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Aircraft Design

Correction of Aeroplane Performance to Standard Atmosphere. (C. W. Tinson, Flight, Vol. XXIII, No. 35, 28/8/31, pp. 862a-862b.) (5.106/22501 Great Britain.)

The author gives the elementary theory and works out numerical examples of correction for rate of climb and ceiling with and without supercharger.

Dynamic Tests to Destruction of Aeroplane Parts. (H. Hertel, Z.F.M., Vol. XXII, No. 15, 14/8/31, pp. 465-474.) (5.15/22502 Germany.)

A comprehensive scheme of tests is drawn up and the appropriate test apparatus is shown in eleven photographs. A number of elementary formulæ are collected and some results are given graphically.

Development of Research in Metal Construction. (A. Koppenhofer, Z.F.M., Vol. XXII, No. 14, 28/7/31, pp. 421-425.) (5.16/22503 Germany.)

A survey is given of progress in metal construction, illustrated by eighteen photographs of typical parts, under construction, under load and after failure.

Light Alloy Construction in Aircraft. (R. Hinzmann, Luftwacht, No. 9, Sept., 1931, pp. 418-422.) (5.16/22504 Germany.)

Progress had been made in die casting, pressure casting and welding. So-called hammer welding is effectively a forging process and removes the troublesome oxide film by mechanical vibration with increased consistency in the results.

Study of Aeroplane Vibration. (S. J. Zand, S.A.E. Jrnl., Vol. XXIX, No. 4, Oct., 1931, pp. 263-279.) (5.17/22505 U.S.A.)

A comprehensive study is made of vibration, particularly with reference to instruments. An elementary analysis of principal modes is carried out, and is applied to the design of a "vibrograph," which is described in considerable detail. The vibrations are magnified optically and are indicated by a

beam of light projected on a screen or on a film. The film is stopped for a sufficient time to record several cycles, the record appearing as an ellipse distorted more or less by harmonics. The principal axes of the ellipse determine the principal component of vibration in the plane. The film is then moved with uniform velocity for a known time and the record becomes a spiral, the number of turns of which determines the frequency.

Several records are reproduced and interpreted and the reduced results are plotted graphically. Photographs are also reproduced showing the effect of vibration on several types of instruments.

Load Factors in Gusty Air. (R. V. Rhode and E. E. Lundquist, N.A.C.A. Tech. Note, No. 374, April, 1931. See also S.A.E. Jrnl., Vol. XXIX, No. 3, Sept., 1931, p. 179, and Airc. Eng., Vol. III, No. 30, Aug., 1931, p. 197.) (5.18/22506 U.S.A.)

An elementary theory of stresses imposed by a sudden change in the incidence of an aeroplane is worked out, and an expression is obtained in terms of the vertical velocity required to produce the concurrent change of incidence. The wind structure of the atmosphere is discussed briefly with reference to violent local disturbances. A number of accelerometer readings from commercial flights are collected from various sources. In addition fifty-four recorded accelerations are tabulated from American civil aviation and the downward component of the disturbance is reproduced by the elementary formula established. A scheme for systematic collection of accelerometer records in gusty air is proposed.

Five references are given.

Characteristics of Aerofoils. (E. N. Jacobs and R. M. Pinkerton, N.A.C.A. Tech. Note, No. 391, Sept., 1931.) (5.2/22507 U.S.A.)

The characteristics of two sets of six aerofoils, each with the same general run but with the ordinates increased in different ratios were measured at Reynolds number 3,000,000. The results are tabulated and shown graphically. In the first set the lift is increased and the stalling point is postponed with thickness ratio increasing from 0.06 to 0.12; thereafter the lift falls off again. With the second set the curvature is greater and the maximum stalling incidence is obtained with a smaller thickness ratio. The characteristics are tabulated and shown graphically.

High Performance Aerofoils. (E. Sanger, Flugsport, Vol. XXIII, No. 13, 24/6/31, pp. 292-300.) (5.2/22508 Germany.)

Aeroplane resistance is made up of body and frame resistance and wing resistance, the latter including profile resistance and induced resistance. Induced resistance can be reduced by increasing the span (a practice adopted with modern gliders) or by preventing the formation of eddies at the tips. According to Lilienthal and the author, in the case of a bird's wing eddies at the wing tips are prevented by a peculiar vorticity of the air on the pressure side of the highly cambered wing. Wind tunnel experiments are described which show that the aerodynamic performances of the selected wing were improved by adopting a heavy camber combined with an upward sweep of the wing tips.

The experiments are to be continued.

Aerodynamic Characteristics of Eight Thick Aerofoils. (E. N. Jacobs, N.A.C.A. Rept., No. 391, July, 1931.) (5.2/22509 U.S.A.)

The thickness of the aerofoils was of the order of 20 per cent. of the chord, beyond which it is considered that the characteristics break down too seriously to offer practical applications. The tests were carried out in each case at different Reynolds numbers and discontinuities of flow marked by sudden drop

of lift at lower Reynolds numbers disappear at high Reynolds numbers. The effects of artificial turbulence were also studied and shown graphically as a considerable increase in the maximum lift. The results are fully recorded in graphical form and some of the more important characteristics are tabulated numerically.

Seven references are given.

Effect of Nose Shape on Aerofoil Characteristics. (R. M. Pinkerton, N.A.C.A. Tech Note, No. 386, Aug., 1931.) (5.2/22510 U.S.A.)

Tests were carried out on nine symmetrical aerofoils with different radii at the leading edges. The profile curves are specified in tables. The results show generally that both maximum lift and minimum drag increase with the thickness. Stalling point is reached sooner with thin sections than with thick sections.

Aerofoils—Tests in V.D. Channel. (E. N. Jacobs and R. M. Pinkerton, N.A.C.A. Note, No. 392, Sept., 1931.) (5.2/22511 U.S.A.)

The characteristics of two groups of six aerofoils each, series 45 and series 65, were measured systematically in the variable density channel at high Reynolds numbers. In each case the thickness ratio, maximum thickness/chord, increases from 0.06 to 0.21 by equal steps of 0.03. The results are tabulated and plotted graphically.

Three references are given.

Wind Tunnel Comparison of Characteristics of Three Normal and Three Reflexed Aerofoils. (G. L. Defoe, N.A.C.A. Tech. Note, No. 388, August, 1931.) (5.2/22512 U.S.A.)

From author's summary.—An investigation was made of the aerodynamic effects of reflexing the trailing edge of three commonly used aerofoils. Six aerofoils were used in the investigation: three having the normal profiles of the Navy 60, the Boeing 106, the Göttingen 398, and three having these profiles modified to obtain a reflexed trailing edge with the mean camber line changed to give $C_{m_{c/4}} = 0$.

The tests were conducted at a value of the Reynolds number of approximately 3,100,000 in the variable density wind tunnel of the N.A.C.A. Measurements of lift, drag, and pitching moment were made on each of the six aerofoils.

Generally speaking, lift and drag curves as functions of incidence are shifted to the right (increasing incidence). The maximum lift and the travel of the centre of pressure are reduced.

Theory of Wing Sections. (T. Theodorsen, N.A.C.A. Rept., No. 383, August, 1931.) (5.2/22513 U.S.A.)

Conformal transformation of a circle to a wing section is developed by the methods of Munk. The work is an extension of Glauert's application to thin aerofoils and follows much the same lines. By adopting a nose of finite curvature discontinuity of velocity is avoided.

In making claims the author, in common with other writers, ignores the possibilities of successive applications of the simple Joukowski transformation.

Characteristics of Symmetrical Aerofoils. (E. N. Jacobs, N.A.C.A. Rept., No. 385, July, 1931.) (5.2/22514 U.S.A.)

The aerodynamical characteristics of six symmetrical aerofoils of the Göttingen 398 type, varying in max. thickness/chord ratio by equal steps from 0.06 to 0.21 are plotted.

The maximum lift coefficient rises with stalling incidence up to thickness ratio 0.18 but falls back slightly for thickness ratio 0.21. Max. lift/drag is obtained for thickness ratio 0.12.

Forced Vibrations of Wings. (M. R. Bouchenot, Rev. S.G.A., July, 1931, pp. 38-41.) (5.24/22515 France.)

A brief mathematical account is given of the method of calculating the natural period of a wing structure. Experimental methods of determining the natural period are described and illustrated by diagrams. The calculated and experimental results are compared in tables and agree within roughly 5 per cent., the largest discrepancy being 9 per cent.

Pressure Distribution Over a Modified Elliptical Wing Tip on a Biplane. (R. V. Rhode and E. E. Lundquist, N.A.C.A. Tech. Note, No. 387, August, 1931.) (5.22/22516 U.S.A.)

From author's summary.—The results are given of flight pressure-distribution tests on the right upper wing panel of a Douglas M-3 aeroplane equipped with a modified elliptical tip having a slight amount of washout.

Tables and curves determine the load distribution for any normal force coefficient within the usual flight range.

Determination of the Best Simple Girder. (J. Cassens, Z.F.M., Vol. XXII, No. 15, 14/8/31, pp. 456-463.) (5.25/22517 Germany.)

Thirteen types of girder are specified in dimensioned sketches. Appropriate formulæ are developed and the forces on members and weight of members are tabulated in four classes. The total weights are summed in a separate column.

Accurate Calculation of Forces and Moments in the Members of a Framework. (H. Stending, Z.A.M.M., Vol. XI, No. 4, Aug., 1931, pp. 285-315.) (5.25/22518 Germany.)

A lengthy mathematical discussion is given, with worked out examples, of the methods of determining the stresses in a frame-girder under load and end thrust.

Metal-Truss Wing Spars. (A. E. Swickard, N.A.C.A. Tech. Note, No. 383, July, 1931.) (5.25/22519 U.S.A.)

Examples are worked out of stresses in metal-truss wing spars using the Berry or Müller-Breslau formulæ in the form adopted by the N.A.C.A.

Elastic Instability of Structural Members. (G. W. Trayer and H. W. March, N.A.C.A. Rept., No. 382, August, 1931.) (5.25/22520 U.S.A.)

A mathematical discussion is given of elastic stability of thin flanges under compression, and tables of coefficients are calculated. Approximate results are obtained by the method of least energy for assumed values of Poisson's ratio. Formulæ and coefficients are tabulated for twenty-three combinations of different sections, loadings, and constraints. Experimental work is described and the results are plotted graphically.

Stabilisation of Seaplanes on the Water by Means of Budig Stabilising Planes. (F. Budig, L'Aerophile, No. 7, 15/7/31, p. 209.) (5.51/22521 France.)

Watertight compartments near the wing tips can be rotated about the wing chord. When not operating the stabilisers conform to the profile of the wing surfaces and do not affect its aerodynamic quality. To prevent dangerous immersion of the wing tips in a cross wind or a swell the stabiliser is rotated till its immersion produces the necessary buoyancy.

Relation between Shipbuilding and Seaplane Construction. (G. Schnadel, Z.M.F., Vol. XXII, No. 15, 14/8/31, pp. 453-456, and Z.V.D.I., Vol. LXXV, No. 27, 4/7/31, pp. 870-872.) (5.56/22522 Germany.)

Analogies are drawn between certain problems in naval architecture and seaplane and flying boat construction such as lateral stability on the water, water resistance, watertight construction, etc.

Loading Assumptions for Landing Shock of Seaplanes. (J. Taub, Z.F.M., Vol. XXII, No. 14, 28/7/31, pp. 433-442, 229th D.V.L. Report.) (5.56/22523 Germany.)

The experimental results of Pabst and Wagner are reviewed. Approximate formulæ are developed for landing shocks and applied to numerical examples. In particular attention is given to the relation between increase of dimensions and landing shock, both for flat and for keeled bottoms. Lanchester's theory of dimensions is quoted. A numerical comparison is made between landing shocks on hulls and on double float aircraft. The author concludes that previous work is reasonably accurate for flat surfaces, but gives widely varying results in excess or in defect of more accurate investigation in the case of keeled surfaces.

Airscrews

Free-Wheel Airscrew. (M. Pillard, L'Aeron., No. 146, July, 1931, pp. 245-252.) (5.61/22524 France.)

A brief mathematical account is given of the torque-thrust relations, and numerical results are exhibited in a diagram. Comparative barographs of flights with and without this device are given, and comparative test results are tabulated. Photographs and sectional drawings of the hub are given.

Airscrew Characteristics, Effects of Small Angles of Yaw and Pitch. (H. B. Freeman, N.A.C.A. Rept., No. 389, July, 1931.) (5.61/22525 U.S.A.)

Tests were made on combinations of four angles of yaw (0°, 5°, 10° and 15°), with five angles of pitch (−5°, 0°, 5°, 10° and 15°). The full-scale effects on an airscrew and body without wings are small. With wings mounted directly behind there is an appreciable decrease of thrust and propulsive efficiency with increasing angle of pitch.

The mounting of the model is illustrated by six photographs. The results are given in seven graphical charts and eight tables. Six references are given.

Full-Scale Airscrew Tests. (H. B. Freeman, N.A.C.A. Report, No. 378, June, 1931.) (5.61/22526 U.S.A.)

A photograph shows the method of mounting in the air jet. Three types of airscrew were selected, and the coefficients of thrusts and torque, and the efficiencies are exhibited in eleven pages of tables and three pages of curves. Two references are given.

Goldstein's Solution for an Airscrew with Finite Number of Blades. (H. B. Helmbold, Z.F.M., Vol. XXII, No. 14, 28/7/31, pp. 429-432.) (5.61/22527 Germany.)

Goldstein's solution for a finite number of blades is compared with Betz's solution for an infinite number of blades with Prandtl's semi-empirical correction factor. Prandtl's corrected solution is a limiting form of Goldstein's exact solution, and is exhibited graphically in terms of parameters which control the numerical run of the solutions. The effect of comparatively high loads and slip are considered, and auxiliary curves are drawn for rapid numerical determination of the relation between the parameters involved. The variation of the chord

along the blade is also considered, and curves are drawn to determine the best shape for efficiency.

Five references are given.

Full-Scale Tests of Metal Airscrews at High Tip Speeds. (D. H. Wood, N.A.C.A. Rept.. No. 375, June, 1931.) (5.61/22528 France.)

The tests were carried out in the full-scale airscrew research channel. Tests were made up to tip speed of 1,350 feet per second. Little loss of efficiency was noticed up to tip speeds of 1,000 feet per second. At this speed the maximum efficiency falls off at about 10 per cent. per hundred feet per second increase of tip speed.

Thin blades permit of slightly higher speeds than thick blades.

The numerical results are given in five pages of tables and 26 diagrams.

Engine-Airscrew Unit, Direct Determination by Graphic Logarithmic Scale. (G. Bilbault, L'Aeron., No. 147, Aug., 1931, pp. 283-290, and No. 148, Sept., 1931, pp. 321-325.) (5.65/22529 France.)

An elaborate series of diagrams is drawn illustrating the numerical application of the author's methods for selecting the best airscrew for a specified performance. Numerical examples are also given.

Windmills

Experimental Work on the Savonius Rotor Windmill and Related Apparatus. (G. Bach, F.G.I., Vol. II, No. 6, June, 1931, pp. 218-231.) (5.62/22530 Germany.)

This apparatus offers a mechanically simple wind drive of low efficiency, and exhibits interesting aerodynamical reactions.

Five forms of rotor blade were investigated. The elementary principles of scale effect are discussed, the calibration of the velocity distribution in the wind channel is given with and without rotor models mounted in the stream. Methods of measurement are described. The measured moments and loads are recorded graphically, with components and reactions plotted against the velocity ratio. Polar diagrams of the transverse force and tangential force are plotted on the analogy of the polar diagram of lift and resistance for an aerofoil. The measured efficiencies are shown graphically and reach a maximum of about 25 per cent.

Undercarriages

Static Drop and Flight Tests of Musselman Wheels. (W. C. Peck and A. P. Beard, N.A.C.A. Rept., No. 381, June, 1931.) (5.55/22531 U.S.A.)

The overall diameter of the wheel is 30in., width 13in., internal diameter 6in., with the tyre fully inflated. Static tests were made with inflation pressures of 5, 10, 15, 20 and 25lbs. per sq. inch, with total loads up to 9,600lbs. Drop tests were made at inflation pressures of 5, 10 15, 20 and 25lbs. per sq. inch with loadings of 1,800 to 3,600lbs. Flight tests were made with a total flying weight of 2,050lbs. per wheel, with inflation pressures of 5, 10, and 15lbs. per sq. inch.

Photographs of the static tests and cinematograph records of the flying tests are reproduced. The detailed results are given in tables and graphically.

Six references are given.

Instruments

Siemen's Universal Oscillograph. (W. Jaekel, Z.V.D.I., Vol. LXXV, No. 19, 9/5/31, pp. 583-584.) (6.104/22532 Germany.)

Visual observations and photographic records of eight different circuits can be made simultaneously. The use of permanent magnets makes high insulation possible.

Measurement of Amplitude of Rigid Body Vibration. (G. v. Békésy, Ann. der Phys., Vol. XI, No. 2, 1931, pp. 227-232.) (6.104/22533 Germany.)

A description is given of an apparatus in which a pointer is brought into contact with a vibrating body, such as the sound box of a violin. The natural period of the apparatus is readily adjustable to agree with that of the body, under which conditions the readily calculated maximum amplitude is substantially unaltered by contact. A diagram of connections shows a four-valve circuit with head receivers of telephone type, by which the determinations are made.

Vibrograph. (Instrument World, Nov., 1931, p. 137.) (6.26/22534 Germany.)

Three masses have each one degree of freedom of rotation about axes, and transmit their motion to a plane mirror which deflects a recording point of light on a strip of sensitised paper with a magnification of ten.

Ionisation Manometer. (E. K. Jaycox and H. W. Weinhart, Bell Tele. Lab., B. 582, Sept., 1931.) (6.251/22535 U.S.A.)

A description is given with a photograph and detailed diagrams of an ionisation manometer which is easy to construct. Calibration curves are reproduced. Pressures of the order of 10^{-9} mm. hg. can be determined.

Cathode Ray Compass. (Luftwacht, No. 7, July, 1931, p. 322.) (6.501/22536 Germany.)

A cathode ray excited at 200 volts consists of a pencil of electrons moving at less than 10,000 km./sec. along the axis of a vacuum tube. A fluorescent screen is fixed at the end of the tube, on which the impinging ray excites a spot of fluorescent light.

When the ray is parallel to the earth's magnetic field it remains rectilinear, but when set at an angle θ to the field it becomes curved, and the point of impingement on the plate is deflected toward the magnetic east by an amount proportional to $\cos.\theta$. When the ray is at right angles to the field the deflection is more than a centimetre.

When the tube is fixed in the aeroplane, usually along the vertical rigging axis, the deflection depends on the attitude of the aeroplane and tube in the magnetic field. The relation between the instantaneous pitching, yawing and rolling angles, and the position of the point of impingement, are readily determined by elementary spherical geometry.

In particular, the correct east and the angles of bank and pitch can be determined. The ray is not sensibly affected by angular velocities and accelerations.

Zermelo's Air Transport Problem. (T. Levi-Civita, Z.A.M.M., Vol. II, No. 4, Aug., 1931, pp. 314-321.) (6.51/22537 Germany.)

The wind velocity distribution is given as a vector field, and the problem of flight from one point to another in the field at constant air speed is proposed. Formal solution is obtained by the methods of the calculus of variations.

Abac for Determination of Aeroplane Climb and Speed. (G. Bilbault, Tech. Aeron., No. 118, Aug., 1931, pp. 206-215.) (6.68/22538 France.)

Elementary approximate equations are developed and numerical solutions are obtained by means of an abac (nomogram), the construction of which is given. Numerical results are tabulated for a list of 57 aeroplanes.

The Present Position and Limit of Optical Projection. (W. Arndt, Z.V.D.I., Vol. LXXV, No. 32, 8/8/31, p. 1021.) (6.8/22539 Germany.)

Commercial diascopes, episcopes and epidiascopes have been examined in the optical department of the Berlin Technical High School. Low voltage lamps

with smaller filaments, in conjunction with reflecting mirrors, improve diascope projections. Episcopes seldom transmit as much as 1 per cent. of the illumination. In the combined instrument, the epidiascope, the brightness of the projected image depends largely on the mode of projection employed.

When there is a certain intensity of external illumination in the projection room, the episcope projection soon loses detail, while the diascope remains effective.

Manœuvrability, Etc.

Dangerous Lateral Instability of an Aeroplane near Stalling Point. (R. Fuchs and W. Schmidt, Z.F.M., Vol. XXII, No. 13, 14/7/31, pp. 393-400.) (7.2/22540 Germany.)

When an aeroplane near stalling, particularly in landing or starting, meets an unfavourable asymmetrical disturbance, the stalling incidence may be exceeded and a yawing motion started under conditions favourable for auto-rotation.

Numerical values are derived for seven coefficients of component moments, and are exhibited graphically. When these values are inserted in the biquadratic criterion for asymmetrical instability, one large positive root is obtained. The numerical magnitude of this root is affected by the coefficients of moment roll and yaw produced by rolling.

The possibilities of reducing these qualities by changing the aerodynamical and inertial qualities of the aeroplane are discussed.

Manœuvrability. Photograph by Camera Obscura. (C. H. Dearborn and H. W. Kirschbaum, N.A.C.A. Rept., No. 386, Aug., 1931.) (7.4/22541 U.S.A.)

A method of observing and recording the manœuvres of an aeroplane by camera-obscura has been evolved. The camera-obscura chamber is mounted on a graduated turntable. The lens may be mounted either on the flat of the roof, or on the sloping part, which makes about 60° with the horizontal. The film is 30in. by 30in., large enough to take in a complete manœuvre of an aeroplane; it is mounted on a table, which can be set rapidly at right angles to the axis of the lens in either position. A specimen film is reproduced showing 37 exposures. The interval between exposures is determined by the operation of a focal-plane shutter. The usual instruments are fitted in the aeroplane. The linear and angular velocities and accelerations, and the positions of the controls thus determined, are plotted. Sixty diagrams of the aeroplane's motion during diving, pulling up, turns, spins and loops are given.

Askania Photographic Trajectory Recorder. (L'Aeron., No. 147, Aug., 1931, p. 300.) (7.4/22542 France.)

A wide angle lens is mounted on a flexible leather cone in parallel with a telescopic sighting apparatus. The trajectory of the aeroplane is followed by means of the telescope, and a series of exposures is made on the same plate (18 by 24cm.). A specimen plate is reproduced, showing over 100 exposures, following three independent trajectories of aircraft across the field.

Engines—Design, Etc.

Chemical Valency in the Light of the Theory of Wave Mechanics. (A. Sommerfeld and K. Bechert, Z.V.D.I., Vol. LXXV, No. 32, 8/8/31, p. 1019.) (8.1/22543 Germany.)

The explanation of the chemical combination of similar non-polar atoms presented considerable difficulty under the old Bohr theory of the atom. According to the modern concepts of wave mechanics, the combination of atoms is equivalent to the coupling of a number of vibrating systems, the energy distribution

depending on the atomic distance. The new theory is capable of explaining simple cases of valency and has been subjected to quantitative proof.

Reference is made to the most recent literature.

Schlieren Method of Photography of Air Disturbances. (D. B. Gawthrop, Rev. Sci. Insts., Vol. II, No. 9, September, 1931, pp. 522-531.) (8.1/22544 U.S.A.)

The method is briefly described, and some striking photographs are reproduced showing disturbances of air by flames and explosions.

Investigations on Combustion in the Four-Stroke Engine. (Autom. Tech. Zeit., Vol. XXXIV, No. 11, 20/4/31, p. 266.) (8.1/22545 Germany.)

The work of Lovell and Boyd reported in Ind. Chem., No. 9, 1930, is reviewed. Using a sampling valve changes in oxygen concentration in the engine cylinder were traced during combustion. By correlating changes in oxygen concentration in flame position the conclusion was drawn that the combustion spreads out from the sparking plug in a relatively narrow zone. The speed of propagation depends mainly on the engine revolutions and there is distinct evidence of slowing up as the flame approaches the wall. The reviewer points out that increased tendency to knock with retarded spark seems to indicate abnormal experimental conditions.

Electrical Determination of the Velocity of Ignition in an Internal Combustion Engine. (K. Kuchtner, F.G.I., Vol II, No. 6, June, 1931, pp. 197-207.) (8.1/22546 Germany.)

A description is given of Bone's apparatus for determining the arrival of the explosion wave at a station by the ionization of the surrounding gas and the increased electrical conductivity across a gap registered by a sensitive galvanometer. Certain disturbing factors interfere with the measurement of the exact moment at which the explosion wave arrives, and to eliminate this a new arrangement is described. A sectional drawing, photograph and diagram of connections are given. A steady alternating current is maintained in the primary circuit, and is rectified in a valve circuit. The disturbing current from the engine cylinder is superposed on the rectifying current and the disturbance is recorded photographically on a moving film. A specimen length is given with time wave of period 1/100 sec. on which the disturbance is recorded clearly. The dead centres and the ignition point are marked on the film. The relations between excess or defect of air, the proportions of the gas mixture, and the velocity and duration of ignition are shown graphically.

The Effect of an Electric Field on the Propagation of Flame. (E. M. Guenault and R. V. Wheeler, Fuel, Vol. X, No. 7, July, 1931, pp. 302-307.) (8.13/22547 Great Britain.)

In agreement with Lewis (see Abstract 22548) deflection of the flame by an electric field towards the negative pole was observed but the exhaustion of the flame is regarded as due either to the cooling effect of the electrode or to the presence of ionized products of combustion.

Additional references are given.

The Effect of an Electric Field on Flames and their Propagation. (B. Lewis, Fuel, Vol. X, No. 7, July, 1931, pp. 297-302.) (8.13/22548 Great Britain.)

The effects of an electric field on the flame of ten hydrocarbon-air and carbon-monoxide-air mixtures were observed. It was found that the flame is deflected towards the negative electrode and by placing the latter downstream, the flame could be extinguished in most cases.

It is concluded that the positive ions play an important part in the maintenance of the flame. A bibliography of 15 references covers the period since 1893.

Empirical Equation for Real Gas. (E. J. M. Honigmann, F.G.I., Vol. II, No. 7, July, 1931, pp. 261-266.) (8.15/22549 Germany.)

Numerous experimental results are collected in the form of P-V-T. diagrams and are compared with the values calculated from the usual formulæ with empirical values of the index.

Eleven references are given.

Forces on Engine Mounting in Spin. (D. Williams, Flight, Vol. XXIII, No. 35, 28/8/31, pp. 262c-262e.) (8.2/22550 Great Britain.)

Gyroscopic forces on the engine and on two and four-bladed airscrews are expressed by elementary formulæ from which numerical values may be readily obtained.

Superchargers

The Turbo Supercharger. (A. L. Berger and O. Chenoweth, S.A.E. Jrnl., Vol. XXIX, No. 4, Oct., 1931, pp. 280-295.) (8.235/22551 U.S.A.)

An account, chiefly descriptive, is given of the development of the supercharger. The turbo supercharger is described in considerable detail with numerous photographs of parts and accessories as mounted on an aeroplane. Test results, in thirteen diagrams, exhibit the principal measured characteristics of aeroplane and engine.

Effect of Valve Timing on Performance of a Supercharged Engine at Altitude and an Unsupercharged Engine at Sea Level. (O. W. Schey and A. E. Biermann, N.A.C.A. Rept., No. 390, Aug., 1931.) (8.235/22552 U.S.A.)

The supercharged conditions at altitude were simulated by exhausting the engine into an evacuating tank.

The normal Liberty valve timing is as follows :—

Inlet open	... ...	10° after T.D.C.
Inlet closed	... ...	45° after B.D.C.
Exhaust closed	...	10° after T.D.C.
Exhaust open	...	50° before B.D.C.

Each of the four valve characteristics was varied in turn over large limits, the other three remaining standard. Thus the time of opening the inlet valve was varied to cover the range from 55° before T.D.C. to 30° after T.D.C. (normal 10° after T.D.C.).

The effect of altering the valve timing was practically the same for normal and supercharged conditions, in disagreement with the suggestion of Mr. Fedden (Jrnl. R.Aer.Soc., 1927, No. 202, p. 933) that earlier inlet closing would be beneficial in the case of the supercharged engine.

Diesel, Etc.

Mobile Diesel Engine of Motorenwerke Mannhein A.G. (Autom. Tech. Zeit., Vol. XXXIV, No. 27, 30/9/31, pp. 606-608.) (8.25/22553 Germany.)

The manufacturers of the well-known Benz two-stage ignition engine have adopted direct injection for their mobile tractor model. The Bosch fuel pump and valve are used, and no attempts are made to produce air turbulence. The piston crown has an indentation in the form of a deep pan into which the fuel stream is projected, this preventing condensation of the fuel on the relatively cool cylinder walls. The three-cylinder construction produces a more variable torque,

but improves the balance and the relative strength of the crankshaft. B.M.E.P. 85 lbs./sq. in. is maintained from 400-1,100 r.p.m., with specific fuel consumption .4lb. of oil per B.H.P. hour.

The stationary model using two-stage ignition, and also built by this firm, usually exceeded .5lb. of oil per B.H.P. hour. On the other hand, the two-stage ignition system is less sensitive to fuel quality. Since, however, fuel oils of good quality are now becoming generally available, this characteristic is of less importance, and this possibly explains the change in design.

The Future of the Diesel Engine. (Autom. Absts., Aug., 1931, p. 24.)

Diesel Engine Evaluated. (H. M. Crane, S.A.E. Jrnl., July, 1931, p. 73.)

Will the Auto-Diesel Prevail? (A. M. Wolf, Machine Design, July, 1931, p. 21.)

European Development of Light-Weight Diesel Engines. (J. O. Huse, Diesel Power, July, 1931, p. 344.) (8.25/22554 U.S.A.)

The above papers refer to solid injection high-speed oil engines which are not Diesel engines at all. In their present form they have no chance of displacing the low power high-speed petrol engine. Above 100 h.p. fuel economy becomes important, and the injection engine has possibilities if its bulk and weight can be reduced, particularly by supercharging.

Oil Film Temperatures on Diesel Engine Piston Rings. (E. H. Hillman, Diesel Power, May, 1931, p. 226. Autom. Absts., Vol. IX, No. 8, August, 1931, p. 242.) (8.25/22555 U.S.A.)

The piston ring temperatures were determined under running conditions by inserting in the back of the ring a series of fusible alloy plugs so small that the molten metal causes no damage in the space behind the ring.

Co-operation of Pumps and Nozzles in Compressionless Diesel Engines. (P. L'Orange, Z.V.D.I., Vol. LXXV, No. 11, 14/2/31, pp. 326-328.) 8.25/22556 Great Britain.)

Pressure records were obtained with a Farnborough electrical indicator at various points in the fuel line of a direct injection engine. The curve depends on the pump cam and the capacity and length of the connecting pipe. The capacity between pump and nozzle should be as small as possible, in accordance with the modern tendency to combine nozzle and pump in one unit.

New Light-Weight Diesel Engine. (A. E. Thiemann, Autom. Tech. Zeit., Vol. XXXIV, No. 18, 30/6/31, pp. 434-436.) (8.25/22557 Germany.)

The *Oberhäusli* Diesel.—The combustion space is displaced and communicates with the cylinder through a narrow neck, which produces turbulence during injection. The combustion space has a liner maintained at about 600°C. by the explosions, which produces good slow running without throttling the intake air or cutting out cylinders.

The main data are:—

Four cylinders, 130 by 185 mm.
Compression ratio 14 : 1.
B.M.E.P. 96lbs. per sq. in.
Consumption, 210 grammes (.45lbs.) of gas oil per B.H.P. hr.
85 h.p. at 1,220 r.p.m.

Design—Miscellaneous

The Baer Rotary Valve for I.C. Engines. (J. Rosendaal, Autom. Tech. Zeit., Vol. XXXIV, No. 18, 30/6/31, pp. 436-438.) (8.32/22558 Germany.)

The valve consists of a hollow cast-iron drum, water-cooled internally, rotating with small clearance in a cast-iron cylinder. The connections between

the valve and the engine consist of bronze shoes, pressed against the valve by springs. A steel diaphragm, on which the shoes are elastically mounted, forms gas-tight joints with small bearing surface. With straight valve passages the drum rotates at $\frac{1}{4}$ engine speed, and, with suitably coned passages, at $\frac{1}{6}$ engine speed. The slow speed reduces lubricating difficulties and losses at the rotary valve.

Air-Cooled Cylinder Head Design. (R. Chilton, S.A.E., Vol. XXIX, No. 1, July, 1931, p. 14.) (8.32/22559 U.S.A.)

A limit to power output is set by the temperature of the cylinder head, in which a thermo-couple should be installed as standard equipment and the readings treated with as much respect as oil pressure and temperature. Materials for poppet valves should have good heat conductivity and should maintain their strength at high temperatures. Most of the alloy steels used for exhaust valves are bad heat conductors and have high coefficients of thermal expansion, which causes warping and bad seating.

Stroke Bore Ratio. (G. Sartoris, Autom. Eng., Vol. XXI, No. 284, Sept., 1931, pp. 239-243.) (8.32/22560 Great Britain.)

The effect of the stroke-bore ratio on the power-weight characteristic of an engine is considered in some detail. The loads on the big-end are tabulated round the complete cycle of two revolutions for ratios of 2 : 1 and 1 : 2, and show a large reduction in maximum resultant thrust for the latter. The kinematical relations are worked out graphically in a comprehensive example.

Crankshafts

Porter's Method for Calculating Natural Frequencies of Torsional Vibration in Crankshafts. (Z.V.D.I., Vol. LXXV, No. 13, 28/3/31, pp. 404-405.) (8.36/22561 Germany.)

The smaller vibrating masses are distributed evenly over the corresponding sections of the shaft and the system finally reduced to a few masses connected by uniform shaft lengths for which the period can easily be determined. Under certain conditions the saving of labour by the new method is considerable. An example is given.

Torsional Oscillations in Multiple Crankshafts. (A. Stodola, Z.A.M.M., Vol. IX, No. 5, Oct., 1929.) (8.36/22562 Germany.)

Linear differential equations of motion are formed, with the usual assumption of linear damping which enables the system to be solved simply. The equations are developed for seven masses connected elastically, and a numerical example is worked out. A case of apparent resonance is discussed, and is shown in certain conditions not to be dangerous. Undamped oscillations are also briefly treated.

Critical Speeds of Crankshafts. (F. Kluge, Autom. Zeit., Vol. XXXIV, No. 25, 10/9/31, pp. 547-549, and No. 26, 20/9/31, pp. 580-581.) (8.36/22563 Germany.)

The author discusses briefly the usual methods of forming a system of linear differential equations of the motion and works out numerically one-crank and two-crankshaft cases by an approximate method. A comparison is made with the results of standard methods in a numerical table. The greatest discrepancy is about 9 per cent. and, generally speaking, the new results are from 1 per cent. to 3 per cent. lower.

Two-throw and four-throw cranks without flywheels are considered. Results are given graphically. The application of the author's method to shafts with more numerous cranks is indicated.

Fractures Due to Vibration. (M. Mahoux, Rev. S.G.A., July, 1931, pp. 29-34.) (8.36/22564 France.)

The stresses imposed on a shaft by torsional oscillation are exhibited graphically on a large-scale polar diagram. Two micro-photographs of portions of a fractured shaft are reproduced with diagrams showing the position of the fracture and of the small portions of the fractured surface photographed. Micro-photographs of strained materials are added for the information of constructors.

Cooling

Franklin Air-Cooled Engines Adapted to U.S.A. Army Tanks. (Radco Automotive Review, June, 1931. Autom. Absts., Aug., 1931, p. 231.) (8.4/22565 U.S.A.)

A water-cooled tank engine requires considerable quantities of water, both for initial filling of radiator system and for making up evaporation loss. This is a great drawback, especially when operating in a desert region. In the U.S.A. air-cooled tank, the air both enters and leaves through louvres in the top of the armour plate, and is directed over the engine cylinders by a fan.

Heat Flow in Cooling Ribs. (C. Bogaerts and P. Meyer, F.G.I., Vol. II, No. 7, July, 1931, pp. 237-244.) (8.4/22566 Germany.)

An iteration method of solving the heat equation is developed whereby the flow of heat in more complicated rib forms can be determined. Examples are worked out showing the radial variations of temperature with changes of profile. The flow of air past cylinders is discussed, and streamlines are reproduced from experimental determinations. The problem is three-dimensional.

Heat Transfer and Pressure Drop in Empty Baffled and Packed Tubes. (A. P. Colburn and others, Ind. and Eng. Chem., Vol. XXIII, No. 8, Aug., 1931, pp. 910-923.) (8.4/22567 U.S.A.)

Extensive numerical data are given showing the relation between high transfer velocity and pressure drop under the three conditions considered. Heat transfer to air flowing through a tube filled with granular material may reach eight times the value for flow through an empty tube. In baffled tubes the heat transfer may be raised six-fold in conjunction with a 200-fold increase of pressure drop. The same increase in heat transfer might be obtained by raising the velocity about 7·75 times with an increase in pressure drop of 60 times.

Mechanism of Heat Transmission. (T. B. Drew and W. P. Ryan, Ind. and Eng. Chem., Vol. XXIII, No. 8, Aug., 1931, pp. 945-953.) (8.4/22568 U.S.A.)

Photographs are reproduced of the flow of air and water past cylinders in streamline pipes and through banks of pipes parallel to and diagonal to the stream. Details of experimental apparatus for measuring the rate of heat flow from a cylindrical surface are given and illustrated by photographs and diagrams.

Thirty-five references are given.

Heat Transfer in Streamline Flow. (T. B. Drew and others, Ind. and Eng. Chem., Vol. XXIII, No. 8, Aug., 1931, pp. 936-944.) (8.4/22569 U.S.A.)

A theoretical discussion is given. Numerous data from different investigations are tabulated and plotted.

Twenty-three references are given.

Water Cooling. (Capt. Sales, L'Aeron., No. 149, Oct., 1931, p. 353.) (8.44/22570 France.)

Arrangements are described for the control of cooling water temperature over a wide temperature range, without change of total flow, by shunting sections

of the radiator. Certain precautions are prescribed. A separator and condenser of small dimensions are required to prevent steam formation.

Water-Tube Radiators. (K. Dehn, Forschungsheft 342, Mar., 1931.) (8.44/22571 Germany.)

In the water-tube radiator the water is carried through tubes which pass transversely through a series of flat cooling plates over which air passes, in contrast with the ordinary type of radiator in which the air passes through a series of hexagonal tubes round which a flow of water in thin sheets is maintained. The laboratory installation is described and illustrated, and the methods of measuring air and water temperatures are discussed. Physical similarity involves not only Reynolds' number R, of dimensions $[vl/r]$, but Péclet's number $Pé$, of dimensions $[vl/k]$, where k is the thermometric conductivity. Semi-empirical equations are given for the total transfer of heat and for the pressure drop in the air passing through the plates. The numerical results are plotted graphically. Experimental and calculated values are compared.

Further research along similar lines is carried out on tubes with cooling fins. A mathematical treatment is elaborated and involves the use of Bessel functions of different kinds. The extensive numerical results obtained are tabulated, and subsidiary problems are discussed. No systematic comparison is made with ordinary radiators. The introduction of correcting coefficients indicates the semi-empirical nature of the investigation.

Engine Cooling. (J. H. Geisse, Army and Navy Register, 12/9/31.) (8.44/22572 U.S.A.)

The cooling medium is diethylene glycol (b.p. 250°C., m.p. below 0°C.).

The jacket surrounds the cylinder completely, permitting free circulation of the fluid, and has external fins for air cooling.

It is stated that an engine thus equipped has been delivered to the Navy Dept. for trials.

Lubrication

Bearing Loads and Lubrication. (F. L. Prescott and R. B. Poole, S.A.E. Jrnl., Vol. XXIX, No. 4, Oct., 1931, pp.296-315.) (8.31/22573 U.S.A.)

Figures from American practice show shaft speeds and bearing loads of aircraft engines. Extensive data are given in tables and indicate the limits of speed and pressure permissible. Angular velocity and acceleration diagrams are drawn on a large scale to illustrate the analysis, and a number of worked out polar diagrams of resultant forces on crank pins and main bearings are reproduced.

The Friction of Well Lubricated Bearings. (P. M. Heldt, Autom. Ind., Vol. LXV, No. 7, 15/8/31, pp. 234-236.) (8.31/22574 U.S.A.)

The coefficient of bearing friction was found to vary directly as the viscosity, r.p.m., and shaft diameter, and inversely as bearing pressure and clearance within the limits of the experiments.

The Development of the Theory of Bearing Lubrication during the Last Five Years. (Z.V.D.I., Vol. LXXV, No. 32, Aug., 1931, p. 1025.) (8.31/22575 Germany.)

It is found that shorter bearings are more rigid, give steadier running conditions and permit higher speeds. Grooves in regions of high oil pressure are definitely harmful.

Thirty-three references to recent work are given.

Chemical Composition of Lubricating Oils. (M. Bestuzhev, Erdol und Teer, Vol. VII, 1931, pp. 159, 191 and 205. Chem. Absts., Vol. XXV, No. 14, 20/7/31, p. 3816.) (8.54/22576 Germany.)

Lubricating oils are mixtures of naphthene and aromatic hydro-carbons, the latter being responsible for carbon deposits in cylinders. New compounds with long side chains are produced by the cracking of heavy naphthenes, but not of light naphthenes.

The Artificial Ageing of Special Mineral Oils. (M. van Rysselberge, New Intern. Assoc. Testing Marerials, Zurich. Chem. Absts., Vol. XXV, No. 14, 20/7/31, p. 3814.) (8.54/22577 Germany.)

The degree of refinement of an oil is measured by the amount of oxygen absorbed after 200 hours at 110°C.

Contribution to the Study of Ageing of Special Oils. (M. van Rysselberge, Chimie and Industrie, Special No., March, 1931, p. 427. Chem. Absts., Vol. XXV, No. 14, 20/7/31, p. 3814.) (8.54/22578 France.)

An oil regenerated by removal of organic acids, as well as of water, dirt and sludge, has the characteristics of new oil.

Ratio of Oil Consumption to Mileage. (A. F. Denham, S.A.E., Vol. LXIV, No. 26, 27/6/31, p. 980.) (8.586/22579 U.S.A.)

The oil consumption of an engine goes up very markedly with speed. The main causes are the resultant rise in oil temperature, the reduced scraping effect of piston rings, and the increase in the quantity of oil thrown on the cylinder walls. The oil pump pressure and the centrifugal pumping action of the crank-shaft also increase. The loss of oil vapour from the crankcase is increased by the increase in the translational speed and the concomitant increase in pressure differences. It is difficult to reduce oil consumption at high speeds without risk of under lubrication at low speeds.

Fuel and Detonation

Measurement of Intensity of Knock Noises. (Wawrziniok, Autom. Tech. Zeit., Vol. XXXIV, No. 25, 10/7/31, pp. 572-574.) (8.645/22580 Germany.)

Receiving apparatus is arranged to record frequencies from 100 to 6,000 Hertz. Seven diagrams are reproduced showing knock frequencies of about 3,300 Hertz at engine speeds of 1,000 r.p.m.

Sound Intensity in Relation to Knock Ratings. (H. F. Huf, J. R. Sabina and J. B. Hill, S.A.E. Jrnl., Vol. XXIX, No. 2, Aug., 1931, pp. 134-136.) (8.645/22581 U.S.A.)

A method of measuring the intensity of sound given out by knock by means of a microphone and valve amplifying set is described with a photograph and diagram of connections. Nine charts of measured sound intensities for different fuels are reproduced.

Knock Ratings, Influence of Carburettor Setting and Spark Timing. (J. M. Campbell, W. G. Lovell and T. A. Boyd, S.A.E. Jrnl., Vol. XXIX, No. 2, Aug., 1931, pp. 129-133.) (8.645/22582 U.S.A.)

The effects of carburettor setting and spark timing on knock-rating are shown in ten diagrams for different fuels and different proportions of tetraethyl lead. The conclusion is drawn that the carburettor should be set for maximum knock and the spark timing for maximum power in order to obtain the most consistent comparisons.

Aeroplane Fuel-Line Temperatures. (O. C. Bridgeman, C. A. Ross and H. S. White, S.A.E. Jrnl., Vol. XXIX, No. 2, Aug., 1931, pp. 121-125.) (8.684/22583 U.S.A.)

The vapour lock tendency of light fuel increases with increase of temperature and decrease of pressure. In a rapid climb the temperature of the fuel adapts itself to the temperature of the surrounding air very slowly, while the pressure decreases rapidly. Vapour lock is more likely in a rapid climb than under any other conditions.

The relation between vapour pressure, vapour lock, temperature and altitude is calculated for a standard atmosphere and shown graphically. Numerous observed fuel system temperatures are plotted for various flights in illustration of these conclusions.

Distribution and Penetration of a Spray: Effect of High Air Velocities. (A. M. Rothrock, N.A.C.A. Tech. Note, No. 376, May, 1931.) (8.705/22584 U.S.A.)

To ensure perfect distribution air speeds of the order of 800ft. per sec. are applied. A directional method of producing air movement by vanes in the intake system involves smaller pumping losses than a piston pump combined with a constricted passage.

Spray-Tip Penetration. (A. M. Rothrock and E. T. Marsh, N.A.C.A. Tech. Note, No. 384, July, 1931.) (8.705/22585 U.S.A.)

Injection pressures of 4,000, 6,000 and 8,000lbs. per sq. in. and valve opening pressures of 1,000, 2,000, 4,000, 6,000 and 8,000lbs. per sq. in. were applied. For the lower pressures a well defined maximum penetration is obtained when the valve opening pressure is equal to the injection pressure. At higher values the maximum is not so clearly defined.

Apparatus for Observation of the Phenomena of Injection and Combustion. (Laurent, Seguin and Labarthe, C.R., Vol. CXCIII, No. 1, 6/7/31, pp. 19-21.) 8.705/22586 France.)

A brief descriptive account is given of a method of recording by cinematograph every phase in the injection of fuel into Diesel engine cylinders. Photographs are obtained by illumination from a 16,000 v. spark. The duration of the spark is of the order of one millionth of a second. The number of exposures can be increased up to 30,000 or even 100,000 per second.

Experiments on a Centrifugal Pump. (A. Closterhalfen, F.G.I., Vol. II, No. 7, July, 1931, pp. 252-260.) (8.74/22587 Germany.)

The case was fitted with side windows through which photographs of flow were obtained by optical methods based on the refraction of light from an electric spark. A few photographs are reproduced with explanatory notes. Ideal streamlines are drawn graphically and expressions are obtained with the introduction of simplifications and empirical numerical factors for the pressure distribution along the blades. Head pressure, torque, power and efficiency are shown graphically as functions of the delivery in litres per second.

Fifteen references are given.

Autogiro. (German patent No. 504,050, L'Aeron., No. 145, June, 1931, p. 218.) (8.78/22588 Germany.)

The patent covers an invention for setting the blades in motion before the start by the expulsion of a jet from the tip of the wing. The pressure is obtained by combustion of a suitable fluid, which is ignited by a cartridge. A diagram shows the mechanical arrangement of the starter, fuel, cartridge, combustion chamber, etc.

Cartridge Starter for Aircraft Engines. (Army Ord., Vol. XII, No. 68, Sept.-Oct., 1931, p. 133.) (8.78/22589 U.S.A.)

The starter is 10½ inches long and weighs 19lbs. The cartridges weigh 22 to the lb. The expansion in a cylinder of the gas from the slow burning powder pushes forward a piston, which acts as a starter.

Anti-aircraft

The Effect of High Velocity Bullets on Armour. (H. Gerlich, Army Ord., Vol. XII, No. 68, Sept.-Oct., 1931, pp. 100-103.) (9.15/22590 U.S.A.)

Numerous technical data are given of special bullets of an armour piercing type. Two photographs show two penetrations, entry and exit, of ½ inch high-resistance armour plate by a 7 mm. bullet with velocity of 5,300ft. per sec. A velocity of 5,800ft. per second has actually been obtained. Applications to aeroplane guns and anti-aircraft small-arm ammunition are suggested.

External Ballistics. (Kourensky, C.R., Vol. CXCIII, No. 15, 12/10/31, pp. 571-572.) (9.16/22591 France.)

The air resistance of a projectile is expressed as a power series starting with negative unity and a constant term and continuing upwards through the positive integers.

By an appropriate transformation the differential equations of motion under gravity are transformed to a canonical form established by P. Appel. A number of previous solutions for special assumptions are particular cases of the present results.

Use of Fasella Tables for Step by Step Calculation of Trajectories. (O. V. Eberhard, Z.A.M.M., Vol. XI, No. 4, Aug., 1931, pp. 253-273.) (9.16/22592 Germany.)

The formula for resistance is expressed in various forms, and the differential equation of the trajectory is expressed and transformed to new variables. The coefficient of resistance is plotted against the velocity, modified for variations of temperature and the corresponding variations of the velocity of sound. Four types of curve are given, showing in each case the peak value with the velocity scales reduced to the corresponding velocity of sound at the prevailing temperature. The method of step by step integration of the path is given in detail, and lengthy numerical computations are worked out and tabulated.

Fire Control from Aeroplanes Against Targets and from the Ground Against Aeroplanes. (Guyomar, Rev. F. Aer., No. 25, Aug., 1931, pp. 935-945.) (9.61/22593 France.)

The problem is discussed and illustrated by sketches, and principles of training are laid down.

The Development of Anti-Aircraft Artillery. (Rev. F. Aer., No. 25, Aug., 1931, pp. 946-964.) (9.77/22594 Germany.)

German views on the development of A.A.C. artillery are reviewed. The German regulations for co-operation with other arms are reproduced. The Reichswehr have sufficient A.A.C. material at their disposal to equip twelve divisions.

A New Anti-Aircraft Weapon. (G. M. Barnes, Army Ord., Vol. XII, No. 68, Sept.-Oct., 1931, p. 93.) (9.77/22595 U.S.A.)

A descriptive account is given with a number of technical details of a 3in. A.A.C. gun mounted on a six-wheel truck. Photographs exhibit the truck,

wheels, various types of track drive and examples of bad ground successfully traversed.

A later type is described on page 132, and illustrated by two photographs on page 99.

Materials

Influence of Iron in Duralumin. (W. Kroenig, Z. für Metallk., Vol. XXIII, No. 9, Sept., 1931, pp. 245-249.) (10.101/22596 Germany.)

Extensive measurements of the properties of iron duralumin alloys show a systematic reduction of strength with increasing iron content. Ten micro-photographs show the structure of five alloys. Corrosion is also increased.

Continuous Nitriding. (R. J. Cowan, Autom. Ind., Vol. LXV, No. 9, 29/8/31, pp. 314-318.) (10.12/22597 U.S.A.)

A continuous process of nitriding in a special design of furnace gives a wide range of penetration. The relation of Brinell hardness to depth of penetration is shown graphically for a large number of specimens.

Heat Treatment of Chromium Plate. (Autom. Ind., Vol. LXV, No. 12, 19/9/31, p. 425.) (10.125/22598 U.S.A.)

The resistance to corrosion of chromium plating can be definitely increased by subjection after plating to 450°F. for approximately half an hour, apparently by the removal of hydrogen evolved during the electrolytic plating, which alloys itself with the chromium.

Corrosion Prevention. (L. C. Milburn, S.A.E. Jrnl., Vol. XXIX, No. 2, Aug., 1931, pp. 148-157.) (10.262/22599 U.S.A.)

The paper deals chiefly with the prevention of corrosion of aluminium and its light alloys in aeroplane structures. Protective paints and greases are specified and electro-chemical deposits are discussed. Methods of protecting parts from exposure to corrosive influences are considered an essential part of manufacturing routine and precautions to be taken in heat-treating, nitriding, anodising and painting are laid down. Dipping tanks and anodising equipment are illustrated by photographs. The usefulness of laboratory corrosion tests is discussed. Technical points were raised in the discussion.

Fabrics, Etc.

Cotton for Parachute Cloth. (W. D. Appel, N.A.C.A. Tech. Note, No. 393, Sept., 1931.) (10.402/22600 U.S.A.)

An investigation was made of the qualities of cotton parachute cloth as a substitute for silk in the event of a curtailed supply. Suitable cotton yarn was produced and cloth woven from the yarn in the Bureau of Standards mill was equal to parachute silk in strength and tear resistance, met the requirements of low permeability to air, and weighed little more per yard than the silk cloth. Practical trials of cotton parachutes carried out by the Navy Department indicate that the cotton parachute approaches the silk parachute in rate of descent, opening time and strength after storing in the pack for sixty days. Specification and tests for cotton parachute cloth are given. Cotton yarns suitable for parachute cloth are now being woven commercially in U.S.A.

Fabrics in Aviation. (C. J. Cleary, Airc. Eng., Vol. III, No. 31, Sept., 1931, pp. 228-229.) (10.402/22601 U.S.A.)

The mechanical properties of the various textile materials available are discussed. Strength, elasticity, and elongation along the warp are plotted against relative humidity. The porosity of parachute cloths is plotted against air pressure.

Gluing in Aircraft Construction. (T. R. Truax, S.A.E. Jrnl., Vol. XXIX, No. 2, August, 1931, pp. 167-168.) (10.66/22602 U.S.A.)

Research is carried out at the Forest Products Laboratory, U.S. Department of Agriculture, with the idea of making a glued joint as strong as the wood itself. A number of technical instructions are given as to seasoning, drying, the best moisture content of the wood, preparation of surface, mixing and applying of the glue, and the external pressure to be applied. The protection of joints from moisture is discussed, and reference is made to Tech. Bulletin No. 205 of the U.S. Department of Agriculture, entitled "Gluing wood in aircraft construction."

Surface Leakage of Pyrex Glass. (W. A. Yager and S. O. Morgan, Bell Tele. Lab., B. 583, Sept., 1931.) (10.406/22603 U.S.A.)

Surface leakage of insulating materials under alternating currents at different humidities has been little studied. Condenser apparatus is described with which sufficient accuracy is obtained for low humidities and high frequencies. The absorption of water at the surface and the conductivity for different frequencies and humidities are tabulated and shown graphically. An elementary mathematical discussion is given and the relative importance of the different factors, on which the dielectric loss depends, is determined. The agreement with experiment is satisfactory.

Wind Tunnels

N.A.C.A. Vertical Wind Tunnel. (C. J. Wenzinger and T. A. Harris, N.A.C.A. Rept., No. 387, July, 1931.) (11.1/22604 U.S.A.)

A description is given of the vertical wind channel with drawings and photographs of the general arrangement. The results of calibration are given graphically. The vertical tunnel is convenient for the study of spinning phenomena.

Five references are given.

Compressed Air Wind Tunnel at N.P.L. (E. F. Relf, Engineering, Vol. CXXXII, No. 3,429, 2/10/31, pp. 428-433.) (11.1/22605 Great Britain.)

An authoritative account illustrated by photographs and diagrams is given of the development of the compressed air wind tunnel at N.P.L. The importance of obtaining full-scale Reynolds numbers is considered to justify the cost.

Airships

The Metal-Clad Airship. (C. B. Fritsche, J.R. Aer. Soc., Vol. XXXV, No. 249, Sept., 1931, pp. 817-883.) (12.1/22606 Great Britain.)

The paper gives much fuller information than has yet appeared in the Press. Methods of construction are given and weights and performance obtainable are compared with British and German airship designs. Numerous technical points were raised in the discussion.

Progress in Airship Design. (C. P. Burgess, J. Am. Soc. N. Engrs., Vol. XLIII, No. 3, Aug., 1931, pp. 419-425.) (12.1/22607 U.S.A.)

The principal data of U.S. airships are given in comparative tables with some analysis of weights and strength. The endurance of the Akron is stated to be four times that of the Shenandoah, and an analysis is given of the way in which improved performance is obtained. Further possible developments are briefly discussed.

"Akron" Trial Flights. (Sci. Am., Vol. CXLV, No. 5, Nov., 1931, p. 336.) (12.3/22608 U.S.A.)

It is stated that the new U.S.A. airship Akron will be taken out for a maiden flight of two hours' duration at normal cruising speed, to be followed by an endurance test of 48 hours. A climb of 6 m. per second and a descent of 4 m. per second is specified. The airship must be taken out of the shed in a wind of not less than 10 m.p.h. with a cross component of not less than 5 m.p.h.

Wireless

High Frequency Atmospheric Noise. (R. K. Potter, Proc. Inst. Rad. Eng., Vol. XIX, No. 10, Oct., 1931, pp. 1731-1765.) (13.1/22609 U.S.A.)

Numerous measurements of atmospheric noise over the range from 5 to 20 megacycles have been carried out over the United States. Numerous results are exhibited graphically and show diurnal variation for the different months and seasons. Generally speaking, the intensity of the atmospheric noise from centres of severe local disturbance appears to be inversely proportional to frequency. Inferences may be drawn from the data as to the effect of sunrise and sunset, eclipse of the sun, and disturbance in the earth's magnetic field. The location of the noise sources is briefly considered.

Long Wave Radio Field Intensity, Correlation with Passage of Storms. (I. J. W. Shiel, Proc. Inst. Rad. Eng., Vol. XIX, No. 9, Sept., 1931, pp. 1675-1689.) (13.1/22610 U.S.A.)

Author's summary.—Variation in received field intensity of long radio waves is compared with variation and temperature, pressure, and rainfall during the passing of general storms at Washington. The results show that in general there is a definite falling off in signal intensity in front of the advancing low. This is followed by an increased intensity which persists from one to two days after the storm centre passes. This indicates some real relationship between received signal strength of long waves and weather over that part of the path of the wave over which it passes shortly before reaching the receiving station.

Communication by Very Short Waves. (E. Karplus, Proc. Inst. Rad. Eng., Vol. XIX, No. 10, Oct., 1931, pp. 1715-1730.) (13.3/22611 U.S.A.)

In the range of known wave lengths from cosmic waves, 10^{-2} cm., up to commercial radio waves of 10,000 metres, two narrow bands can be used for radio communication with rectilinear propagation of the waves themselves. These ranges are from 0.7 μ to 2.0 μ and from 5 cm. to 10 m. Within these ranges there is one and only one line of propagation, so that fading cannot occur. The Radio Corporation of America have applied the method to inter-communication, using 7 m. waves, between the Hawaiian Islands up to 200 miles range, without interfering with existing channels. The Post Department at Berlin has also carried out tests with 3 m. waves, but has finally adopted the 7 m. wave. Successful results have been obtained up to five miles.

A non-mathematical technical description of the apparatus is given, with photographs and diagrams of connections. Some of the electrical characteristics are given graphically.

Propagation of Short Waves Over the North Atlantic. (C. R. Burrows, Proc. Inst. Rad. Engs., Vol. XIX, No. 9, Sept., 1931, pp. 1634-1657.) (13.3/22612 U.S.A.)

The average field strength in decibels per kw. is exhibited by contour lines of equal strength plotted as functions of standard time of day and transmitted frequencies. Fifteen diagrams show results for the months of February, March and June, and also for spring, summer, autumn and winter. A wide variation in the position of best transmission shows that the selected frequencies must be carefully adapted to the season of the year and to the time of day in order to obtain the best results.

Development of Directive Transmitting Antennæ by R.C.A. Communications, Inc. (P. S. Carter, C. W. Hansell and N. E. Lindenblad, Proc. Inst. Rad. Eng., Vol. XIX, No. 10, Oct., 1931. pp. 1773-1842.) (13.31/22613 U.S.A.)

A comprehensive discussion of the development of directive antennæ is given, covering the physical and technical aspects of the subject.

Twenty-Watt Aircraft Transmitter. (A. P. Bock, Proc. Inst. Rad. Eng., Vol. XIX, No. 9, Sept., 1931, pp. 1569-1578.) (13.31/22614 U.S.A.)

A transmitter for telegraph signals is modified to permit of short-range telephone signalling near an air port. The technical description is illustrated by diagrams and photographs of the apparatus. A map shows the district in which the tests were made, and a table gives the signalling strengths received at various ranges, using telephone signals up to 50 miles range and telegraph signals up to 255 miles range.

Simultaneous Radiotelephone and Visual Range Beacon. (F. G. Kear and G. H. Wintermute, Bur. St. J. Res., Vol. VII, No. 2, Aug., 1931, pp. 261-287.) (13.6/22615 U.S.A.)

From Author's abstract.—Increased use of the airway radio services by transport operators has resulted in a demand for continuous range-beacon service. At the same time the weather broadcast information has increased in importance and the interruptions to the beacon service have become more frequent. To eliminate difficulties arising from this conflict a transmitting system has been developed which provides simultaneous transmission of visual range-beacon and radiotelephone signals.

This system is designed to employ existing equipment as far as possible. By combining two transmitting sets into one the cost of buildings and antenna equipment is reduced.

The transmitting set consists of a 2 kw. radiotelephone transmitter operating in a non-directive antenna system and an additional set of amplifier branches, supplying power through a goniometer to two loop antennæ.

The equipment on the aeroplane to receive this service is changed only by the addition of a small filter unit which keeps the low frequency reed voltages from reaching the head telephones and the voice frequencies from the reed indicator.

Numerous flight tests on the system have shown it to provide satisfactory service under adverse interference conditions.

Disturbances Due to Vibration in Movable Wireless Receivers. (Brintzinger, Handel and Viehmann, Z.H.F.T., Vol. XXXIX, No. 1, July, 1931, pp. 1-14, 211 D.V.L. Rept.) (13.32/22616 Germany.)

Wireless receivers and antennæ on aircraft are subjected to unavoidable vibration and the electrical circuits must be designed to mitigate the disturbing effects. The antennæ should be coupled aperiodically to the receiver to prevent re-emission of radiations, and the circuit should be stabilised against changes of frequency and amplitude, by quartz control or otherwise.

Some Characteristics of Thyratrons. (J. C. Warner, Proc. Inst. Rad. Eng., Vol. XIX, No. 9, Sept., 1931, pp. 1561-1568.) (13.5/22617 U.S.A.)

The characteristics of gas and vapour-filled valves controlled by grid electrode are given for comparison with high vacuum valves, with a view to encouraging their application in radio communication.

Precise Measurement of High Frequencies. (F. A. Polkinghorn and A. A. Roetken, Proc. Inst. Rad. Eng., Vol. XIX, No. 6, June, 1931, pp. 937-948.) (13.5/22618 U.S.A.)

Authors' summary.—A description is given of equipment for the measurement of radio frequencies between 5,000 and 30,000 kc. The equipment consists of a million-cycle quartz-crystal oscillator as a standard of frequency, means for producing harmonics and sub-harmonics of this frequency, and means for combining voltages of these known frequencies with a voltage whose frequency it is desired to measure so as to produce beat frequencies in successive stages, the beat frequency produced in each stage having one less digit than that in the preceding stage. A calibrated electric oscillator is used to measure the frequency of the last stage. An indicator gives the sought frequency after a series of dial adjustments. The error of a completed measurement is estimated as less than three parts in a million.

Temperature Coefficient of Quartz Oscillators. (H. Straubel, Z.H.F.T., Vol. XXXVIII, No. 1, July, 1931, pp. 14-27.) (13.5/22619 Germany.)

The dimensions of the quartz can be chosen to control the temperature coefficient so that it remains substantially zero over an appreciable range of temperature.

Echo Measurements in Wireless Telegraphy. (G. Goubau, Ann. d. Phys., Vol. X, No. 3, July, 1931, pp. 329-372.) (13.31/22620 Germany.)

Signals were emitted from two senders, one at Munich and one at Herzogstand, and were received at six stations at distances varying from 3 to 126 km. From the difference in time the height of the Heaviside-Kennelly layer was calculated. Full technical descriptions and diagrams of connections are given. Seventeen photographs are reproduced showing the disturbances of the steady circular motion of the indicating apparatus by vertical jumps of the light trace. The method of deducing the time intervals is fully described and the error in favourable circumstances is stated to be of the order of $\pm 5 \times 10^{-6}$ seconds, corresponding to $\pm 1°$ on the circular oscillogram and ± 1 km. in height. Under bad conditions the error may be doubled. Numerous observations are recorded graphically and in tables.

The general conclusion is reached that a single layer lying between 90 and 100 km. in height will account for all the observed results. It is considered that there is no evidence of a strongly reflecting layer at 200 km.

Twelve references are given.

Photography

Air Photography. (De Fontagnes, Rev. F. Aer., No. 25, Aug., 1931, pp. 915-934.) (14.14/22621 France.)

The application of photography to the production of maps is reviewed. The reduction of height contours by stereoscopic control of reducing mechanisms is considered as completely solved by several types of apparatus. A photograph is given of a French reducing machine with an example of its productions.

Noise Intensity

Noise. (A. H. Davis, J.R. Aer. Soc., Vol. XXXV, No. 248, Aug., 1931, pp. 676-710.) (15.3/22622 Great Britain.)

The author read a comprehensive paper on the present state of the definition and measurement of sound intensity, particularly sounds produced by an airscrew and aeroplane engine. The paper brings out the difficulty of assessing physiological effect in terms of mechanical energy. The available devices for reducing the intensity of the sound produced and for shielding aeroplane passengers from the irreducible residue are fully discussed and quantitative results are given in tables and diagrams. The advantages of the decibel notation are stated. The disadvantages are inherent in the physiological difficulty referred to above. A discussion followed.

Lightning

Lightning Investigation Applied to Aeroplanes. (A. O. Austin, U.S. Air Services, Vol. XVI, No. 8, pp. 28-33.) (16.30/22623 U.S.A.)

The possibilities of lightning striking an aeroplane are discussed, and the types of possible damage are classified and described. A photograph shows an artificial spark entering the tail of a model aeroplane.

Helicopters

Autogiro, Modification. (Sci. Am., Vol. CLXV, No. 5, Nov., 1931, p. 336.) (17.05/22624 U.S.A.)

A descriptive account is given with two photographs of a modification of the autogiro in which the blades equalise the lifts through a complete cycle by feathering instead of by flapping. It is stated that the feathering is produced by the displacement of the centre of pressure. The project appears to be in an early experimental stage.

Meteorological

Meteorological Observation by Aeroplane. (L. T. Samuels, U.S. Air Services, Vol. XVI, No. 10, October, 1931, pp. 20-22.) (19.1/22625 U.S.A.)

A brief description is given of the routine of observation. A photograph shows a meteorograph mounted on an aeroplane wing strut, and a typical reduction chart. Four stations are established at which meteorological flights are subsidised.

Radio Tracking of Meteorological Balloons. (W. R. Blair and H. M. Lewis, Proc. Inst. Rad. Eng., Vol. XIX, No. 9, Sept., 1931, pp. 1531-1560.) (19.1/22626 U.S.A.)

From authors' summary.—A light transmitter, weighing about a pound, is carried up by the balloon at a known ascensional rate. Loop receivers are employed in ranging for this transmitter. The whole project involves the determina-

tion of air temperature aloft, as well as air movement, but the work on it so far has been limited to the development of equipment needed for the observation of wind direction and speed. Positions are usually determined at minute intervals. Tables and equipment employed in the reduction of data are made to fit this interval.

Picking Up Loads

Picking Up of Mails by Aeroplane. (U.S. Air Services, Vol. XVI, No. 10, Oct., 1931, pp. 26-28.) (20.1/22627 U.S.A.)

The " Cabot " device consists of a catapult arm carrying the mailbag and an extended cord which is engaged by a hook lowered from the aeroplane. At the instant of contact the catapult projects the mailbag forward in the direction of flight at the speed of the aeroplane, thereby eliminating shock. The Post Office requirements were limited to 40lb. packages, but it is stated that loads of 1,000lbs. can be dealt with.

Catapults

Aeroplane Catapults. (K. Schwarzler, Z.F.M., Vol. XXII, No. 14, 28/7/31, pp. 425-428.) (20.14/22628 Germany.)

The problem of catapult starting is discussed briefly, and the feasible accelerations are considered. A record of starting accelerations is reproduced. Photographs exhibit the experimental catapult built upon a floating pontoon, and a number of technical details are given in the article and in diagrammatic drawings. Starting data are given for aircraft of $2\frac{1}{2}$, $3\frac{1}{2}$, and 15 to 20 tons, with flying speeds from 100 to 150 km. per hour.

Lighting of Aircraft and Aerodromes—Fog Penetration

Aeroplane Lighting. (Dept. Commerce, Airplane Lighting Sub-Committee, No. 8.) (21.06/22629 U.S.A.)

Under a subject classification American practice in aeroplane lighting is described in detail. Methods of producing and regulating electric power in aeroplanes are described. Lamps for various classes of service and types of lighting equipment are discussed and illustrated. Tables show the effect of voltage drop on light output of lamps. A typical wiring system shows recommended wire and lamp sizes.

Airport Lighting. (Dept. of Commerce, Airport Lighting Sub-Committee, No. 6.) (21.095/22630 U.S.A.)

Airports are rated alphabetically, from A downward, according to their equipment.

A detailed account is given of types of modern lighting equipment, with photographs of the installation and diagrams of distribution of lighting intensity. High intensity of lighting is recommended for the landing area. Recommendations are made for the lay-out of equipment for flood lighting and for subsidiary purposes.

Airways Lighting. (Dept. of Commerce, Airways Lighting Sub-Committee, No. 7.) (21.095/22631 U.S.A.)

An airway map shows the lighted routes in operation and projected. Details are given of American practice, with recommendations for lighting various obstructions. Types of lighting equipment in general use are described, and their disposition along routes is given. The practice of the Dept. of Commerce in

providing intermediate landing fields is stated, and the lighting of these is described in detail. Developments in contemplation are listed. Incandescent lamps are the foundation of lighting of air routes, but fall short of the minimum requirements under adverse weather conditions, when radio takes first place as an aid to aerial navigation.

Transmission of Light Through Fog. (F. C. Breckenridge, Dept. of Commerce, Lighting Sub-Committee, No. 9.) (21.22/22632 U.S.A.)

The King formula and the Stratton and Houghton formula have been applied to the spectral transmission of light through fog. The basis for each is briefly discussed. Six research programmes on the spectral transmission of light through fog, haze, or mist, carried out in the U.S., are described briefly. Applications of the formulæ are discussed, and in some cases coefficients have been derived. The calculated curves are compared with the experimental data. The findings are summarised in seven conclusions.

Aerodynamics and Hydrodynamics

Stability of Superposed Streams. (G. I. Taylor, Proc. Roy. Soc., Vol. CXXXII, No. A. 820, 1/8/31, pp. 499-523.) (22.1/22633 Great Britain.)

The equations of motion for a small disturbance in the form of a wave pattern from steady flow are formed for a variety of cases, and various simplifying approximations are introduced. Where the assumptions and simplifications are brought into equivalence with those made by Rayleigh, the equations and results are in agreement, in particular where the density varies exponentially with height and where the density is uniform. Where the variation of density is linear the conditions for divergent instability are shown to depend on the zeros of a Bessel function of the third kind, the discussion of which the author leaves incomplete as a problem for the pure mathematician. He points out, however, that there is an infinite number of zeros on the imaginary axis with a point of condensation at the origin, from which he infers that a series of stable wave-lengths, depending on the distance between two bounding planes, can be propagated. For a semi-infinite fluid all wave-lengths may be propagated. The cases of fluid layers of different densities separated by a transition layer in which the density varies uniformly between the different uniform velocities of the bounding fluids, and in which the velocity varies linearly across all three layers, are considered in detail, and a formal criterion of stability is obtained.

Where the density is considered as uniform, the criterion reduces to that found by Rayleigh as separating stable from unstable wave lengths. In Taylor's more general case mathematical and graphical solutions are given for five particular cases. The criterion takes the form of a closed central curve with two or four branches of approximately hyperbolic shape. The stream velocity is a parameter determining the position of a variable straight line which cuts these curves in two or four points, according to its position. Cutting in two points corresponds to two possible cases of instability; cutting in four points corresponds to stability in all possible cases. The velocity range for instability is defined in this way. A comparison is made with Goldstein's result (see following abstract), and sufficient numerical agreement is obtained. Further generalisations are discussed, and the corresponding modifications of the results are given.

Stability of Superposed Streams. (S. Goldstein, Proc. Roy. Soc., Vol. CXXXII, No. A. 820, 1/8/31, pp. 524-548.) (22.1/22634 Great Britain.)

The general procedure is similar to that of the foregoing abstract. The method of small disturbances from steady motion is employed. The resulting

linear differential equations are solved and algebraic criteria are obtained. In section 5 a more general case is considered and a non-linear differential equation is obtained which is solved in Bessel functions, the variables being non-dimensional quantities which are functions of the physical quantities involved. Four linear functions of Bessel functions are involved in the solution, and these are tabulated. It is implied by Taylor's remark (see foregoing abstract) that the solution is equivalent to Taylor's solution in elementary functions, a result which is not *prima facie* obvious. The discussion of the roots is elaborate, and indicates the existence of a large variety of possible stable and unstable wave disturbances. As the author remarks, in the case of divergent disturbances the approximations on which the analysis is based must fail when the divergence exceeds a certain amplitude.

Wind Speed Measurements Behind Stalled Aerofoils. (E. Petersohn, Z.F.M., Vol. XXII, No. 10, 28/5/31, pp. 289-300.) (22.1/22635 Germany.)

Measurements of the reduction in channel wind speed behind a wing were applied to the determination of total drag of a wing by the loss of momentum (M. Schrenk, L.F.F., Vol. II, No. 1, 18/5/28; see A. and N. 7, Nov., 1928, No. 9260, p. 10). In the present paper the method is applied to three types of wing :— (1) rectangular, aspect ratio 4-1 ; (2) rectangular, aspect ratio 8-1 ; (3) trapezoidal, narrowing toward the tip.

The principal object is to determine the loss of controllability and stability. A description is given of the arrangement of the apparatus for measuring the reduction of velocity, and the results are plotted for the three types of wing and for different angles of incidence from 0° to 60°. On plotting the drop in pressure against the distance of the recording instruments behind the wing for different incidences between 10° and 60° experimental points lie fairly closely on a curve for all values of the incidence above 30°, while below 30° the reduction of pressure falls off roughly with the incidence.

The results are sufficiently accurate to determine the reduction in relative wind speed behind a stalled wing acting on the body and tail surfaces and the corresponding reduction of controllability and stability of the aeroplane. As might be expected the downward component of wind velocity behind the wing increases with the lift up to stalling incidence and thereafter decreases rapidly with the lift. Certain effects of artificial turbulence on the trapezoidal wing are noted.

As had been previously observed (*cf.* Göttingen Reports, Vol. III, p. 59) the lift curve follows different branches according as the measurements are made with increasing or with decreasing incidence, the lift in the latter case being lower and the stalling incidence smaller.

Damping of a Pendulum in Viscous Media. (G. W. Brindley, Phil. Mag., Vol. XII, No. 77, Aug., 1931, pp. 522-534.) (22.1/22636 Great Britain.)

It is shown experimentally that the damping is proportional to the square of the velocity when the velocity of the bob exceeds a few millimetres per second.

Motion of a Sphere Through a Viscous Liquid. (C. E. Lemin, Phil. Mag., Vol. XII, No. 77, Aug., 1931, pp. 589-596.) (22.1/22637 Great Britain.)

An expression for the fall of small spheres through a viscous medium was obtained by Stokes and discussed by Rayleigh. In carrying out experimental work errors were found to arise from small departures from sphericity and from turbulence set up in the medium (glycerine) by the previous experiment. These errors were eliminated by using steel ball bearings accurate to one part in 10,000,

and by allowing ten minutes to elapse between falls. The Reynolds number was kept below a definite low limit.

Cylinders Oscillating in a Stream of Water. (A. Thom, Phil. Mag., Vol. XII, No. 77, Aug., 1931, pp. 490-503.) (22.1/22638 Great Britain.)

A number of experimental results are published. An attempt is made to form expressions indicating the amplitude of the eddies detached periodically. The serious discrepancies are discussed by the author.

A New Hydraulic Principle. (M. Golaz, C.R., Vol. CXCIII, No. 7, 17/8/31, pp. 336-338.) (22.1/22639 France.)

The author assumes that the overflow streamlines of a reservoir in a channel of rectangular section and curved profile become parallel to the profile at a particular station below the crest and have a common normal and common centre of curvature (taking the problem as two-dimensional). Since the flow is potential this gives the relation $v \times r = \text{const.}$

On making this substitution expressions are found for rate of flow of energy, etc. Further assumptions are brought in and criteria are stated, but the argument is incomplete and appears to be based partly on empirical results.

Experimental Hydrodynamics. (C.R., Vol. CXCII, No. 26, 29/6/31, pp. 1703-4.) (22.1/22640 France.)

Hele Shaw's method exhibits the streamlines of potential flow by injecting coloured filaments in glycerine flowing between parallel plates set closely together. The author inserts a resistance by contracting the channel along a narrow strip orthogonal to the flow, on one side of the obstacle, and thereby obtains the configuration of potential flow with circulation round the obstacle. Photographs exhibit downward displacement of both branching points on a cylinder, and the displacement of one branching point to the trailing edge of an aerofoil.

The Coefficients of Flow Through Standard Diaphragms (Throttle Plates). (G. Ruppel and H. Jordan, F.G.I., Vol. II, No. 6, June, 1931, pp. 207-212.) (22.2/22641 Germany.)

The size and shape of the diaphragms and their mounting in the test pipe are shown in dimensioned drawings. The coefficients of resistance to flow at different Reynolds numbers are given graphically for a variety of diaphragms.

Development of Turbulence in Flow Along Pipes. (A. Naumann, F.G.I., Vol. II, No. 3, Mar., 1931, pp. 85-98.) (22.2/22642 Germany.)

A description is given of the apparatus, including the method of injecting colouring matter. Numerous photographs are reproduced in which the indicator shows the appearance and development of turbulence. It is shown clearly that turbulence near the critical speed is produced by the instability of the boundary layer at the surface and propagated from the walls to the centre of the tube. This should indicate the nature of the mathematical approximations appropriate to investigations of instability near the critical point. There is a theoretical discussion, but it does not appear to attack the well-known mathematical-physical difficulties.

Hydromechanics. (H. Guillemet, C.R., Vol. CXCII, No. 26, 29/6/31, pp. 1701-3.) (22.2/22643 France.)

The formation of vortices behind flat plates and cylinders was observed for small Reynolds numbers, obtained by using a thin layer of oil with unit coefficient

of viscosity (about 60 times that of water). A photograph with aluminium powder as indicator shows the fluid lines in a pair of symmetrical fixed vortices behind a cylinder. Angular and linear measurements are given for both plane and cylindrical obstacles.

Slots, Rings and Boundary Layer Control. (H. C. H. Townend, J.R. Aer. Soc., Vol. 35, No. 248, Aug., 1931, pp. 711-743.) (22.3/22644 Great Britain.)

A comprehensive discussion is given of the control of boundary layer motion by slots and rings. The air flow is illustrated by photographs and sketches from observation, and the aerodynamical results are exhibited in curves and tables. The air flow is made visible by the use of titanium tetrachloride, sulphuretted hydrogen, and the refraction of layers of heated air. An analogy is drawn between the effect of slots which are useful only above stalling point by preventing the branching of the boundary streamline from the surface which would otherwise take place, and the Townend ring, which is useful in conjunction with the cylinder head projecting from the streamlined body by reducing the turbulence and drag due to the latter. Both devices are useful in maintaining to some extent comparatively smooth flow which would be broken down in their absence by the stalling of the wing or by the projections from the smooth body.

Nineteen references are given.

Aerofoil Boundary Layer Control by Backward Opening Slot. (M. J. Bamber, N.A.C.A. Rept., No. 385, Sept., 1931.) (22.7/22645 U.S.A.)

The slot at its opening is substantially parallel to the upper surface of the wing. Air is blown through it under different pressures, with different widths of opening and with different positions on the wing. It was found that the maximum lift was increased to nearly double by one arrangement and the maximum drag decreased by 27 per cent. by another arrangement, both in comparison with the unslotted wing. It is considered that even better results are obtainable.

Numerous data are tabulated and shown graphically. Nineteen references are given.

Methods of Increasing Wing Lift. (Fr. Haus, L'Aeron., No. 145, June, 1931, pp. 205-213.) (22.7/22646 Belgium.)

Applications of slots and ducts influencing the boundary layer are collected from international sources and discussed with reference to diagrams giving the quantitative results obtained. The influence of longitudinal stability is also briefly considered.

Elasticity of Materials—Theoretical

Torsion in Thin Cylinders. (E. H. Atkin, Flight, Vol. XXIII, No. 39, 25/9/31, p. 970f, and No. 44, 30/10/31, p. 1086d.) (23/22647 Great Britain.)

An elementary discussion is given of stresses in cylinders under torsion. After stating some approximate results a brief mathematical discussion is given for multiply connected sections, produced by multiple borings in cylinder blocks.

Miscellaneous Unclassified

A Slide-Rule for the Solution of Air Photographic Problems. (Petitot, Rev. F. Aer., No. 25, Aug., 1931, pp. 965-994.) (22648 France.)

The slide-rule is described and illustrated by photographs. A list is given of over twenty types of calculation which can be carried out with it. Elementary mathematical relations are discussed.

A New Machine for Mechanical Solution of Differential Equations. (V. Bush, Jrnl. Franklin Inst., Vol. CCXII, No. 4, Oct., 1931, pp. 447-488.) (22649 Germany.)

From photographs, the machine mounted on a bench appears to cover an overall area of roughly 3 by 5 metres.

Eleven parallel shafts are capable of being geared to adding, multiplying and integrating units, and the whole system is interlocked through friction drives and spur wheels. Each shaft deals with one term of the expression which is being evoluted. Ingenious mechanical devices are described for reducing back lash and effective slip to a minimum.

A wide field of application is discussed. Two sets of graphical solutions of Legendre's equations for different values of the parameter are reproduced as examples of the final product of the machine. It is sought to keep the error due to back lash and slip within one-tenth per cent. in each unit.

The author considers that mechanical methods of solution will extend indefinitely the range of soluble problems, which at present are held up by the mere weight of the computations rather than by any difficulty in principle.

Research Work at the D.V.L. (W. Hoff, J.R. Aer. Soc., Vol. XXXV, No. 249, Sept., 1931, pp. 771-816.) (22650 Germany.)

The paper gives a comprehensive survey of research methods and activities in the Central German Aerodynamical Institute.

Aircraft and Naval Technique. (L. Kahn, Airc. Eng., Vol. III, No. 31, Sept., 1931. Paper read at Institute of Naval Architects, Paris.) (22651 France.)

The author discusses briefly the questions of designs and structure. Charts show comparative costs of transport by aeroplane, rail and sea, for different traffic densities. Air navigation is discussed as cognate to marine navigation.

Aircraft Production in U.S.A. (Autom. Ind., Vol. LXV, No. 7, 15/8/31, p. 259.) (22652 U.S.A.)

During the first six months of 1931, 1,600 machines have been constructed, including 40 autogyros and 480 military machines. In civil aviation, about three monoplanes were produced for each biplane, including 356 two-seater open-cockpit monoplanes, the most numerous type.

American Engines in Argentine. (Autom. Ind., Vol. LXV, No. 7, 15/8/31, p. 255.) (22653 U.S.A.)

The Curtiss-Wright firm have sold exclusive manufacturing rights of their engines in the Argentine, with a minimum production of 250 engines in five years.

Some Thoughts Concerning the Schneider Cup Race. (E. Billeb. Luftwacht, No. 9, September, 1931, pp. 412-417.) (22654 Germany.)

The maximum speed of aircraft can be increased by increasing power, landing speed, airscrew efficiency and aerodynamical qualities. An analysis of past results shows that aerodynamical quality has not improved materially and 400 m.p.h. appears to be an upper limit for the immediate future, with orthodox designs. The Italian proposal of a waterscrew with a flying boat full should reduce the take-off run and increase the stability.

The experience gained with special racing machines is not directly applicable to commercial craft.

Fire Insurance Costs. (J. P. Wines, Aviation, Vol. XXX, No. 8, Aug., 1931, p. 473.) (22655 U.S.A.)

The installation of a fire warning and extinguishing system at a cost of £5,000 reduced by 80 per cent. the insurance premiums on a Chicago airport buildings and equipment valued at £100,000.

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