

ABSTRACTS AND NOTICES
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Aircraft Design, Performance, etc.

The "Herrera" Slide Rule for the Rapid Determination of Aeroplane Performance. (L'Aérophile, Vol. 42, No. 1, Jan., 1934, pp. 19-20.) (5.10/28701 France.)

The slide is rotatable and gives relations between surface, weight, power, rate of climb, cruising, landing and flying speed at various altitudes.

The relations are based on three typical polars characterised as excellent, average, and bad.

Possible Military Development of the Heinkel 70. (E. Vellay, L'Aéron., No. 177, Feb., 1934, pp. 35-36.) (5.10/28702 France.)

The high performance of the Heinkel 70 is partly due to clean design and small drag, partly to freedom from government restrictions. The machine, in the opinion of the author, is far ahead of contemporary design. Equipped and armed as a reconnaissance machine, it would give a better performance than any existing fighter. The great advance in performance suggests that the design of military aircraft is unduly handicapped by Government restrictions.

High Speed Air Transport. (A. Jona, Riv. Aeron., Vol. 10, No. 3, March, 1934, pp. 427-476.) (5.10/28703 Italy.)

A simplified theory of aeroplane dimensions is discussed. Statistics by various authors are quoted, and costs per ton mile are exhibited graphically as a function of a coefficient derived from the theory.

Extensive comparative statistics of performance are given for two single-engined and two three-engined machines. The author appears to favour higher speeds, on the ground that lower running costs per ton mile will compensate for higher initial costs.

Effect of Fillets on Wing-Body Interference. (A. L. Klein, Trans. A.S.M.E., Vol. 56, No. 1, Jan., 1934, pp. 1-10.) (5.11/28704 U.S.A.)

Two examples of filleting are compared by exploration of the wake behind the filleting by pitot tube. Graphical curves of lift, drag and moment as a function of incidence show comparisons of a low wing and a dropped wing without fillet, with three unsuccessful fillets and with a so-called optimum fillet. The last nearly restores the characteristics of the wing alone.

Further diagrams extend the measured results to various wing configurations and to high speeds.

In the discussion reference is made to buffeting and to the favourable effect of suitable filleting on this phenomenon.

Ten references.

Note on Interference. (E. Ower, *Airc. Eng.*, Vol. 6, No. 62, April, 1934, pp. 93-96.) (5.11/5.32/28705 Great Britain.)

Divergent flow, in which the cross section of the tubes of flow increases down stream, becomes unstable and turbulent at flying speeds.

This principle is applied systematically to explain, qualitatively, a number of important points in flying practice. The best position of the wing in relation to the body, and of a nacelle in relation to the wing, are discussed in the light of test figures.

The airscrew wake introduces some modifications. "Buffeting" is considered briefly.

Ten references.

Effect of Compressibility on High Speed Flight. (J. Stack, *J. Aer. Sci.*, Vol. 1, No. 1, Jan., 1934, pp. 40-43.) (5.13/28706 U.S.A.)

At very high speeds the compressibility of air increases the required power considerably. In a projected design for 550 m.p.h. flying speed the estimated effect of compressibility is an increase of 500 h.p. with a normal wing, and of 200 h.p. with a special wing.

Two references.

High Speed Flight. (M. Schrenk, *Z.V.D.I.*, Vol. 78, No. 2, 13/1/34, pp. 39-47.) (5.13/28707 Germany.)

The development of high speed flying is more a question of aerodynamical design than increased engine power. Freedom from excrescences and smooth exterior of the whole aircraft is essential. The body must be of the minimum cross section, and great care has to be taken in the way body and wings are connected. For high speed work the low wing monoplane is favoured, with special filleting between body and wing.

Retractable landing gear is advantageous, and the use of flaps or wing slots to reduce landing speed allows of higher flying speeds.

Twenty-four references.

A Method of Comparing Performances of Commercial Aircraft. (M. Langley, *J.R. Aer. Soc.*, Vol. 38, No. 282, June, 1934, pp. 477-480.) (5.14/28708 Great Britain.)

Diagrams show the relations between fixed load and disposable load. The latter is divided into fuel and pay load, on the assumption that the former increases and the latter decreases linearly with required range. The extreme range is shown as a limit with fuel only, and no pay load.

The effects of reducing drag, specific fuel consumption and other improvements are shown in diagrams of the same general nature. The method is a purely accounting one and no reference to details of design need be made.

Speed and Economics of Air Transport. (F. M. Green, *J.R. Aer. Soc.*, Vol. 38, No. 282, June, 1934, pp. 449-476.) (5.14/28709 Great Britain.)

Analyses are given of overhead charges and running costs. Graphical analysis of flying weight shows the proportion of power plant and structure, fuel, passenger equipment and the residual true paying load, as functions of

flying speed from 100 m.p.h. to 170 m.p.h., the last item decreasing rapidly with flying speed. Numerical tables give a more detailed analysis.

The effect of design details on commercial performance is discussed. A lengthy discussion and reply thereto bring out the views of other designers and operators.

Impressions of a Tour on American Airways. (P. E. Koster and W. Schilo, *Luftwissen*, Vol. 1, No. 3, 15/3/34, pp. 66-76.) (5.14/28710 Germany.)

Notes on the organisation and operation of U.S.A. lines are prepared from observations and from information supplied personally. Operation includes navigation, engine development, fuel inspection, etc.

Sketches show noteworthy points—flaps, retractable carriages, wireless beacon installation. Statistics are briefly quoted. Photographs show the machine in which the tour was made and two examples of high speed air transport monoplanes with retractable carriages and no external bracing.

Safety in Aeronautical Design. (E. Teichmann and F. Michael, *Autom. Tech. Zeit.*, Vol. 37, No. 2, 25/1/34, pp. 28-36.) (5.17/28711 Germany.)

In the present state of development fatigue stresses are the most dangerous. The aeroplane is a complicated structure with many possible modes of vibration and concomitant danger of resonance. Correlation of model experiments with full-scale work is required.

Twenty-four references.

The Lotz Method of Calculating Wing Characteristics. (B. S. Shenstone, *J.R. Aer. Soc.*, Vol. 38, No. 281, May, 1934, pp. 432-444.) (5.20/28712 Great Britain.)

The characteristics of a wing with variable section are assumed to be summable from wing strip elements on the assumption that each element acts as a strip of an infinite wing.

A systematic scheme of Fourier analysis is developed for routine computations of distribution of lift, drag, pitching and rolling, and yawing characteristics. A numerical example is worked out.

Five references.

"A.G." Wing with Variable Trim Incidence. (G. A. A. Guglielmetti, *Riv. Aeron.*, Vol. 10, No. 4, April, 1934, pp. 18-30.) (5.206/28713 Italy.)

The wing is mounted on a single girder spar built up of steel tubes. From the illustration the cross section of the girder is a square of about 30 cm. side.

The four main tubes pass through a riveted plate rotatable on a central bearing parallel to the axis of the spar and controlled by a lever arm with a simple operating mechanism. Diagrams show the relative positions of the wing required to trim the body in line with the direction of motion through the air in level flight and in climb.

Details of construction are shown by photographs. Test performances are given in tables for different settings and show maintenance of performance and, in some cases, a sensible improvement in spite of the extra weight and the deep section imposed by the construction.

Strength of Aeroplane Wing Spars with Loads Varying in any One Bay. (J. Morris, *J.R. Aer. Soc.*, Vol. 38, No. 282, June, 1934, pp. 515-518.) (5.25/28714 Great Britain.)

Berry's generalisation of the theorem of three moments is extended to the case of varying load in a bay.

Tests of Three Tapered Aerofoils Based on the N.A.C.A. 2200, N.A.C.A. M.6 and the Clark Y Sections. (R. F. Anderson, N.A.C.A. Tech. Note No. 487, Jan., 1934.) (5.25/28715 U.S.A.)

The aerofoils were tested in the variable density wind channel at a Reynolds number of approximately 3,100,000. The Clark Y aerofoil shows the best characteristics.

Three references.

Torsional Vibrations of a Cantilever Monoplane Wing. (A. Bellomo, L'Aerotecnica, Vol. 14, No. 1, Jan., 1934, pp. 27-39.) (5.26/28716 Italy.)

The assumption is made that the wing receives an impulsive distortion from a sudden gust or manœuvre. The differential equation of torsional vibration is formed, and three different cases are considered according to the relative position of the elastic axis. The differential equation is reduced to linear form by approximate assumptions and formal solutions are obtained.

The analysis is extended to three cases of variable torsional stiffness along the spar, and to a spar in several segments, with constant stiffness in each section, but with a jump of stiffness from section to section. In the first type the differential equation thus generalised is solved in Bessel functions of first and second kinds. In the second type the solution in each bay is simpler, but the passage from bay to bay requires a torsional analogue of Clapeyron's theorem of three moments.

Numerical examples are worked out.

Critical Velocities of Single-Spar Cantilever Wings. (C. Minelli, L'Aerotecnica, Vol. 14, No. 2, Feb., 1934, pp. 123-148.) (5.26/28717 Italy.)

The aerodynamic moment and its first derivatives with respect to incidence are assumed to be known. The differential equation is solved in terms of Bessel functions.

A second method is based on a further simplifying assumption which makes the differential equation linear and gives a solution in elementary functions.

Two numerical examples are worked out. Extensions of the method to torsional and dilatational vibration are developed in an appendix.

Four references.

Some Studies on the Flutter of Aerofoils and Propellers. (W. H. Taylor, Trans. A.S.M.E., Vol. 56, No. 2, Feb., 1934, pp. 57-64.) (5.26/5.63/28718 U.S.A.)

The author obtains an expression for the deflection of a cantilever flat bar of uniform section by air forces with elliptic load distribution. An approximate solution for the free torsional vibrations is deduced, and the problem of self-induced vibration is analysed.

An endeavour should be made to keep the period of lateral vibration of a wing or blade as far as possible from the self-induced period and consequent resonance.

Twenty references.

Investigation of "Zap" Wing Ailerons and Flaps. (R. Boname, Tech. Aeron., No. 131, 1934, pp. 4-31.) (5.30/28719 France.)

The Zap aileron is hinged above the trailing edge of the wing. The Zap flap is hinged on the lower surface at a distance of roughly one-third to one-sixth of the chord from the trailing edge. When closed it may overlap the trailing edge and increase the effective chord by roughly 10 per cent. When open (downwards) it acts as a spoiler.

An extensive series of tests was carried out with both flaps and ailerons in various positions. The optimum position of the aileron hinge was one-third aileron chord above the trailing edge. Numerous test results are shown graphically.

The mechanism of the flaps is shown in sketches and a photograph; their use increases the lift and gliding angle and decreases the landing speed.

The conclusions are not particularly favourable, but indicate possible advantages in special applications and in the hands of experienced pilots.

Adjustable Wing Flaps. (Luftwissen, Vol. 1, No. 2, 15/2/34, pp. 38-43.) (5.30/28720 Germany.)

A description is given of adjustable flaps applied to change the surface or form of wings.

The devices include slots and spoilers, and details are exhibited in 18 sketches. Sixteen references.

Aerodynamic Moments of Various Control Surfaces. (P. Rebuffet, Pub. Sc. et Tech., No. 41, 1934.) (5.30/28721 France.)

Lateral control at low speed and high angle of incidence is of paramount importance. Amongst the devices described, the unsymmetrical increase of wing surface by means of a sliding auxiliary wing is of interest. In its normal position the auxiliary wing projects equally on either side of the wing tips of the main wing. The depth of the auxiliary wing is about one-third of the main wing chord, and the total surface about 10 per cent. of the main wing surface. The auxiliary wing slides parallel to the axis of the main wing, extreme position resulting in complete withdrawal into the wing at one side and maximum projection at the other.

Model experiments show that this method gives greater lateral control at large incidence than the normal aileron. The idea dates back to 1910, and is attractive if mechanical difficulties can be overcome.

Wing Fuselage Interference, Tail Buffeting and Air Flow about the Tail of a Low Wing Monoplane. (J. A. White and M. J. Hood, N.A.C.A. Report No. 482, 1934.) (5.32/28722 U.S.A.)

The experiments were carried out in the N.A.C.A. full-scale channel, the air-flow round the machine being indicated by streamers. Tail buffeting is due to the eddying wake of the wing roots. Trials were made with different types of wing fuselage fillets, an N.A.C.A. cowling, a reflexed trailing edge next the fuselage, and auxiliary aerofoils in various combinations.

The best results were obtained by a combination of cowling and fillet, which reduced the tail oscillation to $\frac{1}{4}$ value and increased the all-round performance of the aeroplane. The reflexed trailing edge and the auxiliary aerofoil had little effect. Even without these modifications buffeting occurred only when the air-screw was not working.

Fourteen references.

Aircraft, Landing Gear, Hulls, etc.

Winter Landing Gear. (A. Ferrier, J.R. Aer. Soc., Vol. 38, No. 282, June, 1934, pp. 481-506.) (5.532/28723 Great Britain.)

Landing conditions are tabulated under five headings in respect of the state of the surface snow, and eight cross-headings in respect of the underlying ground—giving forty entries in all.

Photographs and sketches show various types of snow shoe and ski, alone or in combination with wheels or floats.

Pitching moments during landing are shown graphically, and recommendations are given for handling under different conditions.

Completed Tank Test of a Flying Boat Hull with a Pointed Step. (J. N. Shoemaker, N.A.C.A. Tech. Note No. 488, Feb., 1934.) (5.51/28724 U.S.A.)

The pointed step type of hull has less resistance at high speeds and there is a definite saving in take-off power.

Four references.

Investigation of Combined Ship's Stern and Rudder Fairing. (C. H. Rode, W.R.H., Vol. 15, No. 3, 1/2/34, pp. 30-31.) (5.51/28725 Germany.)

Contour lines show the stern form with and without fairing. Model tests were made with (a) stern and rudder unfaired, (b) rudder, only, faired to streamline form, (c) rudder and stern faired jointly.

Tables and curves of resistance as a function of speed show reductions in model resistance of 11 to 17 per cent.

Tank Tests of a Family of Flying Boat Hulls. (J. M. Shoemaker and J. B. Parkinson, N.A.C.A. Tech. Note No. 491, Feb., 1934.) (5.51/28726 U.S.A.)

Systematic changes were made in the hull lines, and characteristic curves are given for six model hulls.

The performance curves appear to be complicated functions of the variables, and the interpretation of the results in any precise manner is not possible. Further tests are suggested.

Five references.

Airscrews and Marine Screws

Measurement of Marine Screw Performance in the Hamburg Shipbuilding Research Society's Cavitation Tank. Part II. (H. Lerbs, W.R.H., Vol. 15, No. 6, 15/3/34, pp. 68-70.) (5.60/28727 Germany.)

In Part I the conditions for dynamical similitude were discussed, and it was shown that Froude's criterion is relatively unimportant when cavitation sets in, and a new parameter called the cavitation coefficient is introduced. (See Abst. 27017.)

In Part II conditions for dynamical similitude, with cavitation, are discussed in considerable detail and expressions are formed for a mean cavitation coefficient by integration. When Froude's criterion is satisfied, corresponding elements of the integrands are equal.

Numerical results are given for four different velocities of a model screw, and graphical representation shows the points lying close to a unicursal curve for low velocities but branching along four different curves at points corresponding to the critical cavitation velocities.

Five references.

Contrary-Turning Co-Axial Screws. (F. Rotundi, Engineering, Vol. 138, No. 3577, 3/8/34, p. 126. Summer Meeting of Institution of Naval Architects.) (5.610/28728 Great Britain.)

Full-scale trials on the training ship "Cristoforo Colombo," of 3,250 tons displacement with Diesel-electric drive, indicated a gain of 18 to 20 per cent. in propulsive efficiency. A similar disposition of airscrews has been made successfully on an Italian flying boat.

Increased Efficiency of Marine Screw with Guide Cowling. (F. Busmann, W.R.H., Vol. 15, No. 3, 1/2/34, pp. 29-30.) (5.644/28729 Germany.)

A sketch shows the annular cowl in section and end view. A converging channel is formed between the cowling and the tapered boss carrying the screw shaft. The section of the cowling wall is of thick aerofoil type. The entry length of the channel appears to be about four times the exit length.

Expressions are formed for efficiency under ideal flow in the manner of Froude and Rankine, and the efficiency—with and without cowl—is calculated and plotted, along with some other parameters, for a 15-knot steamer. The increase in ideal efficiency is from 26 to 32 per cent. at three knots, but only from 73 to 76 per cent. at 15 knots.

Various problems of design are mentioned, and efficiencies of 90 per cent. are considered possible in comparison with the 65 per cent. efficiency which represents common practice. No actual test figures are given.

Four references.

Marine Screws with Guide Cowlings. (L. Kort, W.R.H., Vol. 15, No. 4, 15/2/34, pp. 41-43.) (5.644/28730 Germany.)

As in the previous paper by Busmann (see Abstract 28729) the elementary hydrodynamical relations are worked out on the basis of the Froude-Rankine ideal actuator.

Photographs show two types of twin-screw drive with divergent guide channels formed by cowlings which reduce the emergent velocity. Diagrams show the velocity field with and without guide channels, from which the recuperation of energy may be computed.

In towing vessels a further advantage is obtained by diverting the two wakes to either side of the bows of the towed vessel, with corresponding reduction in the interference resistance.

Test results show noteworthy gains in effective thrust and efficiency.

Tug with Guide Cowling for Screw Propeller. (W.R.H., Vol. 15, No. 6, 15/3/34, pp. 73-74.) (5.644/28731 Germany.)

Section sketches show the general arrangement and the shape of the cowling.

Test results are given in tables and show increases in efficiency under representative conditions. (See Abstracts 28729 and 28730.)

Tests of Auxiliary (Hydroplane) Vanes. (J. B. Parkinson, N.A.C.A. Tech. Note No. 490, Feb., 1934.) (5.644/28732 U.S.A.)

The vanes are shown in a photograph as stub hydroplane surfaces forming a transverse extension of the planing area of a model flying boat hull. The effects were entirely unfavourable.

One reference.

Application of the Results of Systematic Propeller Tests to the Condition of Full-Size Airscrews. (K. Schaffran, Luftfahrtzeugbau und Luftfahrt, Vol. 2, No. 1, 1/1/34, pp. 7-8.) (5.612/28733 Germany.)

The tests were carried on in a water channel on models of airscrews, with the same blade form, but different pitches. The results are in satisfactory agreement with full-scale air tests.

Method of Calculating the Performance of Controllable Propellers with Sample Computations. (E. P. Hartmann, N.A.C.A. Tech. Note No. 484, Jan., 1934.) (5.658/28734 U.S.A.)

The gain in performance is mainly due to the increase of r.p.m. up to the maximum power available, especially with geared and supercharged engines. The take-off run is decreased and the rate of climb and ceiling are increased.

Six references.

The Ratier Variable Pitch Airscrew for Seaplanes. (L'Aérophile, Vol. 42, No. 1, Jan., 1934, p. 26.) (5.658/28735 France.)

There are two working pitches—one for take-off on the ground and one for altitude. The altitude pitch is set automatically when the air pressure falls below a fixed value. A partial balance between hub reaction, air reaction and inertia forces is obtained by inclining the blades from the perpendicular to the shaft and the required governing force is kept sufficiently small for operation under aneroid control.

Electrical Method of Measuring Small Vibrations and its Application to the Measurement of Vibration of Airscrew Blades. (J. Obata, S. Morita and Y. Yoshida, Aer. Res. Institute, Tokyo, Report No. 103 (Vol. 8, No. 7), Feb., 1934.) (5.660/28736 Japan.)

The body under examination forms part of a small air condenser, changes in the capacity of which produce change in the grid voltage of an amplifying set. The free transverse vibration of an airscrew was examined by clamping the boss rigidly and striking the blades at various points. The frequencies obtained are in general agreement with theory.

Five references.

Instruments

Stiffness of Helical Springs in a Direction Perpendicular to Spring Axis. (E. Rausch, Z.V.D.I., Vol. 78, No. 12, 24/3/34, pp. 388-389.) (6.102/28737 Germany.)

With certain simplifying assumptions the author establishes an equation for displacement under a force perpendicular to the spring axis. A useful relation is given with the axial extension under the same load. If under equal loads

δ_a = axial displacement,

δ_w = transverse displacement.

Then

$$\delta_w/\delta_a = 0.38 [1 + 0.77 (h/D)^2]$$

where

h = length of helical spring,

D = diameter of coil.

Five references.

Fluid Flow Indicator. (A. Fischer, Z.V.D.I., Vol. 78, No. 13, 31/3/34, p. 425.) (6.22/28738 Germany.)

The indicator consists of a hinged flap, in a cylindrical pipe, which is moved by the current and actuates a control rod. The control rod is enclosed in a cylindrical casing parallel to and connected with the pipe, with thin highly corrugated walls. One end of the cylinder is fixed, the other is moved axially by movements of the control rod in a manner analogous to a set of capsules in an aneroid. In this way the indications are transmitted externally without use of glands and stuffing box.

Torque Indicators. (K. Reuss, Ing. Arch., Vol. 5, No. 1, Feb., 1934, pp. 25-35.) (6.271/28739 Germany.)

A review is given of various devices. In particular a description is given of a device in which a fixed weight is suspended by a cord passing round a spiral cam, which gives effectively a variable lever arm.

In equilibrium the length of the lever arm is noted. The elementary geometry of the involute and the equiangular spiral is given.

Two references.

Aerodynamic Characteristics of Anemometer Cups. (M. J. Brevoort and M. T. Joyner, N.A.C.A. Tech. Note No. 489, Feb., 1934.) (6.40/28740 U.S.A.)

Authors' Abstract.—The static lift and drag forces on three hemispherical and two conical cups were measured over a range of angles of attack from 0° to 180° and a range of Reynolds numbers from very small up to 400,000. The problem of supporting the cup for measurement and the effect of turbulence were also studied. The results are compared with those of other investigators.

Five references.

Determination of Wind on Ships in Motion. (F. Musella, Riv. Aeron., Vol. 10, No. 1, Jan., 1934, pp. 75-82.) (6.40/28741 Italy.)

Photographs show details and mounting on ship board of a four-cup anemometer with a wind vane and pitot head.

Sketches show the indicating apparatus and divided circle for plotting the true wind from the relative wind and the ship's speed.

Wind Direction and Speed Indicator for the Yacht "Endeavour." (D. C. Gall, J. Sci. Inst., Vol. 11, No. 9, Sept., 1934, pp. 279-280.) (6.40/28742 Great Britain.)

Relative wind direction as determined by a mast head vane is repeated near the tiller by a rheostat electrical control. The relative wind speed is indicated by a hot wire instrument.

Stroboscopic Tachometer. (Engineering, Vol. 138, No. 3581, 31/8/34, p. 233.) (6.44/28743 Great Britain.)

The instrument weighs two pounds and has two speed ranges, 400 r.p.m. to 2,400 r.p.m. and 2,000 r.p.m. to 12,000 r.p.m. The latter range is obtained by observation through five slots.

Application of the Gyrostat to Speed Regulation. (O. Vocca, W.R.H., Vol. 15, No. 5, 1/3/34, pp. 53-55.) (6.44/28744 Germany.)

References are given by the Italian author to papers in the Italian technical Press. The elementary principle is based on the variable moment set up by a gyrostat in uniform rotation about its axis and in variable precession about an axis at right angles, the latter being produced by the coupling to the shaft of the main drive. In general, this device would compete with centrifugal governors.

The present article is restricted to a special application for maintaining effective synchronism (angular velocities equal or in constant ratio) between independent driving shafts.

Two co-axial gyros are kept in rotation in opposite directions by flexible drives from the two main shafts and the whole is kept in uniform rotation on an axis at right angles to the common axis of the gyros. Any departure from equal and opposite velocities produces precession of the housing controlled by spiral springs, and controls electrically a governing servo-motor. A high degree of sensitivity is obtained and in turn gives close regulation.

Nine references.

Oscillations of Automobiles and Their Determination. (E. Lehr, Z.V.D.I., Vol. 78, No. 10, 10/3/34, pp. 329-335.) (6.48/28745 Germany.)

The article describes how to determine experimentally the position of the C.G. and the principal moments of inertia of an automobile. Simple harmonic equations for the oscillation in a vertical plane are developed by replacing the car by a flat disc subjected to two double spring controls. The displacement of the springs is given by an equation of the type—

$$X_1 = A \cos(\omega_1 t) + B \cos(\omega_2 t).$$

The constants in the above equation can be determined with sufficient accuracy by studying the motion of the car when placed on eccentric rollers. The problem is complicated by damping and the author recommends that the experimental study of known successful types of springing must be carried out before the necessary control factors can be numerically estimated.

Eleven references.

Determination of the Speed of Sound by the Acoustic Interferometer. (E. Grossmann, Phys. Zeit., Vol. 35, No. 2, 15/1/34, pp. 83-88.) (6.48/28746 Germany.)

Direct measurement gives points of maximum and minimum intensity in the pressure field. If these are taken as nodes determining the simple wavelength, erratic values are obtained for the speed of sound.

A satisfactory reduction of these anomalies is given from consideration of the pressure field due to the interference of emitted and reflected sound waves. Suggestions that the speed of sound varies with frequency are shown to be superfluous and incorrect. Two examples of wave interference patterns are shown graphically.

Twelve references.

Speed of Air-Driven Rotors in Gyroscopic Instruments. (A. F. Spilhaus, J. Aer. Sci., Vol. 1, No. 1, Jan., 1934, pp. 44-46.) (6.52/28747 U.S.A.)

The various factors affecting rotor speeds are analysed. With a constant suction, the decreased external air pressure at altitude would cause an appreciable increase in rotor speed, which is only partially compensated by increased bearing friction at lower temperature. As a net result an appreciable increase in speed remains, which is more marked for the directional gyro than for the artificial horizon.

Five references.

Sensitive Bolometer Relay. (W. Jaekel, Z.V.D.I., Vol. 78, No. 5, 3/2/34, pp. 169-170.) (6.71/28748 Germany.)

The pointer of an electric current indicator moves across a narrow air stream issuing through a slot and alters its impingement on the bolometer wire. A movement of the pointer of the order of 15×10^{-4} mm. affects the cooling of the wire and energises the relay sufficiently to give a reading. The instrument has been used to measure the variation of plant growth with light intensity.

The air stream is produced by a membrane, vibrated electrically by means of a separate circuit. The relay is sufficiently sensitive to be operated direct by photo-electric cells of the transition layer type, without amplification.

Two references.

Heat Flow Meter for High Temperature. (E. Schmidt and J. Werneburg, Z.V.D.I., Vol. 78, No. 11, 17/3/34, pp. 343-346.) (6.72/28749 Germany.)

The heat flow meter consists of a strip of material in which are embedded thermocouples by which the temperature gradient can be measured. The strip is applied to the surface from which the flow is to be measured. The meter is calibrated by subjecting one face to a source of radiation and measuring by an optical pyrometer the heat transmitted and subsequently radiated at the other face. The heat given to the air by conduction is calculated from the temperature gradient near the surface, care being taken that the air is at rest.

For low temperatures the material of the strip is rubber. For high temperatures a strip of porcelain $6.5 \times 12 \times 0.9$ cm. is employed.

The meter measures heat flows of the order of $10,000 \text{ kcal/m}^2\text{h}$ at surface temperatures from 100°C. to $1,000^\circ\text{C.}$

Four references.

Theory of Heat Conduction in Fluids. (A. Kardos, F.G.I., Vol. 5, No. 1, Jan./Feb., 1934, pp. 14-24.) (6.72/28750 Germany.)

A critical review is given of previous attempts to form empirical, semi-empirical and rational relations between physical properties, thermal conductivity and viscosity. Some of these are moderately accurate within limited ranges. In particular the linear relation of the kinetic theory between viscosity and conductivity in ideal gases is shown by the example of carbonic oxide to be totally inapplicable to the liquid state.

The author propounds a new set of relations based on molecular properties, which give remarkably close numerical agreement with observations over a wide range of liquids and liquid solutions.

Thirty references.

Two Practical Applications of Heat Flow. (E. N. Fox, Phil. Mag., Vol. 18, No. 118, Aug., 1934, pp. 209-227.) (6.72/28751 Great Britain.)

Methods of solution are given for lagged surfaces with main flow of heat in one dimension and subsidiary cross flow.

The prohibitive complications of a full solution are avoided and approximations of various orders are given, according to the number of terms retained, with sufficient accuracy for practical purposes.

Two references.

Heat Transference in Fluids. (M. F. Treer, Phys. Zeit., Vol. 35, No. 6, 15/3/34, pp. 266-268.) (6.72/28752 Germany.)

A brief summary is given of Prandtl's attempt to analyse transfer of momentum and heat by eddies, on the basis of a "mean mixing path."

Experimental results given by four authors, from observations of flow round a cylinder, are plotted for comparison. An empirical formula obtained by Ulsamer contains a product of fractional powers of the Peclet number and the Reynolds number.

Seven references.

Radiation from Luminous and Non-Luminous Natural Gas Flames. (R. A. Sherman, Trans. A.S.M.E., Vol. 56, No. 3, March, 1934, pp. 177-192.) (6.72/28753 U.S.A.)

Natural gas flame may be either luminous or non-luminous. In the former the temperature is lower but the heat radiation is greater, with the additional advantages that the temperature is more uniform and the presence of free carbon is advantageous in many industrial processes, such as steel manufacture.

Fifteen references.

Apparatus for Measuring Thermal Conductivity of Metals up to 600°C. (M. S. van Dusen and S. M. Shelton, Bur. Stan. J. Res., Vol. 12, No. 4, April, 1934, pp. 429-440.) (6.72/28754 U.S.A.)

The comparative conductivities of the metal and of lead are measured. Determinations are made of the axial temperature gradient in two cylindrical bars soldered end to end, one end of the system being heated and the other end cooled. The cylindrical surface is protected from heat loss by a guard tube.

Data are given for various alloys widely used for heating elements and thermocouples.

Ten references.

A New Brake Meter for Cars. (Z.V.D.I., Vol. 78, No. 8, 24/2/34, p. 236.)
(6.73/28755 Germany.)

Deceleration is measured by a pendulum decelerometer consisting of a U tube filled with mercury. The deflection is indicated by a liquid column superposed on the mercury with magnification and temperature compensation.

Two references.

Improvements in Acoustics of a Theatre. (W. Crone, H. Seiberth and J. Zenneck, Ann. d. Phys., Vol. 19, No. 3, Feb., 1934, pp. 299-304.)
(6.95/28756 Germany.)

The reverberation time of a pistol fired in various parts of the theatre was recorded by oscillograph. The paths of reflection of the disturbing echoes were located and the reflecting areas damped by hangings of light stuff materials, with excellent effects.

Noise in Aircraft. (J. Denton, L'Aéron., No. 176, Jan., 1934, pp. 5-12.)
(6.95/28757 France.)

A brief summary is given of physiological relations, with Fechner's approximate logarithmic increase of sensation, and the resulting scale of measurement in decibels.

A comprehensive tabular scheme gives the range of intensity of common sounds from 5 decibels up to 120 decibels, at which sensation becomes painful. Consideration is then given to the problem of aeroplane noises and illustrative figures are given for intensity of sound sources, exhaust, airscrew, engine, the transmission and absorption coefficients of various materials, and of the passengers themselves, with applications to the reduction of noise in the passenger cabin.

Aircraft Flight

Rolling and Yawing Moments Produced by Floating Wing-Tip Ailerons. (M. J. Bamber, N.A.C.A. Tech. Note No. 493, March, 1934.) (7.20/28758 U.S.A.)

A diagram shows the ailerons as continuations of the wing along the span, freely rotatable about the front spar.

Substantial increases in the coefficient of yawing and rolling moments opposing spin are shown graphically.

Nine references.

Effect of Trim Angle on Take-off Performance of a Flying Boat. (J. M. Shoemaker and J. R. Dawson, N.A.C.A. Tech. Note No. 486, Jan., 1934.)
(7.30/28759 U.S.A.)

The effect of trim angle on water resistance was measured with N.A.C.A. models 11A, 16 and 22.

In the case of 11A, the same trim gave both minimum water resistance and minimum total (air and water) resistance.

The effect of trim on take-off and run is worked out in a numerical example. An instrument for determining trim on a seaplane under way is described.

Five references.

Stalling. (Wilbur Wright Lecture.) (B. M. Jones, J.R. Aer. Soc., Vol. 38, No. 285, Sept., 1934, pp. 753-770.) (7.70/28760 Great Britain.)

A descriptive account is given of the relation between air flow over the wing and the resulting air forces, near and above the stalling incidence.

Visual methods were advocated by Osborne Reynolds in 1884 for studying the flow of water and other fluids and have since been unduly neglected until

recent years. The use of visual methods is considered to be of the first importance, and a number of photographs are reproduced in illustration.

Reference is made to the considerable success of slots and other devices, but the lecturer is far from suggesting that the problem is solved, and puts forward his results only as a beginning of the necessary research.

Aerodynamics of the Wing Slot. (M. M. Munk, *J. Aer. Sci.*, Vol. 1, No. 1, Jan., 1934, pp. 28-31.) (7.72/28761 U.S.A.)

The explanation of the action of the slotted wing, propounded by Prandtl and Betz, is unsatisfactory.

Two references.

Measurement of Upper Limits of Cloud and Fog. (R. Feige, *Z. Instrum.*, Vol. 54, No. 1, Jan. 1934, pp. 23-26.) (7.80/28762 Germany.)

A modification of radio sounding apparatus for pilot balloons previously described in *Z. Instrum.*, May 1932, p. 239, makes the registration of cloud and fog limits possible by measurements of light intensity. The sounding apparatus weighs about 5lb. and emits a continuous short wave beam, the exact wavelength depending on the photo-electric current registered on a milliammeter. A special transition layer (Sperrschicht) type of cell is employed and the motion of the milliammeter suspension system directly affects the capacity, and thus the wavelength, of the sending set.

Height signals are sent out by a momentary interruption of the emitted beam brought about by the expansion of a Bourdon pressure gauge.

Two references.

Lighting of Flying Boats on Rough Sea or in the Dark. (W. Pacher, *Flugsport*, Vol. 26, No. 3, 7/2/34, pp. 51-54, and No. 4, 21/2/34, p. 73.) (7.80/28763 Germany.)

A brief descriptive account is given of familiar problems.

A sketch of a device for landing in the dark shows a rope passing through a loop attached to a shock absorber and trailing behind. On contact with the surface an impulse is communicated through the shock absorbed to the pilot and indicates a previously determined height above the surface.

Engines, Thermodynamics

The Influence of Pressure on the Spontaneous Ignition of Inflammable Gas/Air Mixtures. (D. T. A. Townend, L. L. Cohen and M. R. Mandlekar, *Proc. Roy. Soc.*, Vol. 146, No. A.856, 1/8/34, pp. 113-129.) (8.13/28765 Great Britain.)

In this, the third article of a series, experiments are described with hexane and isobutane/air mixtures. The results are in general agreement with the previous experiments using butane and pentane, and demonstrate the great effect of pressure in lowering the ignition temperature.

At certain critical pressures between 1 and 3 atmospheres a relatively small increase of pressure may produce a lowering of ignition temperature of the order of 200°C. For non-critical pressures the effect is much less, e.g., doubling the pressure from 5 to 10 atmospheres will not generally lower the ignition temperature by more than 5°C.

The effect of lead dope is to increase the ignition temperature throughout. The actual rise is again very much magnified at the critical pressure. The authors put forward the view that the lowering of the ignition temperature by increase of pressure is due to the survival of certain unstable intermediate products which are formed in the precombustion period.

The ignition temperatures observed by the authors are accompanied by time lags varying from 1 to 30 seconds and have no direct application to engine conditions with a lag of less than 0.005 sec.

Eleven references.

Flame Temperatures in Methane-Air Mixtures. (W. T. David and J. Jordan, Phil. Mag., Vol. 18, No. 118, Aug., 1934, pp. 228-236.) (8.13/28764 Great Britain.)

The fuel mixtures are exploded in a spherical bomb with central ignition and the flame temperature measured by means of a fine platinum resistance wire near the centre. The reading of the thermometer rises quickly after ignition to a value which remains constant for a time and is followed by a further rise.

The first maximum gives the true flame temperature, the subsequent rise being due to compression. The temperatures obtained in this way are several hundred degrees lower than those obtained by alternative methods, e.g., sodium line reversal.

The authors put forward a physical argument indicating that the latter method gives temperatures in excess of the true equilibrium value.

Eleven references.

The Specific Heat of Gases at High Temperatures. (W. T. David and A. Smeeton Leah, Phil. Mag., Vol. 18, No. 118, Aug., 1934, pp. 307-321.) (8.13/28766 Great Britain.)

The specific heats calculated by Nernst and Wohl for H_2 , N_2 , OO , CO_2 , and H_2O , in accordance with the Planck-Einstein relations, give better agreement with explosion experiments than the generally accepted value, but lead to improbably high engine thermal efficiencies.

It is suggested that the molecules of gases in engines have not time to reach equipartition of energy in the various modes of vibration, and act accordingly as molecules of simpler type with fewer modes of vibration and lower specific heat.

Twenty-two references.

Phenomena of Ionisation in the Adiabatic Expansion of Gases. (P. Benzi, L'Aerotecnica, Vol. 14, No. 3, March, 1934, pp. 267-281.) (8.15/28767 Italy.)

As a preliminary to the study of the ionisation of a fuel mixture in an engine, the author has investigated the behaviour of moist air when undergoing compression and expansion. It appears that ionisation depends on the presence of fog, and that a conductor exposed to the fog will be charged positively or negatively according to the temperature of the conductor.

Eighteen references.

A Critical Test for the Purity of Gases. (M. Shepherd, Bur. Stan. J. Res., Vol. 12, No. 2, Feb., 1934, pp. 185-191.) (8.15/28768 U.S.A.)

One approximately isothermic distillation yields a small initial distillate, a middle distillate containing the bulk of the gas and a small final residue. The vapour pressures of these three fractions are compared and indicate impurities of higher and lower boiling points than that of the approximately pure substance.

Two references.

Engines, Design and Performance

The Bertin Turbo-Compressor. (Engineering, Vol. 137, No. 3569, 8/6/34, pp. 643-645.) (8.235/28769 Great Britain.)

Two discs rotate in opposite directions with equal angular velocities. The blades are approximately equi-angular spirals, and their leading edges seen in

side elevation form an orthogonal system of curves. In side elevation the channels or ducts formed by opposite blade pairs narrow rapidly from hub to periphery and impose a compression on the delivery stream.

The mean rotational velocity is reduced to zero by symmetry, and the eddy energy is relatively small. The diagrams of performance show delivery against r.p.m. with both discs rotating in the same direction, with one stationary, and with both rotating in opposite directions.

The deliveries for the same mean angular speed of rotating parts are in the ratios 1:4:16 against the pressure 16 inches of water.

A Comparison of Several Methods of Measuring Ignition Lag in a Compression Ignition Engine. (J. A. Spanogle, N.A.C.A. Tech. Note No. 485, Jan., 1934.) (8.28/28770 U.S.A.)

A stroborama gave the beginning of fuel injection. The beginning of ignition was estimated by three methods:—

- (a) Beginning of first pressure rise on indicator diagram.
- (b) Point of diagram corresponding to the combustion of 3 per cent. of the injected fuel.
- (c) First appearance of glow in combustion chamber observed through a quartz window.

The first method was found to give the most consistent results. The last method gave considerably greater lags, interpreted as showing considerable pre-combustion before visible flame. In spark-ignition engines the last method gives consistent results.

Six references.

Researches Carried Out in the Physical Laboratory of the French Air Ministry. (L'Aéron., No. 178 (Bulletin), March, 1934, p. 29.) (8.28/28771 France.)

Voltage and current curves of ignition systems were studied by cathode ray oscillograph. The character of the discharges is as important as the maximum voltages.

New Steam Plants for Locomotion. (K. Imfeld and R. Roosen, Z.V.D.I., Vol. 78, No. 3, 20/1/34, pp. 65-74.) (8.294/28772 Germany.)

Messrs. Henschel and Son, Ltd., the well-known German locomotive builders, are developing a new type of steam power plant suitable for lorries, rail cars, and motor boats. Steam at approximately 100 atmospheres and 500°C. is generated in a steel tube, one end of which is exposed to the action of a blow-pipe flame, whilst the feed water enters the other end. The blow-pipe is fed with compressed air and can deal with a great range of common liquid fuels. By means of relays, the temperature and pressure of the steam is kept automatically constant by regulating the heat supply and the amount of feed water.

The steam is employed in a compound engine of orthodox design working directly on the driving wheels. The exhaust is condensed at atmospheric pressure, the necessary cooling air being supplied by an auxiliary high speed fan.

It is stated that the plant competes successfully with Diesel-engined installations.

Two references and forty-four illustrations.

Engines, Design and Strength of Components

Possibilities and Load Characteristics of a New Journal Bearing with the Dimensions of a Roller Bearing. (A. Riebe, Autom. Tech. Zeit., Vol. 37, No. 5, 10/3/34, pp. 133-138.) (8.31/28773 Germany.)

Constructional details are given of narrow journal bearings using "caro-bronze" interposed between steel liners.

The bearings may be cylindrical or of double curvature, and the lubrication may be by wick or pressure. It appears that loads and speeds may be imposed comparable with those for roller bearings of similar dimensions.

The Design of Journal Bearings and Their Lubrication. (E. Meier, *Autom. Tech. Zeit.*, Vol. 37, No. 5, 10/3/34, pp. 138-142.) (8.31/28774 Germany.)

Bearing troubles in Diesel engines applied to transport work are classified under five heads:—

- (1) Excessive crankshaft deflection.
- (2) Insufficient bearing dimensions.
- (3) Unsuitable backing of bearing and bad adhesions of bearing metal.
- (4) Poor manufacture.
- (5) Faulty lubrication.

An investigation was carried out with a simple form of impact machine developed for testing adhesion. Good results were obtained with a lead bronze backing and a cast-on layer of graphite lead, 0.3 mm. thick, as actual bearing surface. The bearings should be machine-cast and there should be no oil grooves on the part of the surface subjected to maximum pressures.

Reliability of Pistons and Rings in Large Air-Cooled Engines. (A. Fussenhauser, *Luftwissen*, Vol. 1, No. 3, 15/3/34, pp. 62-65.) (8.32/28775 Germany.)

Air-cooled engines work at a higher temperature level than water-cooled. The temperature of the barrel near the head is critical, since any marked excess of 180° causes the lubricating oil to distil and the pressure seal between piston and barrel breaks down. This in its turn causes a rapid rise in piston temperature, which already may be in the neighbourhood of 350°C. in the centre of the crown, compared with 250°C. in the case of water-cooled engines.

Light alloy cylinders fitted with special "Niresist" cast iron liners can be run with finer piston clearances, since the expansion of this special cast iron is of the same order as that of al. alloy.

Thirty-seven references.

The Alumilite Process for Pistons. (Comm. Motor, 13/4/34, p. 292.) (8.32/28776 Great Britain.)

It is standard practice in America to cover the surface of aluminium alloys with a film of oxide of varying degrees of hardness, depending on requirements, and to impregnate the film with oil or graphite. The life of piston grooves is increased by this treatment.

The process can also be applied to light alloy parts previously chromium plated. A high reflecting coefficient and a non-tarnishing finish are obtained.

Investigation of Vibration Periods by Electro-Magnetic Analogy. (L. Kettenacker, *F.G.I.*, Vol. 5, No. 2, March-April, 1934, pp. 67-71.) (8.36/28777 Germany.)

A sketch shows an elastic shaft with discrete flywheel masses and the analogous electrical circuit with discrete reactions and capacities. The form of the applicable linear differential equations is the same, and comparison of the constant coefficients gives the electro-magnetic mechanical analogy.

A diagram of connections shows the exciting circuit, "analogy" circuit and recording circuit, the latter producing a resonance curve as the exciting frequency is varied through the appropriate range. By choice of corresponding scales, the resonance diagram can be read directly as torsional oscillations.

A numerical example is given with data for a mechanical system and for the corresponding electro-magnetic system.

Seventeen references.

Cast Crankshafts. (Autom. Tech. Zeit., Vol. 37, No. 1, 10/1/34, pp. 11-12.) (8.36/28778 Germany.)

Certain kinds of Ni-cast iron have found application in cast crankshafts and camshafts. Apart from low cost, the absence of changes in cross-section due to notches and keyways avoids the concomitant peak stresses. The cast shaft may therefore be stronger than a steel shaft, provided the deflections are kept within limits by choice of dimensions. The high internal damping of cast shafts promotes smooth operation.

Two references.

Roller Bearings and Their Employment in Automobile Construction. (Dipl. Ing. Jurgensmeyer, Autom. Tech. Zeit., Vol. 37, No. 5, 10/3/34, pp. 143-148.) (8.37/28779 Germany.)

The noise of bearings is largely a question of clearance. The author discusses the design of various mountings for minimum play. The problem is difficult in the case of conical roller bearings, since the cones assume different positions when mounted under static friction and when running under vibration. The transition from one position to the other may take several hours under load.

Effect of Speed, Load and Clearance on Seizing Temperature. (N.P.L. Report for 1933, p. 158.) (8.38/28780 Great Britain.)

The seizing temperatures vary directly as the speed and inversely as the load, and there is an optimum clearance depending on the viscosity of the oil.

By repeated seizure or approach to seizure a skin of molecular dimensions forms on the metal which is resistant to fracture and is maintained intact at speeds below that at which fluid lubrication is possible. The bearing then apparently improves.

The Running-in of New Engines. (E. Mahle, D.M.Z., Vol. 11, No. 1, Jan., 1934, pp. 12-16.) (8.38/28781 Germany.)

Tapered piston rings reduce the running-in period considerably. They are standard fittings in several American cars.

Four references.

Engines, Cowling

Air-Cooled Engine Cowling. (J. D. North, Airc. Eng., Vol. 6, No. 62, April, 1934, pp. 100-110; also J.R. Aer. Soc., Vol. 38, No. 283, July, 1934, pp. 566-612.) (8.426/28783 Great Britain.)

An account is given of the development of cowlings in comparison (somewhat controversial) with the Townend ring. The design problem involves the cooling of the cylinder head as well as the reduction of head resistance.

A selection of experimental results obtained in this country and U.S.A. is discussed in considerable detail from the viewpoint of the designer.

Eleven references.

The Cowling of Radial Engines. (R. B. Beisel, A. L. MacClain and F. M. Thomas, Airc. Eng., Vol. 6, No. 64, June, 1934, pp. 151-158, and No. 65, July, 1934, pp. 197-200; also J.R. Aer. Soc., No. 283, July, 1934, pp. 613-650.) (8.426/28784 Great Britain.)

The development of radial air-cooled engine cowlings in U.S.A. has proceeded in parallel with the development of the Townend ring in this country. The fundamental objects are to reduce head resistance and to maintain adequate cooling of the cylinders.

Measurements were made with a N.A.C.A. cowling and a disc baffle plate, cut away to clear the projecting cylinders and fins by about $\frac{1}{4}$ in., in a plane slightly aft of the cylinder axes. The air flow is controlled by regulating the air outlet slot in the skirt of the cowling. The test figures show that the reduced air flow, directed closely over the cylinders, gives reduced drag and maintains adequate cooling. More uniform cooling is obtained, especially with two bank radial engines, and the whole or part of the air flow may be supplied by a fan.

A selection of the work done is presented in detail and shows that haphazard methods are unlikely to give satisfactory results.

Rules are laid down to guide the designer.

Three references.

Engines, Lubricants and Lubrication

The Ageing of Castor Oil. (M. Roy. Pub. Sc. et Tech., No. 40, 1934.)
(8.540/28785 France.)

Prolonged heating of castor oil at temperatures in the neighbourhood of 100°C. causes "ageing" involving the following physical and chemical changes:—

- (1) Considerable increases in density, viscosity, refractive index and molecular weight.
- (2) Slight increase in surface tension.
- (3) Marked increase in acidity, with decrease in the iodine value.

The changes in the properties of the oil finally lead to complete jellification. The jelly is insoluble in the usual castor oil solvents, but completely soluble in paraffin oil at 100°C.

The author describes a neat method depending on observation of surface tension for recording the acidity and thence determining the amount of "ageing." Steel containers accelerate the ageing notably. The presence of various so-called anti-oxidants had but slight effect on the changes.

Lubricating Quality (Oiliness) of Oils and Solid Greases. (S. Erk, Z.V.D.I., Vol. 78, No. 12, 24/3/34, pp. 389-390.) (8.540/28786 Germany.)

A testing machine for "oiliness," designed by Thoma, and used in the Munich Technical High School, is here described. It consists of two cylinders in contact under a known force, the axes and force being mutually orthogonal. The cylinders are rotated by external drives and the friction of the contact is measured directly. Although totally immersed in oil, the readings of the machine are not determined by the viscosity of the oil, since the type of contact renders a continuous oil film impossible.

The test conditions are supposed to represent partial seizure in a bearing. It is possible to mix oil to produce a series of constant viscosities, but giving very different friction measurements in the machine, *e.g.*, the addition of rape seed oil to a mineral oil may lower the measured friction by 50 per cent. The reduction in measured friction of the original oil by mixing is not related to the measured friction of the added oil, *e.g.*, glycerine shows a lower measured friction than olive oil, but its addition to a mineral oil is much less effective.

Tests were also carried out on the effect of the material of the cylinders on the friction. White metal with high lead content and lead bronzes produced the least measured friction. The relative order of merit of various bearing metals depended on the nature of the oil.

The experiments are being extended to include certain fats and greases. There appears to be no connection between the lubricating efficiency of a grease and its consistency.

New Methods and Machines for Testing Lubricating Oils. (O. P. van Steewen, W.R.H., Vol. 15, No. 5, 1/3/34, pp. 60-62.) (8.540/28787 Germany.)

The "Spindel" testing machine built by the M.A.N. is described. A rotating disc either dips in the oil to be tested or has its external surface lubricated by a drip feed. A small plane test block is held against the circumference of the disc with an adjustable pressure and the resultant friction is measured by torque reaction of a box which surrounds the disc and to which the arm carrying the test block is attached. The temperatures of the test piece and of the rotating disc are controlled and recorded under varying loads and speeds up to the break-down, from fluid lubrication to practically solid friction. The amount of wear taking place on the block is readily measured and correlated with the nature of the metal and oil.

On account of the simple shape of the block and its method of support, subsidiary forces (such as may exist in normal bearings due to expansion or unsymmetrical application of the load) are obviated and the machine works with great consistency.

Engines, Fuels

Petrol from Coal. (Airc. Eng., Vol. 6, No. 64, June, 1934, p. 171.) (8.600/28788 Great Britain.)

A brief descriptive technical account is given of the processes employed.

Ethyl, etc. (F. R. Banks, J.R. Aer. Soc., Vol. 38, No. 280, April, 1934, pp. 309-372.) (8.645/28789 Great Britain.)

The undoubted effectiveness of tetraethyl lead in suppressing detonation has countervailing disadvantages. Even small concentration in a normal engine produces burning and corrosion of the exhaust valve and deposits on the sparking plug, making starting difficult. These undesirable effects may be mitigated for concentrations of the order of 4 c.c.s per gallon.

Ni-cr. steels of the austenitic type are recommended both for the exhaust valve and seat. To prevent corrosion when the engine is stored, specially treated oils are injected into the cylinders and valve gears. Much can be done by attention to the construction of the sparking plug and its working temperature.

The increasing use of dopes requires an accepted method of rating fuels. At the present there are considerable discrepancies in the findings of various laboratories.

Eleven references.

Engine Knock. (L. Withrow and S. N. Rassweiler, Autom. Eng., Vol. 24, No. 322, Aug., 1934, pp. 281-284.) (8.645/28790 Great Britain.)

Simultaneous records of the pressure rise and flame travel in an engine running under power show that under knocking conditions the gas has a vibrating motion. The frequency of the ripples in the expansion curve of the indicator diagram corresponds closely with the period of variations in flame brightness, both being of the order of 3,000 cycles per sec.

Thirteen references.

The Miscibility of Petrol and Some of its Components with Alcohols of Various Strengths. (W. R. Ormandy, T. W. Pond and W. R. Davies, Inst. Pet. Tech., 1934—I.A.E. Research and Standardisation Committee No. 7131, May, 1934.) (8.649/28791 Great Britain.)

Of the petrol constituents, heptane mixes worst with alcohol and benzene best. Of the alcohols, isopropyl alcohol generally mixes best with petrol constituents. A blend of ethyl alcohol and isobutyl alcohol with petrol gave a water

tolerance far above the mean values and generally greater than for either alcohol unmixed.

A.M. Detachable Connection for Petrol Pipes. (L'Aéron., No. 178, March, 1934, p. 63.) (8.684/28792 France.)

A detachable joint is required when fuel tanks are jettisoned. The joint described is of the bayonet locking type. The union is maintained by a collar against a strong spring and is disengaged by rotation of the collar. The spring forces the ends apart and seals the fixed end.

Engines, Injection and Exhaust Systems

Effect of Viscosity on Fuel Leakage between Lapped Plungers and Sleeves and on the Discharge from a Pump Injection System. (A. N. Rothrock and E. T. Marsh, N.A.C.A. Report No. 477, 1934.) (8.705/28793 U.S.A.)

The principal factor in determining leakage is the clearance between plunger and liner. By suitable design, the leakage can be made independent of the pressure. Provided the injection pump is supplied with fuel under pressure, large changes of viscosity are permissible without affecting the rate of fuel discharge of the pump.

Eight references.

Valve Seat Wear. (C. G. Williams, Autom. Eng., Vol. 24, No. 320, June, 1934, pp. 219-221, and No. 321, July, 1934, pp. 246-248; also Airc. Eng., Vol. 6, No. 63, May, 1934, pp. 141-144.) (8.725/28795 Great Britain.)

Experiments were carried out on a special test ring supplied by the A.E.C. It consists of a water-cooled cylinder head with overhead valves, the exhaust valve being operated in the normal manner, whilst the inlet valve remains shut. The head is subjected to the radiant heat of a gas furnace, arrangements being made for the products of combustion to pass out through the exhaust port of the cylinder. The wear experiments were supplemented with engine trials on two 500 c.c. J.A.P. engines and one 3.64 litre Thornycroft.

Exhaust valve temperature is of the order of the temperature of the exhaust gases measured immediately behind the valve. The seat temperature is usually about half the valve temperature. All temperatures depend on operating conditions such as engine speed, mixture strength and spark setting. Other factors are engine design, degrees of cooling, length of valve guide and materials of guide, valve and seat. It appears that valve materials and tappet clearance are the principal factors in determining wear.

Development in Valve Seats in Automobile Engines. (J. C. Fritz, Autom. Tech. Zeit., Vol. 37, No. 1, 10/1/34, pp. 12-14.) (8.725/28796 Germany.)

Valve seats made of Monel metal or steel are shrunk into the cylinder casting by warming the casting to a temperature depending on the thermal expansion of the material (warm water may be sufficient) and cooling the insert in liquid air. Subsequent stelling of the surface is often useful.

Engines, Gears

The Pitting of Gear Wheels. (M. Ulrich, Z.V.D.I., Vol. 78, No. 2, 13/1/34, pp. 53-55.) (8.761/28797 Germany.)

The pitting of gears due to fatigue of material under varying loads is avoided by accurate workmanship and suitable hardening processes, such as case hardening or cyanide treatment.

Four references.

Principles Underlying Automatic Automobile Gears. (H. v. Thungen, Z.V.D.I., Vol. 78, No. 10, 10/3/34, pp. 309-315.) (8.761/28798 Germany.)

Modern gear boxes are of four types which may be arranged in a scale of decreasing claims on the driver's attention:—

- (a) Synchronised.
- (b) Pre-selector.
- (c) Semi-automatic.
- (d) Fully automatic.

In fully automatic gears the governor actuating the change should respond both to speed and torque. It is hoped that a reliable automatic gear may soon become available, though not so far commercially successful.

Armament

The Madsen Machine Gun. (R. de l'Armée de l'Air, No. 54, Jan., 1934, pp. 87-91.) (9.11/28799 France.)

The heavy calibre gun (20 m./m.) weighs 55 kg. and fires continuously 125 rounds per minute. For short periods the rate can be trebled. Explosive shells can be used, the fuse being sufficiently sensitive to detonate on perforation of a canvas panel.

The light gun (11.35 m./m.) will fire short bursts at the rate of approximately 1,000 shots per minute. The aircraft model weighs 7 kg.

The guns are of Danish construction and are covered by numerous patents.

Patents Concerning the Launching of Torpedoes from Aircraft. (R. de l'Armée de l'Air, No. 56, March, 1934, pp. 352-358.) (9.2/28800 France.)

Three patents, dated Nov., 1928, were taken out by the French Ministry of Marine.

Torpedoes have to be launched from aircraft at about 30 feet above the water and meet the surface nearly horizontally with a considerable shock.

The first patent describes a method of giving a slight pitching rotation to the torpedo by a delayed release acting behind the C.G. Meeting the water at an angle reduces the impact, but the torpedo may ricochet or dive if the incidence is too small or too large.

The second patent covers the correction of diving by a small buoy attached near the nose by means of a rolled up length of rubber cable. On immersion the buoy is released and before parting from its cable exerts the necessary lift on the nose.

The last patent proposes to correct ricocheting by flattening the nose of the torpedo immediately behind the percussion horns.

Air Torpedoes or Bombs. ("Vultur," Riv. Aeron., Vol. 10, No. 3, March, 1934, pp. 391-398.) (9.3/28801 Italy.)

A brief descriptive technical discussion is given of relative cost and weight and personnel involved in relation to the effective amount of explosive.

The argument appears to favour bombs, but the conclusion is left open.

Practice Bomb. (R. de l'Armée de l'Air, No. 55, Feb., 1934, pp. 229-230.) (9.31/28802 France.)

The subject matter of French patent No. 745599 is the visibility of impact on soft ground and in vegetation. The bomb contains a rocket in addition to the principal charge. On impact the destruction of the principal charge emits a smoke cloud. The rocket is fitted with a delay fuse and forms a second smoke cloud about 15 feet above the point of impact.

Sprinkler Installation for Air Defence. (H. Huebner, Z.V.D.I., Vol. 78, No. 7, 17/2/34, p. 216.) (9.4/28803 Germany.)

Reference is made to incendiary bombs with magnesium alloy case and thermit filling, developing a temperature of 2,000°C. and producing an incandescent mass of metal, with its own internal supply of oxygen, and to phosphorus bombs which need only be of a few kilograms weight to penetrate the roofs of dwelling houses, each fragment of phosphorus becoming a potential centre of incendiary fire.

An experiment was carried out with a sprinkler automatically set in action by high temperature. Two photographs show first, a one-kg. thermit bomb starting a fire in a pile of shavings; second, the room after extinction of the fire in 20 seconds by the sprinkler. The formation of explosive gas by dissociation of water at high temperature was investigated and found to be negligible.

One reference.

Aerial Defence of England. (A. A. U. Fischetti, Riv. Aeron., Vol. 10, No. 1, Jan., 1934, pp. 23-31.) (9.77/28804 Italy.)

A brief analysis is given of the problem of defending London against air attack.

A map is reproduced showing zones of A.A.C. defence, lines of defence by aircraft and positions of defending squadrons, with figures of number of aircraft and A.A.C. guns available.

Materials, Characteristics, Defects and Treatment

Tensile Strength of Steels at Low Temperatures. (G. Gruschka, Forschungsheft No. 364, Jan./Feb., 1934.) (10.100/28805 Germany.)

The elastic limit, tensile strength, extension and contraction were measured for a series of steels over the range 20°C. to -200°C. Decrease of temperature generally increased the first two properties but reduced the extension and contraction to a small fraction. The results have important application in the design of liquid gas containers.

Modern Researches on Mechanical Strength and Their Influence on Practical Design. Review of papers read at Materials Congress, Essen. (E. Lehr, Z.V.D.I., Vol. 78, No. 13, 31/3/34, pp. 395-401.) (10.104/28806 Germany.)

In general the fatigue limits of alloy steels are more sensitive to abrupt change of cross section, notches, keyways, etc., than carbon steels. For this reason M.A.N. construct the piston rods of two-stroke engines exclusively in carbon steel, protected by a liner from any corrosive effect of the cooling water. If at all possible shoulders should be avoided and wheels and pinions fitted on plain shafts.

In designing crankshafts useful comparative results are given by the elementary theory of the forces on the pin and web, using the combined gas and inertia forces. The true stresses are appreciably higher, but from experience with 150,000 shafts one firm is confident that the maximum stresses are proportionate to the values calculated in this simple manner.

Fifteen references.

Research on the Fatigue of Steels. (R. Cazand, Pub. Sc. et Tech., No. 39, 1934.) (10.104/28807 France.)

A test piece was subjected to alternating stresses on a modified Wohler machine, the load being applied at the overhung and rotating end. Special attention was given to the shape. Linear relations were found between the elastic and ultimate strength limits and the fatigue limits with large variations in the slopes of the straight line graphs.

For the 95 steel samples tested the factor varies from 0.19 to 0.66. The authors trace a connection between the factor and the composition, heat treatment and micro-structure of the steel. Generally speaking, tempering at temperature of the order of 600°C. increases the fatigue limits, although it may diminish the elastic limit and tensile strength.

Sixty-five references.

Velocity of Corrosion. (U. R. Evans and R. B. Mears, Proc. Roy. Soc., Vol. 146, No. A.856, 1/8/34, pp. 153-165.) (10.125/10.262/28808 Great Britain.)

Consideration is given both to the electro-chemical reaction and to concomitant mechanical effects, such as the setting up of convection currents by local changes in density and by the sinking of corrosion products, the formation of protective films and the effect of cracks in metals. A number of corrosion time graphs illustrates the arguments.

Thirty-two references.

Prevention of Intercrystalline Corrosion in Rustless Austenitic Chrome Nickel Steel. (Z.V.D.I., Vol. 78, No. 8, 24/2/34, p. 252.) (10.125/28809 Germany.)

Intercrystalline corrosion is due to the formation of carbides with high Cr. content. It is prevented by the addition of titanium and reduction of the carbon content below 0.04 per cent.

One reference.

The Stability of Rails. (F. Raab, Z.V.D.I., Vol. 78, No. 13, 31/3/34, pp. 405-410.) (10.140/28810 Germany.)

The end clearances between rail butts to allow for thermal expansion are detrimental to high speeds. Rail lengths may be welded at the butt joints to form a continuous beam at temperatures above the normal so that the continuous welded rail is in tension at mean temperatures. This may be safely done by using a steel with high crushing limit and by strengthening the holding down bolts.

The stability of the arrangement is discussed and experiments show that the continuous welded rail will not deform at temperatures up to 100°C.

Five references.

Measurements of Stresses in Spiral Springs. (F. Thiersch, F.G.I., Vol. 5, No. 2, March/April, 1934, pp. 53-59.) (10.164/28811 Germany.)

The elastic equations are briefly discussed. By introducing approximations at an early stage a simplified expression is obtained which otherwise can be deduced from the general expression.

Experimental values of the strain are compared with calculated values and show discrepancies which generally are within permissible limits. The effects of overstrain and of fatigue are discussed. Practical formulæ for designs are given.

Fourteen references.

Mechanical Properties of Brass. (F. Ostermann, Z. Metallk., Vol. 26, No. 2, Feb., 1934, pp. 40-44.) (10.200/28812 Germany.)

Mechanical properties of a number of brasses are exhibited in twenty-three diagrams, according to composition, cold working, heat treatment, etc.

Seventeen references.

Influence of Temperature on Elastic Properties of Cast Aluminium Alloys. (M. Schwartz and A. Evers, Z. Metallk., Vol. 26, No. 2, Feb., 1934, pp. 37-39.) (10.231/28813 Germany.)

The observed residual extension of a German alloy is plotted against stress for five temperatures from 20° to 250°. Similar curves for a self-hardening

U.S.A. alloy show much higher conservation of mechanical properties in the same temperature range. The results are tabulated numerically and are discussed in some detail.

Three references.

Influence of Heavy Metals in Aluminium Alloys. (P. Rontgen and W. Koch, Z. Metallk., Vol. 26, No. 1, Jan., 1934, pp. 9-18.) (10.231/28814 Germany.)

A brief survey is given of technical papers. The structure, constitution, mechanical properties and hardening are investigated in five groups according to the content of Cu Mo Ni Cr Co Fe Mn Mg Zn and Ag.

A mass of data is given in tables and 41 microphotographs are reproduced. The Brinell hardness and tensile strength of laural are shown graphically as functions of the proportions of chromium after treatment and after annealing. Comparative data are given in a table for three other alloys.

The best alloy is specified on the basis of these data as containing 4 per cent. Cu and 1 per cent. Mo.

Magnesium Alloys for Aeronautical Purposes. (L. Aitchison, J.R. Aer. Soc., Vol. 38, No. 281, May, 1934, pp. 382-412.) (10.232/28815 Great Britain.)

Mechanical properties of magnesium alloyed in various proportions with copper, zinc, cadmium, aluminium and silicon, singly or in groups, are given in Tables 1-8. Mechanical properties after casting, rolling, extruding (with and without heat treatment) and forging are given in Tables 9-14.

Fatigue tests and tensile tests at high temperatures (up to 350°C.) are given in Tables 15 and 16. Examples of petrol tanks and airscrews are shown in photographs.

Tables 20-24 show selected corrosion tests in comparison with aluminium. Fatigue and corrosion, especially in cast magnesium alloys, appear to be the outstanding uncertainties.

A vigorous discussion follows.

Prospects of Beryllium as a Material of Aeroplane Construction. (F. Vogel, Luftwissen, Vol. 1, No. 3, 15/3/34, pp. 77-78.) (10.234/28816 Germany.)

The specific gravity of beryllium is 1.7 compared with aluminium 2.7 and steel 7.9. Pioneer work was done in U.S.A. and a brief account is given of subsequent work in Germany. Siemens and Halske have produced 2,000 kilograms in a year at a cost of 400 R.M. per kilogram (£20 gold).

Cheaper methods of production are anticipated.

Magnetostrictive Alloys with Low Temperature Coefficients of Frequency. (J. M. Ide, Proc. Inst. Rad. Eng., Vol. 22, No. 2, Feb., 1934, pp. 177-190.) (10.240/28817 U.S.A.)

Author's Abstract.—Thirty-four magnetic alloys of iron, nickel, chromium and cobalt were prepared and studied in order to find compositions which have substantially zero temperature coefficient of frequency of longitudinal vibration. Rods of these alloys were made to be used as secondary frequency standards, to stabilise the frequency of magnetostriction oscillators. The same alloys would be valuable for tuning forks.

It was found that the temperature coefficient of frequency is a function of composition, heat treatment, temperature and magnetisation. Seven compositions were found which gave temperature coefficients of the order of one cycle in a million per degree Centigrade, when properly heat-treated and magnetised. Five of these showed large dynamic magnetostriction and gave good frequency stabilisation when used with a magnetostriction oscillator.

Four references.

Growth of Surface Layer of Oxide on Metals. (A. Steinheil, Ann. d. Phys., Vol. 19, No. 5, March, 1934, pp. 465-483.) (10.262/28818 Germany.)

The oxide layers were examined by electron diffraction patterns. The initial rate of growth of aluminium oxide films was abnormally large and thereafter settled down to the growth indicated by diffusion theory. The structure of anhydrous aluminium oxide films was identified as cubic crystals of Al_2O_3 .

Other results are established of immediate scientific interest and possibly with future technical applications.

Sixteen references.

Corrosion of Screws in Aluminium Alloys. (H. Bauermeister, Z. Metallk., Vol. 26, No. 2, Feb., 1934, pp. 34-37.) (10.262/28819 Germany.)

Instrument construction almost invariably involves the use of screws and when aluminium alloys are used the tendency of brass and steel screws to corrosion requires serious consideration. Aluminium screws soon seize and break off when force is used.

A systematic series of trials was made with 24 screws of KSS alloy, silumin (cast), phosphor bronze, brass and iron. In some cases before exposure to corrosion the screws were oiled or greased. The results are tabulated in four classes according to the difficulty of unscrewing after exposure to corroding influences.

1. Easy to unscrew.
2. Medium easy.
3. Difficult.
4. Immovable.

Individual cases are influenced largely by protective greasing. Practical conclusions are given for designers.

Sea-Water Resisting Alloy, "Corrix." (Autom. Tech. Zeit., Vol. 37, No. 5, 10/3/34, pp. 149-150.) (10.262/28820 Germany.)

A new ternary Cu-Al-Fe alloy, density 7.6, has been developed under the trade name of "Corrix." The castings have a tensile strength of the order of 40 tons per sq. in., the extension being over 20 per cent. A simple heat treatment gives a Brinell hardness of over 200.

The alloy is extremely resistant to corrosion and is being widely employed in motor car and seaplane fittings.

Chromium Coating of Surfaces. (G. Eisner, Z.V.D.I., Vol. 78, No. 13, 31/3/34, pp. 415-421.) (10.264/28821 Germany.)

The best current density for the electrolytic deposition of chromium is about ten times that for nickel. Chromium can be deposited directly on nickel or copper, but with other metals it is in general necessary to deposit first a thin film of copper, nickel or other suitable carrier on which in turn the Cr. is deposited.

With suitable precautions as to cleanliness, current density, bath temperature, purity of chemicals, etc., excellent results are now obtainable.

Seven references.

Behaviour of Various Building Materials in a Fire and the Effect of Protective Treatment of Wood. (A. Schulze, Z.V.D.I., Vol. 78, No. 1, 6/1/34, pp. 23-28.) (10.420/28822 Germany.)

Various types of brick walls were tested, one surface being kept at approximately $1,000^{\circ}C$. by an oil fire in an experimental chamber.

The properties of so-called fire resisting glass and protective treatments for wood were investigated. No chemical treatment will prevent the ultimate destruction of wood, but the spread of the fire can be greatly retarded. Fire resisting glass also yields to high temperature.

In reference to the effects of air attacks, further full-scale experiments are recommended.

Two references.

Fire Proofing of Wood. (Paquin, Z.V.D.I., Vol. 78, No. 2, 13/1/34, p. 60.) (10.420/28823 Germany.)

The German chemical combine (I.G.F.I.) has produced a fire proofing dope called "Intravan," suitable for plywood, as it does not affect the mechanical properties of the glue. It can be sprayed without the need of gas masks for the operators.

One reference.

Apparatus for Determining the Surface Finish of Wood. (E. Kratz, Z.V.D.I., Vol. 78, No. 6, 10/2/34, pp. 202-203.) (10.420/28824 Germany.)

A flanged glass tube is pressed on the surface under investigation. The tube is evacuated by means of a water jet pump to a predetermined pressure. The mass of air leaking into the tube across the flange is determined by venturi air meter and gives a measure of the surface finish of the wood.

Formulae are given connecting the leakage with the effective area of surface grooves in the wood, both for viscous and for turbulent flow.

Two references.

Seasoning of Timber—Optimum Conditions. (H. Voigt and E. Ramspeck, Z.V.D.I., Vol. 78, No. 8, 24/2/34, pp. 245-247.) (10.420/28825 Germany.)

A high drying temperature accelerates the seasoning and improves the quality of the final product. Warping and internal stresses produced by unequal drying set a limit which depends on the type of wood, the coefficients of diffusion, conductivity and the mechanical properties.

From the experiments the best drying temperature and duration of the seasoning process are given for beech, pine and fir.

Ten references.

Impregnation of Timber Against Fire. (E. Dietze, Z.V.D.I., Vol. 78, No. 12, 24/3/34, p. 386.) (10.420/28826 Germany.)

Tests are described with a new impregnating material manufactured by I. G. Farben Industries under a trade name.

Two full size models of ship cabins similarly furnished were constructed using treated and untreated wood fittings. A fire was started with petrol. In the treated cabin the fire went out in 12 minutes and the highest temperature reached was 600°C., and a considerable portion of the woodwork survived the fire. In the untreated cabin a temperature of 1,000°C. was reached after 15 minutes and all the woodwork was consumed.

Aeroplane Dopes. (J. J. A. Gilmore, Airc. Eng., Vol. 6, No. 64, June, 1934, pp. 161-164.) (10.600/28827 Great Britain.)

A review is given of the development of cellulose acetate and cellulose nitrate varnishes (nitrocellulose appears to be a misnomer) by the addition of different solvents and pigments to produce the desired combination of qualities—toughening, flexibility, stability under light, etc. Two examples of specifications are given.

Successive advances have led to proprietary varnishes applicable under ordinary conditions of atmospheric temperature and humidity, of which the composition is more or less a trade secret.

An outline of test requirements and methods is given.

Dry Film Glueing in Plywood Manufacture. (R. Sorenson, Trans. A.S.M.E., Vol. 56, No. 1, Jan., 1934, pp. 37-48.) (10.660/28828 U.S.A.)

It has been conclusively established that phenolic resin is the best glue for plywood. It is waterproof, resists atmospheric action and has high shear strength.

Thirteen references.

Measurement of Internal Damping in Engineering Materials. (W. Klein, Ing. Arch., Vol. 5, No. 1, Feb., 1934, pp. 1-6.) (10.90/28829 Germany.)

A sketch shows a cylindrical iron bar on which an electro-magnet imposes longitudinal vibrations. The vibrations of the free end were observed electromagnetically by variation of voltage in an induction coil, measured by a valve voltmeter.

The elastic equations are written down in polar co-ordinates and the numerical solution is plotted graphically. Measured points lie closely along the calculated curve. (See, however, Abstract 26146, 1933.)

Eight references.

Testing Apparatus and Methods of Testing

Experimental Verification of the Theory of Wind Tunnel Boundary Interference. (T. Theodorsen and A. Silverstein, N.A.C.A. Report No. 478, 1934.) (11.10/28830 U.S.A.)

The boundary correction factor of the N.A.C.A. full-scale channel is in satisfactory agreement with flight tests. The theory may be regarded as established and the calculated values are given for all conventional types of channel.

Contribution to the Investigation of Open Throat Wind Channels. (L. Lazzarino, L'Aerotecnica, Vol. 14, No. 3, March, 1934, pp. 245-254.) (11.10/28831 Italy.)

The author develops the results of Tollmien on turbulent diffusion. Jet fluctuations are due to variation of the diameter in the free section, which is increased by the indrawing of the surrounding air.

The pressure is divided into two parts, for which formal expressions are obtained, computed, tabulated and plotted graphically.

Two references.

The Use of the Wind Tunnel in Connection with Aircraft Design Problems. (T. v. Karman and C. B. Millikan, Trans. A.S.M.E., Vol. 56, No. 3, March, 1934, pp. 151-166.) (11.10/28832 U.S.A.)

The corrections applied to model results in a 10ft. channel with steady flow are sufficiently accurate to render unnecessary for general work very large or variable density channels with their prohibitive costs.

Attention is given to the stability of the boundary layer and its effect on the maximum lift coefficient. The large effect of turbulence on the lift coefficient is intimately connected with its effect on the position of transition from laminar flow to turbulence in the boundary layer and the position of the branching point at which the flow is diverted from the surface. The well known effect of turbulence on the characteristic drag of a sphere is due to similar causes.

Thirteen references, twenty-five illustrations.

Superaerodynamics. (A. F. Zahm, J. Frank. Inst., Vol. 217, No. 2, Feb., 1934, pp. 153-166.) (11.10/28833 U.S.A.)

Experiments in high vacuum wind channels would provide data on the effect of a relatively long mean path of the particles of the fluid. The case of an

infinitely long mean free path was considered by Newton. The subject is of interest in the study of the stratosphere (*e.g.*, in reference to resistance of projectiles, rockets and shooting stars).

Five references.

New N.P.L. Wind Tunnels. (A. R. Collar, *Airc. Eng.*, Vol. 6, No. 64, June, 1934, pp. 165-170.) (11.10/28834 Great Britain.)

A technical account is given of the principles applied to the design of two open jet wind channels with closed return circuit replacing one closed channel with open return circuit. The saving in size and power is substantial.

The application of guide vanes at right angle bends has quite superseded other methods and should have an important influence in the general design of ventilating air shafts.

The use of screw vanes in front of the airscrew imparts a preliminary rotation to the air which may be adjusted to give zero mean axial rotation behind the disc. The angular speed of the screw is decreased and the distribution of velocity is improved everywhere, but no appreciable gain in power is obtained.

Much information of interest is given and drawings of general arrangements and of some details are reproduced.

Air Force Measurements on Bodies Moving Through Still Air. (R. H. Smith and J. Van H. Whipple, *J. Aer. Sci.*, Vol. 1, No. 1, Jan., 1934, pp. 21-27.) (11.12/28835 U.S.A.)

The tangential forces at the surface of a body with a certain critical fineness ratio are sensitive to channel disturbances for all attitudes, whereas the normal forces are sensitive only near the stalling attitude.

A coasting apparatus is described which enables the forces on a model in still air to be determined. Calibration runs with flat discs held normal to the wind show satisfactory agreement with other experiments. Further tests are to follow.

Nine references.

Lift on Flat Plate in Bounded Stream. (S. Tomotika, *Aer. Res. Institute, Tokyo, Reports Nos. 100* (Vol. 8, No. 4) and *101* (Vol. 8, No. 5), Jan., 1934.) (11.16/28836 Japan.)

The first report deals with a stream bounded by an infinite plane, the second with a stream bounded by two parallel walls. The same types of conformal transformation are used, in which finally the plate becomes the outer of two concentric circles, the boundary the inner. Elliptic integrals are used, with Weierstrass, sigma, zeta and theta functions. Numerical values are calculated and tabulated for different values of incidence and distance from the wall.

The lift is always increased, in particular by two-thirds at incidence 9° and distance three-quarters chord from the plane.

In report No. 101 with the same types of transformation the plate again becomes the outer of two concentric circles and the boundary the inner. The methods follow closely Rosenhead's analysis (see Abstract 22144). An oversight in Rosenhead's conclusions is pointed out at some length, the latter's results holding only for the important mid-channel position, for which alone numerical values were calculated.

The necessary generalisation for any distance is carried out in the report under review and the corresponding numerical values are tabulated. In every position there is an increase in lift.

When one boundary is removed to infinity the results of the report 100 are reproduced, as should be the case.

Theory of Frahm Anti-Rolling Tanks. (O. Foppl, Ing. Arch., Vol. 5, No. 1, Feb., 1934, pp. 35-42.) (11.20/28837 Germany.)

The problem is stated and illustrated by diagrams. Simplifying approximations reduce the differential equation of motion to linear form, which is solved in the usual way.

Four references.

Airships

Russian Aircraft. (R. de l'Armée de l'Air, No. 54, Jan., 1934, pp. 68-72.) (12.30/28838 France.)

The U.R.S.S. are turning out a number of small semi-rigid airships, the Italian constructor Nobile (of Arctic fame) acting as consultant. These ships are fitted with Titan engines apparently imported from France.

L.Z. 129 Commercial Airship. (Luftwissen, Vol. 1, No. 1, 15/1/34, pp. 13-14.) (12.10/28839 Germany.)

The capacity of the ship is 190,000 m.³, almost double that of L.Z. 127. Both H₂ and H₂ are used, the former for manœuvring purposes.

Four Diesel engines each of 1,200 h.p. max. drive the airscrews. Two small auxiliary engines driving electrical generators are completely isolated from the rest of the ship. The whole of the power plant is controlled by the chief engineer from one control room.

Wireless

New Type of Thyatron Relay. (G. Babat, Proc. Inst. Rad. Eng., Vol. 22, No. 3, March, 1934, pp. 314-323.) (13.2/28840 U.S.A.)

A new form of Thyatron relay circuit is described. It is capable of delivering a direct current without interruption from an alternating current supply. An application of this circuit to photo-electric work is described.

Short and Ultra Short Electric Waves. (A. Scheibe, Phys. Zeit., Vol. 35, No. 5, 1/3/34, pp. 206-215.) (13.31/28842 Germany.)

A brief review is given of the development of radio transmission. The increase in the number of transmitting stations has required a wider range of wave lengths, first in the direction of increasing length up to 18 km., now in the direction of short wave lengths.

The elementary theory is stated and illustrated by diagrams.

Twenty-five references.

Optimum Operating Conditions for Class C Amplifiers. (W. L. Everitt, Proc. Inst. Rad. Eng., Vol. 22, No. 2, Feb., 1934, pp. 152-176.) (13.32/28843 U.S.A.)

Author's Abstract.—A theoretical analysis of the plate efficiency and output of a triode operating as a class C amplifier is made. A linear amplifier with any desired operating angle is described. Three cases in the operation of a triode as a class C amplifier are analysed for the load impedance which will give maximum output.

It is shown that for a given tube, plate voltage and plate loss, there is a definite value of load impedance, C bias, and grid excitation voltage, which will give maximum output. A rapid method of determining these optimum operating conditions is shown and checked experimentally.

Rectangular Short Wave Frame Aerial for Reception and Transmission. (L. S. Palmer and D. Taylor, Proc. Inst. Rad. Eng., Vol. 22, No. 1, Jan., 1934, pp. 93-114.) (13.4/28844 U.S.A.)

In a previous paper (see Abstract 25108) the parameters frame height/wave length and frame width/wave length were correlated with current received and observed critical values were accounted for on physical grounds.

The physical theory is now generalised for receiving and transmitting frames and it is shown that maximum current does not correspond to maximum radiation.

One reference.

Series-Phase Aerials. Marconi's Wireless Telegraph Co., Ltd. (Engineering, Vol. 138, No. 3581, 31/8/34, p. 235.) (13.4/28845 Great Britain.)

Inclined elements arranged in parallel produce a marked concentration of intensity along a parallel direction. The front mast should not be less than half the wave length. The rear mast need only be a few metres from the ground.

A four-element aerial shows gains of 12 to 15 decibels over a half-wave aerial. Radial spacing round a centre allows of selection of the direction of the beam without prohibitive size or cost.

A Compensated Thermionic Electrometer. (K. G. Compton and H. E. Haring, Bell Tele. B-780, 1933.) (13.5/28846 U.S.A.)

A method is described of compensating a single vacuum tube electrometer for variations in battery voltage by inserting an adjustable resistance in the negative lead of the filament. The compensated circuit shows satisfactory stability in comparison with two matched tubes. Uncompensated and compensated calibration records are shown graphically.

Without compensation a decrease of about 5 micro-amperes in the galvanometer circuit was produced by a decrease of 1 per cent. in the operative voltage. With the compensation resistance adjusted to the circuit, the change in the current was insensible. Currents of 10^{-17} amperes can be detected and measured.

Five references.

New Cathode Ray Oscillograph. (F. K. Harris, Bur. Stan. J. Res., Vol. 12, No. 1, Jan., 1934, pp. 87-102.) (13.5/28847 U.S.A.)

The cathode source of the stream of electrons is an oxide coated filament surrounded by a metal shield kept at the same potential with a plane surface, facing the anode and pierced by a small central hole. The anode is a cone truncated at the vertex which faces the cathode.

The focussing effect of this arrangement produces an intense beam of electrons passing through the hole in the anode along the axis of the tube. A focussing coil brings the stream to a focus at the screen. The stream passes through a diaphragm (which sharpens the focus), between the deflection plates and through a grid before striking the fluorescent screen. Between the grid and the screen a second acceleration is applied.

The brightness of the fluorescent spot is a function of the impressed voltage between the grid and the screen, increasing rapidly up to about 5 kv., beyond which it falls off asymptotically to a steady value. The intensified spot gives oscillograms which can be photographed directly.

Applied to the study of hysteresis loss in dielectrics, the instrument gives readings and brings out a relation between abnormal increase in hysteresis and approaching failure of the material which should throw light on the process of breakdown of dielectrics.

Ten references.

The Iconoscope (Image Viewer)—Television. (V. K. Zworykin, Proc. Inst. Rad. Eng., Vol. 22, No. 1, Jan., 1934, pp. 16-32.) (13.7/28848 U.S.A.)

Minute globules of silver deposited on a thin mica sheet are separated by the latter from a conducting plate and the whole is closed in a vacuum tube. The globules are photo-sensitive and emit electrons when exposed to light, the positive charge thus produced being proportional to intensity and to time of exposure, until saturation is approached.

The scene to be transmitted is focussed in the plate and produces a charge distribution on the mosaic, proportional to light intensity. The plate is scanned by an electron beam focussed to a small area (covering about twenty of the photo-electric elements) which discharges the elements successively at such a rate that the mosaic as a whole does not become saturated photo-electrically. Thus a rapidly variable discharge current from the common plate is superposed on a slowly varying current due to changes in the total illumination of the scene. These variations are amplified for transmission.

In scanning methods the time of illumination and the photo-electric charges are reciprocal to the number of picture elements, e.g., with 70,000 elements the illumination is $1/70,000$ that of continuous exposure. Hence, in principle, the charge produced by continuous exposure of the mosaic should be greater in this ratio. Actually 10 per cent. of the increase has been realised, giving a gain factor of several thousands.

Details of development and application are given with characteristic curves, diagrams of connection, and photographs of the complete apparatus.

Four references.

Television. (V. K. Zworykin, J. Frank. Inst., Vol. 217, No. 1, Jan., 1934, pp. 1-37.) (13.7/28849 U.S.A.)

Both translation and reproduction of the image are accomplished by special cathode ray tubes. The image is projected on a photo sensitised mosaic and transformed into a train of electrical impulses by means of a scanning beam of electrons, the electrical "memory" of the mosaic aiding the definition considerably. The impulses are transformed back into variations of light intensity at the receiving end by the bombardment of a fluorescent screen by a second beam of electrons. The synchronised signals are transmitted with the television signals.

Photographs of images obtained by this method show a high order of merit.

Six references.

Velocity Modulation Television System. (L. H. Bedford and O. S. Pickle, Inst. Elec. Engrs., Vol. 75, No. 451, July, 1934, pp. 63-92.) (13.7/28850 Great Britain.)

The principle underlying the method is to vary the brightness by varying the velocity of the scanning ray inversely as the brightness of the object scanned. It is restricted, therefore, to scanning a film behind which is a photo cell system, the output from which controls the speed of the scanning spot.

At the receiving end a ray of uniform brightness traverses a screen with velocity proportional to that of the scanning ray and reproduces the original object on obvious principles of physiological sight perception. The cathode ray oscillographs are the only instruments capable of such rapid variations in speed.

The details are necessarily complicated and are fully described. A mathematical theory is given. A discussion follows.

Thirty-four references.

Measurement of Photographic Densities by Photo-Electric Methods. (S. A. Boutry, Pub. Sc. et Tech., No. 38, 1934.) (13.7/28851 France.)

The measurement of photographic density is intimately connected with thickness of emulsion and optical quality of the glass plate. Details are given of the photo-electric circuits, in which a copper oxide rectifier was used to ensure stability.

One hundred and sixteen references.

Optical Measurement of the Type of Motion of a Piezo-Electric Oscillator in Fluids. (E. Hiedemann and H. R. Asbach, Phys. Zeit., Vol. 35, No. 1, 1/1/34, pp. 26-28.) (13.81/28852 Germany.)

A fluid transmitting high frequency sound acts as an optical grid. Three photographs are reproduced showing interference effects under impulses from a piezo-electric oscillator.

A direct measure of the distribution of energy in the whole fluid or in a thin layer is obtained by adjustment of the thickness of fluid illuminated. Comparison with Rayleigh's theory showed agreement to a first approximation only, which can be improved by modifications of the apparatus.

Nine references.

Supersonic Dispersion in Gases. (E. G. Richardson, Proc. Roy. Soc., Vol. 146, No. A.856, 1/8/34, pp. 56-71.) (13.81/28853 Great Britain.)

The propagation through various gases of supersonic waves emitted by piezo-electrically maintained quartz crystal is examined experimentally. The anomalous dispersion observed may be due to one or more of three factors:—

- (a) Lag in the transfer of energy between the different degrees of freedom of the molecule.
- (b) Resonant or selective absorption.
- (c) Abnormal viscosity under high frequency.

No definite conclusions are reached as to the relative importance of these factors, nor is it definitely known what happens to the absorbed energy. Some evidence is adduced to show that the latter is largely scattered by the gas.

Twenty-five references.

Photography

Objective Visibility Meter. (L. Bergmann, Phys. Zeit., Vol. 35, No. 5, 1/3/34, pp. 177-179.) (14.30/28854 Germany.)

Reference is made to Wigan's apparatus, which depends on the insertion of clouded glasses between eye and object until visibility just vanishes.

In the present apparatus a selenium transition layer photo-cell is employed with sensitivity distributed over the visible spectrum in approximate proportion to that of the eye. A beam of light interrupted by a stroboscopic shutter is partly transmitted through a glass plate at 45° to a distant mirror and returned to a selenium cell, partly reflected on to a similar selenium cell. The cells thus receive rays which have passed over a long and short air path. The short ray is stopped by an iris diagram until the opposed currents just balance.

The variable currents are transformed and pass through a rectifier to a galvanometer. Since only the variable parts of the current are transmitted by the transformer, the apparatus is not affected by steady light and can be operated by day or night.

Five references.

Photographic Emulsion—Notes on Stability of Finished Plates. (B. H. Carroll, D. Hubbard and C. M. Kretchman, Bur. Stan. J. Res., Vol. 12, No. 2, Feb., 1934, pp. 223-230.) (14.60/28855 U.S.A.)

Deterioration on storing may be due to "after-ripening." Fog at the edge of the plate may be due to the migration of the soluble bromide during the drying process, which normally begins at the edges. If the drying is irregular, definite patterns may form on the plates, showing the position of eddies where the drying was slowest.

A number of organic compounds act as preservatives of photographic materials. Chief amongst these is Nitrobenziminazol. Their action is not yet perfectly understood.

Acoustics, Noise Reduction, etc.

Acoustical Device for Finding the Position of Aircraft. (Barbier, Bénard and Turenne, L'Aéron., No. 177 (Bulletin), Feb., 1934, pp. 16-21.) (15.26/28856 France.)

A sound detector follows the motion of the aircraft. By means of a series of linkages a circular spot of light travelling on a glass sheet gives the instantaneous position of the aircraft, with automatic corrections for aberration, time lag and parallax.

The instrument forms the subject of French Patent No. 687246. It appears that a more recent design, unpublished, gives temperature and wind corrections.

The Acoustical Insulation Afforded by Double Partitions Constructed from Similar Components. (J. E. R. Constable, Phil. Mag., Vol. 18, No. 118, Aug., 1934, pp. 321-343.) (15.38/28857 Great Britain.)

An increase in the air spacing between double partition walls may decrease the acoustical damping. A range of frequencies was found over which double glass windows gave less acoustical damping than a single window.

Five references.

Noise Reduction in Cabin Aeroplanes. (P. R. Bassett and S. J. Zand, Trans. A.S.M.E., Vol. 56, No. 2, Feb., 1934, pp. 49-56.) (15.38/28858 U.S.A.)

A tuning fork is set in vibration at a fixed distance from the ear and is compared with the noise to be measured. The time is measured, by stop watch, in which the intensity sinks until it is masked by the noise.

The fork has been calibrated in decibels for initial sound intensity and damping. By using a series of tuning forks of different pitches, an analysis of the frequency distribution is obtained. Over a large number of readings this simple apparatus agrees within ± 2 decibels with an elaborate noise meter measuring sound intensity directly.

In a large passenger machine insulation of the engine mounting and cabin structure, and acoustically filtered ventilation reduced the noise level from 97 decibels to 76 decibels.

Seven references.

Sound Insulating Properties of Plastic Fluid and Granulated Materials. (A. Gemant, Phys. Zeit., Vol. 35, No. 5, 15/2/34, pp. 167-171.) (15.38/28859 Germany.)

The small scale apparatus described and shown in sketch is suitable for testing circular plates of material of 20 cm. diameter and about 2 mm. thickness. A loud speaker and a microphone are fixed in the sending chamber, and microphone in the receiving chamber. The microphones set up e.m.f.s, the squares of which are proportional to the sound intensities.

Numerical results are shown graphically for rigid plates, shell oil, vaseline and water, and for various powdered substances.

Three references.

Accidents and Precautions

Damage to Aircraft by Lightning. (W. Brintzinger and H. Viehmann, Luftwissen, Vol. 1, No. 2, 15/2/34, pp. 32-35, D.V.L. Report No. 363.) (16.30/28860 Germany.)

With improved blind flying by instrument, reports from aircraft struck by lightning have become more numerous, fortunately without serious damage in most cases.

A descriptive account is given of the electrical field in which an aeroplane may be struck. The mean discharge current may be as great as 7×10^6 amperes, the duration as long as 1/1,000th second. A discharge of 50 coulombs (ampere-seconds) in 1/1,000 second will produce a rise of temperature of 500°C. in a conductor of 7 mm.² copper, 16 mm.² aluminium or 20 mm.² iron. Control wires, bracing wires and metal coverings of ordinary dimensions are therefore safe from fusion.

The path of the current is not determined principally by conductivity, but by local reactance and capacity. Points of entry and exit and points of passage from one conductor to another across a gap of air (or other dielectric) are dangerous from the formation of arc flames with a temperature of many thousand degrees. Protection from such arcing is obtained by bonding, particularly the wireless antennæ and other metal parts.

Methods of recording the voltage are discussed and a record is reproduced from an artificial reproduction of lightning effects. A photograph of damage by arcing from a wireless lead-in to metal frame is shown.

Eleven references.

Hazards to Aircraft Due to Electrical Phenomena. (N.A.C.A. Tech. Note No. 494, March, 1934.) (16.30/28861 U.S.A.)

Risks to aircraft from atmospheric electricity are discussed. If trailing antenna and cables are reeled in there is little danger of serious damage to an aeroplane or aircraft with a metallic network properly bonded.

One reference.

Researches on Lightning Discharges Striking Aeroplanes. (R. de l'Armée de l'Air, No. 56, March, 1934, pp. 325-340.) (16.30/28862 France.)

Experiences of pilots "struck" during flight are given. High tension experiments were carried out in U.S.A. on the ground on model and full scale aircraft. Some experiments were also carried out with balloons.

The risk of damage to the structure of an aeroplane by a lightning discharge is small, with suitable bonding. If the discharge passes close to the pilot it may impose a nervous shock, not necessarily fatal in itself, but leading to temporary loss of control, with possibly fatal results. Lightning conductors should therefore be disposed so as to carry the discharge at a distance from the pilot.

Aircraft, Unorthodox

Vertical Flight. (H. H. Platt, J.R. Aer. Soc., Vol. 38, No. 282, June, 1934, pp. 507-514.) (17.05/28863 Great Britain.)

Estimates of the specific power required for vertical flight are shown graphically by illustrative curves.

A brief account is given of the cyclogiro, and figures are quoted from estimates in an N.A.C.A. Technical Note.

Two references.

Aerodynamic Analysis of the Gyroplane Rotating-Wing System. (J. B. Wheatley, N.A.C.A. Tech. Note No. 492, March, 1934.) (17.05/28864 U.S.A.)

The gyroplane is distinct from the autogyro. The rotor consists of four blades rigidly connected in opposing pairs and rotating freely under the air forces about an approximately vertical axis. Each blade pair is mounted in bearings at the hub which permit them to oscillate or feather freely about the bearing axis or feathering axis.

The author puts forward a mathematical analysis of the aerodynamics of the gyroplane. [The rotation of opposing blades as a rigid unit clearly increases the incidence of one blade and reduces the incidence of the other by equal amounts.]

Five references.

The Stipa Aeroplane. (J. Lacaine, L'Aéron., No. 176 (Suppmt.), Jan., 1934, pp. 3-8.) (17.30/28865 France.)

A comprehensive summary is given of the aerodynamical investigations of L. Stipa in connection with his aeroplane.

The tubular fuselage is designed to accommodate the wake of the airscrew without imposing any normal pressures, and has first a contraction, then a divergence, of the hollow section of rotation in accordance with airscrew calculations. Observed lift drag and distribution of pressure are plotted for a complete model.

Photographs show the aeroplane in flight, and a table of characteristics and performance is given. A set of six photographs shows the streamlines round and through a model, with and without engine, at different angles of incidence. Two- and three-engine models with double and triple tubular fuselages are shown.

A 120 h.p. experimental machine has been built, and the performance is comparable with machines of normal design.

Man-Power Flight. (E. Everling, Luftwissen, Vol. 1, No. 2, 15/2/34, pp. 35-38.) (17.40/28866 Germany.)

The available power of human muscles is set as high as 2.5 h.p., but even this is insufficient to maintain in the air the weight of pilot and machine. A flapping machine is described and shown in a flapping glide. (See Abstract 28867.)

Seven references.

Possibility of Flight by Muscular Power. (H. Haessler, Flugsport, Vol. 26, No. 1, 10/1/34, pp. 2-6.) (17.40/28867 Germany.)

It is estimated that a trained athlete weighing 60 kg. is capable of exerting 1.2 h.p. for one minute pedalling an airscrew. It is proposed to catapult into the air a glider with the pilot in a recumbent position, in the expectation that he could maintain flight for about a minute.

End Plates on Glider Wings. (W. Fiedler, Flugsport, Vol. 6, No. 2, 24/1/34, pp. 27-29.) (17.40/28868 Germany.)

The wings of the Fledermaus F.1 had a span of 16.6 m., area 15.15 sq. m., mean chord 0.93 m. Vertical hinged flaps were fitted at the wing tips and set at 5° yaw angle (apparently outwards). Increase in yaw angle of the flap produces increase in drag and sets up a yawing moment. The air reaction acts outwards from the centre of curvature of the aeroplane's path, against side-slipping. The induced resistance of the wing as a whole is decreased.

The flaps can be used together as air brakes to reduce the gliding angle in a forced landing. No comparative test figures are given.

Aerodynamics and Hydrodynamics

Experiments on Settling of Airborne Dust. (E. Kilb, F.G.I., Vol. 5, No. 1, Jan./Feb., 1934, pp. 6-13, and No. 2, March/April, 1934, pp. 89-94.) (22.0/28869 Germany.)

Particles were separated by sifting through sieves of 10, 20, 24, 40, 50, 70 and 80 meshes per cm., giving corresponding fractions. Various fractions were allowed to fall in a chamber with still air free from convection currents.

A photograph shows two "targets" with approximately circular symmetry, and sets of curves show frequency distributions not far from normal error curves, for different heights of fall and mean particle size. Plotting dispersion against height of fall on a logarithmic scale gives slightly curved loci. Straight lines would correspond to an approximate fit by the exponential function with appropriate parameters.

The distribution in a turbulent jet of air is also examined experimentally. A photograph shows an elongated approximately elliptical "target." Frequency distributions are analysed numerically and the results are tabulated.

In Part II non-dimensional parameters are discussed, with a view to applying the results to full scale conditions.

Nineteen references.

The Coefficient of Resistance as a Function of Reynolds Number for Solids of Various Shapes. (H. Wadell, J. Frank. Inst., Vol. 217, No. 4, April, 1934, pp. 459-490.) (22.10/28870 U.S.A.)

The influence of departure from circular sections on resistance is shown graphically. The results have applications in industrial processes depending on sedimentation.

Sixty-five references.

The Vertical Oscillations of Floating Bodies. (A. Dimpker, W.R.H., Vol. 15, No. 2, 15/1/34, pp. 15-19.) (22.10/28871 Germany.)

Four cylinders of different cross-sectional forms, and of length a few mm. less than the tank width, were constrained to oscillate in a vertical plane under spring control. The mounting of the apparatus is shown in a diagrammatical sketch. The four sections were a circle, a rectangle with a semi-circle on lower face, an equilateral triangle with vertex downwards, and a flattened rectangle with rounded corners. Free and forced oscillations and wave formations were observed.

Approximate methods of calculation are developed and discrepancies were expressed in terms of apparent mass. The period, coefficient of damping (observed), and apparent mass (calculated) are shown graphically as functions of the maximum depth of immersion; for small frequencies and amplitudes the waves formed were parallel to the cylinder, but for larger amplitude, "against all expectation," transverse waves were formed of which examples are shown in three photographs.

Motion of an Elliptic Cylinder Through a Viscous Fluid. (G. J. Richards, Phil. Trans. Roy. Soc., Vol. 233, No. A.726, 18/7/34, pp. 279-301.) (22.10/28872 Great Britain.)

A list of mathematical and experimental papers is given.

The two-dimensional equations of viscous fluid motion are put in undimensional form and transformed, in a manner due to Bairstow. A formal integration introduces an arbitrary harmonic function (as a consequence of the elimination of the pressure in the usual way).

A method is described of determining the actual streamlines by stroboscopic photography of small carrier particles under high illuminations. The harmonic function referred to is determined from values at two contours—experimental values along the elliptic boundary and known values at infinity.

Methods of integration on the assumption of steady motion are described, and the calculated values are compared with experiment. Agreement is found only in the upstream field of velocity where the field is steady. Downstream the formation of eddies obviously renders the assumption invalid.

Six photographs are reproduced and show velocity fields, particularly the vortex street behind the cylinder.

The Flow Process of Glass in Melting Furnaces. (A. Schild, Z.V.D.I., Vol. 78, No. 13, 31/3/34, pp. 411-414.) (22.10/28873 Germany.)

The flow of glass in the furnace takes place under very small Reynolds number and can be studied by the use of hydraulic models.

Five references.

New Quantitative Experiments on the Generation of Turbulence. (L. Schiller, Z.A.M.M., Vol. 14, No. 1, Feb., 1934, pp. 36-42.) (22.15/28874 Germany.)

Experiments on tubes with various forms of entry led to the view that general turbulence is set up when the circulation in the vortices carried down the tube reach a certain limiting value. The wave length of the disturbance is an important factor.

The results are compared with observations of flow over a flat plate.

Eight references.

Turbulence and Skin Friction. (T. v. Karman, J. Aer. Sci., Vol. 1, No. 1, Jan., 1934, pp. 1-20.) (22.15/28875 U.S.A.)

Consideration is given to the effect of roughness. A "roughness scale" for materials used in practice is required and further study should be given to the transition ranges in which both the Reynolds number and the roughness parameter influence the friction.

Twenty-four references (since 1930).

Skin Friction Correction. (L. Bairstow, Airc. Eng., Vol. 6, No. 67, Sept., 1934, pp. 245-246.) (22.15/28876 Great Britain.)

A brief resumé covers much the same ground as the previous Abstract (see Abstract 28875).

Reference is made to the remarkable results of Nikuradse on artificially roughened pipes, in which the introduction of a roughness parameter reduces a number of experimental curves to a single unicursal curve in appropriate non-dimensional co-ordinates.

Thirty-three references.

Resistance of Rough Plates. (L. Prandtl and H. Schlichting, W.R.H., Vol. 15, No. 1, 1/1/34, pp. 1-4.) (22.15/28877 Germany.)

The experimental results obtained by Nikuradse on flow in rough pipes (Forschungsheft No. 361, see Abstract 27678) are quoted in terms of the parameter r/k , where r is the radius of a pipe, k the mean amplitude of the roughening of the surface. For a flat plate Reynolds number is expressed in terms of k and of a velocity parameter defined as the square root of the ratio of the tangential pressure on the walls to the density.

Four distinct ranges are covered by numerical values of the Reynolds number thus defined:—

$$R = \infty, 71, 14, 7.1, \text{ zero.}$$

They are designated as completely rough, second transition range, first transition range and hydraulically smooth.

Extensive transformations of semi-empirical formulæ are carried out and the expressions obtained are tabulated numerically.

Graphical charts are given which enable numerical values of local and total resistance to be read off.

Four references.

Distribution of Hydraulic Energy in a Free Stream Dropping Vertically. (C. Rappert, Z.V.D.I., Vol. 78, No. 1, 6/1/34, p. 31.) (22.2/28878 Germany.)

Using the impulse theorem a simple relation is obtained between the total pressure, potential energy, mean speed and thickness of the jet. The formula is verified by experiment.

Two references.

Relation between the Temperature Coefficient of Viscosity and the Association of High Molecular Liquids. (B. Yamaguchi, Aer. Res. Institute, Tokyo, Report No. 102 (Vol. 8, No. 6), Feb., 1934.) (22.2/28879 Japan.)

The viscosity is expressed as a product of a constant coefficient and two functions depending on the molecular associations and the molecular structure.

Increase of concentration of a polar solute in a non-polar solvent increases the molecular associations, not necessarily affecting the molecular structure. With increased concentration an increase in viscosity due to molecular association is superposed on the linear increase due to increased proportion of polar molecules. Increase of temperature decreases the molecular association likewise without necessarily affecting the molecular structure.

These simple considerations lead to useful correlations over a wide range of experimental facts. Extensive data are given in tables and curves and exhibit viscosity relations of fifteen lubricating oils and of ten other organic substances, including para rubber.

In particular a physical explanation is suggested for the well known fact that oleic acid and the fatty oils have a low temperature coefficient of viscosity. The same holds true for voltol oils and lubricating oils made by the polymerisation of olefines. The low temperature coefficient of viscosity of rubber solution is also of interest.

Investigation of Errors in Flow Through Standard Orifice Due to Inaccurate Mounting. (Fr. Kretschmer and G. Walzholz, F.G.I., Vol. 5, No. 1, Jan./Feb., 1934, pp. 25-35.) (22.2/28880 Germany.)

Coefficients of flow, the flow being taken as proportional to the square root of the pressure drop across the diaphragm, are examined for errors due to faulty mounting. The values of the coefficients derived from direct measurement are compared with the values given by German standard rules and the errors are analysed as far as possible and tabulated for systematic changes in the variables, diameter of pipe, diameter of perforation in diaphragm, thickness of diaphragm, roughness of pipe walls, etc. In general the error lies within the given tolerations, but in certain cases exceeds them.

Fourteen references.

Coefficient of Discharge of Standard Nozzles and Orifices under Inflow and Outflow Conditions. (E. Stach, Z.V.D.I., Vol. 78, No. 6, 10/2/34, pp. 187-189.) (22.2/28881 Germany.)

The air meter is usually inserted at some distance from the end of the pipe line, but in certain conditions it is necessary to place it at the end. The author has compared the coefficients of discharge obtained under both conditions.

With inflow the discharge coefficient was found to be constant, both for nozzle and orifice, provided Re exceeded 0.55×10^5 . Its value exceeds slightly the standard value. Under outflow conditions the variations with Re are greater. The maximum difference from the standard mounting may amount to ± 1.5 per cent.

Two references.

Friction of Water Circulating in Water-Tube Boilers. (E. Schmidt, P. Behringer and W. Schurig, Forschungsheft, No. 365, March/April, 1934.) (22.2/28882 Germany.)

Experiments were carried out at pressures up to 40 atmospheres on a boiler consisting of four tubes arranged in the form of a rectangle, the two longer limbs being vertical. One of these was heated electrically and the circulation was measured by an orifice meter placed near the lower end of the other vertical limb.

The heat transfer coefficient was found to be practically independent of the rate of circulation, showing that the scrubbing action is entirely due to steam bubbles. The friction of the mixture of steam bubbles and water was measured directly by the apparent loss of weight of a thin brass liner supported inside the vertical boiler tube.

Thirty-three references.

Oscillations of a Plate at the Surface of a Fluid. (A. Dimpker, Ann. d. Phys., Vol. 19, No. 3, Feb., 1934, pp. 225-251.) (22.35/28883 Germany.)

The problem is first restricted to a periodically "loaded line" and is then extended to a loaded plate of finite breadth. The initial and boundary conditions are defined in an arbitrary manner, so as to facilitate solution of the two-dimensional problem, which is obtained by application of Fourier integrals, Bessel functions and Fresnel functions. The results obtained by Cauchy and Poissons are recorded.

The experimental installation in the latter part of the paper is mounted as described in the author's paper abstracted above (see Abstract 28871).

The observed values are plotted for comparison with computed values and show satisfactory agreement of the main wave, with superposed harmonics with amplitude of the order of 11 per cent. of the fundamental. A photograph shows waves produced experimentally.

Four references.

Surface Tension Measurement by Ripples. (H. E. Becket and H. Sheard, J. Sci. Inst., Vol. 11, No. 7, July, 1934, pp. 214-216.) (28884 Great Britain.)

A description is given of an optical apparatus for viewing standing ripples on the surface of a fluid of known density. From the observed frequency and wave length the surface tension is calculated by Kelvin's formula. The results have an error of the order of $1\frac{1}{2}$ per cent.

Wind Channel Tests on Air Resistance of Railway Trains. (G. Vogelpohl, Z.V.D.I., Vol. 78, No. 5, 3/2/34, pp. 159-167.) (22.4/28885 Germany.)

A model train of German corridor express coaches of orthodox modern designs was suspended close to a model of the permanent way attached to a plate. The plate was fitted with a stationary streamline nose and tail pieces between which the model could oscillate. The resistance of a single coach was measured in different positions in the train. The shape of the coach ends had a predominant effect on the resistance.

Experiments in a water channel with flat sectional models gave two dimensional configurations of flow for different shapes. The amount of ventilating air entering the coaches, especially through open windows, was an important factor.

Goods trains with open empty trucks showed greater resistance than with covered trucks.

By designing the spacing and ventilation in accordance with these experiments, without departing from orthodox design, the air resistance could be reduced by about 25 per cent.

Thirty-two references.

Wind Pressure on Chimneys. (R. Fleming, Engineering, Vol. 138, No. 3577, 3/8/34, pp. 123-5.) (22.4/28886 Great Britain.)

The assumed wind pressure coefficients for various chimneys are given. Reference is made to a list of tall chimneys, including the 752ft. chimney built in 1917 at Tacoma, Washington.

Experimental aerodynamical results are quoted in relation to Reynolds number, and working formulæ are given.

Eighteen references.

Influence of Neighbouring Structure on Wind Pressure on Tall Buildings. (C. L. Harris, Bur. Stan. J. Res., Vol. 12, No. 1, Jan., 1934, pp. 103-118.) (22.4/28887 U.S.A.)

A photograph shows a model of the Empire State Buildings and of neighbouring buildings, the former pierced by pressure orifices distributed at three different levels.

Pressure distribution and resultant forces and bending and torsional moments were measured in the roof wind channel and are recorded graphically and in tables, the distribution being quite different from the usual assumptions.

Shielding is greatest when the shield is up stream, and the shielded area is not so high as the shield. The coefficient of resistance was found to be 0.0038 in ft. lb. (gravitational) units.

Some recommendations are given for designers.

Eight references.

Drag of Streamline Bodies. (M. H. Lyon, Airc. Eng., Vol. 6, No. 67, Sept., 1934, pp. 233-239.) (22.4/28888 Great Britain.)

A concise summary is given of results accumulated by years of patient research. Rational results for laminar flow and semi-empirical results for turbulent flow are combined to yield the total drag of the tangential force.

The effects of previous turbulence remain obscure, and due caution is observed in the interpretation and application of model and full scale experiment to design.

Twenty references.

Measurement of Velocity Variations in Turbulent Flow. (L. F. G. Simmons and C. Salter, Proc. Roy. Soc., Vol. 145, No. A.854, 2/6/34, pp. 212-234.) (22.45/28889 Great Britain.)

The peculiarities of hot wire instruments are discussed, and Kuethé's formula for time lag is quoted. The sensitivity of the circuit is improved by amplification and separation of high frequency effects. A diagram of connections shows the general arrangement, and formulæ are given for the relevant characteristics.

An oscillograph is controlled by the current, and the beam traverses a band on a sensitive plate repeatedly. The density of the band is measured in accordance with previous calibration and determines the duration distribution of the variable component of velocity. Methods of reducing and transforming the results are fully described.

Application was made to the analysis of free stream turbulence and to the eddy formation behind a grid in a 1ft. channel at a speed of 5.3ft. per sec. at

various distances downstream. Close behind the grid the wake of each strip is clearly marked. Some 10ft. downstream the distribution of the eddy components appears to approach the normal error curve.

Two references.

Researches Carried Out in the Physical Laboratory of the French Air Ministry. (L'Aéron., No. 178 (Bulletin), March, 1934, p. 28.) (22.45/28890 France.)

Heating in the boundary layer at high air speeds is measured by thermocouples at centre and periphery in the surface of a rotating disc. A high speed sliding contact is required.

A temperature rise of 4°C. was found to correspond to a peripheral speed of 100 m. per sec.

Turbulent Diffusion of a Jet. (E. Forthmann, Ing. Arch., Vol. 5, No. 1, February, 1934, pp. 42-54.) (22.5/28891 Germany.)

The wind channel and measuring apparatus are shown in photographs and sketches. Pitot-mean velocity distributions are plotted graphically and reduced to a unicursal curve with small scattering by introduction of non-dimensional parameters (see Abstract 27674).

An interesting result is the distribution of apparent mean shear across a jet with a free air boundary on one side. Pitot-mean axial velocity distribution is also plotted for a sudden widening in the channel. Semi-empirical expressions are developed and transformed in the manner of Prandtl, v. Karman, and others.

Nine references.

Turbulence in the Flow of Air Through a Pipe. (H. C. H. Townend, Proc. Roy. Soc., Vol. 145, No. A.854, 2/6/34, pp. 180-211.) (22.5/28892 Great Britain.)

A series of sparks between very fine electrodes heats a succession of small volume elements which are observed by the refraction of a beam of light.

By suitable optical arrangements the beam is rendered convergent, preferably by concave mirrors, and the image reduced to the size of a cinema film.

A photograph shows the installation, and examples of records are reproduced. The records were used to analyse the turbulence in air flow, and the distribution of the observed velocity components is compared graphically with the normal error curve. Comparison with ultramicroscope observation showed satisfactory general agreement, with anomalies at low values of one component near the axis.

The turbulent kinetic energy is expressed as a fraction of the total kinetic energy for small tubes of mean flow and appears to be less than 3 per cent. of the total.

Comment is made on an approximate theory suggested by v. Karman, from which it appears that considerable modifications will be required to bring it into line with experiment.

Eight references.

Materials, Elasticity and Plasticity

Destruction of Materials by Cavitation. (H. Schröter, Z.V.D.I., Vol. 78, No. 11, 17/3/34, pp. 349-351.) (23.0/28893 Germany.)

Samples of various substances were exposed to a stream of water with a velocity of 40 to 60 m. per sec., under conditions favouring cavitation. Loss of weight was measured and surface pitting examined. Sensible changes were observed in heat-treated alloy steels after 48 hours' exposure, and in lead after one minute. Rubber was destroyed in about three minutes.

The effects are restricted to the region of collapse of vapour-filled bubbles in contact with the test piece. The impact forces are not sufficiently great to account for the direct destruction of the surface and electro-chemical reactions must take place.

Two references.

Extensions of Prandtl's Membrane Analogy. (W. Bauersfeld, Ing. Arch., Vol. 5, No. 1, February, 1934, pp. 69-82.) (23.0/28894 Germany.)

The well-known analogies between the slope of an elastic membrane torsion field of stress and streamlines are discussed fully, in particular the velocity field round an aerofoil with circulation imposed on irrotational flow.

The contours are rendered visible by narrow sheets of intense light. Two velocity fields with tangential motion at the trailing tip are reproduced. Applications to the velocity field round turbine blades set radially are also discussed, and the mounting of the experimental apparatus is shown in sketches.

Eleven references.

Allowable Working Stresses Under Impact. (N. N. Davidenkoff, Trans. A.S.M.E., Vol. 56, No. 3, March, 1934, pp. 97-107.) (23.10/28895 U.S.A.)

This paper by the Head of the Mechanical Department of the Leningrad Technical Institute gives a summary of European research.

The yield point and tensile strength of a material under impact are always greater than those given by low speed tests. The working range should, however, remain within static limits. Impact tests on notched specimens cannot be used to determine allowable stresses.

The paper is followed by a useful discussion.

Fifty-five references.

Sensitivity of Materials to Notch Test. (W. Buchmann, F.G.I., Vol. 5, No. 1, Jan./Feb., 1934, pp. 36-48.) (23.10/28896 Germany.)

Ultimate strengths of ten steels subjected to tensile and bending tests under static and alternating loads are given in numerical tables. Stress optical methods are illustrated by a glass model.

A wide range of applications is considered, and numerical results are given graphically. Applications to design are discussed.

Twenty-six references.

The Testing of Materials. (F. Korber, Z.V.D.I., Vol. 78, No. 6, 10/3/34, pp. 195-199.) (23.10/28897 Germany.)

Tests to destruction of composite engineering products are expensive and of doubtful value, since it is difficult to reproduce working conditions. Factors of importance are—rate of application and distribution of load, vibration and corrosion. Information from test pieces in the laboratory must be used with discretion.

Stress optical methods give useful indications of stress distribution in the final product under working conditions. Recently X-ray investigation has also produced useful results.

Eleven references.

Present Stage of Development of Non-Destructive Methods of Material Testing. (X-ray and gamma radiation.) (R. Berthold, Z.V.D.I., Vol. 78, No. 6, 10/2/34, pp. 173-181.) (23.10/28898 Germany.)

X-ray investigation of the internal condition of engineering products has developed rapidly. It is now current practice for examination of light alloy

castings, high pressure steel bottles, reinforced concrete, steel cables, welds, adhesion of bearing metals, etc.

More recently radium preparations have been applied to the examination of inaccessible parts. Various forms of apparatus are described, and consideration is given to the reduction of secondary radiation—which produces disturbing effects.

Thirty-eight references and twenty-one photographs.

Distribution of Stress in Rotating Plastic Disc. (H. Schlichting, *Ing. Arch.*, Vol. 5, No. 1, February, 1934, pp. 7-24.) (23.10/28899 Germany.)

Simple non-linear forms of stress-strain relations are assumed and the elastic equations are modified accordingly. The modified differential equation for a rotating disc is formed and solved by approximate methods.

The lengthy expressions obtained involve a large number of approximate numerical coefficients. The results are shown graphically in thirteen diagrams. The angular velocity of rupture may be computed from the final equations.

Twenty-five references.

Determination of Peak Stresses in Shafts Under Torsion, Using an Electrical Model. (A. Thum and W. Bantz, *Z.V.D.I.*, Vol. 78, No. 1, 6/1/34, pp. 17-19.) (23.10/28900 Germany.)

Even in two-dimensional problems, the solution of the differential equation of elastic deformation is prohibitive unless the boundary conditions are of a few special types. The author describes a simple apparatus which gives analogous two-dimensional fields of electric potentials. Alternating current is led into a shallow trough filled with water, the boundary of the trough being similar to the section.

Peak stresses are indicated by crowding of isopotential lines.

Fourteen references.

Faults in a Material Yielding to Shear Stress while Retaining its Volume Elasticity. (G. I. Taylor, *Proc. Roy. Soc.*, Vol. 145, No. A.854, 2/6/34, pp. 1-18.) (23.10/28901 Great Britain.)

Plastic substances are classified according as the maximum stress increases or decreases after local yielding first appears. In the former case the stress on the volume element which has yielded locally increases less rapidly than on the other elements, and the plastic deformation tends to distribute the stresses equally.

In the second case the element which has yielded loses its shear strength completely and throws increased stresses on the remaining elements. A mathematical theory of strain and failure has been constructed on the second hypothesis and is applied in explanation of the rules given by v. Mises and Mohr.

The theory also predicts the propagation of cracks along their initial direction, both when parallel to and at 45° with the principal stresses.

Six references.

Yield Points of Mild Steel Beams Under Uniform Bending. (F. Nakanishi, M. Ito and K. Kitamura, *Aer. Res. Institute, Tokyo, Report No. 104* (Vol. 8, No. 8), March, 1934.) (23.30/28902 Japan.)

In tensile mild steel beams of T section, usually the material on one side of the axis yields before the material on the other side. This produces two distinct yield points which are shown on four experimental stress-strain diagrams. These points are calculable on simple assumptions and a satisfactory fit is obtained with experiment.

Nomograms for Dimensioning of Compression Rods of Tubular Section. (W. Lohmann, Z.V.D.I., Vol. 78, No. 12, 24/3/34, pp. 386-387.) (23.30/28903 Germany.)

The nomograms apply to three standard qualities of steel tubing for ranges of 30-200 mm. mean tube diameter, 1 mm. to 25 mm. gauge thickness, 0.4 to 10 tons buckling loads, and 0.5 to 15 metres buckling length.

For each specified quality of steel the corresponding values of diameter, length, gauge and buckling load are read off.

Three references.

Stability of Elastic System Under External Forces Affected by the Deformation. (Carlo Minelli, L'Aerotecnica, Vol. 14; No. 1, Jan., 1934, pp. 3-26.) (23.40/28904 Italy.)

The energy criteria of Bryan and Timoshenko is restricted to arbitrary external forces. The present paper extends the results to the case where the external forces are functionally connected with the strains.

Elementary examples are constructed to illustrate the principles. The method is applied to a wing in torsion, the angle of torsion about the axis of torsion being taken as an independent variable.

The equation of energy is formed in the usual way, and approximate solutions are obtained by expansion of the torsion in terms of distance along the wing span. Comparison with more rigorous formulæ shows that sufficient accuracy for technical purposes is attained by comparatively elementary mathematical analysis.

Seven references.

Developments in Aircraft Construction. (H. J. Pollard, J.R. Aer. Soc., Vol. 38, No. 283, July, 1934, pp. 652-686.) (23.41/28905 Great Britain.)

The strength of thin sheets with flanges or stiffeners is discussed at length, and examples of the type of failure at buckling load are shown in photographs. The elements of an approximate theory are stated. Welding and riveting are considered briefly from the constructor's point of view. Corrosion is briefly referred to.

A discussion brought out the difficulties of establishing a more complete theory and elicited the views and some experiences of other designers.

Twenty-three references.

Structural Analysis by Electrical Analogy. (V. Bush, J. Frank. Inst., Vol. 217, No. 3, March, 1934, pp. 289-330.) (23.45/28906 U.S.A.)

The linear differential equations with constant coefficient of internal strain energy lead to systems of equations of the same form as for corresponding electrical networks, and the solution depends on identical systems of linear equations.

By setting up electrical circuits and measuring the currents, numerical values are obtained experimentally (see Abstract 28907).

Five references.

Miscellaneous

Mallock Electrical Calculating Machine. (Engineering, Vol. 137, No. 3571, 22/6/34, pp. 698-700.) (28907 Great Britain.)

Let n shorted electrical circuits be interlinked with $(n+1)$ magnetic circuits and let a_{pq} be the number of turns of electrical circuit p interlinked with magnetic

circuit q , then an induced flow in magnetic circuit q produces e.m.f.'s in the electrical circuits, satisfying the linear equation:—

$$a_{1q}\rho_1 + a_{2q}\rho_2 \dots + a_{n+1,q}\rho_{n+1} = 0.$$

The e.m.f.'s $e_1 \dots \rho_{n+1}$ are read off a volt meter.

Applying this to each circuit in turn we obtain the numerical solution of the system of simultaneous linear algebra

$$\begin{aligned} a_{11}\rho_1 + \dots + a_{1,n+1}\rho_{n+1} &= 0 \\ a_{n1}\rho_1 \quad a_{n,n+1}\rho_{n+1} &= 0. \end{aligned}$$

The coefficients can be set from $-1,000$ to $+1,000$.

Mechanical and electrical details are described and illustrated by diagrams and photographs. The voltage errors due to resistance drop are of the order of $\frac{1}{4}$ per cent.

Refinements of method, compensations and second approximations reduce the final errors, and powerful checks are easily made. Other applications are described and the suggestion is made that a central office be set up where solutions are carried out for a clientele which is potentially at least already in existence.

Applied Mechanics Congress—Summaries of Papers of 4th International Meeting.
(Airc. Eng., Vol. 6, No. 66, Aug., 1934, pp. 215-219.) (28908 Great Britain.)

Useful summaries of 25 papers are given.