

Waste—A World Problem," by Prof. H. J. Spooner. The same firm also announces "Synthetic Products," by A. R. J. Ramsey and H. C. Weston.

MR. EDWARD ARNOLD announces "Aeronautics in Theory and Experiment," by W. L. Cowley and H. Levy, in which will be chapters on the mathematical theory of fluid motion, the aerofoil, structural parts and controls, strength and construction, the air-screw, and stability.

OUR ASTRONOMICAL COLUMN.

NOVÆ IN THE ANDROMEDA NEBULA.—Including that which appeared in 1885, five novæ in the Great Andromeda Nebula have now been recorded. Two were found by Ritchey on plates taken in 1909, their maximum brightnesses being magnitudes 16.3 and 17.0; these are no longer visible. Another nova, of magnitude 17.5, at a distance of 10' from the nucleus, was found by Shapley on photographs taken in September last year. The latest discovery was made by Ritchey on a negative taken on October 16, 1917 (Publications Astr. Soc. of the Pacific, December, 1917). This star was of about the 18th magnitude, and the distance from the nucleus approximately 255" south and 26" west. On this plate Mr. Shapley's nova was observed to have diminished in brightness by at least two magnitudes in the interval of a month. All the photographs in question were taken with the 60-in. reflector at Mt. Wilson.

NEW VARIABLE STARS.—In Circular No. 201 of the Harvard College Observatory Prof. E. C. Pickering gives details of nineteen new variable stars which have lately been discovered by photographic methods, and of two which were found visually. The brightest images observed range from 8.4 to 13.0, and the faintest from 8.8 to <16. One of the variables is of the Algol type, with a period of 2.89570 days, and two others are Cepheids, with periods of 0.4786 day and 0.365 day. As illustrating the enormous wealth of material available for these investigations, the numbers of photographs examined with reference to the three stars mentioned were 292, 537, and 350 respectively.

Circular No. 202 gives the estimated dates during 1918 of maxima and minima of a large number of long-period variables.

TWO SPECTROSCOPIC BINARIES.—The orbits of the spectroscopic binaries γ Phœnicis and σ Puppis have been investigated by Mr. R. E. Wilson with the aid of photographs taken at Santiago, Chile (Lick Observatory Bulletin, No. 303). γ Phœnicis is a star of magnitude 3.3, Class K5, and has been found to complete a revolution in 193.79 days, the orbit being essentially circular. The semi-amplitude of the velocity-curve is 15.8 km., and the system is receding at the rate of 25.8 km. per sec. γ Phœnicis is the only late-type star at present known to be moving in an orbit of very small eccentricity. σ Puppis is of magnitude 2.99, Class K5, and has a period of 257.8 days. The semi-amplitude is 18.55 km., and the velocity of recession of the system 87.3 km. In this case the eccentricity of the orbit is 0.17.

PROPER MOTION STARS.—In *Astronomische Nachrichten*, No. 4922, Dr. Max Wolf gives particulars of nineteen proper motion stars in the region of the Great Andromeda Nebula, and of five which are near δ Arietis. One of the latter is remarkable as showing the large annual proper motion of 1.74", in the direction 130°; the star is of the 14th magnitude, and is situated in R.A. 3h. 6m. 10s., decl. +18° 23.1' (1875).

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MILITARY AERONAUTICS.

MAJOR BAIRD, in introducing the Air Service Estimates to the House of Commons on February 22, gave an outline of the work which had been done in creating the new Air Force. The works and lands used by the R.F.C. and R.N.A.S. have already been taken over, and co-ordination between the Air Ministry, the War Office, and the Admiralty has been secured by holding weekly conferences of the three staffs. Among the more interesting details of the speech from a scientific point of view are the particulars which Major Baird gave of the activities at the front. After all, the real measure of the success of scientific investigation in aeronautics at home is to be sought in the results achieved in the fighting area. These results were expressed in very concrete form in the speech, and we quote some figures given. In one day on the Western front 127 enemy batteries engaged were under aerial observation, twenty-eight gun-pits were destroyed, eighty more were damaged, and sixty explosions of ammunition were caused. In reconnaissance work nearly 16,000 photographs were taken in one month. Our bombing machines, in short-range operations, dropped an average of 6500 bombs per month, representing a weight of about 120 tons. In addition to these activities, about 150,000 rounds of ammunition per month were used in attacking troops from the air. Such figures as these cannot fail to awaken a sense of the extreme importance of the Air Services in modern warfare; and the first item, viz. the destruction of 127 batteries in a single day, brings home in a very convincing manner the effectiveness of aircraft for the control of artillery. Major Baird warmly commended the work of the Advisory Committee for Aeronautics in furthering the technical side of the subject, and expressed the hope that its valuable labours would add to the efficiency of the new Air Force in the future. The speech met with an enthusiastic reception, which it well deserved, for a more remarkable record of progress in so new a branch of the Services could scarcely be imagined.

La Nature for February 9 contains an interesting article from the pen of Lieut. Jean Abel Lefranc under the title "L'évolution de l'aviation allemande." The author traces the general lines of development of German machines since the beginning of the war. At the commencement of hostilities the most prevalent German type was a heavy biplane of very robust construction as compared with the much lighter machines developed in France. The main tendencies towards improvement in this type have been directed towards a reduction of head resistance by the simplification of the lines of the machine, the adoption of stream-lined fuselages made from three-ply wood, and the elimination of all unnecessary struts and tie-wires leading to the very "clean" design of the present-day machines, but necessitating a somewhat heavy construction. The light single-seaters of the Nieuport type, against which our enemies had to contend, led to the development of the Fokker machine, which in turn gave place to the Albatros D III. of the present time. The failure of the Zeppelins to realise the aims of their inventor led to the necessity of a heavy bombing machine, and the development of this type has resulted in the Gotha of to-day. M. Lefranc points out the various technical improvements made by the Germans as time went on, such as the adoption of appropriate fin surfaces instead of the large dihedral angle and swept-back wings of the earlier machines, and the introduction of balanced controls to obtain flexibility. The importance of standardisation has been clearly recognised, and the result is seen in the three main types now in use, represented by the Albatros D III, a light single-seater

capable of a speed approaching 120 miles per hour; the Aviatik L.V.G., a two-seater with a speed of about 100 miles per hour; and the Gotha, a three-seater bombing machine, with a speed of ninety miles per hour. The general type of construction is still heavier than that of French aeroplanes, requiring a larger engine for a machine of the same performance. M. Lefranc's contributions to *La Nature* have been commented upon several times in these columns, and the present article, like its predecessors, is well worth reading.

By permission of the Air Board, the *Engineer* is publishing full particulars and illustrations of the "Maybach" motor as used by the Germans in their Zeppelin airships, and of the "Mercedès" engine as used in the Gotha aeroplanes. The first article, which appears in the issue for February 22, is descriptive of the Maybach engine, particulars of which were obtained from a study of the motors of the German airship S.L.11, which was brought down at Cuffley in September, 1916, by Lieut. W. L. Robinson. The Mercedès engine described is one of two recovered from the wreck of a Gotha biplane of the pusher type, brought down in Flanders last April. Each of the four Maybach engines carried by the airship had six vertical water-cooled cylinders, giving about 200 b.h.p. at 1200 revolutions. Each engine drove an 18-ft. two-bladed propeller. The circulation of water in the jackets is believed to have been achieved by means of a thermo-syphon system, working in conjunction with a large honeycomb radiator for each engine, and assisted by an accelerator driven from the engine crank-shaft. The exhaust pipe is also water-jacketed, presumably in order to prevent an accidental fire. Drawings of all the more important details are included in the article.

THE ASSOCIATION OF TECHNICAL INSTITUTIONS

AFTER an interregnum of three years, owing to the war, the Association of Technical Institutions resumed its annual meeting on Friday last, February 22, in the hall of the Worshipful Company of Drapers, in the City of London. The meeting was numerously attended, and was comprised of representatives of the governors, together with the principals of most of the technical institutions of the United Kingdom. Sir Alfred Keogh, G.C.B., who has been president of the association since 1914, was re-elected for 1918. He has now resumed his duties as rector of the Imperial College of Science and Technology, having resigned his position as director of the Army Medical Service. In his presidential address he emphasised the value of science and scientific training, as demonstrated in the great results which, during the course of this deplorable war, have been achieved in the sphere of medical and surgical practice, in relation to the health of the soldier suffering from sickness and wounds, and especially in dealing with diseases which worked such terrible havoc in the military campaigns of past history. The medical profession has rendered splendid service not only in the treatment of disease, but also in its prevention.

Sir Alfred Keogh believes that the nation has come at last to recognise the place that science must occupy in the domain of industry, and also in the sphere of administration, both local and Imperial, which cannot achieve its best and greatest results unless its *personnel* be guided by the spirit and discoveries of science. The new Education Bill of Mr. Fisher marks an immense step forward. The education of the children of the nation, especially in view of the immense sacrifice of the best of our young man-

hood, has become a question of most serious moment, since they must now assume, at an unusually early age, grave responsibilities, far in advance of their time, in the conduct of affairs. The effective training and the due reward of the teacher are also matters of most grave concern, since, unless these are provided, and the teacher placed beyond anxiety, no education worthy of the name can possibly be ensured.

The training of teachers for technical institutions and for day continuation schools and classes was the subject of a paper read by Principal Watson, of Keighley. Mr. Watson showed how considerable the demand would be, illustrating by the submission of statistical data derived from inquiries made in Keighley, a town of 45,000 inhabitants, from which it appeared that in that town provision must be made for at least 2800 young persons between fourteen and eighteen years of age, requiring at least twenty-five specially trained additional teachers, from which it is deduced that at least 20,000 more teachers will be required of especial character in England and Wales to give adequate effect to the provisions of the Bill with respect to day continuation schools. This is in addition to the extra provision required in the elementary day schools, due to the large number of children who will, under the provisions of the Bill, now be in constant attendance in the schools up to fourteen years of age. The feeling that the education of pupils in the day continuation classes should be based upon liberal lines without vocational bias found strong expression.

Sir Philip Magnus opened a discussion on the best means of continued education, advocating that much advantage is to be gained from a half-time system extending from the age of fourteen until sixteen, with provision for continued education up to eighteen outside the ordinary working hours for at least six hours a week; but the feeling that the association should give unwavering support to the continued education clauses of the Bill as they stand received practically unanimous support. With a view to a more adequate scale of salaries for teachers in technical institutions and with the purpose of securing the services of men of high attainments and ripe technical experience, and to the provision of a suitable scheme of pensions and disablement allowances, it was urged by the association that much larger State grants should be forthcoming in aid of the work of technical institutions.

The regulations for junior technical schools were the subject of much adverse criticism. It was demanded that the course of instruction should be of a liberal character, that it should include a language other than English, that it should not have reference to a special trade or industry, and that the pupil should not be required to signify his intention to adopt a special branch of industry or commerce. The association, in a memorandum on "Education after the War," recently issued, urges that there should be a large increase in the number of scholarships with adequate maintenance grants to enable candidates to proceed to day technical colleges, that the technical departments of universities and technical colleges should be encouraged to undertake research in co-operation with manufacturing firms, and, having regard to the national importance of technical education, should bear a much larger proportion of the cost, and that the Government grants in aid of technical research should be largely increased. In view of the difficulty many institutions have experienced in obtaining necessary supplies, the Ministry of Munitions has empowered the council of the association to endorse applications to which priority will be granted under the order of the hon. secretary. The association extends its warm support to the proposals