

much larger than they were a few years ago, and the rays they produce will penetrate several centimetres of steel, and allow a radiograph of the thickest part of the body to be taken by means of a tube three metres away. At the commencement of the war the military authorities requisitioned all the X-ray tubes in France, but as this supply was found insufficient for the proper equipment of the radiological stations, the two French manufactories, which had been closed owing to their directors being called to the colours, were reopened, in one case by the recall of the director from the front, in the other by the appointment of a member of the Academy of Sciences as director. Under the guidance of a professor of the Collège de France a firm of glass-makers began the manufacture of the special glass for the bulbs, and in a few days was turning out the necessary quantity, so that France is now producing sufficient X-ray tubes to meet her own requirements, and is supplying some to her Allies.

THE essentials in the manufacture of a good rheostat are the use of first-class material and workmanship of a high grade. This useful piece of apparatus should therefore be particularly a British product; the rheostat cannot be considered to be a "competitive" article or one lending itself particularly either to what the Germans term "Massenfabrikation" or to dumping. Yet Messrs. Isenthal and Co., in sending us a new list of their rheostats, frankly admit that they had previously imported these from abroad, but are now manufacturing them entirely in England. The list before us is one of the most complete we have seen. Both the flat slate and the tubular types have hand-shield sliders with well-designed contact-makers, and the number of different arrangements listed should meet practically every requirement. A useful variation from the ordinary flat type is one with limbs of cross-shaped section which affords increased ventilation and enables the maximum number of watts to be dissipated for the minimum dimensions without undue heating. In the tubular type the slate bars are replaced by fire-enamelled steel tubes, and the resistance wire is oxidised so that the insulation of the oxide enables the turns to be wound closely. Dimensions, approximate resistances, weights, and diagrams of connections and arrangements of the terminals are given in detail, so that it should be possible to order rheostats for almost any purpose directly from the catalogue. We trust that Messrs. Isenthal and Co. will continue to manufacture them in England after the war.

THERE is a description of one of the new British projectile-making factories given in *Engineering* for January 28, illustrated by several good photographs showing some of the shops. The nine bays of the factory cover about 196,600 sq. ft., and are arranged so as to reduce to the minimum the distance which the shell has to travel in the process of manufacture. From the entry of the rough bar to the finished shell ready to be put into the breech of a gun, the distance travelled is only 400 yards. There are nearly one hundred operations in making a shell, and many of these take but little time; hence it is important that the time spent in moving the shell from operator to

operator should be as small as possible. Small shells are machined in this factory by female workers, and there are 1800 women in this department. The girls are able to work the machines in three days, and are efficient in seven days; the highest efficiency is attained after two months' experience. One skilled worker suffices for the setting of the machines for twelve female operators. The accuracy demanded is 0.004 in., and it speaks well for the girls that the rejected shells do not amount to more than one per cent.

OUR ASTRONOMICAL COLUMN.

THE SOLAR ECLIPSE OF FEBRUARY 3, 1916.—Official European observatories have perforce had to refrain from participating in the observation of to-day's total solar eclipse, notwithstanding the fact that spectroscopic interest was so unexpectedly intensified by the change recorded in the coronal spectrum at the eclipse of August 21, 1914. From the success that then attended the Spanish expedition, it might almost have been expected that the Madrid observers, at any rate, would have attempted to take advantage of the present opportunities. It would appear, however, that the American observers will have the field to themselves.

Starting in the Pacific Ocean, February 3d. 2h. 29m. G.M.T., in long. 121° 35.6' W., lat. 7° 20.8' N., almost a minimum part of the central line of totality passes over land areas. This portion is nearly parallel to and somewhat north of the Bogota-Caracas line in Columbia and Venezuela. The line then crosses the Caribbean Sea to Guadeloupe. The duration of totality over all this section is about 2½ minutes; the maximum of 2m. 36s. is reached before quitting Venezuela. Sweeping across the Atlantic, centrality passes a little wide of the Azores, and ends about 200 miles off the south coast of Ireland (Mizen Head) at 5h. 31.0m., in long. 9° 50.2' W. and lat. 49° 23.8' N. A partial eclipse will consequently be visible over the greater part of the Americas.

In south-west Europe, north-west Africa, and the British Islands the eclipse will only be partly visible, the sun setting in partial eclipse. At Greenwich the eclipse begins at 4h. 31m., and the sun sets at 4h. 49m., with about one-quarter of the disc obscured. The magnitude of the eclipse increases as the observer is situated further west, until in the south-west of Ireland the obscuration reaches about nine-tenths of the disc.

COMET 1915e (TAYLOR).—Prof. E. Strömgen has sent to NATURE his latest observation of the position of this comet, made on January 23. At 5h. 47m. 6s. G.M.T. the comet's position was α app., 5h. 10m. 1.89s., δ app. +16° 56' 54.1", whence the corrections of the ephemeris of Copenhagen Circular No. 11, $\Delta\alpha = 0s.$, $\Delta\delta = +0.8'$. The comet is stated to have been of the eleventh magnitude.

COLOURS OF STARS IN THE CLUSTERS N.G.C. 1647 AND M. 67.—The first statistical investigation employing the colour classes recently proposed by Prof. F. H. Seares deals with the distribution of colours among the stars in the above clusters (Proc. Nat. Acad. of Sci., i., p. 483). Hertzsprung and Seares have respectively published effective wave-lengths and colour indices for a number of the stars in N.G.C. 1647 (NATURE, September 23, 1915). Hertzsprung's results were alone taken into account, leading to the following correspondences between effective wave-length and colour class:—

Effective w.l.	4190	4260	4330	4400	4470	4540
Colour class	b ₀	a ₀	f ₀	g ₀	k ₀	m ₀

N.G.C. 1647 is principally made up of *a* and *f* stars, but contains a number of *b* and also some *km*, whilst

M. 67 (colour indices measured by Shapley) appears to be almost entirely made up of *g* stars, and contains neither *b* nor *m* classes, reminding us forcibly of the frequent association of the corresponding spectral types among the isolated stars.

Very significantly, in neither case does colour or magnitude vary with condensation. On the other hand, colour and magnitude are found to be connected, showing a marked relationship in the case of N.G.C. 1647, less pronounced in M. 67.

THE COLUMBUS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE sixty-eighth annual meeting of the American Association for the Advancement of Science was held at Columbus, Ohio, from December 27, 1915, to January 1, under the presidency of Dr. W. W. Campbell, director of the Lick Observatory of the University of California. In spite of the fact that the second Pan-American Scientific Congress was held at the same time in Washington, D.C., there was an attendance of something more than eight hundred, and the meeting was unusually successful.

The address of the retiring president, Dr. C. W. Eliot, on the subject, "The Fruits, Prospects, and Lessons of Recent Biological Science," has already been printed in *NATURE* (January 27, p. 605). Addresses of presidents of sections were given as follows:—(A) H. S. White, "Poncelet Polygons"; (B) A. Zeleny, "The Dependence of Progress in Science upon the Development of Instruments"; (F) F. R. Lillie, "The History of the Fertilisation Problem"; (G), G. P. Clinton, "Botany in Relation to American Agriculture"; (H) C. Wissler, "Psychological and Historical Interpretations of Culture"; (I) E. E. Rittenhouse, "Upbuilding American Vitality: the Need for a Scientific Investigation"; (K) R. M. Pearce, "The Work and Opportunities of a University Department for Research in Medicine"; (L) P. H. Hanus, "City School Superintendents' Reports"; (M) L. H. Bailey, "The Forthcoming Situation in Agricultural Work."

One of the most interesting functions of the meetings was a public lecture complimentary to the citizens of Columbus by Dr. D. W. Johnson, professor of physiography at Columbia University, on "Surface Features of Europe as a Factor in the War." Dr. Johnson indicated the strategic reasons for the movements in the great war which have been dependent upon the character of the country involved, and threw a new light on the subject to those who have been puzzled especially by the operations in the eastern war zone. Other public lectures were delivered by Dr. R. F. Bacon, of the Mellon Institute of Pittsburgh, on "The Industrial Fellowships of the Mellon Institute: Five Years' Progress in a System of Industrial Service"; Dr. F. K. Cameron, of the Bureau of Soils, Washington, "The Fertiliser Resources of the United States."

An important symposium on the topic, "The Basis of Individuality in Organisms," was held by Section F and the American Society of Zoologists.

Section K conducted a symposium on the topic, "Foods and Feeding," in the course of which Prof. H. B. Armsby spoke of the "Energy Content of the Diet"; Prof. Ruth Wheeler on the "Effect of the Proteid Constituents of the Diet on Growth"; Prof. E. B. Forbes, "The Mineral Nutrients in Practical Human Diets"; Prof. Carl Voegtlin, "Vitamines"; Dr. C. F. Langworthy, "Food Selection for Rational and Economical Living."

The new section of Agriculture, Section M, conducted a symposium on the topic, "The Relation of

Science to Meat Production," in which President W. O. Thompson (Ohio State University), President H. J. Waters (Kansas State Agricultural College), Prof. L. D. Hall (Office of Markets, U.S. Department of Agriculture), Prof. H. W. Mumford (University of Illinois), and Dr. A. R. Ward (Bureau of Animal Industry, U.S. Department of Agriculture) took part.

The following affiliated societies met with the American Association for the Advancement of Science:—American Association of Economic Entomologists, American Mathematical Society, American Microscopical Society, American Nature-Study Society, American Physical Society, American Phytopathological Society, American Society of Naturalists, Association of Official Seed Analysts of North America, Botanical Society of America; Entomological Society of America, Society for Horticultural Science, Southern Society for Philosophy and Psychology, Students and Collectors of Ohio Archæology; Wilson Ornithological Club.

New York was chosen as the meeting place for Convocation Week of 1916-17.

Dr. C. R. Van Hise, president of the University of Wisconsin, a distinguished geologist, was elected president of the association for the next year. The vice-presidents—that is, presidents of sections—elected were as follows:—Mathematics, L. P. Eisenhart, Princeton University; Physics, H. A. Bumstead, Yale University; Engineering, E. L. Corthell, Brown University, Providence, R.I.; Geology and Geography, R. D. Salisbury, University of Chicago; Zoology, G. H. Parker, Harvard University; Botany, T. J. Burrill, University of Illinois; Anthropology and Psychology, F. W. Hodge, chief of the Bureau of Ethnology, Washington, D.C.; Social and Economic Science, Louis I. Dublin, New York; Education, L. P. Ayres, of the Russell Sage Foundation, New York; Agriculture, W. H. Jordan, director of the New York State Experiment Station, Geneva, N.Y.

The general committee reaffirmed the recently adopted policy of the association in regard to the planning of future meetings, establishing a five years' schedule, largely for the benefit of the affiliated societies in making their plans for the future.

Members of the association who attended the last Columbus meeting in 1899 were greatly impressed by the growth of the Ohio State University during the intervening years, a growth, however, which is characteristic of a number of the great State universities in the United States. At the time of the 1899 meeting there were only one thousand students at this University, and at the time of the present meeting there are more than five thousand. Very many new buildings have been erected in the interim, and the equipment of all is modern and most excellent.

PARIS ACADEMY OF SCIENCES: PROPOSED PRIZES AND GRANTS.

PRIZES PROPOSED FOR 1917.

Mathematics.—The Francœur prize (1000 francs) will be awarded to the author of discoveries or works useful to the progress of pure or applied mathematics; the Bordin prize (3000 francs), for an improvement in some important point of the arithmetical theory of non-quadratic forms; the Poncelet prize (2000 francs), to the French or foreign author of the most important work in applied mathematics published in the course of the preceding ten years; the Vaillant prize (4000 francs), the question set for 1917 is to determine and study all surfaces which can in two different ways be formed by the displacement of an invariable curve.

Mechanics.—The Montyon prize (700 francs), for inventing or improving instruments useful to the pro-