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LIST OF ABBREVIATIONS OF TITLES OF JOURNALS.

Aeron. Eng.	Aeronautical Engineering.
Airc. Eng.	Aircraft Engineering.
Ann. d. Phys.	Annalen der Physik.
Army Ord.	Army Ordinance.
Autom. Absts.	Automotive Abstracts.
Autom. Tech. Zeit.	Automobiltechnische Zeitschrift.
Autom. Eng.	Automobile Engineer.
Autom. Ind.	Automotive Industries.
Bell Tele.	Bell Telephone Laboratory.
Bur. Stan. J. Res.	Bureau of Standards (U.S.A.) Journal of Research.
Chem. Absts.	Chemical Abstracts.
Chem. and Ind.	Chemistry and Industry.
F.G.I.	Forschung auf dem Gebiete des Ingenieurwesens.
Fuel.	Fuel in Science and Practice.
H.F. Technik.	Hochfrequenztechnik und Electroakustik.
Ind. and Eng. Chem.	Industrial and Engineering Chemistry.
J. Aer. Sci.	Journal of the Aeronautical Sciences.
J.R. Aer. Soc.	Journal of Royal Aeronautical Society.
J. Frank. Inst.	Journal of Franklin Institute.
J. Sci. Inst.	Journal of Scientific Instruments.
L'Aéron.	L'Aéronautique.
L.F.F.	Luftfahrtforschung.
N.A.C.A.	National Advisory Committee for Aeronautics (U.S.A.)
Phil. Mag.	Philosophical Magazine.
Phys. Zeit.	Physikalische Zeitschrift.
Proc. Inst. Rad. Eng.	Proceedings of the Institute of Radio Engineers.
Proc. Roy. Soc.	Proceedings of Royal Society.
Pub. Sc. et Tech.	Publications Scientifiques et Techniques du Ministère de l'Air.
Rev. F. Aer.	Revue des Forces Aériennes.
Riv. Aeron.	Rivista Aeronautica.
S.A.E. Jrnl.	Society of Automotive Engineers Journal.
Sci. Am.	Scientific American.
Tech. Aéron.	La Technique Aéronautique.
W.R.H.	Werft-Reederei-Hafen.
Z.A.M.M.	Zeitschrift für Angewandte Mathematik und Mechanik
Z.F.M.	Zeitschrift für Flugtechnik und Motorluftschiffahrt.
Z. Instrum.	Zeitschrift für Instrumentenkunde.
Z. Metallk.	Zeitschrift für Metallkunde.
Z.V.D.I.	Zeitschrift für Vereines Deutscher Ingenieure.

Aircraft Design, etc.

The Heinkel High Speed Mail-Plane (He-70). (E. Heinkel, Z.F.M., Vol. 24, No. 24, 28/12/33, pp. 669-676.) (5.10/28001 Germany.)

Specification performance of some U.S.A. mail planes are given with engines of 300-500 h.p., speeds of 260-358 km./hrs. (160-230 m.p.h.) and flying weights from 1.74-2.36 tons. German postal aeroplanes in 1932 reached 280 km./hrs. (175 m.p.h.).

The 1932 He.70 shows a test speed of 377 km./hrs. (238 m.p.h. at 660 h.p.) with a flying weight of 3.35 tons. Three general arrangement sketches show the dimensions, and four photographs show the complete aeroplane and some details of construction. Test curves and tables show comparative performance. One international and five German records are claimed.

Interference between Struts. (D. Briermann and W. H. Herrnstein, Jr., N.A.C.A. Report No. 468, 1933, 12 pages.) (5.11/28002 U.S.A.)

Various arrangements of struts of streamline and circular section were set up and the resistances measured independently. The results are plotted graphically in comparison with a single strut.

The effects of varying Reynolds number were examined and recorded. Various types of fairing between strut and span were investigated and interference effects compared. Struts side by side with a spacing of five diameters have little mutual effect. Streamline struts in tandem less than 10 diameters apart may be faired together with advantage.

Six references.

Development in Aeronautics in U.S.A. (K. Schnauffer, Z.V.D.I., Vol. 77, No. 46, 18/11/33, pp. 1239-1240.) (5.14/28003 Germany.)

A series of papers read at the Chicago Meeting of the S.A.E. is reviewed. Reference is made to metal propellers of welded Cr-Va steel. A special magneto-electric testing plant detects manufacturing faults. The formation of ice on struts and wires is said to be an inherent danger in biplanes, and preference is given to monoplanes for flights with low atmospheric temperatures.

Two references.

New British Load Factors. (H. B. Howard, Airc. Eng., Vol. 6, No. 60, Feb., 1934, pp. 37-39.) (5.18/28004 Great Britain.)

A brief account is given of the development of stressing rules during the war and their modification to meet the conditions of civil aviation.

An analysis is given of some of the numerous difficulties in adapting rules to different materials and structures, and the reasons for the changes are stated. The effects of gusts receive particular consideration and are exhibited in a diagram corresponding to a simple formula.

The commentary indicates the need of reasonable flexibility of mind towards any body of rules.

Influence of Rounded Leading Edge on Wing Resistance. (E. Wolff, Ing. Arch., Vol. 4, No. 6, Dec., 1933, pp. 521-544.) (5.20/28005 Germany.)

The conformal representation of a lenticular wing section in a circle is given briefly. An elegant representation on the x-axis of a figure enclosed by three circular arcs is obtained in terms of the hypergeometric series and is applied numerically to a wing section bounded by two shallow circular arcs meeting in the tail at a small angle and rounded off at the nose with a small radius. Calculated pressure distribution results are compared with experimental results and show close agreement except for the calculated peaks at nose and tail which are not observed experimentally.

The so-called profile resistance is discussed in the light of the partial theory available and the total resistance thus calculated is compared with measured resistance. It appears that the rounding of the nose and of the finite angle between the surfaces at the tail reduce the wing resistance appreciably.

Twelve references.

Effect on Lift, Drag and Spinning Characteristics of Sharp Leading Edges on Aeroplane Wings. (F. E. Weick and N. F. Scudder, N.A.C.A. Tech. Note No. 447, 1933.) (5.20/28006 U.S.A.)

From authors' abstract.—In the wind-tunnel investigation free autorotation tests, forced rotation tests, and lift and drag tests were made on modified Clark Y airfoils in the 7 × 10 ft. wind tunnel, and check tests on the lift and drag characteristics at several values of the Reynolds number were made in the variable density wind tunnel. Two different forms of sharp leading edge were tried. Both reduced the maximum unstable rolling moment tending to start autorotation, but neither had a substantial effect on the final rate of free autorotation.

In the spin tests in flight, which were made on a small training biplane, the addition of sharp leading edges produced favourable effects, causing a decrease in the angle of attack and rate of rotation and making the controls more effective. The flight and wind-tunnel tests agreed in showing that the use of the sharp leading edges is accompanied by a substantial reduction in the maximum lift coefficient.

Eight references.

Effect of Rivet Heads on the Characteristics of a 6 × 36ft. Clark Y Metal Aerofoil. (C. H. Dearborn, N.A.C.A. Tech. Note No. 461, 1933.) (5.20/28007 U.S.A.)

From author's abstract.—An investigation in the N.A.C.A. full-scale wind tunnel of a metal-covered 6 × 36ft. Clark Y aerofoil showed about 20 per cent. increase in the profile drag.

Two references.

Charts for Determining the Pitching Moment of Tapered Wings with Sweepback and Twist. (R. F. Anderson, N.A.C.A. Tech. Note No. 483, 1933.) (5.20/28008 U.S.A.)

From author's abstract.—A convenient method for calculating the pitching moment characteristics of tapered wings with sweepback and twist is based on the fact that the pitching moment characteristics of a wing may be specified by giving the value of the pitching moment at zero lift and the location of the axis about which the moment is constant. Data for calculating these characteristics are presented by curves which apply to wings having a linear distribution of twist along the span for a large range of aspect ratios. The curves are given for wings having straight taper and distorted elliptical plan forms. The characteristics of wings of other shapes may be determined by interpolation.

Four references.

Stiffness of Aeroplane Wings. (H. R. Cox, J.R.Aer.Soc., Vol. 38, No. 278, Feb., 1934, pp. 73-107.) (5.24/28009 Great Britain.)

The problem is discussed in reference to forced oscillations in flight, popularly known as wing flutter.

The aeroplane as a whole is a complicated and imperfectly elastic structure, and no general solution is in sight which will allow of comparison of different types. The problem is therefore simplified by assuming certain dynamical similarities in types classified for comparison. In particular, biplanes are separated from monoplanes, and types with wings of unusual dimensions or con-

struction are excluded. Even so, the results would require careful interpretation in the hands of experienced designers.

The flexure and bending of two-spar wings with built-in spars are analysed and the stiffening effects of ribs are considered, the results being illustrated by representative curves of flexure and of bending moments. When the ailerons are put in operation, a torsional moment is imposed on the wings and the wings are warped in a sense which reduces the effective rolling moment on the aeroplane. At a particular flying speed the rolling moment may even become negative. If such a critical speed, denoted as the reversal speed, exists it is found by successive approximations.

An elementary theory is given on the assumption of linear relations between incidence, torsion and rolling moments. Numerical examples are given graphically and methods of computation are given. A technical discussion followed, in which the " reversal " condition was the matter of chief interest.

Sixteen references.

Effect of Aileron Displacement on Wing Characteristics. (R. H. Heald, N.A.C.A. Tech. Note No. 448, 1933.) (5.30/28010 U.S.A.)

From author's abstract.—The aerofoils, rectangular in plan, with 10-inch chord and 60-inch span, were mounted on a model fuselage. Two pairs of ailerons, both with 20-inch span, but with 2-inch and 3-inch chord respectively, were set at angles of pitch of 0°, 12°, 20° and 40°. One aileron and two aileron measurements were found to be in satisfactory agreement. Test data are given in tables and graphs.

Seven references.

Aerodynamic Characteristics of Aerofoils as Affected by Surface Roughness. (R. W. Hooker, N.A.C.A. Tech. Note No. 457, 1933.) (5.30/28011 U.S.A.)

From author's abstract.—The surface was varied from rough to very smooth finish. The effect of a rough area in the region of the leading edge was investigated. Aerofoils with surfaces simulating lap joints were tested.

Measurable adverse effects were caused by small irregularities in aerofoil surfaces. The flow is sensitive to irregularities of the order of 0.0002 cm. near the leading edge. Surfaces simulating lap joints show small adverse effects.

Data from earlier tests of a symmetrical aerofoil show the variation of maximum lift coefficient with the Reynolds number for a polished surface and a very rough one.

Five references.

Tail Buffeting. (W. J. Duncan, J.R.Aer.Soc., Vol. 38, No. 278, Feb., 1934, pp. 108-137.) (5.32/28012 Great Britain.)

Tail buffeting is defined as the periodic change of pressure on the tail unit due to eddies thrown off the wing and superimposing stresses of appreciable magnitude in comparison with usual flying stresses. A careful summary is given of relevant experimental work on the magnitude and distribution of such eddies.

A special apparatus was designed in which an aerofoil comparable with a tailplane was mounted behind a model wing. The tailplane had a spring hinge of adjustable strength and an optical device for recording oscillation. The range of oscillation is shown for different dispositions and it is demonstrated that serious stresses may be superimposed under unfavourable conditions, particularly in low wing monoplane designs. The problem is therefore worthy of consideration by designers. It appears to remain in controversy whether this effect has actually been the cause of accidents.

A discussion follows. Sixteen references.

Reduction in Drag of a Forward-Sloping Wind Shield. (E. N. Jacobs, N.A.C.A. Tech. Note No. 481, 1933.) (5.40/28013 U.S.A.)

From author's abstract.—The drag of the wind shield in the original and a final modified form was determined in the variable density wind tunnel. The final form was arrived at by observations of flow in the smoke tunnel. The flow observations and drag measurements show that most of the large drag added by the original wind shield is eliminated by the modification to the final form.

Drag of Streamline Wires. (E. N. Jacobs, N.A.C.A. Tech. Note No. 480, 1933.) (5.42/28014 U.S.A.)

From author's abstract.—Preliminary results are given of drag tests of streamline full size wires over a wide range of speeds in the N.A.C.A. high speed tunnel. They are directly applicable to full-scale problems and include any compressibility effects at higher speeds.

Protuberances may be employed on conventional streamline wires to reduce the drag. Comparison can be made between conventional sections and strut or symmetrical aerofoil sections.

Three references.

Formulæ for Stress Analysis of Circular Rings in a Monocoque Fuselage. (R. A. Miller and K. D. Wood, N.A.C.A. Tech. Note No. 462, 1933.) (5.45/28015 U.S.A.)

From authors' abstract.—In the stress analysis of fuselage bulkheads of approximately circular form and uniform cross section, complicated load systems acting on a ring are resolved into simpler systems, and formulæ for moment, axial force, and shear are given, with numerical examples.

Four references.

Aircraft—Landing Gear

Aerodynamic Effect of a Retractable Landing Gear. (S. J. de France, N.A.C.A. Tech. Note No. 456, 1933.) (5.515/28016 U.S.A.)

From author's abstract.—Measurements were made in the N.A.C.A. full-scale wind tunnel of the lift and drag characteristics of a Lockheed Altair aeroplane through the flying range of incidence, with the landing gear both retracted and extended.

Covering the wheel openings with carriage extended reduced the drag only by 2 per cent., with a lift coefficient of 1.0, a negligible effect on the take-off. Retracting the landing gear reduced the minimum drag of the complete aeroplane by 50 per cent. [The additional weight is not stated.]

One reference.

Airscrews

Adaptation of Screw Propeller Theory to practical Computations. (K. Schimamoto, W.R.H., Vol. 14, No. 21, 1/11/33, pp. 297-302.) (5.60/28017 Germany.)

The usual assumptions are made and standard formulæ are established. The results are expressed in functions of angles and offer certain advantages for computations, which are facilitated by curves and numerical tables.

Estimation of the Variation of Thrust Horse-Power with Air Speed. (S. Ober, N.A.C.A. Tech. Note No. 446, 1933.) (5.60/28018 U.S.A.)

In extension of Report No. 350, the characteristics of a conventional thin metal fixed pitch propeller are calculated on the assumption that they are functions of the single parameter V/nD.

Three references.

Measurement of Pressure Variations in the Neighbourhood of an Airscrew Disc. (Y. Yosida, Aeronautical Research Institute, Tokyo, Report No. 99, Vol. 8, No. 3.) (5.61/28019 Japan.)

The pressure variation was recorded by a condenser microphone, amplifier and oscillograph. A photograph shows the complete installation and a diagram shows the positions selected for measurement. Oscillograph records are reproduced and sketches show the average wave forms at the 13 different positions.

Amplitude is plotted against angular velocity for different blades and positions. Amplitude is also plotted against distance from the blade disc. The wave form undergoes heavy distortion with distance from the blade disc until the distance is large compared with the radius, after which the whole disc may be regarded as a source with an approximate sine wave distribution.

Three references.

Variable Pitch Airscrew. (W. G. Jennings, J.R.Aer.Soc., Vol. 38, No. 277, Jan., 1934, pp. 1-23.) (5.64/28020 Great Britain.)

The aerodynamical effects of varying the pitch diameter ratio are reviewed and illustrated by graphical representations of static thrust, rising thrust, range, maximum r.p.m. in a dive, etc., as functions of this parameter. The application of variable gears is also considered.

Definite aerodynamical advantages are obtained, but consideration of the disadvantages of weight and complication is left to airscrew and engine designers. An important discussion followed.

Recent Designs for Ships and Rudders Utilising Eddy and Slip Losses for Propulsion. (W. R. H., Vol. 14, No. 24, 15/12/33, pp. 347-350.) (5.644/28021 Germany.)

The devices discussed consisted principally of rings or tubes shrouding the propeller. At the same time a propulsion effect can be obtained by the reaction of the propeller jet on the rudder, if the latter is of suitable shape and placed correctly.

From the discussion it appears that although these devices often give beneficial results, there is no general agreement on underlying principles.

Experiments with a Counter-Propeller. (E. P. Lesley, N.A.C.A. Tech. Note No. 453, 1933.) (5.644/28022 U.S.A.)

Tests at Stanford University on a rotating two-bladed airscrew in conjunction with a fixed four-bladed counterscrew show an increase of about 2 per cent. in the efficiency over the full working range.

Instruments

Determination of the Density and Viscosity of Gases by the Schilling-Bunsen Apparatus. (W. Schiller, F.G.I., Vol. 4, No. 5, Sept./Oct., 1933, pp. 225-229.) (6.225/28023 Germany.)

The apparatus compares the time of discharge through a small orifice of equal volumes of two gases kept at the same pressure and temperature. Difficulties arise from variations in the discharge coefficient.

Methods of construction of small nozzles with a constant coefficient are given. The instrument can be used as a viscosimeter after simple calibration. An example shows a satisfactory degree of accuracy.

Ten references.

Apparatus for Measuring Waves. (W. Pabst, Z.F.M., Vol. 24, No. 21, 4/11/33, pp. 598-600, and No. 22, 28/11/33, pp. 616-619. D.V.L. Report No. 360.) 6.24/28024 Germany.)

A moored buoy, in the shape of a flat double cone, carries a water pressure registering apparatus at the end of a vertical cable, the length of which is adjustable to half the wavelength or more. The equations of motion for a two-dimensional wave in uniform depth are quoted from Lamb. The expression for the pressure gradient as a function of the depth is periodic with the wave, and is integrated to give the effective pressure at any point and in particular at the registering apparatus. Corrections are required for the finite depth of suspension and for the inertia of the whole apparatus under periodic wave forces.

Examples of errors are shown graphically for particular assumptions, and families of curves give corrections for any combinations of wavelength, cable length and depth. Examples of records are reproduced and the corresponding data are given in a table. A chart shows the Lübeck Bight in which the measurements were made.

Thermal Relay for Increasing the Sensitivity of Galvanometers. (Z.V.D.I., Vol. 77, No. 48, 2/12/33, p. 1290.) (6.35/28025 Germany.)

The reflected beam of a galvanometer falls on a thermocouple with two junctions connected by a bridge piece in a vacuum, which produce a current when the beam strikes the bridge piece asymmetrically. A small deflection of the first galvanometer produces a relatively large deflection in a second galvanometer.

One reference.

Theory of Airscrew Anemometers. (F.G.I., Vol. 4, No. 5, Sept./Oct., 1933, p. 257.) (6.40/28026 Germany.)

The effect of friction of the mechanism and of the air becomes serious at low air speeds. Expressions are developed with coefficients determined by calibration. The pitch of flat blades which gives the earliest response to small air currents is 40°, irrespective of number and size.

Two references.

Aircraft Power-Plant Instruments. (H. Sontag and W. G. Brombacher, N.A.C.A. Report No. 466, 1933, 57 pages.) (6.44/28027 U.S.A.)

About half the report deals with engine tachometers, of which the centrifugal and chronometric types are the most important. Considerable space is given to electric tachometers. Methods of calibration are described.

Thermometers include liquid filled, vapour pressure, electrical resistance and thermocouple types. Pressure gauges include Bourdon and electrical types. Calibration and performance are discussed. Supercharging pressure gauges are discussed separately. Fuel quantity gauges of float and hydrostatic pressure type and flow meters of indicating and recording type are considered and illustrated.

The report covers present U.S.A. practice.

Fifty-nine references.

Accurate Altitude Angles Determined by Periscope Sextant. (G. Förstner, Z.F.M., Vol. 24, No. 24, 28/12/33, pp. 680-684. D.V.L. Report No. 356.) (6.532/28028 Germany.)

The sextant is mounted with the object glass exposed above the cabin roof and cowled to reduce resistance. The rays from the object observed are reflected into a vertical tube with a horizontal eye piece. The field of view includes level and cross level bubbles, segments of the graduated altitude and azimuth circles

and of the compass card. Calibration on the ground showed errors of one-tenth minute in altitude and one-tenth degree in azimuth.

Observations in flight gave position fixes on a map, which were compared with determinations of the aeroplane's position upon the ground. The methods of reduction are stated briefly and numerical results are given in extensive tables. A systematic error of 15 ft. was found, and deviations lying between +65 ft. and −59 ft. The mean error was about ±3.8 ft., as compared with ±4.4 ft. in a hand sextant.

Three references.

Development in Echo Sounding Devices. (W. Kunze, Z.V.D.I., Vol. 77, No. 47, 25/11/33, pp. 1265-1267.) (6.62/28029 Germany.)

The article deals mainly with the design of the well-known "Atlas" apparatus for water sounding. Depth between 200 and 500 metres can be measured 23 times per minute with an accuracy of ±½ m. A record depth of 13,000 metres has been found in the Caribbean Sea. The sound took 17 seconds for the double journey.

Two references.

Investigation of Accelerations Imposed on Aircraft by Manœuvres and Gusts. (A. Guglielmetti, Riv. Aeron., No. 11, Nov., 1933, pp. 234-257.) (6.73/28030 Italy.)

A review is given of British and American work and the use of accelerometers is recommended in test flights of types subject to high accelerations.

Aircraft Flight

Experimental Determination of Moments of Inertia of Aeroplanes. (H. A. Soulé and M. P. Miller, N.A.C.A. Report No. 467, 1933, 15 pages.) (7.20/28031 U.S.A.)

The periods are affected dynamically by the virtual mass added by the surrounding air, and to a slight extent statically by the buoyancy and the air contained in the wings, body, etc. The standard formulæ of hydrodynamics for the virtual mass are plotted graphically for rapid computation of the effect of the wings regarded as plane laminæ.

The body offers greater difficulties, and an empirical factor was obtained by independent tests on a mock-up body. Effects of dihedral and gap were estimated and are exhibited graphically. Methods of suspension are described and a numerical example is worked out. Errors lie within ±2.5 per cent., ±1.3 per cent., ±0.8 per cent. for rolling, pitching and yawing moments of inertia.

Five references.

Problems on Stabilisation of Water and Aircraft. (W.R.H., Vol. 14, No. 24, 15/12/33, p. 345.) (7.50/28032 Germany.)

A development of the Frahm damping tank has led to the so-called "activated" stabilisation system. It is intended to give greater accuracy to artillery fire, especially on destroyers and small cruisers (up to 5,000 tons). The fundamental principle of resonance between the oscillating water in the tanks and the motion of the ship is retained, but the motion of the water is governed by air pressure under gyro control. The combination is stated to be superior to the direct stabilisation by large scale gyro.

Experiments have also been carried out in conjunction with the Italian Navy, employing a weight with a controlled movement along a curved track.

Devices for the stabilisation of aircraft have been investigated. They depend on a direction indicator regulating a servo motor which works the controls. Additional damping devices as used in ships are not utilised.

Study of Factors Affecting the Steady Spin of an Aeroplane. (N. F. Scudder, N.A.C.A. Tech. Note No. 468, 1933.) (7.62/28033 U.S.A.)

From author's abstract.—Data from wind tunnel tests on a model of the NY-1 aeroplane in steady spin showed that the important factors were mass distribution effects and aerodynamic effects.

Experimental data from various sources were available to verify nearly all the deductions resulting from the study of the curves.

In seeking to control the spin, the yawing moment equilibrium was found to offer the most promising field for research. The most serious unfavourable effect on the damping yawing moment of the tail is the blanketing of the vertical surfaces by the other parts of the tail.

Fifteen references.

Effect of Stabiliser Location upon Pitching and Yawing Moments in Spins—Tests with the Spinning Balance. (M. J. Bamber and C. H. Zimmerman, N.A.C.A. Tech. Note No. 474, 1933.) (7.72/28034 U.S.A.)

From authors' abstract.—A low-wing monoplane with the fin faired into the fuselage was tested for the effect of stabiliser location upon the pitching and yawing moments given by the tail surfaces in spinning attitudes.

The horizontal surfaces in normal location seriously reduced the yawing moment of fin and rudder, particularly at angles of attack of 50° or more; a forward or rearward location gave no consistent decided improvement. A lower location greatly increased the harmful shielding; a higher location decreased the shielding and interference effects, and even increasd the yawing moment at high angles of attack.

The stabiliser and elevator gave the largest pitching moment, in general, in the low and most rearward locations. High location gave feeble elevator pitching moments which vanished at angles of attack higher than 50°.

Seven references.

Effect of Split Trailing Edge Wing Flaps on the Aerodynamic Characteristics of a Parasol Monoplane. (R. N. Wallace, N.A.C.A. Tech. Note No. 475, 1933.) (7.72/28035 U.S.A.)

From author's abstract.—Tests were made in the N.A.C.A. full-scale wind tunnel on a Fairchild F-22 aeroplane with split trailing edge flaps, 90 per cent. of the wing span, and 20 per cent. of the wing chord.

With a flap setting of 59° the maximum lift was increased 42 per cent. and the range of available gliding angles from 2.7° to 7.0°. With flaps down the landing speed of the aeroplane is decreased without seriously affecting longitudinal balance, but the calculated climb and level flight performance is inferior. The take-off distance required to clear an obstacle 100 ft. high is not affected by flap settings from 0° to 20°, but is greatly increased by larger flap angles.

Two references.

Thurston Wing Tip Rotors. (A. P. Thurston, J.Roy.Aer.Soc., Vol. 38, No. 277, Jan., 1934, pp. 59-65, and No. 278, Feb., 1934, pp. 138-140.) (7.72/28036 Great Britain.)

Sketches show the rotor shaped as an auxiliary aerofoil, of constant section and camber in the shape of a lune, pivoted at the centre and capable of lying smoothly along the leading edge of the wing or of being raised and rotating approximately parallel to the plane of the wing. Test results show the removal of the drop in the lift curve above stalling incidence.

The author comments on the results in the official R.A.E. report B.A. 1083 and suggests general lines of development and application.

Thurston Wing Tip Rotors. (A. S. Hartshorn and C. Callen, J.R.Aer.Soc., Vol. 38, No. 278, Feb., 1934, pp. 141-161. R.A.E. Report B.A. 1083.) (7.72/28037 Great Britain.)

Lift was measured for 86 different arrangements and drag for 19 different arrangements of Thurston rotors. The latter are small cambered aerofoils, with no pitch, mounted at their centre on spindles at the wing tips, and auto-rotate in flight.

A mass of test figures is published, and, by selection of the most favourable positions, substantial increases in maximum lift are obtained, in favourable comparison with slots.

The paper is preceded by a commentary by Dr. Thurston with suggestions for practical applications.

Tests of Wings with Auxiliary Aerofoils. (F. E. Weick and R. Sanders, N.A.C.A. Report No. 477, 1933, 20 pages.) (7.72/28038 U.S.A.)

Half-span wings with an end plate and attached auxiliary aerofoils of three different sections and four different chord lengths were tested in the five-foot vertical channel. The auxiliary aerofoils are mounted forward of the leading edge. The lift, drag, and moment coefficients are tabulated and plotted against incidence in groups for comparison. The lift is increased slightly with the increased area, and in the best positions the L/D ratio is increased.

Elaborate diagrams show curves of C_L, L/D, etc. No very striking results were obtained.

Three references (to authors' previous work only).

Wind Tunnel Tests on Model Wing with Fowler Flap and Specially Developed Leading Edge Slot. (F. E. Weick and R. C. Platt, N.A.C.A. Tech. Note No. 459, 1933.) (7.72/28039 U.S.A.)

From authors' abstract.—A special form of slot was developed in conjunction with the Fowler flap and the best combinations increased the maximum lift coefficient from 3.17 to 3.62. The minimum drag coefficient with both devices retracted was increased in about the same proportion.

The special slot, with or without the Fowler flap, gave higher values of the maximum lift coefficient than slots of conventional form, with proportional increase in the minimum drag coefficient.

Four references.

Effect of Partial-Span Split Flaps on the Aerodynamic Characteristics of a Clark Y Wing. (C. J. Wenzinger, N.A.C.A. Tech. Note No. 472, 1933.) (7.72/28040 U.S.A.)

From author's abstract.—Aerodynamic force tests were made in the N.A.C.A. 7 ft. × 10 ft. wind tunnel on a model Clark Y wing with a 20 per cent. chord split flap deflected 60° downward to determine the effect of partial-span split flaps, located at various positions along the wing span, on the aerodynamic characteristics of the wing-and-flap combination.

The results are given in the form of curves of lift, drag and centre of pressure.

Five references.

Effect of Slots and Flaps on Lateral Control of a Low Wing Monoplane as Determined in Flight. (H. A. Soulé and J. W. Wetmore, N.A.C.A. Tech. Note No. 478, 1933.) (7.72/28041 U.S.A.)

From authors' abstract.—Maximum angular accelerations in roll and yaw produced by sudden application of the ailerons, and maximum accelerations in yaw produced by sudden application of the rudder during gliding flight were recorded for various wing arrangements.

The full span slots and the flaps had about equal influence on the aileron rolling moments. In the range covered by the tests the effectiveness of the controls was appreciably reduced by the wing tip slots. The adverse yawing moment of the ailerons experienced at the large lift coefficients obtained with the flaps was appreciably less than at similar lift coefficients with full span or wing-tip slots. The yawing moments produced by the rudder were slightly affected by the auxiliary devices. The aeroplane was found to be laterally unstable with all combinations tested.

Four references.

Engines—Thermodynamics

The Radiation of Luminous and Non-Luminous Flame of Natural Gas. (A. Schack, F.G.I., Vol. 4, No. 5, Sept./Oct., 1933, pp. 255-256.) (8.10/28042 Germany.)

Experiments were carried out in a furnace, with flames varying between 25 and 89 cm. in thickness, at about 1,400°C. With a non-luminous flame the ratio of observed radiation per sq.m.hr. to black body radiation ranged from 0.05 to 0.2. With luminous flames the ratio may approach 0.7. The gas becomes more opaque and this may seriously affect the quantity of radiation from the walls to the centre of the furnace.

Five references.

Fuel Vaporisation in the Diesel Engine. (L. Richter, Z.V.D.I., Vol. 77, No. 45, 11/11/33, p. 1204.) (8.13/28043 Germany.)

The results of the N.A.C.A. report No. 435 indicate that combustion in Diesel engines is largely controlled by previous vaporisation of the fuel. This is contrary to the generally accepted view that combustion starts on the liquid surface.

Further experiments are recommended before accepting the implications of the American experiment.

One reference.

The Rate of Heating of Wires by Surface Combustion. (W. Davies, Phil. Mag., Vol. 17, No. 11, Feb., 1934, pp. 233-251.) (8.13/28044 Great Britain.)

Combustion in the gas phase begins on the surface of the wire, but by the time the temperature of the gas in the immediate neighbourhood of the wire has been raised to the ignition point, the concentration of combustible gas in this region has been reduced to such an extent that it will not propagate the flame. The wire must, therefore, be heated considerably above the ignition temperature before a propellant flame is produced.

Six references.

Influence of Natural Oscillation of Burning Gas Mixtures on their Speed of Combustion. (H. Nielsen, F.G.I., Vol. 4, No. 6, Nov./Dec., 1933, pp. 300-307.) (8.13/28045 Germany.)

Experiments with pentane mixtures in a cylindrical bomb showed the visual increase in flame speed as combustion proceeds. The pressure rise was measured piezo-electrically and the flame speed by ionisation. Gas vibration was recorded by a sensitive valve amplifier with the quartz indicator.

A definite connection is traced between amplitude of gas vibration and flame speed. It appears that a phenomenon similar to that existing in " singing flames " occurs, the gas vibration being the cause of the increased rate of energy release and not the result. The vibration was suppressed and the flame speed lowered by lining the walls of the bomb with glass wool.

Seven references.

The Supposed Intervention of Steam in Hydrocarbon Combustion. (W. A. Bone and J. Bell, Proc. Roy. Soc., Vol. 144, No. A.852, 29/3/34, pp. 257-266.) (8.13/28046 Great Britain.)

From a review of existing data and explosion photographs of acetylene and ethylene, both dry and moist, it is concluded that the formation of steam does not affect the reactions and that the oxidation is direct.

Three references.

Flame Temperatures in CO/Air Mixtures. (W. T. David and J. Jordan, Phil. Mag., Vol. 17, No. 110, Jan., 1934, pp. 172-180.) (8.13/28047 Great Britain.)

Flame temperature during the pressure period of CO explosives in bombs was measured from records by a Pt-Rho resistance thermometer .0005 inches in diameter. The results are considerably lower than those calculated from the best values of specific heat and dissociation. The authors are satisfied that radiation losses cannot account for the difference, which must be due to some abnormality in the freshly-burnt gas.

Eight references.

Influence of Pressure on Flame Spectra. (W. A. Bone and F. S. Lamont, Proc. Roy. Soc., Vol. 144, No. A.852, 29/3/34, pp. 250-256.) (8.13/28048 Great Britain.)

With H_2 and CO mixtures, as the pressure is increased to 100 atmospheres, direct oxidation of CO progressively replaces indirect oxidation.

Three references.

Thermo Elements for High Temperatures. (A. Schulze, Z.V.D.I., Vol. 77, No. 46, 18/11/33, pp. 1241-1242.) (8.14/28049 Germany.)

Up to 1,500°C. the Pt-Pt.Rho couple of Chatelier is generally used. For higher temperatures couples made of Ir-Ir. Ruth. (up to 1,800°C.) and Ir-Rho.Ir (up to 2,000°C.) have been developed. Magnesium and thorium oxides are the most suitable materials for protective tubing at very high temperatures.

Five references.

N.A.C.A. Chamber Gas-Sampling Valve—Some Preliminary Test Results. (J. A. Spanogle and E. C. Buckley, N.A.C.A. Tech. Note No. 454, 1933.) (8.15/28050 U.S.A.)

A gas-sampling valve, inertia-operated, for procuring samples at identical points in successive cycles has been used to investigate the CO_2 content of gases taken from the quiescent combustion chamber of a high-speed compression-ignition engine operating with two different multiple-orifice fuel-injection nozzles. The analysis of the gas samples shows that quiescence is maintained in the chamber during combustion.

Seven references.

Relation of Hydrogen and Methane to Carbon-Monoxide in Exhaust Gases from Internal Combustion Engines. (H. C. Gerrish and A. M. Tessman, N.A.C.A. Report No. 476, 1933.) (8.15/28051 U.S.A.)

The hydrogen in the exhaust gases is in constant proportion to the carbon monoxide, between .3 and .5, according to the fuel. The methane content is small and apparently independent of the mixture strength. No satisfactory explanation is available.

Seven references.

Engines—Design and Performance

Effect on Engine Performance of Change in Jacket-Water Outlet Temperature. (E. A. Garlock and G. Ellis, N.A.C.A. Tech. Note No. 476.) (8.20/28052 U.S.A.)

Authors' abstract.—Tests made on a Curtiss D.12 engine in the Altitude Laboratory at the Bureau of Standards show the following effects on engine performance of change in jacket-water outlet temperature:—

(1) Friction at all altitudes is a linear function of jacket-water temperature, decreasing with increasing temperature.

(2) The brake horse-power below an altitude of about 9,000 ft. decreases, and at higher altitudes increases, with increasing jacket-water temperature.

(3) The brake specific fuel consumption tends to decrease, at all altitudes, with increasing jacket-water temperature.

(4) The percentage change in brake power output is roughly equal to the sum of the percentage changes in volumetric efficiency and mechanical efficiency.

Six references.

Developments in High Powered Aircraft Engine. (G. D. Angle, Aero Digest., Vol. 23, No. 4, Oct., 1933, pp. 41-44, and No. 5, Nov., 1933, pp. 46-47.) (8.20/28053 U.S.A.)

Engines with outputs exceeding 800 h.p. are being developed in Italy and France. Great Britain formerly held the lead, but more attention is now being given to reliability than to high output for individual engines.

In 1927 the U.S.A. Packard firm built a 24-cylinder X engine of 1,200 h.p., which did not get into production. At the moment manufacturers in America appear to keep within 800 h.p.

The Development of the Air-Cooled Engine. (A. H. R. Fedden, J.R.Aer.Soc., Vol. 38, No. 279, March, 1934, pp. 169-234.) (8.20/28054 Great Britain.)

The author is of the opinion that aero engines for sport, civil work and military purposes will mainly be of the four-stroke cycle, with electric ignition, using petrol as fuel. Improvements in fuel and oils, valves and other design features will improve the volume-power output. The air-cooled engine will maintain and extend its position in comparison with water-cooled engines.

Descriptive technical data are given of materials, design details, assembly and performance. The paper may be regarded as a statement of the point of view of the designer of successful air-cooled engines. In the discussion the claims of water cooling and higher temperature liquid cooling were stated. Paper and discussion give a useful exposition of current design and of prospective lines of advance.

Thirty-three illustrations.

The Scavenging Process of Two-Stroke Engines. (W. Lindner, Forschungsheft, No. 363, Nov./Dec., 1933, pp. 9-22.) (8.21/28055 Germany.)

The air paths in a model during scavenging are made visible by finely powdered Mg.O. Photographs show generally the presence of a central vortex of intensity governed largely by the shape and inclination of the scavening air port. In a working engine the scavenging process is followed from point to point by a sampling valve and similar conclusions are reached.

Fifteen references and 30 illustrations.

Investigation on High Speed Superchargers of the Eccentric Vane Type. (H. J. Venediger, Autom. Tech. Zeit., Vol. 36, No. 23, 10/12/33, pp. 583-597, and No. 24, 25/12/33, pp. 619-622.) (8.235/28056 Germany.)

The two types of superchargers were fitted with external and internal blade control members respectively. The Zoller type has blades fitted with shoes which slide on internal eccentric bosses. The Powerplus type has a blade control drum which surrounds the blades and is driven at the same speed as the rotor by a ring drive.

The maximum pumping efficiencies are approximately equal. The Powerplus type is more robust and can be operated at higher speeds, especially in the larger sizes. For general applications improved pumping efficiency at low speeds is required.

Six references.

Engines Fitted with Superchargers. (D. Cosci, L'Aerotecnica, Vol. 13, No. 11, Nov., 1933, pp. 1451-1478.) (8.235/28057 Italy.)

The operation and characteristics of the positive and centrifugal type of supercharger are described. The Roots type of blower fitted to the Alfa Romeo D.2 radial engine is shown in an illustration.

Research Problems in Power Plants for Ships. (Z.V.D.I., Vol. 77, No. 47, 25/11/33, p. 1270.) (8.25/28058 Germany.)

Consideration is given to Diesel-electric power transmission with synchronous electric motors of new design.

As regards design questions, the V.D.I. are collecting available information on the stress distribution round notches, in keyways and constructional elements, and on the effect of surface conditions on fatigue limits. Special attention is being given to the stresses arising in the manufacture of turbine rotors, and the subsequent effect of corrosion.

Two references.

The Compression Ignition Engine. (C. B. Dicksee, J.Roy.Aer.Soc., Vol. 38, No. 277, Jan., 1934, pp. 24-45.) (8.25/28059 Great Britain.)

A review is given of developments in the compression-ignition engine and representative data and performance are given graphically. A number of problems of detail are discussed, in particular the type of injection spray and the shape of the combustion chamber.

Comparison with the petrol engine shows that further advances are required before aircraft designers can consider application of compression-ignition engines to aeronautics. The author is hopeful that this will ultimately come about.

Increasing the Air Charge and Scavenging the Clearance Volume of a Compression Ignition Engine. (J. A. Spanogle, C. W. Hicks and H. H. Foster, N.A.C.A. Report No. 469, 1933.) (8.25/28060 U.S.A.)

Experiments were carried out on a single-cylinder four-stroke injection engine with boost pressures up to eight inches of mercury. Both normal valve timing and one giving 145° overlap were employed. The overlap leads to a considerable increase in air consumption, since some of the air is employed in scavenging the exhaust products.

After making allowance for work absorbed in the blower, the scavenged engine gave about 10 per cent. more power than the unscavenged engine for the same amount of boost (about 4 lb. per sq. in.), with a slightly better specific fuel consumption. The advantage of valve overlap appears to be limited to relatively low boost pressures.

Eleven references.

Investigation on the Compression Ignition Engine with Separate Air Chamber. (K. Neumann, F.G.I., Vol. 4, No. 6, Nov./Dec., 1933, pp. 268-279.) (8.25/28061 Germany.)

In the well-known two-stage ignition engine, combustion starts in the so-called pre-combustion chamber into which the fuel is injected. The combustion is completed in the main cylinder.

In the engine described combustion is started in the main cylinder, the function of the air chamber being to produce a vigorous eddy during the initial stage of the expansion stroke. The eddy may be entirely formed by the re-transfer of air compressed during the previous stroke or in part by a certain amount of combustion in the air chamber of fuel from the main cylinder. In the latter case the effect of the eddy is modified. The large number of possible intermediate constructions obscures the patent position.

The author concludes that the best results are given by high compression ratio and large capacity of the air chamber producing a vigorous " suction eddy " during the expansion stroke.

Engines of this type are well adapted to high-speed work, and their use in mobile units is increasing.

Six references.

Development of Diesel Aviation Engines. (F. A. F. Schmidt, Z.V.D.I., Vol. 77, No. 44, 4/11/33, pp. 1183-1187.) (8.25/28062 Germany.)

The volumetric output in horse-power per litre is shown graphically against volume, as a mean of 140 carburettor air engines and 12 Diesel air engines. Total weight, mean effective pressure and mean piston speed are also shown graphically on a stroke volume basis.

Indicator diagrams of two Diesels with different types of injection are plotted for comparison. Four photographs are reproduced showing Junkers, Rolls-Royce, Bristol, and Hispano-Suiza Diesel air engines, the two former water-cooled, the two latter air-cooled.

Twelve references.

Direct Driven Diesel Locomotive. (A. Lengen, Forschungsheft, No. 363, Nov./Dec., 1933, pp. 1-8.) (8.252/28063 Germany.)

For starting and low power, the double-acting two-stroke engine is supplied with compressed air at 300 lb. per sq. in. An auxiliary hot wire ignition system is fitted, and a supply of low-pressure fuel and air is regulated to maintain nearly constant pressure through the greater part of the expansion stroke. As engine speed and load increase, the air and low-pressure fuel supply is diminished and the high-pressure fuel injection system started. The engine passes through a state of supercharging, and finally functions as a normal Diesel.

The advantage claimed for this system is the small air consumption when starting and on low load, since the heat of the injected fuel makes the air drive more efficient.

Results on service are awaited.

Electrically Heated Sparking Plugs. (B. v. Lengerke, Autom. Tech. Zeit., Vol. 36, No. 23, 10/12/33, p. 592.) (8.283/28064 Germany.)

A plug is shown fitted with an electric heating device to prevent deposition of fuel on the insulator and electrode.

Sulzer Single Tube Steam Generator. (Prof. A. Stodola, Z.V.D.I., Vol. 77, No. 46, 18/11/33, pp. 1225-1232.) (8.294/28065 Germany.)

The tube diameter is 40 mm., length 1,300 metres, working pressure 100 atmospheres. Feed water enters at 150°C., 130 atmospheres, and leaves as superheated steam at 400°C., 100 atmospheres. The pressure drop along the tube ensures active circulation and high heat transfer.

Over 7,000 kg. of water are evaporated per hour, giving 24 kg. of steam per hour per square metre of heating surface.

Two references.

Steam Propulsion for Aircraft. (F. W. Ellyson, Flugsport, Vol. 25, No. 20, 27/9/33, pp. 429-431.) (8.294/28066 Germany.)

According to a report by American engineers, a two-cylinder compound V engine of 3-in. stroke and 2-in. and 5¼-in. bore, supplied with steam at 1,200 lb. per sq. in. pressure, gives 180 h.p. at 1,625 r.p.m., engine weight 180 lb. The boiler is heated with oil fuel, consists of a single tube 500 ft. in length, and, with accessories, weighs 150 lbs. No details are given of condensing plant and water consumption.

Three photographs show the plant as installed in a U.S.A. aeroplane.

Engines—Design and Strength of Components

Bending Loads on Connecting Rods. (O. Heck, Ing. Arch., Vol. 4, No. 6, Dec.; 1933, pp. 596-605.) (8.32/28067 Germany.)

Kinematical relations are obtained in the usual way by trigonometric and algebraic expansions in series.

The dynamical and elastic equations are expressed and lead to integral equations for the determination of the bending stresses. The cores of the equations are expressed in comparatively simple algebraic forms and numerical solutions are worked out for particular cases.

Torsional Vibration of Aircraft Engine Crankshafts. (W. G. Lundquist, Aeron. Eng., Vol. 5, No. 3, July/Sept., 1933, pp. 133-139.) (8.36/28068 U.S.A.)

Torsional vibrations of several radial engines and a 12-cylinder V engine are compared. The damping factor is of the same order. Crankshaft vibration when it does occur is usually more serious in the radial, the amplitude of the disturbing harmonic being greater in the operative range. The best cure is proper dimensioning of the parts and good distribution of mass.

Vibration dampers are not recommended. They do not eliminate the source of the trouble, are heavy and liable to faulty adjustment.

New Piston Designs. (Z.V.D.I., Vol. 77, No. 49, 9/12/33, p. 1310.) (8.38/28069 Germany.)

The upper part of the piston, of light alloy, has an insert of Niresist cast iron, with approximately the same coefficient of thermal expansion, in which two of the ring grooves are cut. Freedom from differential expansion troubles has increased the piston's life, notably in a small high-speed Diesel for mobile work.

Two references.

Gas Tightness and Gumming of Piston Rings. (N. Champsaur, Pub. Sc. et Tech., No. 31, 1933.) (8.38/28070 France.)

Gas leakage past the piston rings is measured by connecting the engine crankcase breather to a small gas meter. Details are not given, nor is it clear how leakage through the crankcase bearings is allowed for.

The author states that gumming is indicated by a gradual increase in leakage long before variations in power, temperature, etc., are sensible.

Engines—Cooling

Experiments on the Cooling of Hot Bodies by a Current of Air. (P. Vernotte and E. Blouin, Pub. Sc. et Tech., No. 36, 1933.) (8.40/28071 France.)

Air flows from a tank at four atmospheres pressure to a tank at lower pressure through aluminium tubes of various sections heated electrically. Air speeds up to 120 m. per sec. were obtained. The heat transfer coefficient is approximately a linear function of the speed and reaching .01 cal/cm²/sec. at maximum speed.

Dissipation of Heat from Hot Wires and Pipes in a Current of Air. (R. Hilpert, F.G.I., Vol. 4, No. 5, Sept./Oct., 1933, pp. 215-225.) (8.40/28072 Germany.)

The wires and tubes were electrically heated, with elaborate precautions to ensure uniform temperature distribution. The range of diameters varied from 0.2 mm. to 90 mm. in conjunction with an air speed variation from 2 to 30 m. per sec., this gives a range of Reynolds numbers from 2 to 10^5. Tables and curves give the variation of the heat transfer, which generally decreased with increasing R from 3,000 K cal/m^2h°C. for small wires to less than 20 for the largest body examined.

Eleven references.

Heat Flow through Piston and Piston rings in a Diesel Engine. (F. Salzmann, F.G.I., Vol. 4, No. 4, July/Aug., 1933, pp. 193-198.) (8.40/28073 Germany.)

Of the total heat received by the piston, 67 per cent. is transmitted to the cylinder through the piston rings, 24 per cent. through the skirt and oil film, and 9 per cent. was carried off by leakage-air and oil splash.

Thirteen references.

Influence of Wall Roughness on Heat transfer to Water. (W. Pohl, F.G.I., Vol. 4, No. 5, Sept./Oct., 1933, pp. 230-237.) (8.40/28074 Germany.)

The author determined both the resistance and the heat transfer coefficient of steel, copper, and cast iron tubes with varying degrees of roughness of the internal surface. The tube carried water at app. 12°C., the wall being kept at app. 20°C. The heat transfer coefficient was found to diminish with increase of surface roughness, although the resistance coefficient increased in disagreement with semi-empirical expressions in current forms.

Established expressions for the heat transfer coefficient in smooth pipes are in general agreement with the author's results for smooth pipes.

Thirteen references.

Reduction of Drag of Radial Engines. (E. Everling, Z.V.D.I., Vol. 77, No. 44, 4/11/33, pp. 1197-1200.) (8.426/28075 Germany.)

A brief descriptive account is given of the forms of cowling in use, illustrated by eleven representative photographs of cowled engines mounted on aeroplanes.

Six references.

Engines—Lubricants and Lubrication

The Acidity of Castor Oil and its Neutralisation by Organic Base. (S. Montelucci, L'Aerotecnica, Vol. 13, No. 11, Nov., 1933, pp. 1479-1484.) (8.540/28076 Italy.)

The author suggests that the use of trietanolamine soaps as a castor oil " dope " reduces the acidity and gumming tendency of the oil and increases its lubricating quality.

One reference.

Research on the Spread of Castor Oil and Various Glycerides on the Surface of Water. (C. Bouhet and R. Lafont, Pub. Sc. et Tech., No. 33, 1933.) (8.540/28077 France.)

The surface tension of the film is measured by a torsion balance. The lubricating value appears to be intimately connected with the mean size of molecule, and increases with the molecular spread of the film on the water surface.

Colloidal Graphite as an Addition to Lubricating Oils. (E. Schida, Autom. Tech. Zeit., Vol. 36, No. 21, 10/11/33, pp. 527-531.) (8.540/28078 Germany.)

The experiments were carried out on a small four-stroke engine of 250 cc. capacity. Torque curves were taken with the oil supply cut off. With ordinary lubricant the engine seized after about eight minutes. The addition of colloidal graphite to the oil delayed the moment of seizure, especially if the engine had previously been " run in " on the mixture.

It is concluded that the graphite forms a film on the cylinder which has lubricating properties and enables the engine to continue running after failure of the oil supply for some time (roughly 14 minutes). The seizure is also less severe.

Influence of Anti-Friction Metals on Lubricants. (Fournery, L'Aéron., No. 173, Oct., 1933, pp. 232-233.) (8.540/28079 France.)

The mounting of the experiments and the run of the results are shown qualitatively in sketches, which show the thickness of the lubricating film as a decreasing function of the load and an increasing function of the bearing speed.

Engines—Fuels

Report on the 16th General Meeting of the Fuel Association, Berlin. (A. Sander, Autom. Tech. Zeit., Vol. 36, No. 24, 25/12/33, pp. 623-625.) (8.6/28080 Germany.)

The aim of the Association is to render Germany as independent as possible of foreign fuel supplies. The manufacture of fuel suitable for carburettor and injection engines from coal is therefore of paramount importance. The two-stage ignition engines and the air chamber engines are less sensitive to the grade of fuel available and are being actively developed. Experiments have been carried out with compressed methane and hydrogen.

Oil Production in Germany. (O. Zaepke, Z.V.D.I., Vol. 77, No. 52, 30/12/33, pp. 1374-5.) (8.6/28081 Germany.)

In 1932 229,000 tons of oil were produced, mostly from very deep bore holes. The technical difficulties are described and special attention is given to the conservation of natural gas.

Five references.

Performance of a Fuel Injection Spark Ignition Engine Using a Hydrogenated Safety Fuel. (O. W. Schey and A. W. Young, N.A.C.A. Report No. 471, 1933.) (8.602/28082 U.S.A.)

Injection at an average pressure of 5,000 lb. per sq. in. through five holes controlled by a spring loaded needle valve, started approximately 90° after T.D.C. on the suction stroke and lasted for about 90° crank angle. Combining the fuel injection with scavenging and mild boost at high compression ratio, a brake m.e.p. of 175 lb. per sq. in. was maintained for a consumption of .5lb. of safety fuel per b.h.p. hour.

In the unmodified engine the specific fuel consumption with hydrogenated fuel was about 10 per cent. greater than with petrol for the same power output.

Starting is difficult with the safety fuel. Satisfactory control requires accurate timing between the throttle and injection pump.

Engine Performance with a Hydrogenated Safety Fuel. (O. W. Schey and A. W. Young, N.A.C.A. Tech. Note No. 466, 1933.) (8.602/28083 U.S.A.)

From authors' abstract.—Tests were made on a single-cylinder universal test engine at compression ratios of 5.0, 5.5 and 6.0, with a fuel injection system, and one with a carburettor using gasoline for comparative performance.

The b.m.e.p. obtained with safety fuel in an injection system is slightly higher than with gasoline and a carburettor, but the fuel consumption is higher. The idling test was satisfactory. Starting was difficult with a cold engine, but not when the jacket water was hot. The use of the safety fuel should eliminate crash fires.

Four references.

Wood Gas as a Fuel for Light Oil Engines. (G. Kuhne, Z.V.D.I., Vol. 77, No. 48, 7/12/33, pp. 1293-1294.) (8.604/28084 Germany.)

A wood gas has been produced with a calorific value of approximately 1,300 kcal. per cubic metre, or 590 kcal. per cubic metre of combustible mixture, which is seriously less than the 830 kcal. per cubic metre of benzole mixture.

The difference can be partly made up by supercharging. With 5 lb. per sq. in. boost pressure a lorry engine which gave 52 h.p. with benzole gave 45 h.p. with wood gas, after allowing for the horse-power absorbed by the blower.

Two references.

The Use of Infra Red Absorption Spectra in the Study of the Constituents of Petrol. (J. Lecomte and P. Lambert, Pub. Sc. et Tech., No. 34, 1933.) (8.640/28085 France.)

The infra red absorption bands over the range 6μ to 16μ are measured by a recording thermopile. Most of the usual ring compounds and their derivatives are identified by their characteristic bands. The method is useful in examining small quantities.

The Importance of Auto-Ignition Lag in Knocking. (E. S. Taylor, N.A.C.A. Tech. Note No. 452, 1933.) (8.645/28086 U.S.A.)

In practice, knocking is caused by auto-ignition of the last part of the charge to burn. All fuels will knock if kept at a high temperature for a sufficient time.

Favourable fuel characteristics are long time lag of auto-ignition at high temperature, giving a wide range of running conditions, within which normal combustion of the whole fuel takes place.

Seven references.

Engines—Couplings

Shaft Drives for Airship and Aeroplane Propellers. (J. L. Goldthwaite, Aeron. Eng., Vol. 5, No. 3, July/Sept., 1933, pp. 129-132.) (8.765/28087 U.S.A.)

Long shafts require perfect balancing to prevent deflection at speed. Satisfactory flexible couplings used on the American airship " Akron " are described.

Reference is made to a composite coupling link composed of a loop of steel wire embedded in rubber. Short splines in shafts facilitate inspection of a detail which requires great care.

Armament

The Bombing of Reservoirs in Wartime. (Rougeron, Rev. F. Aer., No. 52, Nov., 1933, pp. 1203-1208.) (9.3/28088 France.)

A direct hit is not necessary for vital damage to containing walls. An underwater explosion within 100 ft. of the wall will probably wreck it. A bomb dropped from a fast machine flying at a low altitude will travel under water in the direction of the target with corresponding latitude in the accuracy of release.

Four references.

The Gehrlich 35/25 mm. Aircraft Machine Gun. (Flugsport, Vol. 25, No. 26, 20/12/33, p. 559.) (9.11/28089 Germany.)

The barrel is cylindrical internally for some distance at the root and then tapers from 35 mm. to 25 mm. The projectile of 25 mm. diameter is fitted with two collars of 35 mm. diameter of soft material, which are flattened by the choke and give a muzzle velocity stated to exceed 5,300 ft. per second.

Production of Very High Temperatures and Pressures. (C. Ramsauer, Phys. Zeit., Vol. 34, No. 24, 15/12/33, pp. 890-894.) (9.59/28090 Germany.)

A photograph shows two rifle barrels facing each other. A shot fired from one enters the other and compresses the air adiabatically up to the point of zero motion and maximum pressure and temperature. The initial velocity is measured by a cinematic camera and details of the films are reproduced.

The density, pressure and temperature are calculated for argon, nitrogen and carbon dioxide, for four initial velocities, the latter giving $\rho = 19 \times 10^4$ gr./cm.^{3} $p = 32 \times 10^9$ dynes/cm. (200 tons per sq. in.) $T = 89 \times 10^3$ degrees C.

Three references.

Materials—Characteristics, Defects and Treatment

Precision High Power Metallographic Apparatus. (F. F. Lucas, Bell Tele. G-771, 1933.) (10.1/28091 U.S.A.)

Details are given of the design, construction and operation of a metallographic apparatus with a resolving process giving clear definitions up to 6,000 diameter magnification. Objectives corrected for infinite tube length are superior to those corrected for a fixed tube length of 190 mm. The use of monochromatic light allows of further improvement in the objective.

Five references.

Method of Testing Hardness. (M. le Rolland, L'Aéron., No. 173, Oct., 1933, pp. 229-230.) (10.101/28092 France.)

A pendulum is supported by a ball bearing which rests on the surface to be tested. The diameter of the (circular) area of contact is in inverse proportion to the change in the period of the pendulum.

Extreme simplicity and accuracy is claimed and the absence of permanent strain is an obvious advantage over the Brinell test. Details of the mounting of a test are given.

Notes on the Increase of Fatigue Strength by Surface Pressure. (A. Thum and O. Föppl, Z.V.D.I., Vol. 77, No. 50, 16/12/33, pp. 1335-1337.) (10.104/28093 Germany.)

The authors agree on the beneficial effect of surface pressure treatment on fatigue strength, but disagree in their explanation. Thum and his collaborator attribute the effects to residual stresses in the material, which reduce the subsequent fatigue stresses. Föppl attributes the effects to a hardening of the surface layer accompanied by a re-orientation of surface molecules.

Twelve references.

Fatigue Strength Under Vibrating Load. The Effect of Corrosion and Preliminary Surface Pressure Treatment. (O. Föppl, O. Behrens and T. Dusold, Z. Metallk., Vol. 25, No. 11, Nov., 1933, pp. 279-282.) (10.104/10.245/28094 Germany.)

Torsional and bending loads were applied to test pieces of high grade alloy steels, and one of pure nickel immersed in a current of water.

In all cases preliminary surface pressure treatment reduces the corrosion and increases the fatigue strength, especially under bending stresses.

Six references.

Rubber Protection of Propeller Shafts Against Corrosion. (Z.V.D.I., Vol. 77, No. 51, 23/12/33, p. 1363.) (10.125/28095 Germany.)

Japanese experiments indicate that a good protection is obtained on ships by winding the propeller shaft with rubber strips, subsequently vulcanised. The weight and cost are relatively small.

The Use of Light Alloys in Ship Construction. (Z.V.D.I., Vol. 77, No. 47, 25/11/33, pp. 1270-1271.) (10.230/28096 Germany.)

Calculation shows that a saving in weight amounting to 1,200 tons results in the case of the ship " Arcone," by using a combined steel and light alloy construction for the upper structure of the ship. Rolling and pitching are thus considerably reduced. Without going to extremes weight can be saved by the use of light alloy for internal fittings, ventilating shafts, doors and furniture.

Electro-chemical oxidation against corrosion has been improved by subjecting the porous oxide layer to a condensation process.

Thermal Resistance and Hardness of Different Al. Alloys. (A. v. Zeerleder, Bosshard and Irmann, Z. Metallk., Vol. 25, No. 12, Dec., 1933, pp. 293-299.) (10.231/28097 Germany.)

Experiments carried out on pure aluminium and various alloys show the importance of preheating for various periods for the mechanical properties. It is essential that experimental conditions be accurately defined during annealing and hardening if stability of the product is to be assured.

Eleven references.

The Casting of Magnesium. (A. Caillon, Pub. Sc. et Tech., No. 32, 1933.) (10.232/28098 France.)

The author recommends the use of three fluxes in succession :—

1. During melting the usual sodium carnalite.
2. A flux containing Bo as well as Mg and BaF_2 to remove the chlorine.
3. Flux consisting of B_2O_3 and $Na_2B_4O_7$ for the final casting.

Seventy illustrations.

Fatigue of Materials in Aircraft and Engines. (K. Matthaes, Z.F.M., Vol. 24, No. 21, 4/11/33, pp. 593-598, and No. 22, 28/11/33, pp. 620-626. D.V.L. Report, No. 337.) (10.245/28099 Germany.)

Failing load is plotted against number of reversals for five metals or alloys and for spruce, and elastic coefficients are given in a table.

The ratio of static and fatigue failing loads are plotted from selected experiments and, in general, lie in narrow angular sectors with an angular variation of about 20 per cent. Test specimens are carefully finished and polished. Actual working materials show irregularities of surface finish arising in the course of manufacture, which in general lower the ultimate strength.

A table is given of ultimate strength of manufactured parts of different materials showing the observed reduction in comparison with test pieces. The influence of the fibrous structure and of manufactured shape are discussed. Light metals show differences, which are considered separately. Surface hardening, corrosion and concentration of stress are also discussed. The general considerations are applied more particularly to structural elements and to bolted, screwed and riveted joints.

The general impression conveyed by the paper is that careful attention to the points discussed may lead to notable improvements in reliability, even under apparently higher stresses, with materials already available and in general use. A note is added referring to similar work done by R. E. Petersen.

Thirty-one references.

Corrosion of Magnesium Alloys. (J. D. Bengough and L. Whitby, Airc. Eng., Vol. 6, No. 59, Jan., 1934, pp. 7-12.) (10.262/28100 Great Britain.)

An account is given of the behaviour of specimens exposed to a variety of conditions, with quantitative figures of the rate of formation of corrosion products and their composition.

Protective coats are formed by dipping in solutions and more than 500 solutions tried by the authors and many by other experimenters have come under examination. Of these, only two so far are considered as effective, the alum-dichromate process and the selenium process.

Specifications are given of various selenium dips and photographs show the comparative protection afforded by this and by other methods. A marked superiority of the selenium processes is indicated by the 21 photographs reproduced.

Specifications of treatments and many other useful details of technical information are given.

Twelve references.

The Assembly of Wood Structures. (M. Monnim, Pub. Sc. et Tech., No. 37, 1933.) (10.400/28101 France.)

The author is convinced that under proper supervision wood is superior to all the materials weight for weight. Certain precautions must be taken in assembling the bolts and ferrules. Later reports will give methods of calculation.

The Structure of Timbers. (F. W. Jane, J.Roy.Aer.Soc., Vol. 38, No. 277, Jan., 1934, pp. 46-58.) (10.400/28102 Great Britain.)

The properties of a large variety of timbers are briefly discussed in relation to their use. The applications range somewhat at random from battleships to cigar boxes, but the systematic exposition of principles is worthy of study by timber users.

Types of cellular and fibrous structure are shown in sketches.

Thirteen references.

Analysis of Torsional Tests on Timber Spars. (H. Hörig, Ing. Arch., Vol. 4, No. 6, Dec., 1933, pp. 570-576.) (10.400 Germany.)

The anisotropic character of timber introduces complications into the elastic equations. The simplifications introduced by assuming a mean shear modulus make such reductions of test results by simplified formula arbitrary and unreliable.

More general expressions are formed for spars of circular and square section, introducing three elastic coefficients, numerical values of which are computed and tabulated from measurements of torsion tests by Stamer and Sieglerschmidt on specimens of oak, red beech and oregon pine.

If rhombic symmetry of the material is assumed there are nine elastic coefficients. These are computed and tabulated from the same tests, and figures for spruce computed from Carrington's tests are added for comparison.

Nine references.

Mercerisation of Cotton for Strength, with Special Reference to Aircraft Cloth. (J. B. Wilkie, N.A.C.A. Tech. Note No. 450, 1933.) (10.424/28104 U.S.A.)

Mercerisation treatment with caustic solution increases the strength of the yarn from 40 to 100 per cent., comparing equal weights. During treatment the temperature should be kept below 0°C. and sufficient tensions maintained to prevent a shrinkage of over 3 per cent.

Two references.

Testing Apparatus and Methods of Testing

Supersonic Wind Channel for Model Tests. (W. Margoulis, Comptes Rendus, No. 196, 1933, p. 24; Phys. Berichte, No. 23, 1/12/33, p. 1916.) (11.10/28105 France.)

A blower delivers an air jet of 8 cm. diameter at velocities up to 925 m. per sec. Model test results differed fundamentally from those at ordinary velocities and the physical explanation will require new developments of hydrodynamical theory.

The Farnborough Seaplane Tank. (L. P. Coombes and W. G. A. Perring, Airc. Eng., Vol. 6, No. 61, March, 1934, pp. 63-66.) (11.20/28106 Great Britain.)

A note is given on the historical development of tank research. A table shows comparative data of German, American and Farnborough tanks. Considered reasons are given for the comparatively small dimensions of the latter. A description is given of the equipment and mounting of models.

A programme of tests covers the technical problems under consideration.

[An article by S. Truscott on the N.A.C.A. high speed tank follows. (See Abstract No. 28114.)]

Tank Tests of Two Floats for High-Speed Seaplanes. (J. W. Bell, N.A.C.A. Tech. Note No. 473, 1933.) (11.22/28107 U.S.A.)

Two quarter-scale seaplane float models were tested at speeds up to 60ft. per sec., one similar to the floats of the 1926 Macchi Schneider Trophy competitor, the other a new design.

The test figures show the improved water performance of the latter. It is also expected that the air resistance will be lower on test.

One reference.

Scale Effect in Model Tests in Marine and Aircraft Construction. (F. Gutsche, Z.V.D.I., Vol. 77, No. 47, 25/11/33, pp. 1255-1260.) (11.22/28108 Germany.)

Scale effects are largely dependent on surface friction, which in its turn determines instability of the boundary layer. Polished and roughened models show considerable difference in the high speed wind channel. In the case of propellers, the problem is complicated by hull interference and cavitation.

Twelve references.

Complete Tank Test of Model of a Flying Boat Hull, N.A.C.A. Model No. 11. (J. M. Shoemaker and J. B. Parkinson, N.A.C.A. Tech. Note No. 464.) (11.22/28109 U.S.A.)

Authors' abstract.—This note discusses the limitations of the conventional tank test of a seaplane model. The advantages of a complete test, giving the characteristics of the model at all speeds, loads, and trim angles in the useful range, are pointed out.

The data on N.A.C.A. Model No. 11, obtained from a complete test, are presented and discussed. The results are analysed to determine the best trim angle for each speed and load. The data for the best angles are reduced to non-dimensional form for ease of comparison and application.

A practical problem using the characteristics of Model No. 11 is presented to show the method of calculating the take-off time and run of a seaplane from these data.

Six references.

Complete Tank Test of Model of a Flying Boat Hull, N.A.C.A. Model No. 11A. (J. B. Parkinson, N.A.C.A. Tech. Note No. 470, 1933.) (11.22/28110 U.S.A.)

From author's abstract.—Model No. 11A was designed as an improvement on Model No. 11, a complete test of which is described in Tech. Note No. 464. In contrast with the longitudinal upward curvature in the planing bottom forward of the main step on Model No. 11, the planing bottom of Model No. 11A was made as flat as practicable. Otherwise, the two models have nearly the same form.

Towing test data are given in tables and curves for a wide range of speed, load on the water, and trim angle, along with non-dimensional coefficients. The improvement obtained is demonstrated by applying the data from Model 11A to the illustrative design problem in the note on Model No. 11.

Two references.

Complete Tank Test of Model of a Flying Boat Hull, N.A.C.A. Model No. 16. (J. M. Shoemaker, N.A.C.A. Tech. Note No. 471.) (11.22/28111 U.S.A.)

From author's abstract.—A model of a two-step flying boat hull, of the type generally used in England, was tested according to the complete method described in N.A.C.A. Tech. Note No. 464. The lines of this model were taken from offsets given by Mr. William Munro in *Flight*, May 29th, 1931. The data

cover the range of loads, speeds and trim angles required for design. The results are reduced to non-dimensional form for design problems and for comparison with hulls.

The water characteristics of Model No. 16 are compared with those of Model 11A, which is representative of current American practice. Under optimum conditions for each, the performance of Model No. 16 will be somewhat inferior to that of Model No. 11A.

Five references.

Effect of Spray Strips on a Model of the P3M-1 Flying Boat Hull. (J. R. Dawson, N.A.C.A. Tech. Note No. 482, 1933.) (11.22/28112 U.S.A.)

From author's abstract.—A series of tests was made in the N.A.C.A. tank on a sixth scale model of the hull and side floats of the Navy P3M-1 flying boat for the purpose of reducing the amount of spray thrown into the propellers when taking off and landing.

The model was tested bare and with five spray-strip arrangements. The best arrangement was an improvement over the bare hull, but not sufficient to be satisfactory with the propellers in the designed position.

One reference.

Hydrodynamic Knowledge and Measures for the Improvement of Ship Propulsion. (E. Klindwort, Z.V.D.I., Vol. 77, No. 47, 25/11/33, pp. 1267-1269.) (11.22/28113 Germany.)

Improvements are due to changes in the shape of the hull, as well as propeller and rudder position. By altering the nose part only of certain liners of the Hamburg-America Line a reduction of 10 per cent. in the drag has been achieved. The interaction of propeller, hull and rudder is more complicated and the reason for the undoubted improvements which have been achieved in certain cases by relatively small modifications are not always understood.

Photographs of the development of cavitation round a propeller are given.

Six references.

High Speed Towing Basin for Model Floats. (S. Truscott, N.A.C.A. Report No. 470, 1933, 23 pages.) (11.22/28114 U.S.A.)

General arrangement sketches give the plan side and end elevations of the basin, building and towing plant. Photographs show a general view of Langley Field buildings, the empty basin and the towing apparatus. The free towing length is about 1,980ft. (600 metres), width 24ft. (7.3 metres), depth 12ft. (3.65 metres); maximum towing carriage speed 88ft. per sec. (27 metres per sec.).

Froude's conditions of dynamical similitude are given for dimensions, speeds, forces and moments.

Tests on different types of step fitted to the same flying boat hull at three or four different incidences are given graphically. Fluting the steps fore and aft has no substantial effect on performance. In every case there is a discontinuous drop in resistance at the critical speed of change from buoyancy to hydroplaning.

Eight references.

Balloons

Selection of Favourable Winds by Control of Altitude. (P. Perlewitz, Z.F.M., Vol. 24, No. 21, 4/11/33, pp. 586-589.) (12.19/28115 Germany.)

The horizontal travel of free balloons is entirely dependent on the wind prevailing at selected altitudes, but airships and aeroplanes can profitably study the variation of wind with altitude and apply the knowledge to increasing their effective performance.

A description is given, with a sketch and two photographs, of a micro-compass with a fixed reflecting prism bringing the compass card into the field of view and a rotatable prism for bringing a fixed object into the field of view. Particulars for four free balloon voyages are illustrated by maps showing changes in direction of course.

Seven references.

Wireless

Natural Frequency of Electromagnetic Oscillations in Conductors of Straight, Circular and Spiral Form. (K. F. Lindman, Ann. d. Phys., Vol. 18, No. 7, Dec., 1933, pp. 805-815.) (13.2/28116 Germany.)

The experimental layout is described and numerical values are shown graphically in comparison with previous results, which require considerable modification.

Nine references.

Ferrocart, a Magnetic Material for High Frequencies. (A. Schneider, Z.V.D.I., Vol. 77, No. 46, 18/11/33, pp. 1233-1235.) (13.2/28117 Germany.)

Thin strips of paper coated with Ni/Fe particles varying from 5 to 20 μ diameter in an adhesive insulating emulsion are built up into laminated plates 2-3 mm. thick. The plates, cut to shape, form the core of high frequency coils which give sharp tuning in wireless circuits, since they are practically free from hysteresis.

Two references.

Wave Forms at a Distance from a Dipole Sender with Different Conductivities and Di-Electric Coefficients at the Earth's Surface. (K. F. Niessen, Ann. d. Phys., Vol. 18, No. 8, Dec., 1933, pp. 893-912.) (13.30/28118 Germany.)

A mathematical physical discussion is given of the general problem of the form of waves emitted from a dipole sender at a height above the earth which is considerable compared with the dimensions of the sender. Wave forms are calculated for four different wave lengths and for four different assumptions as to the dielectric coefficient and conductivity at the earth's surface, corresponding to dry land, moist land, fresh water and salt water. The angular relations are shown graphically.

Reception from Synchronised Broadcast Stations. (C. B. Aiken, Bell Tele., No. B-758.) (13.32/28119 U.S.A.)

Phase differences between carrier waves and side frequencies are the principal causes of distortion, and time delays of the order of 200 micro-seconds have serious effects at receivers outside the region between the stations. At points between the stations at less than 40 km. distance there is no distortion between identical modulated waves. This suggests the application of a number of lower power recorders distributed round the area and supplied by transmission circuits with identical modulated waves from a central station. The total radiated power required would be far less than for a single station and the total sky wave and interference outside the area would also be reduced.

Thirteen references.

Vacuum Tubes of Small Dimensions. (B. J. Thompson and G. M. Rose, Proc. Inst. Rad. Eng., Vol. 21, No. 12, Dec., 1933, pp. 1707-1721.) (13.5/28120 U.S.A.)

Photographs show two small tubes in different aspects. The linear dimensions are of the order of 1/10th the conventional size and the interelectrode capacities are correspondingly reduced.

Successful applications have been made to receiving on wave lengths from 100 cm. down to 30 cm.

Aircraft Radio Direction Finder. (W. S. Hinman, Jr., Bur. Stan. J. Res., Vol. 11, No. 6, Dec., 1933, pp. 733-741.) (13.6/28121 U.S.A.)

A directional dissymmetrical loop antenna is reversed with respect to the ground, thereby producing two equal and opposite distorted field curves. The reversal is accomplished by alternately grounding the ends through rectifier tubes, and applying the voltage induced in the loop to a radio receiver. The dissymmetry of the circuit involves the matching of a pair of resistances within ½ per cent. A pair of condensers is also matched.

A diagram of connections is given and photographs show the aerial mounted in an aeroplane, the circuit installation and the course indicator dial.

An angular calibration curve is obtained by swinging the aeroplane and shows a maximum deviation of 2°. Some operational experiences are given and a claim is made to freedom from serious course errors unless the loop antenna is resonated below the bearing station frequency.

New Field of Application for Ultra-Short Waves. (E. Kramar, Proc. Inst. Rad. Eng., Vol. 21, No. 11, Nov., 1933, pp. 1519-1531.) (13.6/28122 U.S.A.)

From author's abstract.—A new method of forming a guide ray by keying the reflectors is stated. The dependence of the guide ray upon size, spacing and number of reflectors is measured. There is no distortion due to reflections. A description is given of the use of the radio range beacon for blind landing of airplanes in thick weather. Simultaneous visual and aural reception in the airplane is possible without changing the method of keying the transmitter.

Nine references.

Short Wave Propagation in the Atmosphere. (K. Försterling and H. Lassen, H.F. Technik., Vol. 42, No. 5, Nov., 1933, pp. 158-178.) (13.6/28123 Germany.)

The authors examine the propagation of electro-magnetic waves in an ionised gas subjected to a magnetic field. The well known dependence of range and intensity of wireless signal on time of day and wave length is correlated with the presence of two conducting layers in the upper atmosphere. The so-called double echo is explained by magnetic double refraction.

Eleven references and 25 illustrations.

Progress in Photo-Electric Cells with a "Resistor" Dielectric Layer. (F. Rother and H. Bomke, Phys. Zeit., Vol. 34, No. 23, 1/12/33, pp. 865-870.) (13.7/28124 Germany.)

The formation of a layer of copper sub-oxide between the metal surface of a sheet of copper and a layer of higher copper oxides is the basis of a new technique in photo-electric cells. More complicated arrangements are also discussed. Methods of preparation are described and the observed relation between the current (of ions) and the light intensity is shown graphically. A substantial advance in photo-electric sensitiveness is claimed.

Ten references.

Experimental Television. (E. W. Engstrom, Proc. Inst. Rad. Eng., Vol. 21, No. 12, Dec., 1933, pp. 1652-1654.) (13.7/28125 U.S.A.)

Application of the cathode ray tube as the image producing element of the receiver depends on control of direction and intensity of the ray. The beam is controlled by two variable magnetic fields, vertical and horizontal, with frequencies of 24 and 2,880 cycles per second.

Diagrams of connection and calibration curves of the elements are given. Synchronisation is maintained by periodic synchronising impulses.

Two references.

Electron Conductivity of Copper Sub-Oxide. (W. Schottky and F. Waibe, Phys. Zeit., Vol. 34, No. 23, 1/12/33, pp. 858-864.) (13.7/28127 Germany.)

Experimental results on the displacement of electrons in a layer of copper sub-oxide are given in tables and are plotted graphically. A theoretical discussion takes into account the wave properties of an electron to explain anomalies arising from the corpuscular conception. The method has important applications. (See Abstract 28124.)

Eleven references.

Modes of Vibration of Piezo Electric Crystals. (H. Straubel, Phys. Zeit., Vol. 34, No. 24, 15/12/33, pp. 894-896.) (13.81/28128 Germany.)

The modes are made visible by optical interference patterns, in reflected rays. With ordinary light the interference pattern does not show the nodal lines. By placing the quartz crystal parallel to the second mirror of a Michelon interferometer adjusted to give uniform darkness initially, under vibration the nodal lines remain dark, while the vibrating portions become bright.

Nine photographs of patterns are reproduced.

Four references.

Photography

Memoranda on Air Photography. (H. Roussilhe, Pub. Sc. et Tech., No. 30, 1933.) (14.00/28129 France.)

A permanent advisory committee has been formed to consult with the French Air Ministry on optics and aerial photography. The present number contains six reports on standardisation, interchangeability and multiple lens photography.

A report on the stereotopographic instrument of Poivilliers will be presented shortly.

Thirty-nine illustrations.

Photogrammetric Apparatus. (O. v. Gruber, Z.V.D.I., Vol. 77, No. 44, 4/11/33, pp. 1177-1180.) (14.40/28130 Germany.)

A brief description of recent apparatus is illustrated by fourteen photographs.

A circular cylinder carrying a film is adapted for panoramic views from a single point. A specimen film is reproduced with sliding scales for reading off direction and elevation of details. Aerial cameras include double and quadruple cameras with focal lines at fixed angles for taking two or four oblique photographs simultaneously.

A pocket stereoscope is suitable for rapid inspection and a table stereoscope with a micrometer for adjusting the two views is capable of more exact work. A bench stereoplanigraph of the most elaborate type is also shown.

Two references.

Air Navigation and Maps

International Air Maps. (R. Grasso, Riv. Aeron., No. 11, Nov., 1933, pp. 205-233.) (15.5/28131 Italy.)

The international standardisation of air maps is discussed in relation to the decision taken at the various international congresses. A list of agreed symbols is given.

A brief account is given of the characteristics of national surveys and air maps.

Accidents and Precautions

Regulations for Rescue Service on Seaplane Lines. (A. Pirozzi, Riv. Aeron., No. 11, Nov., 1933, pp. 275-283.) (16.15/28132 Italy.)

A clear map shows the network of Italian seaplane routes in central and eastern Mediterranean. A summary is given of the principal decisions of the Italian air authorities for rescue and salvage preparation and operation.

Examples of Damage to Aircraft by Lightning. (H. Koppe, Z.F.M., Vol. 24, No. 21, 4/11/33, pp. 577-586.) (16.30/28133 Germany.)

The electrical fields round pylons, trees, buildings, free and moored balloons, dirigibles and aircraft with and without trailing antennæ are shown graphically in a diagram. The generation of an electrical field in the atmosphere by precipitation is discussed.

A list of recorded accidents from direct lightning stroke is given, a total of 31, only one of which is previous to 1925. An analysis of the accidents by constructional details is given. In 26 cases out of 29 in which lightning struck directly, antennæ were being towed. Photographs of damaged parts are reproduced.

One reference.

Aircraft—Unorthodox

Simplified Aerodynamic Analysis of the Cyclogiro Rotating Wing System. (J. B. Wheatley, N.A.C.A. Tech. Note No. 467, 1933.) (17.05/28134 U.S.A.)

From author's abstract.—A simplified aerodynamic theory is presented, with numerical examples showing the effect of varying the design parameters. A performance prediction indicates the feasibility of hovering flight, vertical climb, and reasonable forward speed under normal expenditure of power and gliding descent with autorotation under no power.

Wing Pressure Distribution and Blade Motion of Autogiro in Flight. (J. B. Wheatley, N.A.C.A. Report No. 475, 1933, 11 pages.) (17.05/28135 U.S.A.)

The type under test had wings of 30.3ft. span and 101 sq. ft. projected area. The incidence of wing to rotor disc was 3.6°. Pressure orifices were distributed over the wings and the contribution of one wing was determined in steady flight and of both wings in accelerated flight and in turns.

A cinema camera was mounted on the rotor hub, pointing along a blade, and the angular position was determined from the record. Reduced plots of the blade angle for a complete cycle are shown for speeds of 30 m.p.h. and 105 m.p.h. The numerous recorded points lie very closely on mean periodic curves and show the change in phase and amplitude very clearly. At 30 m.p.h. the blade moved between 4.6° and 10.2° about a mean of 7.4°, the amplitude being 2.8° with a phase advance of about 35°. At 105 m.p.h. the blade moved between −0.6° and +13° about a mean of 6.2°, the amplitude being 6.5° with a phase advance of 65°. The rolling axis is taken as zero azimuth.

Lift coefficients of wing and rotor, rotor speeds, coning and flapping angles and proportion of load carried by wing are plotted as functions of tip speed to air speed ratio. Distributions of lift are plotted under various conditions.

The data are of importance in checking the semi-empirical formulæ in use.

Aerodynamic Tests of a Low Aspect Ratio Tapered Wing with an Auxiliary Aerofoil for Use on Tailless Aeroplanes. (R. Sanders, N.A.C.A. Tech. Note No. 477, 1933.) (17.30/28136 U.S.A.)

From author's abstract.—In wind tunnel tests of a model wing with aspect ratio 3, tapered plan form, straight trailing edge and a fixed auxiliary aerofoil

of constant chord, trimming moments were obtained by the upward deflection of a full span, constant chord trailing edge flap.

The auxiliary aerofoil increased the maximum lift of the model in about the same proportion as the drag for high speed flight. The lift in the trimmed condition compares favourably with that of a conventional aeroplane.

The improvements by application of the auxiliary aerofoil in the position tested, *i.e.*, parallel to the leading edge, did not justify the complication.

Eleven references.

Aerodynamic Tests of a Low Aspect Ratio Tapered Wing for Use on Tailless Aeroplanes. (F. E. Weick and R. Sanders, N.A.C.A. Tech. Note No. 463, 1933.) (17.30/28137 U.S.A.)

From authors' abstract.—Wind tunnel tests were made of a model wing having an aspect ratio of 3, a tapered plan form with a straight trailing edge, a Clark Y aerofoil section and no washout, longitudinal balance and control, depending on a trailing edge flap. The wing has aerodynamic characteristics well suited for use on tailless aeroplanes.

Eight references.

Meteorology and Physiology

Change of State of Moist Air. (F. Bosnjakovic, F.G.I., Vol. 4, No. 6, Nov./Dec., 1933, pp. 280-286.) (19.10/28138 Germany.)

The entropy-water content diagram of moist air is constructed for use in conjunction with the total heat-water content diagram of Mollier, with applications to the equilibrium of atmospheric air and the compression of fuel mixtures.

Eight references.

Branching of Lightning and Polarity of Thunderclouds. (J. C. Jensen, J. Frank. Inst., Vol. 216, No. 6, Dec., 1933, pp. 707-748.) (19.10/28139 U.S.A.)

A summary is given of various explanations of electrification of clouds, most weight being given to Simpson's " divided rain drop " theory. The effects of ionisation on the stratosphere in increasing or decreasing the charge are discussed. Ionisation in the lower levels of the atmosphere is taken as the chief cause of branching of lightning for positive discharges only. Diagrams of cloud formation illustrate the argument. Numerous photographs of lightning are reproduced.

Thirty references.

Extraterrestrial Electrical Disturbance. (K. G. Jansky, Bell Tele., No. B-764, 1933.) (19.10/28140 U.S.A.)

Space-directional observations of certain high frequency atmospherics observed throughout the day and year show a diurnal and annual period. The mean right ascension is $270° \pm 7\frac{1}{2}°$ and a declination of $-10° \pm 30°$. The wide scattering in declination is attributed to the ionised layers of the earth's atmosphere and to attenuation over the earth's surface.

Six references.

Functioning of the Nasal Organs in High Altitude Flying. (A. Mangiacapra, Riv. Aeron., No. 11, Nov., 1933, pp. 258-274.) (19.20/28141 Italy.)

The symptoms affecting the nasal organs are classified. In a number of test flights, some up to 7,000 m., schedules of progress in symptoms are given for every 1,000 m. in ascent and descent. Recommendations for treatment are given.

Physiological and Psychological Effects of Fatigue on the Activity of the Pilot. (G. Fatuzzo, Riv. Aeron., No. 11, Nov., 1933, pp. 284-291.) (19.29/28142 Italy.)

The results of investigations on industrial fatigue are discussed briefly with reference to the selection of pilots.

Effect of Acceleration on the Human Frame. (H. v. Diringshofen, Z.F.M., Vol. 24, No. 21, 4/11/33, pp. 589-592.) (19.29/28143 Germany.)

The physical factors and the physiological effects are discussed along the usual lines. The advantages of a semi-recumbent position are brought out.

Five recommendations are made—the selection of small pilots, abdominal pressure belts and special development of the abdominal muscles, semi-recumbent or recumbent position, special dieting immediately before flight, use of drugs.

Compressor for Oxygen and Acetylene. Method of Storing. (V. Fischer, Z.V.D.I., Vol. 77, No. 45, 11/11/33, pp. 1212-1214.) (19.32/28144 Germany.)

Oxygen compressors are lubricated with water, since the ordinary lubricants decompose explosively. The piston is sealed with flexible fibre bushes and the stuffing box is made of leather. Parallel piston motion without side thrust is obtained by flexible mounting of the piston rod on the cross head.

In the case of acetylene, normal piston rings and oil lubrication can be employed, but extra cooling is required as acetylene is liable to decompose explosively. Acetylene is so highly soluble in acetone that the saturated solution stored in cylinders at 15 atmospheres yields a volume of free gas comparable with that given by oxygen cylinders of equal volume at 150 atmospheres.

Two references.

Lighting—Visibility

Transmissibility of Visible Light Through a Cloud of Particles. (D. Nukiyama, Aeronautical Research Institute, Tokyo, Report No. 98, Vol. 8, No. 2, Dec., 1933.) (21.22/28145 Japan.)

Beams of light were transmitted through clouds of incense smoke of NH_4Cl particles. The intensity decrement was measured and the results were plotted against the inverse fourth power of the wave length. An approximately linear relation was obtained for small wave lengths, but irregularities appear for larger wave lengths, and the separation of absorption and scattering effects is not attempted. Direct photographic measurement of scattered light intensity was undertaken.

The general arrangement of the optical apparatus with cloud producing apparatus (NH_4Cl) is shown in a diagrammatic sketch. The cloud was formed in a circular cylindrical vessel. A specimen photographic film is reproduced, along with graphical records prepared from it.

Finally, the results are given in numerical tables and in diagrams of intensity of scattered light in radial directions from the axis of the cylinder. Comparison is made with physical theory, but the discrepancies suggest that the scattering particles used are of more complicated type than those assumed by Rayleigh, Mie, Blumer and others.

Ten references.

Aerodynamics and Hydrodynamics

Determination of the Velocity Potential. (F. Vasilesco, Pub. Sc. et Tech., No. 29, 1933.) (22.10/28146 France.)

A method proposed by Riabouchinsky for expressing the velocity potential in terms of initial boundary surface conditions is developed at some length, particularly for a spherical boundary in terms of spherical harmonics, with discussion of existence theorems and conditions of convergency.

Three references.

Temperature and Velocity Field Round a Heated Pipe in the Case of Free Convection. (K. Jodlbauer, F.G.I., Vol. 4, No. 4, July/Aug., 1933, pp. 157-172.) (22.10/28147 Germany.)

The experiments were carried out on pipes of 20, 50 and 90 mm. diameter at various surface temperatures up to 150°C., with air temperature, at a distance, 20°C. throughout. The temperature distribution in the heated air was measured with a fine wire thermocouple (.015 mm.); the air speeds were recorded by deflection of a quartz fibre viewed by microscope. There is evidence that the instrument disturbed the experimental conditions.

An attempt is made to develop a formula for the heat transfer of large tubes which seems to give results of the right order for Grashof numbers above 10^4.

Nine references.

Theory of Viscosity of Liquids. (E. N. da C. Andrade, Phil. Mag., Vol. 17, No. 112, Feb., 1934, pp. 497-511, and No. 113, pp. 698-732.) (22.10/28148 Great Britain.)

Molecular spacing of fluids is much nearer that of the solid than of the gaseous state and the frequency of molecular vibration in the liquid state just above melting point may be taken as equal to the frequency in the solid state just below melting point.

Considering a sheet of molecular thickness, between two adjacent parallel molecular sheets in relative shearing motion a molecule in the middle sheet in the course of a vibration may enter combination with the nearest molecules in an adjacent sheet during the extreme stage of vibration and thus transfer momentum, but in the mean range may pass from the molecular field of the nearest molecule to the field of an adjacent molecule in the direction of shear displacement. This simple conception, together with established relations of molecular physics, leads to an expression for viscosity containing one arbitrary coefficient and yielding remarkable agreements.

The relative orientation of molecules affects the molecular exchanges and the viscosity. If the solid state is assumed to give the orientation of maximum molecular field, then rise of temperature will cause the orientation to approach random distribution and the mutual molecular fields will be weakened and the viscosity will decrease.

When these further considerations are taken into account the previous expression may be generalised, but two experimental coefficients are now introduced. When these coefficients have been determined for one temperature the viscosity is immediately expressed for a range of temperatures above melting point. Ninety organic substances show agreement substantially within the experimental error.

Chlorine, iodine and mercury also show close agreement, but water shows a discrepancy of -15 per cent. to $+27$ per cent. and two organic substances show discrepancies of the same order as water. Mercury gives good agreement.

One of the coefficients is about 1/10th of the total internal energy in the solid state derived from Waal's equation of state for a large number of substances, but anomalous cases arise.

The wide range of agreements indicates that important correlations have been established. The essential mechanism of viscosity is the same as for gases and depends on collisions and exchanges of momentum, but the molecular paths are very different in magnitude and direction and the exchanges of momentum differ in frequency, duration and intensity.

Fifty-two references.

Measure of Viscosity by the Uniform Motion of a Sphere in a Circular Cylinder. (G. Duffing, Z.A.M.M., Vol. 13, No. 5, Oct., 1933, pp. 366-373.) (22.10/28149 Germany.)

Simplifying assumptions lead to an approximate expression for the resistance of a sphere moving with small clearances in a long cylinder, which is applied to the design of a viscosimeter.

A satisfactory fit is obtained with the results of direct calibration.

Four references.

Flow Experiments in a Rotating Laboratory. (G. Vogelpohl, Z.V.D.I., Vol. 77, No. 48, 2/12/33, p. 1294.) (22.10/28150 Germany.)

Experiments have been carried out at Göttingen on the velocity distribution of straight and curved rotating channels, both instruments and observer sharing the rotation. The relative motion calculated for a frictionless fluid is a useful first approximation of observed motion.

Two references.

Turbulent Flow between Two Rotating Co-Axial Cylinders. (F. Wendt, Ing. Arch., Vol. 4, No. 6, Dec., 1933, pp. 577-595.) (22.15/28151 Germany.)

A description is given of an elaborate apparatus for repeating G. I. Taylor's classical experiment. The outer cylinder has a fixed radius of 14.70 cm. and three inner cylinders could be fitted with radii of 10.00 cm., 12.50 cm. and 13.75 cm.

There are fittings for measuring pressure distribution, mean fluid velocity and torque. The r.p.m. varied from $+172$ to -172 and the velocity field was explored by a pitot tube inserted between the cylinders and carried through a mercury seal to the manometer.

The end effect was shown by fitting a flat end disc alternatively at rest or rotating. It is large for the greatest difference of radii, 4.75 cm., but almost insensible for the smallest difference, 0.95 cm. The readings were extended with the turbulent range far beyond the critical speeds and the resistance coefficients derived from the measurements show characteristics of the same general nature as for flow in a pipe. The critical speeds agree fairly closely with Taylor's results.

Eleven references.

Diffusion of Vorticity in Laminar Motion. (W. Müller, Z.A.M.M., Vol. 13, No. 6, Dec., 1933, pp. 395-408.) (22.15/28152 Germany.)

The author discusses the diffusion of vorticity into an infinite viscous fluid.

1. From a plane laminar jet initially in uniform motion between the plane boundaries.
2. From a uniform initial distribution of vorticity in a circular cylindrical sheet.
3. From a circular cylindrical jet initially in uniform axial motion.

Formal solutions are obtained in terms of the error function for the plane boundaries and of Bessel functions for the cylindrical boundaries.

Numerical results are given graphically.

Twelve references.

Small Disturbances of an Infinite Set of Eddies. (G. Durand, Pub. Sc. et Tech., No. 35, 1933.) (22.15/28153 France.)

The motion of a long but finite single row of equal and equally spaced vortices is considered, first near the centre of symmetry, then near a vortex which divides the row into unequal sets (p and $p+m$).

The velocity potential now contains the additional term $\log m/p$, which the author considers paradoxical. [A physical interpretation is easily given by considering the initial field of a finite rectilinear vortex sheet, near the centre of symmetry and near a point dividing it in the ratio of $p/(p+m)$; all, of course, before the rolling up of the ends has proceeded to any appreciable extent.] The case of two rows is then considered, for symmetrical and staggered formation, and v. Kàrmàn's result is obtained for the latter.

From the form of the solution it is inferred that an initial disturbance which alters the mean relative position of the two rows from v. Kàrmàn's equilibrium configuration produces an unstable condition, in other words, that disturbances which have not zero mean value over a finite length, tend to increase with time.

Measurement of Water Flow with Venturi Channels. (F. Engel, Z.V.D.I., Vol. 77, No. 48, 2/12/33, pp. 1285-1287.) (22.2/28154 Germany.)

The open Venturi channel is less affected than a weir by muddy water and the loss of head is less as there is a considerable recovery of energy.

The author has calibrated a Venturi channel over a considerable range of flows in terms of two non-dimension parameters, the Reynolds and the Boussinesque numbers. The flow is affected by waves in the throat of the channel and further investigation with channels of this type may throw light on wave formation and ship propulsion.

Nine references.

Contributions to the Knowledge of the Flow Resistance of Curved Rough Pipes. (O. Fritzsche and H. Richter, F.G.I., Vol. 4, No. 6, Nov./Dec., 1933, pp. 307-314.) (22.2/28155 Germany.)

The resistance in an indiarubber tube 10 m. long and approximately 20 mm. internal diameter laid out straight was approximately the same as that of a commercial brass tube.

The roughness of the internal surface was therefore taken to be of the same order and may be designated as "commercially smooth." The rubber tube was bent in successive curves and the resistance measured for Reynolds number from 3,000 to 300,000 both with air and water. Tables give the pressure drops due to friction and to curvature (the values of the latter being obtained presumably by subtraction of the total resistances in the two cases).

Twelve references.

Approximation to Entry Flow in a Pipe. (G. Vogelpohl, Z.A.M.M., Vol. 13, No. 6, Dec., 1933, pp. 446-447.) (22.2/28156 Germany.)

The author forms the equation of accelerated motion from initial uniform flow in a long pipe with constant axial pressure gradient and obtains the subsequent distribution of velocity as a function of time and radius until the steady parabolic distribution of velocity is set up.

The total flow is variable in time, with initial and final flow equal. In order to maintain uniform flow throughout the whole time of transition a variable axial pressure gradient is required and is determined by an integral equation, the solution of which is known.

The numerical values of the first three coefficients in the comparison are given. Lanchester's transformation for the entry flow from a reservoir is suggested and further corrections are indicated.

Two references.

Conditions of Flow in a Vertical Bend. (C. Keutner, Z.V.D.I., Vol. 77, No. 45, 11/11/33, pp. 1205-1209.) (22.2/28157 Germany.)

The bend had a diameter of 25 cm. The rate of flow was varied from 0.3 to 4 m. per sec. The pressure distribution along the wall and the velocity distribution across a number of sections were determined.

On account of the unsteady nature of the flow simultaneous photographic registering of the readings was employed. In the centrifugal field of force the retarded boundary layers flow inward and the unretarded fluid outwards, along the radius of the bend, just as in a horizontal bend.

(The practical value of the investigation is small, as guide vanes at sharp bends give much superior results.)

Nineteen references.

Characteristics of Sprays from Pintle-Type Injection Nozzles. (E. T. Marsh and C. D. Waldron, N.A.C.A. Tech. Note No. 465, 1933.) (22.2/28158 U.S.A.)

From authors' abstract.—Tests were made with two injection nozzles, one having a pintle angle of 8°, the other of 30°. The fuel was injected into a glass-windowed pressure chamber and the spray photographed. Curves give the penetration of the spray tips of fuel oil injected by pressures of 1,500 to 4,000 pounds per square inch into air at room temperature and densities of 11 to 18 atmospheres.

The pintle angles have little effect on the size of the spray cone angle, which is about the same as that of sprays from plain round-hole orifices. The penetration with an 8° pintle is slightly higher than with a 30° pintle. Increase in air density decreases the penetration in about the same ratio for all the injection pressures.

Fourteen references.

Formation of Stationary Surface Waves. (W. Schuler, Z.A.M.M., Vol. 13, No. 6, Dec., 1933, pp. 443-446.) (22.35/28159 Germany.)

When a long circular cylinder or a wedge is immersed symmetrically and subjected to forced oscillation progressive waves are formed which travel at right angles to the line of immersion and, under certain conditions, stationary waves are formed along the line of immersion.

When a sphere is submerged a semi-diameter and subjected to oscillation, progressive waves are formed which travel radially outward and standing waves are formed round the circle of immersion. The critical condition depends on the amplitude as well as the frequency of the forced oscillation. No physical explanation is offered.

Photographs of Fluid Flow by Ultramicroscope. (A. Fage, Proc. Roy. Soc., Vol. 144, No. A.852, 29/3/34, pp. 381-386.) (22.36/28160 Great Britain.)

A description is given of an established method of illuminating microscopic particles, such as are carried in ordinary tap water, by an intense beam of light which renders the particles visible against a dark background.

The present paper describes the further progress of the technique from visual observation to the photographic record. Nineteen such photographs are reproduced and show the paths of suspended particles in unobstructed channels and in the neighbourhood of cylinders and triangular prisms.

Six references.

Experiments on Fluid Motion in the Marseilles Institute of Fluid Mechanics. (P. Léglise, L'Aéron., No. 173, Oct., 1933, p. 227.) (22.36/22.76/28161 France.)

A summary is given of work by J. Valensi. Two strobometric photographs with exposures of 1/50 and $1/10^6$ secs. show flow past a wing in a wind jet 0.67 m. × 0.65 m. with a velocity of 39 m. per sec.

A strobometric photograph shows flow past a cylinder of 10 mm. dia. in a jet of water velocity 2.10 m. per sec. exposure $1/10^6$ sec.

Resistance of Air to Oscillatory Motions. (M. le Rolland, L'Aéron., No. 173, Oct., 1933, pp. 231-232.) (22.76/28162 France.)

Serious complications are introduced by the variable motion. The results are expressed in empirical expressions. The hot wire measurement, calibration and compensation are of interest. A smoke indicator shows the formation of eddies at the edge of an oscillating plate.

Experiments on Fluid Motion in the Toulouse Institute of Fluid Mechanics. (C. Camichel and others, L'Aéron., No. 173, Oct., 1933, p. 228.) (22.76/28163 France.)

Photographs show a steady vortex pair behind a plate, vortices formed by the rolling up of layers of transition, turbulent flow at a boundary and laminar flow in the body of the fluid, and steady laminar flow near a plate. The first is a good example of strobometric methods of determining the velocity field.

Materials—Elasticity and Plasticity

Strain Stress and Small Oscillations of Beams with Initial Curvature and Twist, in Rotation with a Transverse Axis. (H. Reissner, Ing. Arch., Vol. 4, No. 6, Dec., 1933, pp. 557-569.) (23.30/28164 Germany.)

The problem of strain and stress in the blades of a rotating turbine or screw is more general than similar problems dealt with by various authors and included in Love's text book. In the present paper the differential equations are further developed to include the effects of large screw pitch and of high angular velocities.

The elastic and dynamical equations are formed along usual lines, and permissible approximates are discussed. Numerical values of the coefficients are derived from tests of materials (metals and timbers) and the results are put in a suitable form for computations.

Numerical applications will follow in a subsequent report.

Four references.

Stresses Induced by Flexure in a Deep Rectangular Beam. (D. B. Smith and R. V. Southwell, Proc. Roy. Soc., Vol. 143, No. A.849, 1/1/34, pp. 271-284.) (23.30/28165 Great Britain.)

St. Venant's solution is an approximation to a more general result. A second approximation is expressed formally and values obtained by numerical solution are exhibited graphically. A third approximation is unnecessary for practical design, but shows the interesting fact that the neutral axis is sensibly nearer the compression side.

Five references.

New Method of Calculating the Buckling Load in Struts of Variable Section. (K. Hohenemser, Z.F.M., Vol. 24, No. 22, 28/11/33, pp. 609-614, and No. 23, 14/12/33, pp. 640-644.) (23.30/28166 Germany.)

The conditions for buckling are expressed as an integral equation and a formal solution is expressed as a series. An approximate solution is obtained by various simplifying assumptions.

Numerical values of the parameters are computed and tabulated and applied to particular cases in comparison with the values given by approximate formulæ. The method is applied to buckling with a number of nodes. A numerical example is fully worked out.

Eight references.

Stability of Thin-Walled Tubes Under Torsion. (L. H. Donnell, N.A.C.A. Report No. 479, 1933, 24 pages.) (23.30/28167 U.S.A.)

Numerous test data are collected and shown graphically in comparison with different types of approximate solutions. A description is given of the test apparatus, illustrated by sketches and by photographs showing the mounting of specimens and examples of failure under load.

A critical historical note shows the relation of the paper to previous work, in particular to the methods and solution of Southwell and Skan for a flat strip, which is a limiting case of the present problem. The elastic equations are expressed in cylindrical co-ordinates and, after simplifying approximations have been introduced, the solution is formed in terms of algebraic parameters and Fourier series, including the elastic coefficients and the dimensions of the tube.

Numerical values are computed, tabulated and shown graphically.

Eleven references.

Thin-Walled Duralumin Cylinders in Compression. (E. E. Lundquist, N.A.C.A. Report No. 473, 1933, 20 pages.) (23.30/28168 U.S.A.)

In continuation of Report No. 427, further test results are collected. Photographs show specimens mounted in the test apparatus and examples of symmetrical and asymmetrical buckling.

Previous approximate solutions of the equations of elastic instability are discussed and compared with each other and with experiment. The experimental points are rather widely scattered about a mean test curve.

A critical length is defined in terms of which a distinction is drawn between " long " and " short " cylinders, and rules are given for bulkhead spacing.

Twenty-six references.

Strength Tests of Thin-Walled Duralumin Cylinders in Pure Bending. (E. E. Lundquist, N.A.C.A. Tech. Note No. 479, 1933.) (23.30/28169 U.S.A.)

From author's abstract.—This report, the third of a series, presents the results of strength tests on thin-walled cylinders and truncated cones of circular and elliptic section, including pure bending tests on 58 thin-walled duralumin cylinders of circular section with ends clamped to rigid bulkheads. The stress on the extreme fibre at failure, calculated by the ordinary theory of bending, is from 30 to 80 per cent. greater than the compressive stress at failure for thin-walled cylinders in compression. The length/radius ratio has no consistent effect upon the bending strength. In cylinders of the same dimensions the size of the wrinkles on the compression half in bending is approximately equal to the size round the complete circumference in compression.

Six references.

Exact Solutions of Notch Effect in Discs and Cylinders. (H. Neuber, Z.A.M.M., Vol. 13, No. 6, Dec., 1933, pp. 439-442.) (23.30/28170 Germany.)

The elastic equations are written down with solutions for a variety of boundaries. The fields of stress are shown graphically.

Five references.

Torsional Stresses in Thin-Walled Box Girders, with Constraint against Curvature of Cross Section Members. (H. Ebner, Z.F.M., Vol. 24, No. 23, 14/12/33, pp. 645-655, and No. 24, 28/12/33, pp. 684-692. D.V.L. Report, No. 349.) (23.41/28171 Germany.)

Reference is made to formulæ given by R. Bredt (1896) for computation of stresses in box girders with free curvature in cross sections. The present paper develops the corresponding formulæ when such curvature is completely prevented by constraints.

In aeroplane practice such constraints are partially imposed, *e.g.*, by stiffener, and the method is extended to calculation of the corresponding departure from the values given by Bredt's formulæ.

Numerical examples are worked out. The analysis, which follows the usual lines, is heavy and unsuitable for abstracting.

Fifteen references.

Summary of Design Formulæ for Beams having Thin Webs in Diagonal Tension. (P. Kuhn, N.A.C.A. Tech. Note No. 469.) (23.41/28172 U.S.A.)

Author's abstract.—This report presents an explanation of the fundamental principles and a summary of the essential formulæ for the design of diagonal-tension field beams, *i.e.*, beams with very thin webs, as developed by Professor Wagner, of Germany.

Seven references.

Comparison of Three Methods for Calculating Compressive Strength of Flat and Slightly Curved Sheet and Stiffener Combinations. (E. E. Lundquist, N.A.C.A. Tech. Note No. 455, 1933.) (23.41/28173 U.S.A.)

From author's abstract.—A comparison is made of three methods for calculating the compressive strength of flat sheet and stiffener combinations in stressed-skin or monocoque structures for aircraft. The method based upon joint action of the stiffener and an effective width of sheet as a column, gave the best agreement with tests.

Seven references.

Pendulum Tests of Structural Rigidity. (M. le Rolland, L'Aéron., No. 173, Oct., 1933, p. 230.) (23.46/28174 France.)

A simple illustrative example is given in the form of a vertical encastré beam with a short cross piece at the upper end carrying two equal pendulums. The first pendulum is set in motion and transfers its energy to the second pendulum. The elementary relation is given between the rigidity of the test piece and the time of transfer.

A more elaborate application to a framed structure enables similar structures, manufactured in series, to be compared.

Miscellaneous

Uniformity of Symbols in Aircraft Structural Calculations. (A. Teichmann, Z.F.M., Vol. 24, No. 23, 14/12/33, pp. 655-660.) (28175 Germany.)

To facilitate interchange and comparison of results a systematic scheme of lettering diagrams and denoting mechanical quantities is proposed under the auspices of the German Standard Committee for Aeronautics. Double, triple and quadruple suffixes are employed to meet the exigencies of denoting the mass of geometrical and mechanical terms involved.

Three references.