

ABSTRACTS AND NOTICES
FROM THE
SCIENTIFIC AND TECHNICAL PRESS

PART I.—PHYSICS AND ENGINEERING SCIENCE

Issued by the
Directorates of Scientific Research and Technical Development, Air Ministry
(Prepared by R.T.P.)

No. 35. SEPTEMBER, 1935

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.
D.M.Z.	Deutsche Motor-Zeitschrift
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.
Riv. Aeron.	Rivista Aeronautica.
S.A.E. Jnl.	Society of Automotive Engineers Journal.
Sci. Am.	Scientific American.
Tech. Aéron.	La Technique Aéronautique.
Trans. A.S.M.E.	Transactions of the American Society of Mechanical Engineers.

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, Performance, etc.

Performance of Modern Light Aeroplane. (W. Pleines, Z.V.D.I., Vol. 79, No. 3, 19/1/35, pp. 57-64.) (5.10/30501 Germany.)

A detailed comparison is made of the seven types of aeroplane which took part in the European circuit of 1934. The rapid progress of the past ten years is slowing down as the possible technical improvements become more fully exploited.

Glen L. Martin Clipper No. 7. (Sci. Am., Vol. 152, No. 3, March, 1935, pp. 149-150.) (5.14/30502 U.S.A.)

A photograph shows the general appearance of the high wing monoplane flying boat with four 800 h.p. Wasps mounted on the leading edge. The estimated performance is given for a total flying weight of 51,000lb.

Wasted Effort in the Pacific. (Re Trans-Oceanic Flights.) (J. Am. Soc. of Naval Engineers, Vol. 47, No. 1, Feb., 1935, pp. 157-158.) (5.14/30503 U.S.A.)

According to report twenty-four naval and ten army aircraft have been searching for the aviator C. T. Ulm and his companion, missing in flight from California to Hawaii.

The French Government prohibit flights across the Sahara until a deposit is made to cover search by the French Air Force in case of accident. It is suggested that the U.S. Government and shipping firms should announce that no search will be made for missing trans-oceanic flyers.

Technical Points from the Australian Flight. (Luftwissen, Vol. 1, No. 11, 15/11/34, pp. 312-314.) (5.14/30504 Germany.)

A technical appreciation is given of the conditions of the flight and the performance of the principal competitors.

Three references.

Conference on Aeronautical Research. (Luftwissen, Vol. 1, No. 11, 15/11/34, pp. 299-309.) (5.14/30505 Germany.)

The Annual Meeting of the D.V.L. has hitherto been the most important occasion of the year. The great expansion of German aeronautics has given comparable importance to the meeting of the "V.L.F." (Association for Aeronautical Research). Its membership consists of recognised experts and authorities and its most important function is to bring about exchange of information and experience throughout Germany by papers and visits. It has also promoted research work. Summaries of the following papers are printed:—

Daeves.—Collaboration of research and industry.

Grimm.—Projecting and working out a research programme in a chemical works.

Seewald.—Organisation of aeronautical research in other countries.

v. Schlippe.—Influence of power plant characteristics on aeroplane design.

Bruckmann.—Influence of aeroplane requirements on engine design.

Ebert.—Influence of aeroplane and power plant on airscrew design.
 Lürenbaum.—The engine as a source of vibrations.
 Damm.—Accessibility and maintenance of engines.
 Eisenlohr.—Engine mountings and engine tests.
 Neugebauer.—Problem of distant drive.
 Lorenz.—Cooling of aero engines.

Formulæ and Methods of Calculation for Sheet and Shell Construction of Aircraft.
 (O. S. Heck and H. Ebner, L.F.F., Vol. 11, No. 8, 6/2/35, pp. 211-222.
 D.V.L. Report 34/01.) (5.152/30506 Germany.)

Collected formulæ are drawn from numerous sources under the following headings:—

- (1) Isotropic rectangular plates under end pressure—twenty-three references.
- (2) Strength of rectangular plates with stiffeners, under pressure—ten references.
- (3) Rectangular plates with stiffeners, under shear—seven references.
- (4) Isotropic circular cylindrical shell segments under axial pressure—three references.
- (5) Circular cylindrical shell segments with stiffeners, under pressure—four references.
- (6) Strength of complete circular cylindrical shells under axial load—nineteen references.
- (7) Complete circular cylindrical shells under bending—six references.
- (8) Complete circular cylindrical shells under torsion—seven references.

Translated by A.I. (T.). Translation No. 264.

Constructional Details of (Non-German) Smooth Shell-Built Aeroplane Bodies.
 (H. Winter and E. Hoffmann, L.F.F., Vol. 11, No. 8, 6/2/35, pp. 235-240. D.V.L. Report 34/02.) (5.152/30507 Germany.)

Examples are collected from the non-German technical press. Four photographs, eight perspective sketches and some section sketches are reproduced. Specifications of U.S.A. riveting practice are given in a table.
 Three references.

The Power Plant as a Source of Vibrations. (K. Lürenbaum, L.F.F., Vol. 11, No. 7, 14/1/35, pp. 200-201.) (5.17/30508 Germany.)

A brief descriptive account is given of vibration troubles and methods of restricting them.

Vibrations of Coupled Systems. (W. Quade, Ing. Arch., Vol. 6, No. 1, Feb., 1935, pp. 15-34.) (5.17/30509 Germany.)

After some generalities on transformation of co-ordinates detailed consideration is restricted to two degrees of freedom. The types of motion with two degrees of freedom are classified according to the nature of the roots of the determinantal equation. Five diagrams of elastic systems illustrate different types of coupling, corresponding to different types of roots.

Eight references.

Variation of Maximum Lift Coefficient with Turbulence and Reynolds Number.
 (C. B. Millikan, Trans. A.S.M.E., Vol. 56, No. 11, Nov., 1934, pp. 815-818.) (5.20/30510 U.S.A.)

Previous tests with N.A.C.A. 2412 profile in turbulent air led to certain conclusions, particularly that the boundary layer branched from the surface near

the trailing edge, but at stalling incidence the branching point ran back to the neighbourhood of the leading edge. Tests on the effect of tail splitting flaps and tests with other wing profiles show such irregularities that the assumption can have no general application.

Test data are given graphically.

Five references.

Theoretical Investigation of Maximum Lift Coefficient. (T. v. Kármán and C. B. Millikan, *J. of Applied Mechanics*, Vol. 2, No. 1, March, 1935, pp. A-21—A-27.) (5.20/30511 U.S.A.)

Measurements with an N.A.C.A. 2412 aerofoil indicated a correlation between turbulence and maximum lift coefficient. An explanation is constructed in terms of boundary layer phenomena, particularly with regard to the point of transition from laminar to turbulent flow and the branching point at which the stream is diverted from the upper surface.

Anomalies are recorded and the difficulty of extended application is recognised.

Induced Resistance of Wings with Small Aspect Ratio. (Schilhansl, L.F.F., Vol. 12, No. 1, 28/3/35, pp. 55-56.) (5.20/30512 Germany.)

The field of velocity near the wing tips was explored by small streamers. In certain positions, in the neighbourhood of the wing tips, the streamers described conical gyrations, from which it was possible to determine the axes of the two twirling eddies into which the vortex sheets had rolled up. The distance between the eddy axes was greater than the wing span by an amount which increases with decreasing aspect ratio from zero at 6:1 to 25 per cent. of the span at 1:2. The induced velocity calculated in accordance with this result accounts for certain variations in the induced velocity from the value calculated by the usual theory.

Influence of Section on Wing Characteristics. (F. Ursinus, *Flugsport*, Vol. 27, No. 1, 9/1/35, pp. 33-36.) (5.20/30513 Germany.)

An empirical algebraic expression is given for a profile with thickness equal to 20 per cent. of chord and maximum thickness at about one-third chord.

Investigations of the Downward Component of Velocity Behind Wings with Rectangular and Elliptic Plan Form. (H. Muttray, L.F.F., Vol. 12, No. 1, 28/3/35, pp. 28-37.) (5.22/30514 Germany.)

The belt of vorticity streaming backwards from the wing rolls up into two roughly circular tubes of vorticity.

The calculation of the velocity field due to the vorticity distribution may be carried out mathematically either on the assumption that the rolling up is complete at the wing, or on the assumption that no rolling up takes place for a large distance behind the wing. The former assumption is a better approximation for the rectangular form, the latter for elliptical forms.

The usual theoretical considerations are recapitulated and results of computations are shown graphically.

Experimental results are plotted for comparison with different incidences and different stations behind the wings.

Eight references.

Torsional Vibration of Cantilever Monoplane Wings. (A. Bellomo, *L'Aerotecnica*, Vol. 15, No. 3, March, 1935, pp. 276-298.) (5.24/30515 Italy.)

Aerodynamical characteristics are taken from N.A.C.A. Report No. 460.

The equations of motion are formed in the usual way and numerical applications are worked out in detail.

Effect of Trailing Edge Flaps. (G. A. Allward, Aero Digest, Vol. 26, No. 3, March, 1935, pp. 24-26.) (5.30/30516 U.S.A.)

Expressions for flap moments are determined in terms of lift coefficient and moment given graphically as functions of relative incidence and total effective incidence of wing and flap.

Airscrews

Propeller Cavitation Studies. (C. O. Kell, J. Am. Soc. of Naval Engineers, Vol. 47, No. 1, Feb., 1935, pp. 123-136.) (5.60/30517 U.S.A.)

Reference is made to observations of full-scale phenomena by a window in the hull of a destroyer and to stroboscopic observation in the model channel.

Face cavitation is described and appears to be due to bad entry at the leading edge near the root. It is observed only at high slip ratios and does not affect the performance. It is unknown in blades designed on modern lines in accordance with aerodynamic theory, a result of some importance.

The rest of the paper is on the usual lines and gives interesting independent observations. In the discussion Hunsaker refers to an experimental installation at the Massachusetts Institute of Technology for the visual study of cavitation. Riabouchinsky refers to numerical solutions of the equation of flow round a cylinder with cavitation.

Sixteen references.

Influence of Pitching on Resistance of Ships and Efficiency of Screws. (G. Kempf, W.R.H., Vol. 16, No. 1, 1/1/35, pp. 1-4.) (5.60/30518 Germany.)

Graphical records are given of variations in shaft load as functions of speed in calm water and with waves of 80 m. and 120 m. in length. The screw efficiencies under these conditions are given as 64, 55.5 and 36.5 per cent.

Four references.

Propeller Vibrations and the Effect of Centrifugal Force. (T. Theodorsen, N.A.C.A. Tech. Note No. 516, 1935.) (5.63/30519 U.S.A.)

The frequency of transverse vibration of a full-scale propeller is first investigated with the propeller stationary, the engine crankshaft being subjected to periodic impulses.

The effect of centrifugal force is very marked, the relationship between stationary and revolving propeller frequencies being given by the relation

$$f = \sqrt{f_0^2 + CN^2}$$

when f = frequency of revolving propeller (vibration/minute).

f_0 = frequency of stationary propeller (vibration/minute).

N = r.p.m.

C = a constant depending on mode of vibration.

(C increases rapidly with order of vibration, ranging from 1.7 for fundamental to 12 for third order.)

As an example, a stationary frequency (third order) 10,000/minute is raised nearly 50 per cent. if propeller rotates at 3,000 r.p.m.

The author has devised a neat experimental method of determining the effect of centrifugal force by subjecting a model propeller or reduced stiffness to slow speed rotation. The blades of the model are enclosed in tubes and resonance is detected by contact during rotation. From this model experiment the effect on the full-scale propeller can be estimated.

Seven references.

Systematic Measurements on Variable Pitch Airscrews. (H. B. Helmbold, L.F.F., Vol. 12, No. 1, 28/3/35, pp. 4-9.) (5.64/30520 Germany.)

Comprehensive numerical data are given for the construction of a blade with constant geometrical pitch for no lift incidence of each element. With change of Reynolds number the no lift incidence changes slightly from section to section.

The blade width is given by a formula which contains a correction for compressibility and is strictly applicable only for a particular combination of angular and axial velocities.

The aerodynamic theory for variable incidence is developed along usual lines with some modifications, particularly the introduction of empirical coefficients which are tabulated numerically for different values of the effective pitch and number of blades and also shown graphically.

Measurements were carried out and pitch, thrust coefficient, torque coefficient and efficiency are tabulated numerically and shown graphically for a range of pitch settings.

The observed values are compared with the values calculated from the semi-empirical equations and show satisfactory agreement until stalling is approached.

Six references.

Design and Construction of Variable Pitch Airscrews. (K. Otto and S. Hesse, Luftwissen, Vol. 2, No. 1, Jan., 1935, pp. 6-11, and No. 2, Feb., 1935, pp. 35-40.) (5.658/30521 Germany.)

American design data are reproduced graphically. Elementary expressions are formed for required thrust at starting and in flight and numerical values of efficiency, engine horse-power and thrust horse-power are tabulated for steady flight and for climb at three different speeds, for fixed pitch, variable pitch and ideal airscrews. Starting data are tabulated for single and two-engine aircraft.

The performance of a two-engine commercial machine at sea level, at 2,100 metres and at 4,000 metres with ideal variable pitch and fixed pitch airscrews is tabulated separately. Substantial advantages are shown.

Eight references.

Instruments

Fluid Meter Nozzles. (B. O. Buckland, Trans. A.S.M.E., Vol. 56, No. 11, Nov., 1934, pp. 827-832.) (6.22/30522 U.S.A.)

Shape and dimensions of forty nozzles are given tabularly and section sketches show the position of static pressure orifices in the nozzle.

Test results are given graphically and non-dimensional coefficients from 22 calibration curves plotted against Reynolds number lie with moderate scattering about unicursal curve.

Calibration of a "Normdüse" shows a sharp dip in the characteristic curve, corresponding to change of flow type at a certain value of Reynolds number.

Six references.

Intake Orifices for Testing Exhaust Fans. (N. C. Ebaugh and R. Whitfield, Trans. A.S.M.E., Vol. 56, No. 56, Dec., 1934, pp. 903-911.) (6.22/30523 U.S.A.)

The installation of fan, 23in. diameter pipe orifice, and measuring instruments is shown by photographs and sketches.

The configuration of mean flow is shown diagrammatically with a well defined vena contracta surrounded by an eddy region, marked by a pressure drop. This is followed by expansion of the effective jet to the point where it fills the pipe, with maximum recovery of pressure.

Calibration characteristics of six orifices, with diameters from 20 to 100 per cent. of the pipe, are tabulated and a scheme of tests by calibrated orifices is proposed.

Twenty-one references.

Throttle Plate for the Measurement of Oscillating Gas Streams. (S. Erk, Z.V.D.I., Vol. 79, No. 3, 19/1/35, p. 77.) (6.22/30524 Germany.)

The mounting and pressure measurements follow V.D.I. standard practice. The throttle plate recommended by Maekawa (Japan) has rounded edges and a thickness $d/3$, where d =diameter of plate opening. The flow coefficient is constant (0.835) in the range of Reynolds number from 14,000 to 100,000 for the ratio $(d/D)=0.4$, where D =diameter of tube containing throttle.

Hydraulic Current Meters. (F. A. Nagler, Trans. A.S.M.E., Vol. 57, No. 2, Feb., 1935, pp. 59-67.) (6.22/30525 U.S.A.)

Different types of water screw mountings are shown in eight photographs.

Examples of velocity distribution across channels are shown in over twenty contour charts. Difficulties of accurate calibration are discussed and the effect of turbulence in producing variation in velocity and direction are considered briefly.

Casual measurements of weir discharge gave errors of 40 per cent., but careful reduction of properly distributed observations reduced the maximum variation to less than 5 per cent.

Twenty-four references.

Note on Surface Tension Effect in Viscometers. (W. Linke, Phys. Zeit., Vol. 36, No. 2, 15/1/35, p. 45.) (6.225/30526 Germany.)

Discrepancies in viscometer measurements are explained in terms of surface tension effects.

Two references.

The Torsion Balance as Micromanometer. (H. Reichardt, Z. Instrum., No. 1, Jan., 1935, pp. 23-33.) (6.251/30527 Germany.)

A brief account is given of the defects of the pressure head manometer in reading small pressure differences.

A description is given of a direct pressure reading instrument. The pressure is transmitted to the head of a piston fitting a cylinder with a small clearance. The piston is mounted on a lever rotating about the axis of the torsion balance. The theory of the period and damping of the mechanism is discussed. The leakage flow past the piston is assumed to have parabolic distribution of velocity and the corresponding error is calculated from known expressions.

The mechanical details are shown in plan and elevation sketches. The range of measurement depends on the strength of the control spring, the sensitivity being about one thousandth of the whole range. With a fine spring measurement can be made over a range from 0 to 0.01 mm. of water, to 0.00001 mm. accuracy.

Pressure Recording Instruments for Rapid Pressure Variation. (S. Berg, Z.V.D.I., Vol. 78, No. 44, 3/11/34, pp. 1295-1296.) (6.251/30528 Germany.)

A short length of bent tubing of small volume (about 10 cubic millimetres) high period and great stiffness, carries a mirror at the closed end. Deflection proportional to the fluid pressure is recorded on a rotating drum at a distance.

The instrument is suitable for recording fuel pressure in the pipe line of injection engines.

One reference.

Electrical Speed Indicator for Ships, Submarines or Aeroplanes. (M. J. Breton, Comptes Rendus, Vol. 200, No. 10, 4/3/35, pp. 812-814.) (6.40/30529 France.)

The velocity head forces the fluid to flow through a pipe. The flow in a shunt pipe is warmed by an electric heater, the temperature rise being an inverse measure of velocity. By restricting the flow in the shunt pipe, the sensitivity can be maintained with small heating currents.

Junkers Aviation Log. (R. Preuschen, Luftwissen, Vol. 1, No. 11, 15/11/34, pp. 315-318.) (6.40/30530 Germany.)

The installation comprises a revolution counter, an air log depending on the calibration of r.p.m. of small airscrews against distance for different air speeds and a time-distance recording apparatus. Experience has shown the great advantage of logging air runs accurately. It is stated that the D.V.L. are progressing along similar lines. Five photographs show details of the installation.

One reference.

New Method of Measuring Ship Speed. (H. Hoppe and H. Lerbs, W.R.H., Vol. 16, No. 4, 15/2/35, pp. 53-56.) (6.40/30531 Germany.)

Examples are given of serious errors in logs actuated by towed screws. In the new method a dynamic pressure orifice in the stem and a static pressure orifice in each side, 5-10 m. aft, form a large scale pitot head. Three examples are given from a ship with the usual sharp stern and the "Bremen" and "Europa" with bligl sterns. Sketches show the bow profile, the water line section and the position of the orifices.

From the calibration curves the coefficient of velocity as a function of the square root of the pressure head appears to be practically constant for a given trim and to vary less than 1 per cent. for usual changes of trim. An experimental installation proved so satisfactory during the trial runs of the "Bremen" that a permanent installation was fitted in the "Europa." Details of the transmission and recording apparatus are given in a photograph and section sketches.

A graphical speed record during the run from Bremerhaven to Southampton is reproduced with critical notes on the effect of depth of water, rudder, etc., on the speed for given engine revolutions.

Three references.

Experiments on the Refraction of Ultra-Sound Waves. (W. Bez-Bardili, Phys. Zeit., Vol. 36, No. 1, 2/1/35, pp. 20-24.) (6.48/30532 Germany.)

Ultra-sound waves are generated by a quartz oscillator and propagated through a surrounding liquid medium. The periodic variations in density of the liquid form an optical grid, and illumination produces refraction patterns which indicate the position of the elastic waves. By interposing obstacles of various materials the refraction of the sound by the materials alters the wave pitch, from which the velocity is deduced.

Frequencies were used up to 18×10^6 cycles per second. The velocity of ultra-sound waves in Al and Cu is about 20 per cent. greater than for audible sound, in nickel about 50 per cent.

Six references.

Experiments with Copper Sub-Oxide Photocells. II. Hysteresis Phenomena. (W. Bulian, Phys. Zeit., Vol. 36, No. 1, 2/1/35, pp. 33-34.) (6.87/30533 Germany.)

Copper sub-oxide cells, with sputtered silver electrodes are entirely free from temperature effect from 10° to 80°C. The further condition of freedom from hysteresis is investigated and it is shown that after 150 hours' exposure the readings settle down to a nearly constant value of about 45 per cent. of the initial rating.

Five references.

Aircraft Flight

Mutual Influence of Power Plant, Aeroplane Performance and Airscrew Design. (H. Ebert, L.F.F., Vol. 11, No. 7, 14/1/35, pp. 197-199.) (7.15/30534 Germany.)

The elementary relations between power, r.p.m., flying speed, airscrew diameter and (fixed) pitch are discussed by illustrative numerical examples.

The theoretical advantages of variable airscrew pitch at high altitudes are shown graphically.

Mutual Influence of Power Plant and Aeroplane Structure. (B. v. Schlippe, L.F.F., Vol. 11, No. 7, 14/1/35, pp. 192-196.) (7.15/30535 Germany.)

The maximum cross section of the aeroplane body is largely determined by the type of engine. Outline sketches show side views of glycol-cooled, water-cooled and air-cooled engines, the effective area of resistance being given as 0.047, 0.15 and 0.1 respectively.

Suitable shaping of the airscrew blades near the hub may reduce air-cooled temperature by 20° to 40°C. Overheating of the cabin by the cooling air was experienced and remedied by closing the cowl above and letting the cooling air escape below.

For engines of comparatively low power air-cooled designs have lower head resistance, but for large powers the water-cooled engine, with radiator, becomes more compact.

A brief reference is made to shaft drive from central power plant. Ease of mounting and dismounting and accessibility are discussed from practical cases and illustrated by five photographs. The engine is considered as a source of forced vibrations and elementary physical relations are stated.

Airscrew Back-Stream and Longitudinal Stability. (H. Blenk, L.F.F., Vol. 11, No. 7, 14/1/35, pp. 202-206.) (7.20/30536 Germany.)

The equations of motion are formed in the usual way and a discussion is given of the modifications required to take into account the back-stream from the airscrew.

Comparisons are given graphically of model and full-scale experiments on Junkers A.35. Relations between airscrew thrust components and moments are given graphically as functions of incidence and polar curves are deduced.

Finally sixteen curves of elevator position are given for four positions of the C.G. and five throttle openings showing comparison between calculated and observed rudder angles. A scheme of research is suggested.

Nine references.

Air Conditions Close to Ground and Aeroplane Landings. (F. L. Thompson and others, N.A.C.A. Report No. 489, 1934.) (7.30/30537 U.S.A.)

A mast carried compound vanes indicating direction and intensity of wind at five heights, from 6ft. to 51ft. Thirty photographic records were taken at the

rate of one per second. The results, reduced to curves of wind velocity and direction as functions of time, are shown in seven figures. The mean wind speeds range from 8 to 16 m.p.h. Variation of wind speed is also shown as a function of height and an empirical equation giving a moderate fit is a parabola of the seventh degree.

A description is given of a recording theodolite camera, with calibrating controls, with which the flight path of aeroplanes was recorded during glide and landing. The results show graphically the wind velocity and aeroplane vertical velocity component as functions of height.

Seven references.

Siemens "Autopilot." (Luftwissen, Vol. 1, No. 11, 15/11/34, pp. 309-312.) (7.56/30538 Germany.)

The Siemens "autopilot" is an electric hydraulic installation regulated by suitable controls. The instruments required are substantially the same as for blind flying. A compass sets the course, a pressure head the speed, and a combination of gyro and pendulum the lateral control. These controls act separately or in groups on a relay which magnifies the control forces hydraulically. The damping is provided by gyrostat.

The settings of the controls for longitudinal and lateral trim in straight flight and in turns are described and diagrams of connections show full details and general arrangements of two installations.

Two photographs show the compact hydraulic relay in light alloy casing and the arrangement of the instrument board.

Effect of Mass Distribution and Control Setting on the Spinning of an Aeroplane. (N. F. Scudder, N.A.C.A. Report No. 484, 1934.) (7.62/30539 U.S.A.)

Previous investigations on the spinning of an aeroplane are continued with another aeroplane used for naval training. Extensive data are tabulated and the results are stated to be in accord with mathematical theory.

Five references.

Experiments with Suction Wings. (O. Schrenk, L.F.F., Vol. 12, No. 1, 28/3/35, pp. 10-27.) (7.72/30540 Germany.)

A thick profile (depth 40 per cent. of chord) had slots of different width pierced at different positions in the upper surface towards the trailing edge, through which air from the boundary layer was sucked into the interior of the wing. The volume of air removed per second is shown graphically as a function of suction pressure for eight combinations of slot width and position. The corresponding lift, polar and pressure distribution are shown graphically by faired curves.

Similar measurements with suction of the boundary layer were made on a thinner wing with trailing edge flaps of three different designs and the characteristics are shown by plotting observed values which lie on fairly smooth curves with moderate scattering.

Comparison between the two profiles (and a third profile without suction) is made in a brief numerical table showing the minimum resistance coefficient, maximum lift coefficient and maximum lift to minimum drag from which the thinner wing equipped with flaps appears to give a better all round characteristic than the thick profile.

No detailed analysis of the mass of figures in twenty-five numerical tables can be given, but there is a definite improvement in the calculated rate of climb, ceiling, starting and landing yaws with the second type of wing.

Seven references.

Engines—Thermodynamics

Advantages of the Terres Engine. (A. R. Leye, Science Absts. B, Vol. 38, No. 450, 25/6/35, p. 311.) (8.10/30541 Great Britain.)

This is a six-stroke engine, the normal expansion stroke of the four-stroke cycle being followed by a recompression stroke. Additional air is supplied before the final expansion stroke takes place. It is claimed that in this way there are no partly burnt exhaust products and the efficiency of the engine is improved.

Catalytic Combustion at High Temperatures. (W. Davies, Phil. Mag., Vol. 19, No. 126, Feb., 1935 (Supplmt.), pp. 309-325.) (8.13/30542 Great Britain.)

A wire of diameter 0.001 in., heated to 1,250°C. in the most explosive mixture of CO and air does not cause ignition and gives no indication of combustion in the gas phase at its surface. At lower temperatures a gas phase reaction occurs readily. An explanation is given in terms of the Langmuir theory.

Eight references.

Engines—Design and Performance

Economic Engine Operation for Cruising Reliability. (E. T. Allen and W. B. Oswald, Aviation, Vol. 34, No. 3, March, 1935, pp. 89-92.) (8.225/30543 U.S.A.)

An engine failure is defined as engine trouble (apart from fuel system), causing a forced landing and a delay of ten minutes or more in schedule starting.

The rapid drop of reliability with increased cruising speed and power is shown in tables and graphs.

Two-Stroke Ship's Diesel Engine of 5,500 h.p. (G. Eichelberg, Z.V.D.I., Vol. 79, No. 5, 2/2/35, pp. 130-132.) (8.232/30544 Germany.)

The fuel injection pipe line is made intentionally long so that sufficient lag is obtained to enable the use of an injection cam which is symmetrical with regard to T.D.C. The engine can therefore be reversed in four seconds without having to touch the injection timing. The scavenge air is supplied by a piston compressor fitted with copper piston rings.

Re-design of Air Injection to Airless Injection (Ship's Diesel Engine). (K. Mohr, Z.V.D.I., Vol. 79, No. 5, 2/2/35, p. 144.) (8.25/30545 Germany.)

Messrs. Krupp have re-designed several air-injection engines to operate with direct fuel injection by Prof. Archaouloff's method. The old injection pump and cylinder head are retained. A small spring-loaded plunger operates, in tandem, a second plunger of smaller cross-section placed in the fuel line between the injection valve of the engine and the delivery of the original (low pressure) fuel pump.

The fuel is metered at low pressure as for air injection, compressed during the engine compression stroke and injected against the compression pressure. The timing depends on the hydraulic magnification and the spring load on plunger and injection valve. The injection system is water-cooled. Results are stated to be extremely satisfactory.

Aircraft Diesel-Power. (G. D. Angle, Aero Digest, Vol. 26, No. 3, March, 1935, pp. 30-34.) (8.26/30546 U.S.A.)

A fairly complete table is given of experimental aero Diesel engines showing rated h.p., weight/h.p., r.p.m., number and arrangement of cylinder and makers' names.

Four photographs are reproduced. No design details are given.

Engines—Design and Strength of Components

Current Practice in Lubrication of Oil Film Bearings. (H. A. S. Howarth, Trans. A.S.M.E., Vol. 56, No. 12, Dec., 1934, pp. 891-902.) (8.31/30547 U.S.A.)

Extensive data, supplied by makers of bearings are tabulated and exhibited graphically.

Practical rules for bearing design and selection of lubricant are given. Sixteen references.

Design of Steam Turbine Disc Wheels. (I. Malkin, Trans. A.S.M.E., Vol. 56, No. 8, Aug., 1934, pp. 585-600.) (8.35/30548 U.S.A.)

Established formulæ are reduced to forms suitable for computation. Numerical tables of the functions involved are given. Two numerical examples are worked out.

Twelve references.

Side Leakage in Journal Bearings. (S. J. Needs, Trans. A.S.M.E., Vol. 56, No. 10, Oct., 1934, pp. 721-732.) (8.37/30549 U.S.A.)

Kingsbury devised a method of solving Reynolds general differential equation of motion of lubrication in a bearing by direct electrical measurements based on a mathematical physical analogy. In the present paper results obtained by this method are tabulated numerically and shown graphically. They include eccentricity and length of bearing, thickness of film, pressure distribution, flow of lubricant, side leakage and friction.

A numerical example is worked out for a 10-inch shaft carrying a total load of 25,000lb. at 1,500 r.p.m.

Ten references.

Rotor Balancing. (J. Bromberg, Trans. A.S.M.E., Vol. 56, No. 10, Oct., 1934, pp. 707-710.) (8.39/30550 U.S.A.)

A graphical method is given for determining the application of balancing masses from the out-of-balance forces and couples determined by experiment on a balancing machine. The object of the method is to eliminate trial and error adjustments.

Five references.

Dynamic Balancing in the Field. (E. L. Thearle, Trans. A.S.M.E., Vol. 56, No. 10, Oct., 1934, pp. 745-753.) (8.39/30551 U.S.A.)

A rod is fastened by an adaptor to the vibrating part, *e.g.*, a turbine generator bearing, and imposes vibration on a coil in a stationary magnetic field. A cam drive from the shaft makes and breaks the induced A.C. through alternate arcs of 180°. The D.C. micro-ammeter is connected in the circuit and by angular adjustment of the contact the current may be rectified to a maximum reading which is a measure of the amplitude, or to zero reading, giving the phase angle. Two such devices, one on each bearing, give sufficient data for determining the necessary balancing by a graphical process, of which a worked example is given.

There are twenty photographs and diagrams.

Engines—Cooling

Recent Advances in Heat Flow Research. (E. Schmidt, Z.V.D.I., Vol. 79, No. 3, 19/1/35, pp. 68-72.) (8.40/30552 Germany.)

The symposium of papers presented to the 10th Annual Meeting of the Subcommittee for Heat Research covers a wide field. Specific heat and dissociation values of technical gases have been reviewed with the object of furnishing more reliable data for the thermodynamics of explosions.

In connection with steam research, recent developments render some of the theories of the late Prof. Callendar untenable. Throttle plate measurements of technical gases have now reached a high order of precision. If the gases contain suspended particles of water (in the form of fog) measurements are liable to errors of the order of 10 per cent.

The effect of roughness on pressure measurements in pipes has been further investigated by Schiller. The free convection of heat from square plates has been investigated with a quartz fibre anemometer.

Thermal Conduction Through Vapours. (S. W. Milverton, Proc. Roy. Soc., Vol. A. 150, No. 870, 1/6/35, pp. 287-308.) (8.40/30553 Great Britain.)

The precautions taken to prevent convection are of interest, in reference to the criterion for instability of layers of a gaseous layer heated from below. Eleven references.

Calculation of Surface Temperatures. (S. Goldstein, Z.A.M.M., Vol. 14, No. 3, June, 1934, pp. 158-162.) (8.40/30554 Germany.)

In calculating the rate of cooling of bodies bounded by planes, cylinders and spheres, the function expressing the temperature field may be integrated in series.

For small values of time the operational method of Heaviside gives approximate expressions in terms of the error function and exponentials which give accurate values by easy computations, in the region where the corresponding series converge so slowly that the numerical computations become laborious and the number of significant figures obtainable becomes small.

Examples are given for plane circular cylinder and sphere, with numerical tables.

The Average and Local Rates of Heat Transfer from the Surface of a Hot Cylinder in a Transverse Stream of Fluid. (J. Small, Phil. Mag., Vol. 19, No. 125, Feb., 1935, pp. 251-260.) (8.40/30555 Great Britain.)

The average rate of heat transfer was obtained from the total heat input in watts. The local rate was estimated from the readings of a thermocouple imbedded in the surface. The coefficient of heat transfer reaches a minimum value on the diameter at right angles to the stream. On the diameter parallel to the stream the coefficient reaches about three times the minimum value.

Eight references.

Best Forms of Grate Bars. (J. Bock, F.G.I., Vol. 6, No. 1, Jan./Feb., 1935, pp. 23-32.) (8.40/30556 Germany.)

Simplified problems of flow of heat in bars receive elaborate mathematical treatment. The flow of air through the bars and of mixed gases in the furnace are discussed empirically and numerous curves of velocity distribution are reproduced.

The combined problem leads to elaborate families of curves giving total flow of heat as a function of bar spacing.

Fourteen references.

Improved Measurement and Calculation of Heat Transfer from Condensed Steam in a Vertical Tube. (M. Jakob, S. Erk and H. Eck, Phys. Zeit., Vol. 36, No. 3, Feb., 1935, pp. 73-91.) (8.40/30557 Germany.)

A description is given of the apparatus with dimensioned sketches. Extensive experimental data are exhibited graphically.

A differential equation is formed from the rate of heat exchange in accordance with Nusselt's assumptions as to the thickness and velocity of the film of water

condensed on the surface of the tube. A solution is obtained by numerical methods and shows extensive similarities with observed phenomena.

Semi-empirical expressions are formed which give satisfactory numerical agreement with measurements.

Six references.

The Number of Water Drops Formed by Condensation on Various Solid Surfaces. (G. Tammann and W. Boehme, *Ann. d. Phys.*, Vol. 22, No. 1, Feb., 1935, pp. 77-80.) (8.40/30558 Germany.)

Repeated condensation and evaporation shows that water drops reform on identical parts of a metal plate. Such favoured spots are evidently characterised by the presence of specially active atoms (noble metals) or oxides (base metals). The number of drops condensed on polished magnesium (1,000 per 0.01 mm.²) is five times greater than on gold (200 per 0.01 mm.²). Experiments with alcohol and benzol exhibit continuous films, not discrete drops.

The Thurston Rotor Cowl. (A. P. Thurston, *J.R. Aer. Soc.*, Vol. 39, No. 293, May, 1935, pp. 445-447.) (8.426/30559 Great Britain.)

The cowl is formed of aerofoil vanes mounted on a rotating frame, coaxial with the (radial) engine. The system of rotating vanes may autorotate or may be driven in the opposite direction. In this latter case cooling air is drawn from the boundary layer and may postpone turbulence, with a corresponding reduction in head resistance.

Engines—Lubricants

Lowering of the Pour Point of Lubricating Oils by the Colloidal Method. (R. Kaladzhai, *Chem. Absts.*, Vol. 28, No. 22, 20/11/34, p. 7507.) (8.540/30560 Russia.)

The effect of a mixture of triethanolamine and Al stearate and of "parafloc" on the pour point of automobile lubricating oils is compared, previously to dewaxing of the oil. Al stearate alone is not as effective as the mixture. Complete dewaxing is detrimental to the oil.

Storing and Loading of Palm Oil. (W. Loos, *W.R.H.*, Vol. 16, No. 4, 15/2/35, pp. 59-62.) (8.540/30561 Germany.)

The article is chiefly concerned with storage tanks, pump and pipe lines (in Sumatra).

Experimental determinations are given of viscosity and specific gravity at temperatures from 27° to 31.5°.

Some Diesel Engine Lubrication Difficulties and Their Remedies. (A. Wolf, *Chem. Absts.*, Vol. 28, No. 22, 20/11/34, p. 7495.) (8.540/30562 U.S.A.)

Addition of fatty acids increases the greater solvent property of the treated oil for asphaltic deposits and thereby improves the lubricating properties. Oils should be tested periodically for acidity.

Investigation of Chemical Stability of Automobile Oils. (L. Nikiforov and others, *Chem. Absts.*, Vol. 28, No. 22, 20/11/34, p. 7496.) (8.54/30563 Russia.)

The oils were oxidised by the Butkov and Hardford method and also subjected to engine conditions. Asphaltene, carbene and carboid content were determined. The changes in the oil appear to be mainly due to cracking, which may take place on the metal surface at temperatures as low as 100°C.

The Use of Anti-Oxidants in the Stabilisation of Cracked Gasoline. (A. Degtyarèva, Chem. Absts., Vol. 28, No. 22, 20/11/34, p. 7504.) (8.54/30564 Russia.)

The best stabilisers are hydroquinine and pyrogallol. They are not affected by the material of the container.

New Developments in Lubrication. (G. W. Miller, Chem. Absts., Vol. 28, No. 22, 20/11/34, p. 7506.) (8.540/30565 U.S.A.)

If lubricating oil is subjected to chlorination in the presence of anhydrous $AlCl_3$, a heavy semi-solid oil is obtained (paraffin). Small additions of this processed oil to normal oil will reduce the pour point and viscosity at low temperatures, without affecting the properties of the oil at high temperatures.

Oil Film Whirl. (B. L. Newkirk and L. P. Grobel, Trans. A.S.M.E., Vol. 56, No. 8, Aug., 1934, pp. 607-615.) (8.580/30566 U.S.A.)

It is stated that at or beyond twice critical shaft speed the oil lubricating film becomes unstable and the shaft whirls at its natural period. In the discussion the phenomenon is referred to as obscure and the hydrodynamical assumptions are challenged.

Six references.

Engines—Fuels

Application of Film Concept in Petroleum Refining. (C. C. Monrad, Ind. and Eng. Chem., Vol. 26, No. 10, Oct., 1934, pp. 1087-1092.) (8.60/30567 U.S.A.)

The evaporation from large plane surfaces is studied and equations are derived from the laws of heat transfer and diffusion.

Aircraft Engine Performance with 100 Octane Fuel. (F. D. Klein, J. Aer. Sci., Vol. 2, No. 2, March, 1935, pp. 43-47.) (8.640/30568 U.S.A.)

The Air Corps rating on the C.F.R. engine was employed (Specification 3566). The 100 octane fuel consisted either of standard reference fuel C_8 or of mixtures of iso-octane with petrol and isopentane, with from 1 to 8.5 cc. of ethyl lead per gallon. The tests were carried out on Wasp and Cyclone engines with compression ratio 6 and 6.4 respectively. General agreement with the C.F.R. rating of the fuel was obtained.

The higher octane number enabled the power output of the engine to be increased, with wider throttle opening, before detonation set in. The increase ranged from 70 h.p. to 160 h.p. and was relatively greater for the weaker mixtures. The higher power output was accompanied by a rise in mean cylinder head temperature (from 480° to $525^\circ F.$).

The better performance was confirmed by flight tests. The engines under test were not specially constructed for high knock rating fuels and still better results could be obtained by fitting the supercharger with inter-coolers. The provision of commercial iso-octane at a reasonable price should improve the performance of aircraft.

Influence of Temperature on the Explosion of Mixtures of Air and Hydrocarbons. (P. Mondain-Monval and R. Wellard, Comptes Rendus, Vol. 200, No. 3, 14/1/35, p. 232.) (8.64/30569 France.)

The hydrocarbon mixture under a pressure of 5 atmospheres is contained in a steel bomb and exploded by a spark. The rapidity of the explosion is registered by an indentation method. The experiment is repeated at increasing temperatures and at a critical temperature well below the auto-ignition tempera-

ture the explosion becomes extremely rapid. This fact is attributed to the presence of unstable chemical compounds formed during heating up.

Six references.

Fuels for Heavy Oil Engines. (L. J. le Mesurier and R. Stansfield, Chem. Absts., Vol. 28, No. 22, 20/11/34, p. 7495.) (8.640/30570 Great Britain.)

Cylinder liner wear is due to abrasive materials collected in the fuel oil during transit. The effect may be increased on sea-going installations by the presence of free H Cl from leakage of sea water into the crankcase.

Octane Number of Russian Petrols. (I. M. Kligerman, Chem. Absts., Vol. 28, No. 22, 20/11/34, p. 7505.) (8.640/30571 Russia.)

The following are representative values:—

Baku straight	...	...	...	75
„ cracked	...	...	...	81
„ naphtha	...	...	...	67
Grozny straight	...	...	...	68
„ cracked	...	...	...	73
“ Trust NN ”	...	...	...	57
Aviation NN	...	...	...	61

High Octane Fuel Tests. (W. R. Hopkins, Aero Digest, Vol. 26, No. 3, March, 1935, pp. 27-28.) (8.640/30572 U.S.A.)

Five fuels with octane numbers from 90 to 100 were tested by the fuel research staff at Wright field in a Wasp engine.

Specifications of the fuels show the general proportions of hydrocarbons and the amount of ethyl lead. Extensive test data as to horse-power, consumption, fuel flow, temperatures of cylinder heads, are drawn graphically.

Standardisation of Diesel Engine Fuel. (Fr. Sass, W.R.H., Vol. 16, No. 5, 1/3/35, pp. 67-71.) (8.640/30573 Germany.)

The quality of a Diesel fuel depends on the ease with which combustion is initiated and the completeness of the subsequent combustion. Ignition temperature and delay can be determined by laboratory methods (*e.g.*, cetene rating). Completeness of combustion (carbon residue) is more difficult to determine. The distillation curves and the coke number (Conradson test) give some indication.

The problem is of especial importance in the case of small high speed engines, where excessive wear accompanies the use of unsuitable fuel.

Fifteen references.

The Knocking of Motor Fuels and its Prevention. (E. Endo, Chem. Absts., Vol. 28, No. 22, 20/11/34, p. 7505.) (8.645/30574 U.S.A.)

The following alcohol mixtures are recommended:—

For engines with compression ratios up to 6.5—

Alcohol (98% purity)	...	...	...	15—20%
Ether	...	...	...	2—5%
Petrol	...	...	...	83—75%
or Alcohol (99% purity)	...	...	...	15—20%
Petrol	...	...	...	85—80%

For engines with compression ratios up to 7.5—

Alcohol (98% purity)	...	...	...	15—20%
Benzol	...	...	...	40%
Petrol	...	...	...	45—40%

Knocking Characteristics of Hydrocarbons. (W. G. Lovell and others, *Ind. and Eng. Chem.*, Vol. 26, No. 10, Oct., 1934, pp. 1105-8.) (8.645/30575 U.S.A.)

Knocking characteristics of 103 pure hydrocarbons are given. The compression ratio of incipient detonation of a mixture of two compounds is not always the mean of the individual compression ratios weighted by the proportions in the mixture.

Eleven references.

The Resistance to Detonation of Different Isomeric Hydrocarbons. (Aubert and Duchêne, *Chem. Absts.*, Vol. 28, No. 22, 20/11/34, p. 7505.) (8.645/30576 France.)

The tendency of fuel to detonate was measured by examination of photographs of spark explosions in a bomb, fitted with a compressor piston. The compression ratio was kept constant throughout, but the initial temperature was varied.

Benzene and toluene lose their effectiveness as anti-detonants with rise of initial temperature. Alcohol was unaffected.

Engines—Injection and Exhaust Systems

Automatic Engine Controls. (G. W. Knott, *Flight*, Vol. 27, No. 1374, 25/4/35, pp. 23-25, and No. 1379, 30/5/35, pp. 29-32.) (8.701/30577 Great Britain.)

The elementary principles are discussed and illustrated diagrammatically by characteristic curves of fuel consumption against throttle opening.

Improved Exhaust Tailpipe. (M. S. Kuhring, *Canadian Aviation*, Vol. 8, No. 2, Feb., 1935, pp. 10-11.) (8.721/30578 Canada.)

Sketches show the shape of various tail pieces, and arrows indicate the observed flow in the neighbourhood.

Tables show pressure readings at two stations and an advantage is claimed for the tail piece designed at the Ottawa engine laboratory of the National Research Council of Canada.

Oscillation in Exhaust Pipes of Internal Combustion Engine. (T. Schmidt, *Z.V.D.I.*, Vol. 79, No. 1, 5/1/35, pp. 27-28.) (8.721/30579 Germany.)

Using data published by Waetzmann and Noether (*Ann. d. Phys.*, Vol. 13, 1932, p. 212), an acoustic filter was constructed and fitted to a single cylinder two-stroke Diesel with crankcase scavenging. The filter consisted of four insulated chambers, through which the exhaust pipe passed, communicating with each chamber through adjustable holes. The silencer is placed close to the engine and silences the upper harmonics effectively, but allows free passage to the fundamental air vibration corresponding to the short exhaust pipe. With this arrangement the exhaust back pressure is low during the scavenging period and the working of the engine considerably improved.

The Functions of the Exhaust Valve. (R. J. Cousins, *Airc. Eng.*, Vol. 7, No. 75, May, 1935, pp. 107-108.) (8.725/30580 Great Britain.)

Pressure is plotted against crank angle for different areas and timing of inlet and exhaust valves. The total available area for valve seatings is limited and the best compromise between relative size of inlet and exhaust valves is discussed in terms of the diagrams.

Engines—Pumps

Theory of Water-Jet Pump. (K. G. Klone, Z.V.D.I., Vol. 79, No. 3, 19/1/35, pp. 77-78.) (8.74/30581 Germany.)

The low efficiency of water jet pumps can be considerably increased by subdividing the jet and using cold water.

Junkers Free Piston Compressor. (K. Neumann, Z.V.D.I., Vol. 79, No. 6, 9/2/35, p. 155.) (8.745/30582 Germany.)

A combination of the opposed piston engine with an air compressor is constituted by designing the air piston (of increased diameter) as an extension of the power piston. There are no crankshafts, the piston assembly being kept in step by a system of coupling rods engaging with a centrally placed gear wheel. Combustion forces the piston outwards and compresses the air on the compressor side. Part of this air is delivered, but enough is retained to ensure the return stroke of the piston assembly and to provide the necessary scavenge air.

The article deals fully with the fundamental principle underlying this design (length of stroke, number of cycles per second, maximum pressure, etc.). Since no crankshaft bearings are employed high explosion pressure can be used, with corresponding thermal efficiency. Photographs show the compact appearance of the compressor which is built for pressures from 3 to 250 atmospheres at 500 to 1,000 strokes per minute. No details of the coupling system are given.

Influence of Bends in Fan Outlets. (L. S. Marks, J. H. Raub and H. R. Pratt, Trans. A.S.M.E., Vol. 56, No. 10, Oct., 1934, pp. 767-771.) (8.745/30583 U.S.A.)

Experimental data, exhibited graphically, appears to show that obstructions or bends in the intake have a serious effect in reducing delivery, while bends in the outlet have little effect. (The conditions cover a limited range.)

Two references.

Design and Performance of Axial Flow Fan. (L. S. Marks and J. R. Weske, Trans. A.S.M.E., Vol. 56, No. 11, Nov., 1934, pp. 807-813.) (8.745/30584 U.S.A.)

An aerofoil section with flat under-surface was selected and the details of a three-bladed fan design are shown graphically. Five and ten-blade guide vanes were installed and comparative tests made.

The mean velocity field round the hub is plotted. Relations between volume of air discharged, static pressure, power and efficiency, are shown graphically. The effect on efficiency of axial clearance between guide vanes and fan blade is shown separately.

Tests with and without diffuser are also shown. Noise measurements are recorded in decibels against volume delivered.

Engines—Transmission

A New Turbo-Transmission. (Autom. Ind., Vol. 72, No. 7, 16/2/35, p. 216.) (8.761/30585 U.S.A.)

A sketch of the general arrangement is given and a diagram shows torques and speeds of primary and secondary, and efficiency of transmission. It is known as the Voith turbo-transmission and is used in rail cars built by the Austro-Daimler-Puchwerke of Austria.

Armament

American Munitions. (G. H. Dern, Army Ordnance, Vol. 15, No. 89, March/April, 1935, pp. 263-267.) (9.0/30586 U.S.A.)

The rapid obsolescence and deterioration of military equipment and stores renders necessary a large manufacturing capacity. It is impossible to maintain, in peace time, Government establishments on a scale adequate for war. This can only be done by private industry.

Difficulties of controlling exports of raw materials and finished munitions are discussed.

Motion of High Pressure Gases and Compression Waves at the Muzzle of a Rifle. (K. Terazawa, M. Tamano and S. Hattori, Aer. Res. Inst., Tokyo, Report No. 117 (Vol. 9, No. 9), Jan., 1935.) (9.01/30587 Japan.)

Thirty-seven strips of cinema record are reproduced. An interpretation of the phenomena is given and numerical data obtained by measurement from the photographs are given graphically and in tables.

A description of the apparatus is given. (Original in Japanese, with English summary.)

Aeroplane Machine Gun Coupled to Engine. (Review of Patents.) (P. Légliise, Rev. de l'Armée de l'Air, No. 67, Feb., 1935, pp. 215-228.) (9.1/30588 France.)

The mechanism is described at length with fifteen diagrammatic sketches and the relative merits critically discussed.

On the Origin of the Luminosity Accompanying the Detonation of Explosives. (H. Muraour and A. Michel-Levy, Comptes Rendus, Vol. 200, No. 11, 11/3/35, pp. 924-926.) (9.03/30589 France.)

The luminosity is due to the rapid adiabatic compression of the surrounding gas by the shock wave. It is similar to that accompanying a powerful electric discharge.

Pattern Counter-Bombing of Aircraft Bombers. (A. Vanin, Riv. Aeron., Vol. 11, No. 2, Feb., 1935, pp. 233-246.) (9.3/30590 Italy.)

A bomb of 15 kg. has an effective radius of 80 m. according to the calculations given. Six fast fighters fly over a bomber and release 3×6 bombs in a pattern filling a parallelepiped, 800 m. long by 480 m. deep and 80 m. wide. The calculated probability of an effective hit is given as 54.5 per cent.

Chemical Warfare—(Europe Looks at). (A. H. Waitt, Army Ordnance, Vol. 15, No. 89, March/April, 1935.) (9.4/30591 U.S.A.)

Extracts from European literature on chemical warfare are given. Seven photographs are reproduced, illustrating gas barrages, smoke screens and gas shelters.

Materials—Characteristics, Defects and Treatment

Organisation of Research in the (German) Steel Industry. (K. Daeves, L.F.F., Vol. 11, No. 7, 14/1/35, pp. 185-188.) (10.100/30592 Germany.)

An account is given of the procedure in the firm with which the author is connected (Pereinigte Stahlwerke). The research is stated to be directed solely to the processes of steel making, but the boundary is not rigidly defined.

In the first place all relevant literature is examined and indexed by subject matter and the technical notices thus produced are circulated so as to render the information readily accessible to individual specialists employed by the firm.

These specialists are distributed through the shops, test and laboratory staff and touch is maintained with less directly relevant research through various institutions and societies.

Recent Developments in Special Steels. (A. Fry, W.R.H., Vol. 16, No. 4, 15/2/35, pp. 63-65. From Krupp Technical Reports, Sept., 1934.) (10.100/30593 Germany.)

A summary of progress is given under the headings of—Resistance to high temperatures, corrosion, acid reactions, fatigue and nitriding, low hysteresis and welding. Representative data are given in tables.

Ferrous Metallurgy in Aeronautics. (W. H. Hatfield, Airc. Eng., Vol. 7, No. 75, May, 1935, pp. 113-125, and No. 76, June, 1935, pp. 143-152.) (10.100/30594 Great Britain.)

Tables exhibit the composition, treatment and mechanical properties of 31 steels, specified in aircraft construction. Thermal, welding and magnetic properties are also tabulated. Micro-photographs $\times 200$, show the grain of 22 steels.

A general survey deals with case-hardening, nitriding, machine welding and corrosion properties.

Six references.

Research on Engine Valve Steels. (I. Musatti and A. Reggiore, L'Aerotecnica, Vol. 15, No. 3, March, 1935, pp. 299-306. A review of research published in La Metallurgia Italiana.) (10.103/30595 Italy.)

Thirteen steels, partly of martensitic, partly of austenitic structure were examined for mechanical strength at temperatures ranging from 500°C. to 800°C. Chemical stability tests (oxidation and corrosion) were carried out over the same range. Best results were obtained with alloy steels with high Ni and Cr contents and small proportions of tungsten and silicon.

Fatigue of Shafts (at Press Fits, etc.). (R. E. Peterson and A. M. Wahl, J. of Applied Mechanics, Vol. 2, No. 1, March, 1935, pp. A-1 A-11.) (10.104/30596 U.S.A.)

Press fits produce stress concentrations and rubbing corrosion.

Extensive data are quoted from a German State railway report and further figures are given from the author's work in the Westinghouse research laboratories.

Stress optical diagrams are reproduced and from them are prepared diagrams of stress distribution over the surface of a press fit.

Seventeen references.

Fatigue Properties of Steel Wire. (S. M. Shelton and W. H. Swanger, Bur. Stan. J. Res., Vol. 14, No. 1, Jan., 1935, pp. 17-32.) (10.104/30597 U.S.A.)

Machining and polishing the surface as received from the manufacturers increased the fatigue strength by such figures as 40, 60 and 82 per cent. The results depended on the maximum stresses only and were independent of the mean stress.

Fourteen references.

The Welding of Heat Resisting Steel Alloys. (H. Schottky, Z.V.D.I., Vol. 79, No. 2, 12/1/35, pp. 41-47.) (10.140/30598 Germany.)

Welding steel alloys presents great difficulties if the weld is exposed to the action of unsymmetrical pressures and to corrosion. Such problems arise in

chemical technology. After careful study of the welding alloy, Cr. Mo. tubes carrying H_2 at 300 atmospheres pressure and $650^\circ C$. have been successfully welded by electric arc.

Twenty-three illustrations.

Weldability of High Tensile Strength Steels. (J. Muller, Z.V.D.I., Vol. 78, No. 44, 3/11/34, pp. 1293-1294.) (10.140/30599 Germany.)

Cracks and local hardening may appear near welds of thin steel strips (0.5 to 3 mm. thick). Hardening renders subsequent working difficult and affects the fatigue limits. Cracking may be reduced by a low ($P+S$) content, especially if the per cent. C. exceeds 0.2 per cent.

Hardness is controlled by selection of a suitable C. or Mo. alloy steel and by subsequent heat treatment. Methods of inspection for cracking and hardening are described.

Three references.

Specifications for Welded Ship Hulls. (R. Schmidt, W.R.H., Vol. 16, No. 2, 19/1/35, pp. 21-24.) (10.140/36600 Germany.)

In the light of more extensive experience, modified specifications for welding hull plates have been issued by the German Standards Committee.

A critical comment is given with sketch illustrations.

Four references.

Welding of Iron and Steel—Symposium of Iron and Steel Institute. (Engineer, Vol. 159, Nos. 4140-4144, May-June, 1935, pp. 506-509, etc.) (10.140/30601 Great Britain.)

The number of papers presented was about 150. Summaries of 32 papers and of the subsequent discussion are given.

Formation of Blisters in Heat Treatment of Aluminium Alloys. (W. Gatzek, L.F.F., Vol. 11, No. 3, 18/8/34, pp. 65-73. D.V.L. Report 33/06.) (10.231/30602 Germany.)

Specifications of twelve alloys are given. Systematic tests were carried out in a vacuum and in various gases, with heat treatment in a salt bath and in the electric oven.

It appears that the formation of blisters is not an inherent property of the alloy, although the tendency to blister formation increases with the magnesium content. The source of trouble is the release of free hydrogen which can be removed by previous heating in a vacuum. For this reason the presence of water vapour is to be avoided during melting. If preliminary removal of hydrogen is not possible the electric oven is preferable to the salt bath.

Photographs show 47 test pieces, microstructure and blistering effects.

Nine references.

Applications of Beryllium Alloys in Watch Making. (W. Rohn, Z.V.D.I., Vol. 79, No. 1, 5/1/35, pp. 22-23.) (10.234/30603 Germany.)

A beryllium content of 1 per cent. in steel and non-ferrous alloys is stated to produce remarkable qualities of invariance and robustness. Such alloys are non-magnetic and have applications in the manufacture of watch springs.

Two references.

The Influence of Beryllium on Steel. (W. Kroll, Z.V.D.I., Vol. 79, No. 1, 5/1/35, pp. 28-29.) (10.234/30604 Germany.)

English experimenters have failed to confirm the results of German scientists as to the beneficial effect of Be on certain steels. The authors attribute the

failure to unsuitable melting furnaces and to the use of Ni-C steels. Without certain precautions Be attacks the fire-resisting lining of cupolas instead of dissolving in the steel.

The beneficial effect is, moreover, restricted to certain classes of Ni-Cr steels. Under the combined action of temperature control, nitriding and ageing, a tool steel is produced which combines a glass hard surface with a tough core.

Elastic Properties of Timbers. (J. Stamer, Ing. Arch., Vol. 6, No. 1, Feb., 1935, pp. 1-8.) (10.400/30605 Germany.)

Photographs show test pieces cut normally, tangentially and radially, with reference to the axis determined by the annual rings, as closely as the asymmetry of growth allowed. The moisture content was kept approximately the same in most specimens.

Eight kinds of timber were tested and the measured values of density, moisture and elastic moduli are given in Table I. The influence of the cross sectional shapes on the apparent shear moduli is shown in Table II, and the influence of the direction of cutting in Table III.

Great uncertainties arise in assuming average values of the moduli and applying the elastic theory of isotropic bodies; test measurements on a model beam gave 1,200 kg./cm.² as the ultimate strength, while a full-scale test on a large beam gave only 250 kg./cm.². The problems thus raised are discussed in the following paper (see Abstract 30606).

Eight references.

Elastic Theory of Anisotropic Bodies Applied to Timber Measurements. (H. Horig, Ing. Arch., Vol. 6, No. 1, Feb., 1935, pp. 8-14.) (10.400/30606 Germany.)

Following Voigt's notation for the rhomboidal system of crystal structure nine moduli and nine coefficients are introduced into the usual stress-strain relations. These quantities are determined from the experimental measurements and tabulated for the same timber as in the previous article.

Voigt's values of the moduli of rhombic crystals of baryte, aragonite and topaz are tabulated for comparison. The results are also expressed in terms of the usual engineering moduli. It is easy to recognise general similarities imposed by the similar fibrous structure of the various timbers.

Three references.

Variation in Density of Important Conifer Timbers According to Region where Grown, Location of Tree and Individual Trees. (R. Trendelenberg, Z.V.D.I., Vol. 79, No. 4, 26/1/35, pp. 85-89.) (10.400/30607 Germany.)

The moisture content of timber depends remarkably on the place of growth. It is possible to produce timber of predetermined moisture by selection of location.

Moisture Relations of Aircraft Fabrics. (G. M. Kline, Bur. Stan. J. Res., Vol. 14, No. 1, Jan., 1935, pp. 67-84.) (10.402/30608 U.S.A.)

Balloon cloth, airship outer cover and aeroplane fabrics treated and untreated were exposed in a bell jar to various degrees of humidity above and below the equilibrium value and the rate of change of weight with time was observed.

Numerical values are given in extensive tables.

Eleven references.

Influence of Previous Heat Treatment on Physical Qualities and Structure of Glass. (S. Erk, F.G.I., Vol. 6, No. 1, Jan./Feb., 1935, pp. 33-39.) (10.406/30609 Germany.)

Glasses may be considered as polymerised fluids. With decreasing temperature the polymerisation increases and the rate of polymerisation decreases

rapidly. Some of the author's results can be extended to artificial resins, which find increasing application as electrical insulators.

Twenty references.

Photo-Elastic Properties of Soft Vulcanised Rubber. (W. E. Thibodeau and A. T. McPherson, *Bur. Stan. J. Res.*, Vol. 13, No. 6, Dec., 1934, pp. 887-896.) (10.408/30610 U.S.A.)

The composition is given of thirteen rubber preparations with from 0.3 to 8 per cent. weight of sulphur. A description is given of the apparatus.

The results are shown graphically and a correlation is given between sulphur content and the three coefficients of an empirical cubic relation for optical retardation.

Longitudinal Shear in "Checked" Wooden Beams. (J. A. Newlin, G. E. Heck and H. W. March, *Trans. A.S.M.E.*, Vol. 56, No. 10, Oct., 1934, pp. 739-744.) (10.420/30611 U.S.A.)

(A check is a fissure along the grain of the beam.)

The elementary mathematical theory for isotropic material is applied with modifications of the boundary conditions brought in by the presence of fissures.

A beam was built up with an artificial fissure in the neutral plane. In the neighbourhood of the fissure the resistance of the beam approaches that of two superposed beams sliding freely over each other.

Results of tests are tabulated and plotted for comparison with the extreme "two-beam" values, which give lower limits.

Testing Apparatus and Methods of Testing

Plane and Image Methods of Representing Ground Effect in Tests on Vehicle Models. (R. H. Heald, *Bur. Stan. J. Res.*, Vol. 13, No. 6, Dec., 1934, pp. 863-870.) (11.10/30612 U.S.A.)

Wind channel tests on models of motor cars and trains were made with fixed planes representing the ground and with two models in mirror image positions. When the leading edges were faired the figures obtained by the two methods for streamlined automobiles agreed within about 1 per cent. Results for a train model differed by about $3\frac{1}{2}$ to $4\frac{1}{2}$ per cent.

The presence of the fixed plane with boundary layer is obviously not strictly equivalent to the plane of symmetry of the mean flow in the image method.

Air Forces and Yawing Moments on Three Automobile Models. (R. H. Heald, *Bur. Stan. J. Res.*, Vol. 13, No. 6, Dec., 1934, pp. 871-878.) (11.14/30613 U.S.A.)

Three models are shown in profile sketches with the method of mounting on the air channel balance. Yawing moments and lift drag and cross-wind forces are given graphically as functions of yaw angle. Full-scale values are computed and tabulated.

Problems of Naval Aviation. (Lt. Lenoir, *Rev. de l'Armée de l'Air*, No. 66, Jan., 1935, pp. 3-20.) (11.22/30614 France.)

Experiments with an aeroplane equipped with emergency floats are described and illustrated by photographs. The problems of deck landing are discussed mathematically at length.

Aerostats—Materials

Permeability of Synthetic Film Forming Materials to Hydrogen. (T. P. Sager, Bur. Stan. J. Res., Vol. 13, No. 6, Dec., 1934, pp. 879-885.) (12.42/30615 U.S.A.)

Specifications are given of the chemical constitution and relevant physical properties of film forming materials, with suitable solvents. A brief consideration of weight, permeability, hygroscopic property and chemical stability, shows anomalies which prevent any simple correlation.

Hitherto, highly hygroscopic materials have been largely used on account of their low permeability, in spite of the disadvantage of variations in weight. It is considered that less hygroscopic material may become available in the near future.

Twelve references.

Wireless

Proportion of Radiated Energy from a Vertical Dipole Absorbed by the Earth. (K. F. Niessen, Ann. d. Phys., Vol. 22, No. 2, Feb., 1935, pp. 162-188.) (13.30/30616 Germany.)

The electro-magnetic equations are written down in polar co-ordinates and solutions are developed in integrals of products of Bessel functions and exponentials.

Numerical values are computed for assumed conductivities of salt and fresh water and for moist and dry soil. The results are exhibited graphically and in numerical tables.

Four references.

Automatic Syntraction of Two Broadcast Carriers. (V. V. Gunsolley, Proc. Inst. Rad. Eng., Vol. 23, No. 3, March, 1935, pp. 244-248.) (13.30/30617 U.S.A.)

Author's Abstract.—A phase meter is adapted to control automatically the space-phase between two carriers at any described point in the area of common frequency broadcasting.

Experimental results of syntraction between a crystal controlled oscillator and broadcast carrier are given.

An Objective Method for Measuring the Wave Length of High Frequency Sound Waves. (J. Zühlke, Ann. d. Phys., Vol. 21, No. 7, Jan., 1935, pp. 667-670.) (13.30/30618 Germany.)

Wave-lengths of the order of 200 μ are measured with an error of $\pm 10 \mu$ by a photographic recorder applied to Pierce's standing wave apparatus.

Three references.

Radio Interference. (E. A. Smith, J. Frank. Inst., Vol. 218, No. 6, Dec., 1934, pp. 653-663.) (13.32/30619 U.S.A.)

A summary is given of sources of interference, with particular reference to high voltage electric power supply transmission systems. Examples of interference are given graphically and devices for prevention and shielding of high frequency discharges are discussed briefly.

Apparatus for Recording Average Amplitude of Wireless Echoes. (F. J. Farmer, Proc. Camb. Phil. Soc., Vol. 31, Pt. 2, April, 1935, pp. 295-302.) (13.32/30620 Great Britain.)

Diagrams of connections show the circuits employed, with pulse transmitter, cathode ray oscillograph, synchronised time base, amplifiers and diodetectors.

Calibration curves and records of signals and echoes on a wave-length of 150 m. are reproduced.

Designing Resistive Attenuating Networks. (P. K. McElroy, Proc. Inst. Rad. Eng., Vol. 23, No. 3, March, 1935, pp. 213-233.) (13.40/30621 U.S.A.)

The usual expressions developed in the theory are collected and computation is facilitated by numerical tables of factors which occur frequently.

Three references.

Horizontal Rhombic Antennas. (E. Bruce, A. C. Beck and L. R. Lowry, Bell Tele. Pubcn. No. 835.) (13.4/30622 U.S.A.)

Photographs show details of a rhombic receiving aerial and its mounting on a pole-mast with guy control from the ground. Each side of the rhombus was $3\frac{1}{4}$ wave-lengths. A gain of 14 decibels was shown over a half wave horizontal dipole at the same height. A simplified theory is developed and vibration intensity fields calculated. Best dimensions, rhombic angle, height and orientation are determined by the theory.

In practice satisfactory compromises with working conditions can be made. Experimental measurements lie well on the calculated curves of field intensity.

Theory of Electron Gun. (I. G. Maloff and D. W. Epstein, Proc. Inst. Rad. Eng., Vol. 22, No. 12, Dec., 1934, pp. 1386-1411.) (13.5/30623 U.S.A.)

The principle of the electron gun is to generate, control and concentrate an electron beam on to a required spot. The theory of electron lenses with detailed analysis of the action of the various parts of the gun is given.

Five references.

An Electron Oscillator. (B. J. Thompson and P. D. Zottu, Proc. Inst. Rad. Eng., Vol. 22, No. 12, Dec., 1934, pp. 1374-1385.) (13.60/30624 U.S.A.)

Authors' Abstract.—A new type of thermionic tube, capable of producing ultra-high frequencies by means of electron oscillations, has parallel plane electrodes, instead of cylindrical electrodes as in the conventional Barkhausen-Kurz tubes, and a fourth element called a backing plate.

The relations between wave-length and amplitude of oscillation and electrode potential are shown by measurements on a typical tube. The filament voltage is not critical, space-charge-limited operation is satisfactory, and only one mode of oscillation is obtained. Both factors appear to give these tubes an advantage in stability over cylindrical Barkhausen-Kurz tubes.

A tube of the flat type described has produced oscillations at a wave-length of less than 10 centimetres in the fundamental mode with a positive grid potential of 150 volts.

Five references.

Vacuum Tubes for Ultra-High Frequencies. (C. E. Fay and A. L. Samuel, Proc. Inst. Rad. Eng., Vol. 23, No. 3, March, 1935, pp. 199-212.) (13.6/30625 U.S.A.)

Authors' Abstract.—The failure of the conventional vacuum tube to oscillate above some critical frequency is analysed and illustrated by a tube which will oscillate at frequencies up to 300 megacycles.

A Barkhausen tube giving output of the order of five watts in the range from 450 to 600 megacycles is described. For higher frequencies (up to 2,500 megacycles) spiral-grid Barkhausen tubes have been used.

By departing from conventional construction principles, it is possible to extend the operation of negative grid oscillators above 300 megacycles, one tube described giving six watts at 500 megacycles with an efficiency of 19 per cent.

By further refinement appreciable power has been obtained at 1,000 megacycles and the possibilities have by no means been exhausted.

Fifteen references.

Ultra-Short Waves in Radio Communication. (F. A. Kolster, Proc. Inst. Rad. Eng., Vol. 22, No. 12, Dec., 1934, pp. 1335-1353.) (13.6/30626 U.S.A.)

Author's Abstract.—In general, this paper deals with the generation and practical utilisation of ultra-short waves below ten metres. The first part of the paper describes an ultra-high-frequency oscillator in which a "tank circuit" of novel design is used for the purpose of obtaining a high degree of frequency stabilisation without resorting to frequency doubling or crystal control. Later, the feasibility of utilising ultra-short waves as carriers of signal channels from a remote receiving station to the city operating room is discussed and preliminary experiments described.

Behaviour of Biological Objects under High Frequency Radio. (H. Danzer, Ann. d. Phys., Vol. 21, No. 8, January, 1935, pp. 783-790.) (13.6/30627 Germany.)

Physiological aspects of the phenomena are discussed, in particular the conductivity of the blood under short wave radiation. Details of the apparatus employed for measurements under very short and medium wave-length radiation are given.

The electrical resistance, shown graphically, drops to about one-third for ultra-short wave-lengths. A comparison with the theory gives only qualitative agreement.

Eight references.

Ultra-Short Radio Waves as Higher Harmonics in Space Charge Oscillations. Part I. (J. Muller, Ann. d. Phys., Vol. 21, No. 6, Jan., 1935, pp. 611-648.) (13.6/30628 Germany.)

A modified Barkhausen circuit is described for the production of ultra-short waves of length determined by the natural period of the grid spiral. Design details of experimental valves are given.

Computed and calculated values are tabulated and show satisfactory agreement.

Radiating Properties of Antennas. (C. A. Nickle, R. B. Dome and W. W. Brown, Proc. Inst. Rad. Eng., Vol. 22, No. 12, Dec., 1934, pp. 1362-1373.) (13.70/30629 U.S.A.)

Authors' Abstract.—A system of tuning is described by which the current distribution and therefore the radiating properties of an antenna may be varied over wide range. This is effected by a localised capacity and inductance connected to the top of the radiator. The capacity may conveniently take the form of a sphere, a cylinder, or a disc. The inductance may take the form of a coil housed within the sphere or cylinder or of two parallel wires. By appropriate adjustment the current distribution may be varied.

Frequency Effects in Photo-Electric Cells. (W. Leo and C. Müller, Phys. Zeit., Vol. 36, No. 4, 15/2/35, pp. 113-122.) (13.7/30630 Germany.)

A description is given of the apparatus installed at the Physikalisch-Technische Reichsanstalt, for exposing photo-electric cells to a beam of accurate sinusoidal light intensity and constant frequency.

The results are given graphically in twelve diagrams, and marked differences are shown.

In some cases caesium cells show a sensible falling off in the response at from 300-1,000 cycles, while a cuprous oxide boundary layer cell maintains full response up to 5,000 cycles.

The effects of the area of illuminated surface, the light intensity and the spectral distribution of beam intensity remain to be further investigated.

Ten references.

Photo-Electric Apparatus for Measuring High Air Speeds. (Luftwissen, Vol. 1, No. 11, 15/11/34, p. 318.) (13.70/30631 Germany.)

A brief description is given of a camera with two lenses. One lens is directed at the aeroplane and shows calibrating marks in the field; the other lens at two chronometers, one controlled by a tuning fork in a thermostat and the other electrically synchronised with the corresponding chronometers at the other end of the measured distance. A chronometer rate of 0.06 seconds in twenty-four hours is obtainable.

One reference.

Photography

Cinema-Metallography. (E. O. Bernhardt and H. J. Wiester, Z.V.D.I., Vol. 79, No. 1, 5/1/35, pp. 7-11.) (14.28/30632 Germany.)

A description is given of polarising microscope and cinematograph apparatus for taking metallograph film records at the rate of 20 per second, under progressive cooling of the metal.

Records are reproduced and show the sudden appearance of needles of martensite on the surface of austenite within the interval of 1/20th second. Other records show the small beginnings of a tin crystal formation and its almost complete formation in the following record, the time of formation being slightly greater than 1/20th second. Reference is made to other applications.

Eleven references.

Modern Processes for Making Blue Prints. (A. Schade, Z.V.D.I., Vol. 79, No. 5, 2/2/35, p. 139-142.) (14.60/30633 Germany.)

Ordinary blue prints require washing in water and subsequent drying. Modern papers can be developed in a semi-dry or completely dry state, with improved speed of operation and clearness of detail.

Acoustics, Noise Reduction, etc.

Acoustic Fixing of Aircraft. (P. Léglise, Rev. de l'Armée de l'Air, No. 66, Jan., 1935, pp. 37-59, and No. 67, Feb., 1935, pp. 147-172.) (15.25/30634 France.)

The author states that the problem has been thoroughly explored only in France, U.S.A., Czechoslovakia and Germany, but has not been the subject of serious work elsewhere.

Directional listeners are more accurate than the unaided ear, but without mechanical corrections for course and speed the time error and corresponding range error impose costly and ineffective barrage fire.

Reference is made to infra-red and heat-ray detection, but in spite of the remarkable results obtained in star observations, the application of aircraft detection is disappointing by reason of local temperature variation near the receiver. The latter method has been tried and abandoned in France five years ago. The directional reception of electro-magnetic radiation from the magneto is completely prevented by suitable shielding.

Only the acoustical method is considered at length. A description is given of combined visual and aural direction fixing, whereby the mechanical corrections

can be directly checked. A searchlight is coupled to the telescope and it is stated that once an aircraft has been picked up by it, escape from the beam is very difficult. Results of trials are tabulated and give a high proportion of successful fixes.

A schematic view is given of the Goerz system of acoustic fixing with four four-gun A.A.C. batteries mechanically controlled by the acoustic position fixers.

An exposition is given of the elementary geometry and kinematics of the problem of fixing from two acoustic stations on a base line, with a detailed account of mechanical devices for recording the altitudes and azimuths, and mechanical methods of determining the speed and allowing for the change of position during the acoustical time lag.

Acoustic Threshold Values (IV). (E. Waetzman and L. Keibs, *Ann. d. Phys.*, Vol. 22, No. 3, March, 1935, pp. 247-256.) (15.20/30635 Germany.)

Various methods of measuring the damping of sound waves in pipes are discussed.

The ratio of pressures at successive wave peaks is measured, for frequencies from 400 to 1,400.

Observed values of the damping coefficient are greater by about 8 per cent. than values calculated from Kirchoff's formula. The damping increases with frequency.

Six references.

Effect of Skewing Slots on Noise in Electrical Machinery. (S. J. Mikina, *Trans. A.S.M.E.*, Vol. 56, No. 10, Oct., 1934, pp. 711-720.) (15.30/30636 U.S.A.)

Skewing the slots by one slot pitch reduces the periodic variation in magnetic inductance to a relatively negligible amount, with corresponding reduction in hum from this source. The elementary mathematical theory is worked out.

Two references.

Trans-Ocean Air Transport—Conference W.G.L., Jan., 1935. (*Luftwissen*, Vol. 2, No. 1, Jan., 1935, pp. 11-13.) (15.5/30637 Germany.)

A summary is given of ten papers read at the XXIII Meeting of the Scientific Society for Air Navigation, 21st/22nd January, 1935:—

- (1) Foreign States in reference to oversea and coastal air transport in the North and South Atlantic. (H. N. Wronsky, Jun.)
- (2) German trans-oceanic air transport. (Buddenbrock.)
- (3) Development of long range oversea flights by non-German countries in recent years. (R. Schulz.)
- (4) Problems of long range flights. (Dipl. Ing. Koster.)
- (5) Meteorological problems of trans-Atlantic air transport. (Prof. Dr. Seilkopf.)
- (6) Long range air navigation over land and sea in Germany and other countries. (Kpt. Niemann.)
- (7) Wireless navigation in the South Atlantic. (Dr. Dierbach.)
- (8) Development and present state of automatic control in other countries. (Dr. Wunsch.)
- (9) Equipment of aeroplane tenders and carriers in other countries. (W. Bartz.)
- (10) Scientific problems and observations, particularly in free balloons. (P. Perlewitz.)

Accidents and Precautions

Investigation of Accident to Flying Boat "Sirohato." (Aer. Res. Inst., Tokyo, Report No. 116 (Vol. 9, No. 8), Jan., 1935.) (16.00/30638 Japan.)

The report (in Japanese) is illustrated by over two hundred photographs, sketches and diagrams. An extensive summary is given in English. The meteorological conditions are discussed with weather maps and tables of data.

The accident is attributed to the disconnecting of a turnbuckle on an aileron cable. The cable was too short and an insufficient number of screw threads were engaged. No mention is made of locking the turnbuckle. It is supposed that the turnbuckle became unscrewed in bumpy weather, leaving the aileron free to oscillate, and that subsequent fluttering of the wings produced rupture.

The conditions of the accident were reconstructed in the laboratory and wind channel.

Building Precautions Against Air Attack. (G. Rùth, Z.V.D.I., Vol. 79, No. 1, 5/1/35, pp. 13-21.) (16.00/30639 Germany.)

Seven photographs show examples of damage done by bombs.

Forty-one architectural drawings illustrate suggestions for reinforcement of building structures against bomb attack. In large buildings the space occupied by the staircase and well is more suitable for provision of bombproof shelters than the cellar.

The mitigation of fire risks is discussed and costs of converting buildings are estimated.

Three references.

Aircraft—Unorthodox

Wingless Autogiro. (Sci. Am., Vol. 152, No. 3, March, 1935, pp. 148-149.) (17.05/30640 U.S.A.)

Photographs show the general appearance and some details, particularly the inverted control columns. A specification of performance is given.

Mathematical Theory of Flapping Flight. (W. Schmeidler, Z.A.M.M., Vol. 14, No. 3, June, 1934, pp. 163-172.) (17.10/30641 Germany.)

Potential flow of an ideal inviscid fluid is assumed and expressions are written down for the components of air forces acting on the wing and for the circulation. The double integrations over a cycle of flapping motion and over the wing's surface are difficult. A numerical example is worked out and gives 7 h.p. for 274 kg.

Three references.

Flapping Flight by Man-Power. (A. Piskorsch, Flugsport, Vol. 27, No. 1, 9/1/35, pp. 7-12, and No. 2, 23/1/35, pp. 26-31.) (17.10/30642 Germany.)

Mechanical details are discussed and illustrated by sketches. The reciprocating forces are supplied by the strain energy of the spring mounting. The aerodynamics of pulsating wing motion is discussed in elementary terms.

Aircraft Carriers

The Aeroplane on Board the Submarine. (I. A. Gavrilof, U.S. Nav. Inst. Proc., Vol. 61, No. 383, Jan., 1935, pp. 17-23.) (18.2/30643 U.S.A.)

The long immunity of the German merchant steamer "Wolf" as a raider is attributed to the skilful use of the seaplane carried on board. Submarines fitted to carry seaplanes have great tactical and strategic possibilities.

The loss of the M.2 seaplane-carrying submarine is attributed to failure of the air shed under water pressure and indicates the chief difficulty of design.

Meteorology and Physiology

Wind Pressure on Buildings. (O. Flachsbart, Trans. A.S.M.E., Vol. 56, No. 8, Aug., 1934, p. 584.) (19.10/30644 U.S.A.)

In an abstract of the original paper elementary formulæ are quoted and numerical examples are given from measurements on buildings.

Nature of Lightning Discharges. (H. Norinder, J. Frank. Inst., Vol. 218, No. 6, Dec., 1934, pp. 717-738.) (19.10/30645 U.S.A.)

A description is given of a cathode ray oscillograph for recording the disturbances set up by lightning discharges without fogging the photographic plate. Two hundred and ninety discharge records were made within 16 km. of the station. The results are partially analysed and data as to intensity and time of discharge are deduced.

Four photographic records are reproduced and intensity of field is plotted against time in diagrams. A diagram of intensity as a function of distance shows wide scattering within fairly well defined upper limits, negative and positive records being roughly equal in number.

Five references.

Ionising Effect of Meteors. (A. M. Skellett, Bell Tele. Pubcn., No. 853, and Proc. Inst. Rad. Eng., Vol. 23, No. 2, Feb., 1935, pp. 132-149.) (19.10/30646 U.S.A.)

The observational evidence for ionisation by impact of a meteor is discussed. Successful correlations have been made of bright meteor observations with increase in atmospheric ionisation.

Thirty-five references.

Weather's Third Dimension (Upper Air Research). (P. Del Vecchio and D. Sayre, Aviation, Vol. 34, No. 3, March, 1935, pp. 86-88.) (19.10/30647 U.S.A.)

Daily air soundings up to 5 or 6 kilometres are carried out at 20 stations in U.S.A.

Carburettor Ice Formation. (Sci. Am., Vol. 152, No. 3, March, 1935, p. 151.) (19.15/30648 U.S.A.)

Brief details are given of a research installation on a Lockheed "Orion" for investigation of ice formation and prevention.

Equipment

Air Mail Pick-up. (Sci. Am., Vol. 152, No. 3, March, 1935, p. 151.) (20.10/30649 U.S.A.)

A metal chute turning with the wind has a wide vee entrance narrowing down to a slot. The passing aeroplane trails a cable carrying a mail sack, which enters the chute and is released. Immediately after a catapult launches a mail sack for collection in the direction of flight and a mechanical device attached it to the trailing cable. A shock absorber is fitted to the aeroplane end of the trailing cable.

Lighting

Mazwell Colour Triangle with Uniform Chromaticity Scales. (D. B. Judd, Bur. Stan. J. Res., Vol. 14, No. 1, Jan., 1935, pp. 41-57.) (21.22/30650 U.S.A.)

Trilinear co-ordinates in terms of red, blue and green standards determined by trial and error give differences of stimuli very nearly proportional to the length of any straight line segment in the triangle.

Forty references.

Improvements in Lighting at Tacoma. (R. L. Kelly, *Aero Digest*, Vol. 26, No. 3, March, 1935, pp. 14-15.) (21.15/30651 U.S.A.)

A technical descriptive account is given of the lighting equipment of the air port. The octagonal lighting scheme and landing ways are shown in a photograph and a diagram.

Aerodynamics and Hydrodynamics

Neutral Equilibrium of Eddy Filaments. (A. Kneschke, *Z.A.M.M.*, Vol. 14, No. 3, June, 1934, pp. 178-183.) (22/30652 Germany.)

The problem is restricted to two-dimensional velocities with transverse lines of vorticity. Reference is made to the relation between Routh's stream function and Kirchoff's hodograph function.

An example is worked out for a symmetrical eddy pair and three types of hodographs are shown graphically, each having one position of equilibrium.

Coefficient of Viscosity of Water and Other Substances in Terms of Physical and Chemical Constants. (W. Schmidt, *W.R.H.*, Vol. 16, No. 2, 19/1/35, pp. 19-21.) (22/30653 Germany.)

Empirical numerical relations are given between viscosity of water and hydrocarbons, and melting temperature, critical vapour temperature and number of atoms in the molecule. Applications to lubricants and melted alloys are suggested.

Measurements of Viscosity in Molten Silica. (W. M. Cohn, *Ann. d. Phys.*, Vol. 21, No. 8, Jan., 1935, pp. 761-782.) (22/30654 Germany.)

The viscosity was determined by observation of spheres of platinum rhodium alloy falling freely in molten silica. The passage of the falling sphere through fixed coils was determined by radio transmission apparatus. The results are shown in four tables and in six diagrams.

Thirty references.

Hydrodynamical Resistance of Rods. (G. Sprick and A. Becker, *Ann. d. Phys.*, Vol. 22, No. 2, Feb., 1935, pp. 195-208.) (22/30655 Germany.)

Rate of fall of circular cylindrical rods with hemispherical ends was observed in water and in glycol. The results are shown in numerical tables and graphically. The resistance is given as a function of velocity and the coefficient of resistance as a function of Reynolds number from 2 to 130.

Three references.

Flow Round Plates and Wing Profiles of Small Aspect Ratio. (H. Winter, *F.G.I.*, Vol. 6, No. 1, Jan./Feb., 1935, pp. 40-50, and No. 2, March/April, 1935, pp. 67-71.) (22/30656 Germany.)

The aspect ratio, span/chord, varies from 2 to $\frac{1}{2}$ in the 37 models listed. The plan forms are rectangular, elliptic, half-elliptic and triangular. Families of polar curves and lift, drag and moment curves as functions of incidence are given in 18 diagrams. Pressure distributions are also given graphically.

Photographs of smoke jets and of etching on end plates give some visual idea of the general flow round the models.

Seventeen references.

Viscosity of Emulsion in Water. (R. Hermann, *F.G.I.*, Vol. 6, No. 1, Jan./Feb., 1935, pp. 1-8.) (22/30657 Germany.)

The emulsion contained fine particles of clay in suspension, the time allowed for settling of the heavier particles ranging from 2 to 190 days. Fluidity is

defined as the inverse of the apparent viscosity and experimental values are plotted against the tangential pressure on the wall of the tube. The observed results are plotted graphically and show that the fluidity increases (the viscosity decreases) with increasing tangential pressure on the wall (increasing pressure gradient and increasing velocity).

The tangential pressures range from 0-30 bars (dynes/cm.²) so that the pressures (and velocities) are small. By extrapolation to zero the fluidity is made to disappear for zero velocity (a result which throws doubt on the validity of the extrapolation).

It appears to be established that the emulsions do not exhibit constant apparent viscosity for low Reynolds numbers.

Twenty-five references.

Subsoil Flow. (G. Hamel, Z.A.M.M., Vol. 14, No. 3, June, 1934, pp. 129-157.) (22/30658 Germany.)

The problem is reduced by drastic simplification to ideal two-dimensional potential flow, expressed in terms of complex quantities. Elegant examples are worked out.

In the last paragraph reference is made to the physical impossibility of infinite velocities at the boundary and a corrective term for the transition layer is constructed.

Five references.

Recent Research on Fluid Mechanics. (T. v. Kármán, W. Bollay and A. J. Ippen, J. of Applied Mechanics, Vol. 2, No. 1, March, 1935, pp. A.28-A.32.) (22.10/30659 U.S.A.)

A brief summary is given of recent work under headings such as potential flow, laminar viscous fluid, turbulence and skin friction, vortex motion, cavitation, etc.

A comprehensive bibliography of 174 references is added.

Circulation in Vacuum Pans. (A. L. Webre, Trans. A.S.M.E., Vol. 56, No. 12, Dec., 1934, pp. 913-922.) (22.10/30660 U.S.A.)

The convection flow in sugar boilers is investigated and temperature variations are recorded.

Thirty Years of Research in Fluid Mechanics. (D. P. Riabouchinsky, J.R. Aer. Soc., Vol. 39, No. 293, May, 1935, pp. 377-444.) (22.10/30661 Great Britain.)

The author was in charge of work at the Koutchino Laboratory, near Moscow, instituted in 1904. His paper covers a wide range of original experimental and mathematical contributions and is an important historical document. The author's influence on aerodynamical research has probably been much greater than he seems to think.

A list of 105 papers by the author is given.

Resistance to Rotation of a Disc Immersed in a Viscous Fluid. (S. Goldstein, Proc. Camb. Phil. Soc., Vol. 31, Pt. 2, April, 1935, pp. 232-243.) (22.15/30662 Great Britain.)

v. Kármán's rough approximate solution for laminar motion has been put on an accurate basis by Cochran, Proc. Camb. Phil. Soc., 365-375, 1934. The solution for turbulent motion necessarily depends on empirical expressions such as the well known v. Kármán parabola of the seventh power for the velocity gradient. This has since been replaced by an empirical logarithmic relation of

considerable generality, also due to v. Kármán, which lends itself to the extensive transformations and integrations of the present paper.

The two formulæ are plotted against experimental values and a reasonable fit is exhibited with moderate scattering.

Instability of a Thread of Viscous Fluid Surrounded by Another Viscous Fluid. (S. Tomotika, Proc. Roy Soc., Vol. 150, No. 870, 1/6/35, pp. 322-337.) (22.15/30663 Great Britain.)

The equations of viscous fluid motion are formed in cylindrical co-ordinates (r, θ, z) referred to the axis of the thread as axis of symmetry, and simplified by neglecting terms containing squares and products of velocity components and derivatives. The assumption is made that the motions contain the factor $\exp(qt + ikz)$ and two solutions are found in terms of Bessel functions of r only.

Boundary conditions are introduced and elimination of four arbitrary coefficients leads to a fourth order determinant, which is reduced to a form determining the ratio of the wave-length to the radius. A limiting case reduces to a particular form worked out by Rayleigh.

In another example the numerical values of the data are taken from experimental work by G. I. Taylor and the solution is computed for comparison with Taylor's experimental results. The size of the drops observed by Taylor agrees with the size determined by the calculated wave-length of instability, within about 13 per cent.

Five references.

Measurement of Eddy Frequency. (H. Blenk, D. Fuchs and F. Liebers, L.F.F., Vol. 12, No. 1, 28/3/35, pp. 38-41.) (22.15/30664 Germany.)

The frequency of eddies shed by cylinders, plates and wing profiles was observed systematically by the pitch of aeolian tones of wires in the wind channel and by visual observation in the water channel. The results are plotted and show, in the case of cylinders, a simple linear relation between wind speed and frequency for a given diameter.

A non-dimensional coefficient is defined and plotted against Reynolds number. The points lie along a unicursal curve with moderate scattering, considering that independent English experiments in air and water are included for comparison.

In the case of plates and wings the angle of incidence affects the results greatly, but if in forming the non-dimensional coefficient, the projected chord in a vertical plane is taken as the characteristic linear dimension, the non-dimensional coefficient does not differ much from that for cylinders.

Five references.

Pressure Measurements in Unsteady Flow. (M. Schwabe, Ing. Arch., Vol. 6, No. 1, Feb., 1935, pp. 34-50.) (22.15/30665 Germany.)

A vertical circular cylinder suspended from above the surface of a water tank to the bottom, is carried along the tank and sets up a relative flow which is not steady. Particles are strewn on the surface and photographed with short time exposures of known length. The distance travelled by a particle gives the mean velocity, successive particles in the same streamline give accelerations along the path, and the curvature of the path gives the accelerations normal to the path.

Except in boundary layer the effect of viscosity is negligible for the times considered and the generalised form of Bernoulli's equation is applicable to each instantaneous streamline. The principles are simple, but evidently great experimental care is required.

Seven photographs of flow are reproduced and examples of reduction are given graphically. It is finally suggested that analytical expressions could be constructed for the motions thus determined.

Five references.

Motion of a Cylindrical Bubble in a Tube. (S. Hattori, Aer. Res. Inst., Tokyo, Report No. 115 (Vol. 9, No. 7), Jan., 1935.) (22.2/30666 Japan.)

A physical theory is given of the relation between surface tension and resistance of the bubble in the tube. Extensive data are given in tables and graphs, showing the position as a nearly linear function of time.

The slopes give the velocities which are shown as functions of the diameter of the tubes. For a critical lower limiting value of the diameter the velocity becomes zero. Measurements were carried out with a number of fluids and the surface tensions are deduced.

Seven references.

Steady Flow in the Boundary Layer Near the Surface of a Cylinder in a Stream. (L. Howarth, R. & M. No. 1632, 1935.) (22.3/30667 Great Britain.)

A critical review is given of methods of forming and solving the flow of a viscous fluid in the transition layer from zero velocity at the solid boundary to approximately "potential" flow at a "sufficient" distance.

The differential equations of viscous fluid motion being non-linear, enormous labour has been expended on obtaining solutions for the simplest cases of steady flow, under various simplifying assumptions. The author's conclusions indicate that, beyond this point, most of the results are negative or trivial. He appears to underrate Thom's work in obtaining particular solutions by successive numerical approximations.

Numerical tables are given for extending the methods of Blasius and Pohlhausen. The flow up to the point where the boundary streamline branches from the boundary has been determined with sufficient accuracy and the position of the branch point itself appears to have been determined to a fair approximation for the critical Reynolds number. Beyond this no mathematical advance has been made.

Various approximate solutions up to the branch point, and the determinations of the branch point itself are compared graphically.

Eight references.

Lift Coefficient of a Thin Elliptic Cylinder. (L. Howarth, Proc. Roy. Soc., Vol. 149A, No. 868, 10/4/35, pp. 558-586.) (22.3/30668 Great Britain.)

Continuing on the lines of R. & M. 1632, the author refers to Joukowski's well known result as an approximate solution of wing lift. (It is, of course, an accurate solution for a wing with a sharp trailing edge in a perfect fluid.) An attempt is made to proceed beyond the determination of the branch points at which the zero streamline (of which the aerofoil surface is part) becomes unstable and leaves the boundary.

References are made to a wide range of effort by Prandtl, Taylor and others to bring turbulent motion within some sort of calculus. Numerical coefficients are taken from experiment so that it is difficult to accept the conclusion that the circulation has been determined theoretically. None the less, this and the preceding paper (Abstract 30667) should be read by anyone who proposes to attack a highly intractable problem.

Measurements on Resistance of Spheres, with Reference to Turbulence and Surface Finish. (S. Hoerner, L.F.F., Vol. 12, No. 1, 28/3/35, pp. 42-54.) (22.3/30669 Germany.)

A brief summary is given of the so-called boundary layer theory in application to spheres and the distribution of pressure is exhibited graphically. The effect of the mounting in the wind channel is discussed at greater length, with numerous illustrations from practice shown graphically. The influence of

turbulence, generated in different ways receives detailed consideration and comparative results are given.

Full-scale experiments were carried out. A photograph shows the mounting of a sphere on an aeroplane and measurements were carried out in a car. The full-scale results are compared with wind channel results.

Finally the effects of surface finish are discussed, and remarkable differences in the critical Reynolds number, distribution of pressure, and coefficients and resistance are shown.

Thirty-two references.

Diversion of a Circular Jet Impinging on the Surface of a Flat Plate. (W. Schach, *Ing. Arch.*, Vol. 6, No. 1, Feb., 1935, pp. 51-59.) (22.35/30670 Germany.)

Reference is made to a previous paper (see Abstract 29934).

Discussion is restricted to normal impact. By superposing a flow with symmetry of rotation on the flow due to a circular line source an expression for the velocity potential is obtained in the form of an integral equation.

The analytical details are worked out fully and numerical results are shown graphically. Finally, streamlines and potential line are drawn. Comparison with experiment shows a slight discrepancy in the form of the free surface.

Three references.

Air Flow in Fan Discharge Ducts. (L. S. Marks, *Trans. A.S.M.E.*, Vol. 56, No. 11, Nov., 1934, pp. 871-878.) (22.4/30671 U.S.A.)

Comparisons of nozzle measurements and pitot tube exploration in a fan discharge duct show discrepancies, which are attributed to failure of pitot tube calibration for a steady flow in application to turbulent flow. Air pulsation and incorrect location of tube at outer edge of jet cause small errors. The principal error is attributed to oblique flow relatively to the pitot tube.

Calibrations of pitot tubes for varying inclinations to the mean flow are given in six diagrams and correction curves are deduced. Examples of distribution of mean velocity are given in six diagrams.

Three references.

Self Checking Notation for Vector Diagrams. (A. C. Walshaw, *Phil. Mag.*, Vol. 19, No. 129, May, 1935, pp. 1027-1032.) (22.4/30672 Great Britain.)

A simple self consistent notation is proposed whereby relative velocities and accelerations exhibited in lettered diagrams may be written down immediately as vector sums and differences.

Pulsating Air Flow. (N. P. Bailey, *Trans. A.S.M.E.*, Vol. 56, No. 10, Oct., 1934, pp. 781-786.) (22.4/30673 U.S.A.)

A description is given, with two sketches, of a portable instrument which is stated to give true average air velocity for any degree of pulsation. Simple mathematical expressions are given for average velocity.

The effects of pulsation in blowers, in engine cylinders and near propellers are shown graphically. (The real difficulties of mathematical physical theory are hardly touched on.)

Turbulence Near the Ground. (W. Schmidt, *J. Roy. Aer. Soc.*, Vol. 39, No. 293, May, 1935, pp. 355-376.) (22.45/30674 Great Britain.)

A rectangular frame carrying from twenty-five to seventy-five light vanes in horizontal rows and staggered columns was exposed to the wind in the open air. The vanes hung from pivots with a lever arm of 10 cm. and carried indicator

plates showing the angle of deflection. The oscillations were highly damped, the plates being light in relation to their surface.

Transverse photographs of the frame recorded the instantaneous deflections of all the plates and taking the deflections as proportional to the square of the local velocities, the latter were plotted as functions of position in the rectangle.

Numerous diagrams of plots are reproduced and exhibit the highly variable motion of the air. The effect of the types of ground surface over which the wind passed before reaching the frame was recorded in this way.

The experiments are a useful systematic contribution to a subject in which mathematical analysis has so far been powerless.

Materials—Elasticity and Plasticity

Magnetostrictive Oscillation of Chladni Plates. (R. C. Colwell and E. A. Bryant, J. Frank. Inst., Vol. 218, No. 6, Dec., 1934, pp. 739-748.) (23/30675 U.S.A.)

A pure nickel rod 10 inches length, $\frac{1}{8}$ inch diameter, was set in vibration by an electro-magnetic coil. Squares and circular plates, mounted on the end of the rod, formed Chladni figures, of which twenty are reproduced. The frequencies were in ratios of small whole numbers to those of the exciting current.

Three references.

The Strength of Materials at Low Temperatures. (W. Schwinning, Z.V.D.I., Vol. 79, No. 2, 12/1/35, pp. 35-40.) (23/30676 Germany.)

Low temperature exerts a beneficial influence on the tensile strength, yield point and fatigue strength under load reversal of steels. The strength under notch tests is considerably reduced. Lowering of the temperature is without apparent effect on either tensile or notch strength of light alloys.

Progress in Applied Mechanics. (Trans. A.S.M.E., Vol. 56, No. 8, Aug., 1934, pp. 563-568.) (23/30677 U.S.A.)

A brief survey of progress is given under group headings:—

Elasticity	...	...	...	...	27	references.
Strength of materials	...	...	...	...	8	„
Plasticity	...	...	...	...	6	„
Dynamics	...	...	...	...	16	„
Fluid mechanics	...	...	...	...	56	„
Thermodynamics	...	...	...	...	11	„

Visco-Elasticity. (E. Madelung and S. Flugge, Ann. d. Phys., Vol. 22, No. 3, March, 1935, pp. 209-222.) (23/30678 Germany.)

Linear differential equations with constant coefficients are formed in tensor notation for periodic strain and stress, the coefficients representing the effects of elasticity, viscosity and relaxation in Clerk Maxwell's sense.

A solution is constructed for a sphere in terms of Bessel functions of order $(n + \frac{1}{2})$ and lines of equal amplitude and equal phase are shown in an equatorial section in a segment of 45°, implying quadrantal symmetry.

An analysis is made using optical dispersion and curves are calculated for the case where both relaxation and viscosity terms appear.

The author appears diffident as to the correct interpretation of the results.

Two references.

Finite Strain in Elastic Problems. (B. R. Seth, Phil. Trans. Roy. Soc., Vol. A.234, No. 738, 27/4/35, pp. 231-264.) (23.10/30679 Great Britain.)

The equations of elastic stability are modified to take into account finite strains by the inclusion of terms of higher order than those retained in the ele-

mentary theory. The additional terms are worked out for the torsional couple on a cylinder and numerical values are computed and tabulated.

Eighteen references.

Stress Concentration Produced by Holes and Notches. (A. M. Wahl and R. Beeuwkes, Trans. A.S.M.E., Vol. 56, No. 8, Aug., 1934, pp. 617-625.) (23.10/30680 U.S.A.)

Stress optical methods are applied and the numerical results are shown graphically. Two photographs illustrate the apparatus and seven stress optical photographs are reproduced.

Seventeen references.

Bending of Circular Plates with Large Deflection. (S. Way, Trans. A.S.M.E., Vol. 56, No. 8, Aug., 1934, pp. 627-636.) (23.10/30681 U.S.A.)

The equations of elastic equilibrium are written down and appropriate types of solutions are worked out numerically and shown graphically in tables. Nadai's approximation is sound and differs from the more exact theory by a few per cent. only.

Five references.

Bending Oscillations of a Circular Plate Loaded at its Mean Plane. (K. Federhofer, Ing. Arch., Vol. 6, No. 1, Feb., 1935, pp. 68-74.) (23.10/30682 Germany.)

The equations of elastic deformation are formed and solutions in Bessel functions discussed. Numerical values are tabulated for three cases.

Eleven references.

Micro-Cinema Study of Cutting Metal. (Autom. Ind., Vol. 72, No. 7, 16/2/35, pp. 202-203 and 214.) (23.10/30683 U.S.A.)

A photograph shows the mounting of microscope and cinema-camera on the milling machine.

Micro-photographs are reproduced from the film record, showing details of the yield of the metal under the cutting edge.

Studies in Photo-Elastic Stress Determination. (E. E. Weibel, Trans. A.S.M.E., Vol. 56, No. 8, Aug., 1934, pp. 637-658.) (23.15/30684 U.S.A.)

A description is given of the apparatus and methods of calibration along usual lines. Creep receives lengthy consideration and examples of strain-time characteristics are reproduced. The soap film analogy is used for determining the sum of the principal stresses.

Extensive experimental results are given graphically and ten stress optical photographs are reproduced. A lengthy discussion follows.

Twenty references.

Membrane Analogy Supplementing Photo-Elastic Methods. (J. G. McGivern and H. L. Supper, Trans. A.S.M.E., Vol. 56, No. 8, Aug., 1934, pp. 601-605.) (23.15/30685 U.S.A.)

The sum of the principal stresses in generalised plane strain is fixed by measuring ordinates of a stretched membrane. The mathematical analogy is comparatively simple.

A photograph shows the membrane measuring apparatus and examples of three-dimensional stress surfaces are shown in perspective.

Five references.

Construction of Iso-pachs from Photo-Elastic Observations. (H. P. Neuber, Trans. A.S.M.E., Vol. 56, No. 10, Oct., 1934, pp. 733-737.) (23.15/30686 U.S.A.)

Stone's approximate relations for iso-pachs are rendered exact by inclusion of small terms and a graphical method is developed for point to point plotting.

As an example, the iso-pachs in a stressed angle-plate and the stress field deduced therefrom are shown graphically. (An iso-pach is defined in Coker and Filon's "Treatise" as lines along which the sum of the principal stresses is constant.)

Six references.

Continuous Beams. (J. Hanson, Flight, Vol. 27, No. 1374, 25/4/35, pp. 26-27, and No. 1379, 30/5/35, pp. 32-36.) (23.30/30687 Great Britain.)

A brief historical note is given with reference to the so-called Berry method for spars uniform between nodes. For tapering spars the analysis requires lengthy modifications and a graphical method is proposed.

A numerical example is fully worked out, the necessary graphical work is reproduced and the numerical values taken therefrom are tabulated.

Displacement and Deformation of an Elastic Bar. (E. H. Bateman, Phil. Mag., Vol. 19, No. 129, May, 1935, pp. 1011-1015.) (23.30/30688 Great Britain.)

By equating the work of deformation and the work of displacement under external forces of each unit of an elastic framework, a number of strain stress relations are obtained in a simple and direct manner.

Two references.

Free Elastic Vibrations of Cylinders and Tubes. (L. Posener, Ann. d. Phys., Vol. 22, No. 2, Feb., 1935, pp. 101-128.) (23.30/30689 Germany.)

The elastic equations in polar co-ordinates are written down for thin tubes and a variety of boundary conditions is considered, with different types of vibration. The solutions of special limiting cases by Love-Timpe and Rayleigh are reproduced in elegant form.

The coupling of longitudinal and transverse vibration is exhibited. The vibrations involving expansion and torsion are separable. Love's complete solution for the latter is cited. Pochhammer's method of solution for the former is developed at considerable length in terms of Fourier Bessel series.

Buckling of Thin Cylinders under Axial Compression and Bending. (L. H. Donnell, Trans. A.S.M.E., Vol. 56, No. 11, Nov., 1934, pp. 795-806.) (23.30/30690 U.S.A.)

A photograph shows a testing machine designed for the application of combined torsion, bending and compression or tension, on thin circular tubes. When the length is too short to permit Euler's buckling without failure, the buckling load is a function of the yield stress, as well as of the elastic constants.

General differential equations in polar co-ordinates of elastic equilibrium and of strain energy are discussed, with simplifying approximations introduced by different writers and by the author.

Comparisons of ideal theory, with tests on necessarily imperfectly symmetrical specimens show unsystematic discrepancies, but the assumption of a particular form of failure with relatively small strain energy, and the further assumption of maximum shear energy at the nodes of the buckling waves, leads to a semi-empirical approximation which fits the mean experimental curves better than the ideal result. The relative analysis is given in appendices. Extensive test data are given in numerical tables and graphically, and nine photographs show types of buckling failure.

Seven references.

Collapse of Thin Cylindrical Shells under External Pressure. (D. F. Windenburg and C. Trilling, *Trans. A.S.M.E.*, Vol. 56, No. 11, Nov., 1934, pp. 819-825.) (23.30/30691 U.S.A.)

Semi-empirical formulæ, derived from elastic theory by simplifying assumptions, are quoted, and their mutual relations are discussed.

Extensive test data are tabulated numerically. Comparison of formulæ and test results is given graphically. A family of curves gives the relation between thickness/diameter, length/diameter and the number of lobes in tube which collapses under uniform radial and axial pressure.

Twenty-two references.

Buckling of Flat Curved Bars and Slightly Curved Plates. (S. Timoshenko, *J. of Applied Mechanics*, Vol. 2, No. 1, March, 1935, pp. A.17-A.20.) (23.30/30692 U.S.A.)

Euler's buckling formulæ is given in Perry's approximate form and the stability criterion given as an integral equation becomes immediately integrable. The numerical consequences are discussed graphically and the results extended to the buckling of bimetal strips.

Sheet Strip with Beaded Circular Holes Under Shear. (K. Schüssler, *L.F.F.*, Vol. 11, No. 3, 18/8/34, pp. 74-85.) (23.30/30693 Germany.)

Tests at the Aachen Aerodynamical Institute on beaded lightening holes show that lightening may be consistent with actual increase in strength. Photographs and sketches show strip with beaded lightening holes before and after buckling.

The results are given in a table for 78 test pieces and graphical representation shows the relations between load, spacing, size of beading, thickness and width. Each width and thickness of strip had an appropriate spacing and beading of lightening holes.

Seven references.

Buckling Strength of Cylindrical Shell with Stiffeners Under Pressure. (Dji-Djuan Dschou, *L.F.F.*, Vol. 11, No. 8, 6/2/35, pp. 223-234.) (23.30/30694 Germany.)

Approximate formulæ are developed and the functions involved in the solution are shown graphically in five diagrams.

General conditions for the critical buckling load are given by three simultaneous differential equations which express the equality of the buckling loads to the resultants of the internal stresses of the strained shell. Eliminating the undetermined quantities a determinant of the third order, equated to zero, gives the criterion for buckling. The determinantal equation is reduced to a convenient algebraic equation of general applicability.

Numerical examples are given.

Five references.

Increasing the Fatigue Strength of Structures. (H. Ude, *Z.V.D.I.*, Vol. 79, No. 2, 12/1/35, pp. 47-53.) (23.40/30695 Germany.)

The symposium of papers deals largely with bearing metals and corrosion. In the case of engine crankshaft bearings, it is difficult to avoid deformation in the crankcase with consequent unequal bearing loads. In one case stiffening the crankcase webs caused the bearing to fail, since it could no longer follow the deformations.

Copper lead alloys are suitable for bearings exposed to sudden shocks (Diesel engines). In another case sea water corrosion of "V₂ An" steel was considerably reduced by mechanised surface pressure treatment.

Experiments on Buckling of Thin Walls. (F. J. Bridget and others, Trans. A.S.M.E., Vol. 56, No. 8, Aug., 1934, pp. 569-578.) (23.40/30696 U.S.A.)

Test figures for circular cylinders are given and examples of buckling are shown in photographs. Test figures for L struts are given. Up to a certain width of side plate, Euler's formula for columns applies, beyond this width, which is sharply defined, the buckling is of the flat plate type with corrugations. On plotting the normal stress against shear stress on logarithmic scale, approximately linear characteristics are obtained, with rather heavy scattering in some cases.

Eleven references.

Miscellaneous

Research in the Chemical Industry. (H. G. Grimm, L.F.F., Vol. 11, No. 7, 14/1/35, pp. 189-191.) (O.G./30697 Germany.)

The author is connected with the I.G. Farbenindustrie and describes the interrelation of educational establishments, societies, research institutions and works laboratories on the one hand and the projection, protection by patents, manufacture and marketing of products.

A statistical table shows that while total exports have fallen to one-third from 1929-1933, chemical exports have fallen only to one-half, and were about 14½ per cent. of the total exports in 1933.