from numerical trigonometry. Mr. F. W. Dobbs (Eton) thought the recommendations went too far, whereas Mr. Barnard said that the Rugby masters thought the suggested syllabus was inadequate. Other speakers supported the views of the authors, and the general effect of the discussion was to strengthen the hands of the committee and to endorse their conclusions. The meeting referred to the committee a paper read by Mr. C. V. Durell, who urged that much commercial arithmetic should be omitted in order to find time for work more productive of mathematical intelligence.

Among interesting exhibits were a projection of the earth's surface on a cube, shown by Prof. Turner, a celestial cylinder by Dr. T. P. Nunn, and apparatus illustrating Mr. Goodwill's paper. Prof. E. W. Hobson has accepted the office of president for the coming year.

Sir E. Ray Lankester opened the science masters' meeting with an address upon "Compulsory Science *versus* Compulsory Greek." The main question he desired to raise was whether the right choice of subjects for study was made in our public schools, and whether it was right and proper, as he should suggest, to cease altogether the cumbrous efforts to teach the Greek language to school-boys and to substitute for it as a regular and necessary part of the curriculum a well-considered, duly adapted, and skilfully designed course of instruction in natural science—using that term in the most comprehensive sense. The results of education were not transmitted by physiological heredity. Every individual born had to begin its education on a blank sheet. But man had created for himself a gigantic and overpowering possession, a sort of physical envelope of customs, taboos, traditions, laws and knowledge, which, though not transmitted to new individuals at birth as part of their structure, was yet a heritage by which man was educated. This heritage was put into his possession by gesture; by word spoken, written, or printed; by law; by the training given in the nursery and school; and by the experience of life. Individuals did not start equal, and it was the business of the educator to ascertain the various degrees of educability in the young and to adapt the course of education administered to them to their varying aptitudes. The well-educated man was he who had been enabled most fully to benefit by the accumulated inheritance of human knowledge and experience, and to enter on manhood as the heir of all the ages. The true Greek spirit was