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Aircraft Design, etc.

Ideal Aeroplane Polar Characteristic in Relation to Load Factor. (A. R. Weyl, Z.F.M., Vol. 24, No. 14, 28/7/33, pp. 383-385.) (5.10/27501 Germany.)

Consideration is given to the practicability of "spoiling" the aerodynamic characteristic outside the operating range lying between the maximum horizontal speed and the maximum climbing speed. In this way rigid regulations, imposing load factors for improbable conditions of diving and flattening out, could be met with appreciable saving in structural weight.

Flight Measurements of the Effect of Surface Roughness. (H. Ebert, Z.F.M., Vol. 24, No. 19, 14/10/33, p. 529-532. D.V.L. Report, No. 343.) (5.10/27502 Germany.)

Polar curves of lift drag relations are given for test flights under different conditions—full throttle, zero thrust, and horizontal flight, with different wing fabric finish.

Gliding polars are compared for different types of surface. The highest resistance and lowest lift is shown by an aeroplane with corrugated sheet wing covering, the lowest resistance and highest lift by an aeroplane with highly finished wing and body fabric surfaces, especially at large wing incidence.

The pitch of the airscrew appears to have little influence on the flying resistance.

Influence of Wind on Starting Flight. (G. Mathias, Z.F.M., Vol. 24, No. 17, 14/9/33, pp. 472-3. D.V.L. Report, No. 351.) (5.10/27503 Germany.)

Simple formulæ are found for the influence of wind on the time and length of the starting run.

Pitching Oscillations of an Aeroplane with Free Elevator. (H. Blenk, Z.F.M., Vol. 24, No. 13, 14/7/33, pp. 365-370. D.V.L. Report, No. 334.) (5.102/27504 Germany.)

The equations of motion are formed in the usual way, subject to the condition of a free elevator. Numerical results are obtained for given data and exhibited graphically.

Wind channel experiments lead to slight modifications of the formulæ, in particular the conditions for static stability are more sharply defined, but the conditions for dynamical stability are the same.

Experiments on Longitudinal Oscillations of Aeroplane in a Wind Channel. (R. Seiferth, Z.F.M., Vol. 24, No. 16, 28/8/33, pp. 446-448.) (5.102/27505 Germany.)

The experiments were subject to conditions of elevator spring control. The strength of the spring was determined so that a discontinuous reversal of elevator moment took place on passing through the zero position.

A discussion is given of the possibility of dangerous movements, with free elevator, such as a rapid loop. Rules are given for safe position of the centre of pressure and centre of mass of the elevator.

Six examples of model tests are given graphically, one of which shows dangerously rapid increase of the pitching amplitude. The centre of pressure on the elevator may be seriously displaced by interference and by airscrew wash.

Wind Forces and Moments on a Waterborne Seaplane. (M. Kohler, Z.F.M., Vol. 24, No. 16, 28/8/33, pp. 442-446.) (5.102/7.22/27506 Germany.)

A model seaplane is mounted on a rotatable circular disc let into the floor of a wind channel, the floats being cut away at the water flotation line. The mounting is illustrated by a photograph and by sketches. The velocity field near the plate is explored and shown graphically.

Measurements of forces and moments about axes fixed in the machine were made for the whole range of yawing angle from 0° to 360° and for ranges of pitching and rolling angles. The results are given in numerical tables and graphically and should enable designers to predetermine the seaworthiness in a wind of this type.

Four references.

Air Forces and Moments on a Spinning Model. (M. J. Bamber and C. H. Zimmermann, N.A.C.A. Report, No. 456, 1933.) (5.102/27507 U.S.A.)

A photograph shows the model mounted in a vertical downward stream of air, with the mechanism of the balance exposed to view. A full technical description is given. The results show coefficients of lift, drag and moment for four elevator settings -27° (down) $+3^\circ$, 18° and 33° (up), and for rudder settings from -40° to $+40^\circ$. Change of rudder settings from $+40^\circ$ (with spin) to $+40^\circ$ against spin produced a large yawing moment against the spin with elevator up and about one-fourth the moment with the elevator down.

This was the only control moment produced by the rudder and elevator comparable in magnitude with the yawing moment which maintained the spin.

Fifteen references.

Nacelle-Airscrew Combination. (D. H. Wood, N.A.C.A. Report, No. 462, 1933.) (5.11/27508 U.S.A.)

The effects of position and of cowlings in this, the third of a series of tests, was carried out with the same cowled radial engine mounted in 21 positions relatively to a smaller wing than in the previous tests of this series. Sketches show the dimensions of nacelle and photographs show the 21 positions. The results are tabulated and shown graphically. Cowlings (fixed into the wing) are more effective than changes of position.

The cowled engine should be fitted immediately in front of the wing. Further improvements are obtained by fairing the cowling into the wing, etc.

Seven references.

Influence of Airscrew on Wing. (C. Ferrari, L'Aerotecnica, Vol. 13, No. 8, Aug., 1933, pp. 989-996.) (5.11/27509 Italy.)

The elements of the circulation theory of wing lift and drag are applied and expressions are formed for the influence of the airscrew. Numerical coefficients are introduced from model tests and the effects on lift and drag are calculated. The semi-empirical results thus obtained show close agreement with direct measurements. Lift and drag measurements are made on a trapezoidal model wing (Göttingen No. 420) behind an airscrew (Turin No. 23) driven by an electric motor.

Mutual Influence of Wings and Airscrew. (C. Wieselsberger, Abhandlungen aus dem Aerodynamischen Institut an der Technischen Hochschule, Aachen, No. 13, 1933, pp. 1-11.) (5.11/27510 Germany.)

Consideration is given to the case where the wing is outside the airscrew wake, either above or below. The usual simplifications are made and the distribution of downward induced velocity along the span is expressed by an integral which is evaluated numerically or graphically.

The results are applied to calculate the polar curve of lift and drag. The lift drag polars are plotted for wing above and wing below the wake. Close agreement is obtained between calculation and experiment by suitable choice of semi-empirical coefficients.

The elementary mathematical transformations involved are collected in an appendix.

Effect of Turbulence on Wing Characteristics. (B. Randisi, L'Aerotecnica, Vol. 13, No. 7, July, 1933, pp. 867-889.) (5.11/27511 Italy.)

Reference is made to the effect of turbulence on the resistance of a sphere, and the application of the latter as a standard of turbulence.

A systematic series of measurements of wing characteristics with a transverse wire set before the leading edges is given graphically. For certain positions of the wire the sharp drop of the lift curve is flattened out beyond the stalling point, a matter of importance in avoiding autorotation and spinning instability.

Four references.

Influence of Body and Housings on Wing Qualities. (J. Vladea, Z.F.M., Vol. 24, No. 20, 28/10/33, pp. 555-558, Report of Aerodyn. Inst., Aachen.) (5.11/27512 Germany.)

Following J. Lotz, discontinuous distributions for lift or circulation are expressed in Fourier Series satisfying the Dirichlet condition.

An application of the method is worked out in some detail for wing and body, and for wing, body and housings, and the numerical results are shown graphically for six or seven angles of incidence. Polar curves of lift-drag relations are also given.

Two references.

Relative Loading on Biplane Wings. (W. S. Diehl, N.A.C.A. Report, No. 458, 1933.) (5.112/27513 U.S.A.)

The mathematical methods of Betz, Fuchs, Munk and others, for the determination of the distribution of air, velocity and pressure over the lifting surfaces of a biplane are collected in expositional form and a large number of curves are drawn which enable the designer to read off numerical values of the numerous expressions involved.

A schedule of procedure is given to facilitate numerical computations and a numerical example is worked out.

Fifteen references.

Aero Exhibition, Paris, 1932. (F. N. Scheubel, Z.F.M., Vol. 24, No. 13, 14/7/33, pp. 353-358.) (5.14/27514 Germany.)

A brief account is given of developments and tendencies shown by the exhibits. The principal characteristics of 70 aeroplanes and 69 engines are given in tabular form.

Technical Report on the Flights Round Germany, 1933. (Leander, Z.F.M., Vol. 24, No. 20, 28/10/33, pp. 549-555.) (5.14/27515 Germany.)

The scheme of classification is given and points awarded for each of five selected qualities. Seventy-five machines completed the flight and obtained from 99.5 per cent. down to 26.5 per cent. of the full marks, the details being tabulated. Forty-one machines fell out for various reasons which are shown in a table.

About forty types were represented. The power of individual engines varied from 20 h.p. to 155 h.p. Nearly every large German town was included in the circuit.

Decrease of Wing Lift in Relation to Drag. (J. Stüper, Z.F.M., Vol. 24, No. 16, 28/8/33, pp. 439-441.) (5.20/22.6/27516 Germany.)

Investigations into the partly laminar, partly turbulent, boundary layer are discussed and applied to modify the mathematical theory of Joukowski by introducing resistance in the boundary layer. The point at which laminar flow over a profile changes into turbulent flow is shown graphically for ranges of relative wind speed and incidence on upper and lower surfaces. The methods are necessarily semi-empirical, but they put wing design on as systematic a basis as is possible.

Six references.

Theoretical Determination of Wing Characteristics. (A. Betz, Z.F.M., Vol. 24, No. 16, 28/8/33, pp. 437-439.) (5.20/22.4/27517 Germany.)

Reference is made to developments of Joukowski's methods for profiles which are not immediately transformable to a circle, in particular by development in Fourier series and to mathematical and experimental work on laminar and turbulent boundary layers. Boundary layer relations are given graphically.

Nine references.

Trend of Wing Characteristics. (J. v. Koppen, Z.F.M., Vol. 24, No. 18, 28/9/33, pp. 505-510.) (5.20/27518 Germany.)

The change of plan form from practically rectangular wings to the highly tapered trapezoidal wings of modern German aeroplanes is also visible in the tailplane and rudder.

Stability characteristics and control are discussed and characteristic curves of moments are exhibited graphically as functions of lift. Damped pitching oscillations under different conditions are also shown graphically. The characteristics near stalling speed are discussed separately in relation to safe landing speeds.

Characteristics of 78 Related Aerofoils. (E. N. Jacobs, K. E. Ward and R. M. Pinkerton, N.A.C.A. Report, No. 460, 1933.) (5.20/22.4/27519 U.S.A.)

The sections or profiles are shown in sketches and numbered, and the lift, drag and moment are given graphically and to some extent in tables, and confirm the superiority in aerodynamic quality of wings with moderate thickness and camber.

Systematic conclusions are given in 16 paragraphs as to effect of thickness and camber on the wing characteristic.

Seventeen references.

Pressure Distribution over Twenty Aerofoils in Potential Flow. (I. E. Garrick, N.A.C.A. Report, No. 465, 1933.) (5.20/22.4/27520 U.S.A.)

The aerofoil sections are numbered in reference to published U.S.A., English and German specifications. The pressure distribution is given for four values of the lift coefficient 0, 0.5, 1.0 and 1.5. Corrections for aspect ratio and for ratio to speed of sound are facilitated by tables of parameters worked out numerically.

Thirteen references.

Wing Profiles Near the Ground. (J. Ackeret, Z.F.M., Vol. 24, No. 16, 28/8/33, p. 442.) (5.20/27521 Germany.)

The introduction of a flat board in a wind channel to represent the ground produces serious disturbances. The method of testing two models in mirror image positions is better. Towing experiments are correct in principle.

Measurement of Deformation of Wings. (Guerbilsky (summarised by P. Légli), L'Aéron., No. 166, March, 1933, pp. 58-69.) (5.25/27522 France.)

The method is exhibited by depositing a strip of graphite 1.5 mm. thick on a wooden rule. The resistance of the graphite in the unstrained state is about 50,000 ohms, and varies with bending strain. The strip is connected to a neon tube oscillograph in a modulated circuit.

The variation in resistance is obtained by bending the rule to either side, imposing compression or extension on the graphite strip. A figure shows the calibration of proportional changes of resistance against strain. The relation is approximately linear.

An installation for application of the method to wings was exhibited.

The Strength of Wings with Rigid Covering. (P. Bodet, L'Aérophile, No. 11, Nov., 1933, pp. 336-338, and No. 12, Dec., 1933, pp. 364-365.) (5.252/27523 France.)

The author deals with combined shearing and bending force. The method of minimum work is applied to the strain energy in spars and covering.

Analytical expressions are worked out in considerable detail. No numerical applications are given.

Airscrews

Tests of Six Airscrew Sections. (J. Stack, N.A.C.A. Report, No. 463, 1933.) (5.60/27524 U.S.A.)

A description of the channel and accessories is given, with illustrations and calibration figures. The sections are based on R.A.F. and Clark Y sections, with the thickness increased by factors increasing towards the hub.

The effects at high lift speeds of the compressibility of the air are plotted. Generally speaking, the lift coefficients rise to a critical ratio between top speed and speed of sound, which is defined with some sharpness, and then fall abruptly, the critical range being 0.5 to 0.8 of the speed of sound, but there are some anomalous cases lying outside the range. The drag coefficients increased slightly up to the critical value and then steeply.

Comment is made on attempts to establish a mathematical physical theory of the effects of compressibility and it is concluded that they must fail near and above the critical ratio.

Nineteen references.

Thrust and Torque of Adjustable Pitch Metal Airscrew. (E. P. Hartman, N.A.C.A. Report, No. 464, 1933.) (5.64/27525 U.S.A.)

The characteristics are plotted against V/nD for the positive range and against nD/V for the negative range, for a range of blade angle settings measured at .75 radius from -23° to 22° and for different positions of engine nacelle. Below 7° blade angle, engine power is required to give maximum drag in a glide.

Numerical examples are given to illustrate possible uses of the controller pitch, in particular for air braking.

Seven references.

Lifting and Propelling Paddle Wheels. (C. B. Strandgren, L'Aéron., No. 172, Sept., 1933, pp. 81-88.) (5.643/27526 France.)

Blades, set round a wheel, feather so as to maintain flying incidence. The kinematical relations are worked out and are illustrated by six diagrams. The aerodynamical relations are expressed as integrals round a cycle and involve approximate assumptions as to mean lift with variable relative velocity and incidence. Mutual interference raises a further and highly intractable problem.

Three photographs show the paddle wheel actually constructed and the photographs show a Strandgren machine with a pair of paddle wheels under stationary test and a Moineau machine in the field.

Experiments on Wing Profiles in Circular Grid Formation. (F. Numachi and I. Masuko, Ing. Arch., Vol. 4, No. 5, Oct., 1933, pp. 470-480.) (5.643/27527 Germany.)

The main object of the experiments is the study of flow through the guide vanes of water turbines of the propeller type. The inclination of the vanes can be altered relatively to the radial water flow and the pressure distribution over the vane is recorded.

The number and angular setting of the vanes was varied over wide limits. At a small negative incidence (-5°) there was least interference and the flow did not vary appreciably when the number of vanes varied from 4 to 12.

Eight references.

Aerodynamics—Autorotation. (Riabouchinsky (summarised by P. Léglise), L'Aéron., No. 166, March, 1933, p. 55.) (5.644/27528 France.)

A fan with two blades of zero pitch set in rotation continues to rotate, while guide vanes mounted freely behind the fan rotate in the opposite direction.

Instruments

Instrument for Measuring and Recording Seaway. (Z.V.D.I., Vol. 77, No. 27, 8/7/33, p. 755.) (6.24/27529 Germany.)

A pressure recording device is suspended below a floating buoy. The pressure fluctuations are a measure of the surface motions of the buoy.

Influence of Ship Form on Motion in a Seaway. (G. Weinblum, Werft-Reederei-Hafen, Vol. 14, No. 19, 1/10/33, pp. 269-275, and No. 20, 15/10/33, pp. 289-292.) (6.24/27530 Germany.)

The problem being one of forced oscillations the quantities involved are the ship's dimensions, moments and products of inertia, the metacentric height and the applied forces. The natural periods of rolling, pitching and immersion are determined in the usual way, along with the periodic forces applied by waves of specified height, length and velocity. Non-dimensional parameters are constructed, analytical expressions are formed and their mutual relations are computed. The results are tabulated and shown graphically in families of curves, each curve corresponding to a given instant in the cycle.

In Part II, the effect in a seaway of ship's form, particularly of the fullness factor, is discussed and curves of immersion and pitching oscillations are calculated on approximate assumed data. A differential equation is formed for forced oscillations and is discussed by the usual methods. Numerous numerical results are given in tables and in graphical charts showing families of curves giving the relation between the angular displacement and lever arm for different ratios of free-board, beam and draught. The fundamental result is given in a diagram showing the effective lever arm under varying conditions. Within a certain shaded area of the diagram abrupt changes of the amplitude may occur.

Twelve references.

A New Micromanometer. (Z.V.D.I., Vol. 77, No. 37, 16/9/33, p. 1019.) (6.251/27531 Germany.)

Particulars are given of a simple form of bubble manometer using a single liquid and reading to .01 mm. water.

A New Indicator for High Speed Engines. (F. Schmidt, Z.V.D.I., Vol. 77, No. 27, 8/7/33, pp. 748-749.) (6.252/27532 Germany.)

A pressure balance method is employed, as in the Farnborough instrument. When a prescribed pressure is exceeded a diaphragm closes a circuit containing a neon lamp, which operates with the minute current of 10-20 m.-amps with relatively small time lag in comparison with the lag in the Farnborough inductive circuit. The lamp is focussed on a strip of sensitised paper carried by a rotating drum attached to the shaft and slides along it in proportion to the imposed pressure. Each exposure prints a narrow strip and the strips overlap and build up a composite indicator diagram for a large number of cycles. The pressure is controlled by a pressure chamber with a small orifice which produces a slow pressure drop from above the maximum cylinder pressure to atmospheric pressure.

The overlap of successive strip records appears to mask irregularities of firing. This could be improved by opening the scale of the sliding displacements along the shaft.

Combined Mechanical-Optical Speed and Power Meter. (P. Müller, Z.V.D.I., Vol. 77, No. 28, 15/7/33, p. 758.) (6.271/27533 Germany.)

A transmission dynamometer gives direct power readings by inter-gearing the torque spring with a centrifugal pendulum responding to the speed of rotation. The combined deflection is observed optically.

A Balloon Compass. (P. Perlewitz, Z. Instrum., No. 7, July, 1933, pp. 330-331.) (6.501/27534 Germany.)

A transparent compass card of 17 mm. diameter is attached to the magnetic needle, the total weight of the moving parts being 0.9 gm. The time of a half oscillation is about 1 second. The instrument is intended for drift observation and for this purpose is mounted in a vertical pocket of a small telescope, which in operation is held horizontally. A system of prisms projects the observed land or astronomical mark into the field of view, along with a section of the card illuminated from below. The complete instrument weighs less than 4lb.

Determination of Wind Drift in the Aeroplane without Ground or Astronomical Observations and without the Use of Wireless. (P. Raethjen, Luftwacht, No. 10, Oct., 1933, pp. 313-316.) (6.51/27535 Germany.)

The drift is determined relative to cloud banks possessing some characteristic feature. The motion of the bank relative to the ground has to be determined separately. Examples are given of successful drift determination from two cloud banks.

The "Crocco" Incidence Indicator. (A. Gigli, *L'Aerotecnica*, Vol. 13, No. 8, Aug., 1933, pp. 1012-1020.) (6.54/27536 Italy.)

A "Krell" capsule has the general form of a pitot head, but has two orifices diametrically opposite in the side of the tube. The tube is pivoted on the leading edge of the wing with the orifices in the plane of symmetry and is capable of rotation through $\pm 50^\circ$ in that plane about a hinge in the leading edge of the wing.

For each wing incidence the "Krell" head is rotated until zero differential reading between the pressures at the two orifices is noted. The angle of rotation is a direct measure of the angle of incidence.

Calibration curves are reproduced.

Altitude Hysteresis of a Valve Generator. (H. Löwy, *Phys. Zeit.*, Vol. 34, No. 19, 1/10/33, pp. 730-731.) (6.64/27537 Germany.)

An instrument is described for determining height by variable capacity. A diagram of the circuit shows a variable capacity in a circuit with a single valve with oxide cathode. The decrease of capacity rate with height is over compensated by increase of current rate with decreasing capacity. This effect depends on the hysteresis loop in the current capacity characteristic and the adjustment is made so that the capacity at a selected height is just above the lower branch of the hysteresis loop.

In a calibration test flight in a Zeppelin the height selected was 250 metres, at which no current flowed. Up to 350 metres the current rose continuously from zero to 90 m.-amps, after which the circuit became unstable. A range from 100 m. to 200 m. could be selected in practice.

Pressure Head Statoscope. (L. Scriba, *Flugsport*, Vol. 25, No. 21, 11/10/33, pp. 450-452.) (6.67/27538 Germany.)

It is stated that the statoscope, which indicates slow changes of static pressure, is erratic in recording. The new instrument records slight changes in the velocity pressure head and thereby slight changes in incidence.

It has been used in glider flight and the claim is made that it is useful for controlling the height in blind flying.

A photograph shows the connections with pressure head, air chamber and recording instrument.

Aircraft Flight

Extension of Theory of Lateral Instability with Numerical Examples. (G. Matthias, *Z.F.M.*, Vol. 24, No. 19, 14/10/33, pp. 527-529, and No. 20, 28/10/33, pp. 563-568. D.V.L. Report, No. 350.) (7.20/27539 Germany.)

The author emphasises the simplification of the analysis by the introduction of non-dimensional parameters (*Aeronautical Glossary*, 1921). The analysis follows the usual lines. In numerical examples the lines of demarcation, between statically stable and unstable regions are shown graphically in three diagrams for groups of three parameters, in which the position of the centre of lift is always in evidence. The delimitations between regions of dynamical stability and instability are more complicated and are exhibited in eleven diagrams.

The values of the physical coefficients from which the non-dimensional characteristics and coefficients are formed are determined in the usual way from full scale and model data.

Six references.

Manœuvrability of "O3U-1" Observation Aeroplane. (F. L. Thompson and H. W. Kirschbaum, N.A.C.A. Report, No. 457, 1933.) (7.40/27540 U.S.A.)

Two previous investigations have been given (Reports 369 and 386). A photograph of the aeroplane is given and a schedule of performance figures. The methods of test reduction are specified and the results given graphically in 31 charts.

The quantities measured include linear and angular accelerations, under maximum control movements, and in complete manœuvres such as rolling, half loop and Immelman turns.

Eight references.

The Sperry Automatic Gyroscopic Control. (Rev. F: Aér., No. 51, Oct., 1933, pp. 1176-1181.) (7.54/27541 France.)

An illustrated description is given of the "Automatic Pilot" as fitted to the Lockheed "Vega" machine in which Wiley Post did a solo world trip. The installation weighs about 75lbs. Air and oil transmission are applied. An alarm sounds if the aircraft motion becomes unsteady, so that the pilot may release his attention and even obtain some sleep.

One reference.

Engines—Thermodynamics

Glow Plugs for Starting Diesel Engines. (Flugsport, Vol. 25, No. 22, 25/10/33, pp. 479-480.) (8.13/27542 Germany.)

Glow plugs are either single pole or double pole and require 2-3 volts for operation. The heating spiral is made of braided Ni-Cr wire and has a satisfactory life.

Ignition Lag in Diesel Engines. (Autom. Ind., Vol. 69, No. 9, 26/8/33, pp. 248-250.) (8.13/27543 U.S.A.)

Attempts have been made by Kuttner and Ripper to measure ignition lag by recording the time at which the bouncing pin leaves its seat. Apart from the electrical lag of the time recording apparatus there is a possible serious error due to the inertia of the pin itself.

Grading of the Diesel fuels by this method does not agree with the critical compression ratio method of the Co-operative Fuel Research Committee. Further, the C.F.R. engine at high compression ratio does not operate as a representative Diesel engine and gives trouble with fuels which are found suitable for commercial engines. The problem of rating Diesel fuels remains obscure.

Contribution to the Combustion Technique of High Speed Diesel Engines with Precombustion Chamber. (G. Ritz, Autom. Tech. Zeit., Vol. 36, No. 8, 25/4/33, pp. 197-203.) (8.13/27544 Germany.)

The author varied compression ratio, speed, size of precombustion chamber and nature of spray. Indicator diagrams showing ignition delay and maximum pressure were obtained. He concludes that for smooth running the compression ratio should be of the order of 20/1; the precombustion chamber should be as large as possible consistently with this. The spray must be coarse to ensure that preliminary combustion only starts in the chamber. With these precautions good consumption figures can be obtained with maximum explosion pressure below 900lb. per sq. in.

Six references.

Engines—Design and Performance

Definition of Terms as Applied to Aero Engines with Special Reference to High Altitude Engines. (H. Oestrich, Z.F.M., Vol. 24, No. 14, 28/7/33, pp. 393-398. D.V.L. Report 339.) (8.20/27545 Germany.)

Such terms as normal output, maximum output and continuous output when applied to aero engines require precise and accepted definitions. Suggestions put forward by the D.V.L. have received official sanction. An international agreement on these matters is urgently wanted.

New Method of Scavenging Two-Stroke Diesel Engines. (Dr. Ing. Mohr of Krupps (Germaniawerft), Autom. Tech. Zeit., Vol. 36, No. 8, 25/4/33, pp. 203-205.) (8.21/27546 Germany.)

Single piston engines with transverse scavenging retain an exhaust residue which eddies near the cylinder head. The author provides two additional scavenging ports diametrically opposite on an axis at right angles to the usual ports. An additional exhaust port is placed slightly above the usual scavenging port. The three additional ports are of relatively small cross section and do not weaken the cylinder construction.

A model is described which enables the flow to be studied. Engine tests are stated to have given favourable results.

Single Cylinder Test Engine of the D.V.L. (F. Nuffert and W. D. Bensinger, Autom. Tech. Zeit., Vol. 36, No. 15, 10/8/33, pp. 391-392. D.V.L. Report, No. 326.) (8.22/27547 Germany.)

The single cylinder test bed is of robust construction, and will take full size aircraft engine cylinders. The bed plate to which the cylinder is attached can be raised or lowered to give a wide variation of the compression ratio and elaborate arrangements are made to vary the valve timing. Both adjustments can be made under engine load. Air measurements are made by wet gas meter. Supercharging is applied by a Root's blower.

Consideration of Similarity—Applied to the Design of Internal Combustion Engines. (O. Lutz, Ing. Arch., Vol. 4, Aug., 1933, pp. 373-383.) (8.225/27548 Germany.)

By introducing parameters, such as the speed, of dynamically similar engines of 1 h.p. or of 1 litre, characteristics of totally dissimilar engine designs are made immediately comparable, e.g., the variation in heat transmission. This representation exhibits similarities between the characteristics of the Man engines fitted to the battleship "Deutschland" and those of aero engines. It is stated that the Man are developing the high speed ship engine for aeronautical purposes.

The Development of Air-Cooled Engines by the Use of a Separate Blower. (Z.F.M., Vol. 24, No. 15, 14/8/33, p. 426. D.V.L. Report, No. 324.) (8.235/27549 Germany.)

The heat transfer when an air stream from the blower is directed on to the cylinder is greater than when the cylinder is freely exposed to the relative wind; the power absorbed by the blower is less than that absorbed as drag by the exposed cylinder. The heat flow from the head is eight times the flow from the barrel (6 cal./cm.²/sec. and $\frac{3}{4}$ cal./cm.²/sec. respectively).

Tests of a Rateau Centrifugal Supercharger for a 700 h.p. Engine. (H. Oestrich, Autom. Tech. Zeit., Vol. 36, No. 16, 25/8/33, pp. 405-411. D.V.L. Report, No. 325.) (8.235/27550 Germany.)

The supercharger compresses in two stages at a shaft speed of 1,700 r.p.m. with an internal clutch and step-up gear ratio of 12.3. From the illustration

the impeller wheels, approximately 20 cm. in diameter, are housed in a separate casing from the gears. The fan casing space is about 50 cm. diameter by 40 cm. long, the gear casing about the same. No weights are given. At a compression ratio of 2.23, corresponding to an altitude of 6,250 metres, the fan absorbed 110 h.p., showing an adiabatic compression efficiency of 52 per cent.

Three references.

The Henschel-Lanova Diesel Engine. (A. E. Thiemann, Autom. Tech. Zeit., Vol. 36, No. 8, 25/4/33, pp. 206-207.) (8.25/27551 Germany.)

The Lanova engine has two horizontal chambers in series communicating with the combustion space through a relatively large hole. Injection takes place early in the stroke, through a nozzle diametrically opposite the chamber and the spray thus has to traverse the whole of the annular combustion space before it can enter. High injection pressures (1,200 lb. per sq. in.) are combined with a low compression ratio (12/1).

The design utilised a floating wet liner and the provision for stiffness is ample. A centrifugal oil cleaner is fitted. Specific weight is about 15 h.p. for a six-cylinder of 100 h.p. engine.

One reference.

Diesel Engine Design Development. (P. M. Heldt, Autom. Ind., Vol. 69, No. 10, 2/9/33, pp. 279-280.) (8.25/27552 U.S.A.)

Increased Diesel engine speeds are obtained by controlling flow of fuel in pipe lines so as to avoid pressure surges and maintain definite injection periods free from dribble. Injection engines with spark ignition are liable to carbon formation and crankcase oil dilution.

The Daimler-Benz 700 h.p. Aircraft Diesel Engine. (Autom. Tech. Zeit., Vol. 36, No. 8, 25/4/33, p. 209.) (8.25/27553 Germany.)

The engine has 12 cylinders in V, bore 165 mm., stroke 210 mm., and a precombustion chamber. It develops 700 h.p. at 1,675 r.p.m. giving a volume output of 13 h.p. per litre. The specific weight is just under 3 lb. per h.p. A 1.7/1 reduction gear is fitted. Ball and roller bearings are extensively used for the crankshaft and needle bearings for the valve rockers.

The Man 100 h.p. Light Weight Diesel. (Autom. Tech. Zeit., Vol. 36, No. 8, 25/4/33, p. 205.) (8.25/27554 Germany.)

The engine has six cylinders of 120 mm. bore and 180 mm. stroke and develops 100 h.p. at 1,400 r.p.m. There is direct injection, combined with mixing in an auxiliary air chamber near the jet, communicating with the combustion chamber through a set of small holes. Air taken into the mixing chamber passes into the main combustion chamber during the following expansion stroke. There is no combustion in the air chamber such as takes place in the precombustion chambers of certain types of engines.

The manufacturer attained an engine weight of 15 lb. per h.p. by welded steel construction.

The Ganz-Jendrassik Lorry Diesel Engine. (K. Danninger, Autom. Tech. Zeit., Vol. 36, No. 8, 25/4/33, pp. 207-209.) (8.25/27555 Germany.)

The engine has a precombustion chamber of large capacity and a recessed piston crown into which the flame projects. The fuel pump has a spring trigger action which maintains high plunger speeds at low engine r.p.m. Variable inlet valve timing throttles the air at starting.

The Influence of Pressure on Spontaneous Ignition of Inflammable Gas-Air Mixtures. I. Butane-Air. (D. T. A. Townend and M. R. Mandlekar, Proc. Roy. Soc., Vol. 141, No. 844, 1/8/33, pp. 484-493.) (8.28/27556 Great Britain.)

The ignition temperature of butane mixtures as determined by the Mallard and Le Chatelier method undergoes a fall with increases of pressure, especially in the neighbourhood of a critical pressure. The effect of ethyl lead in raising the ignition temperature is practically confined to the critical region. It is suggested that intermediate oxidation products are formed in confirmation of the Bone hydroxylation theory. No peroxides were discovered.

Spontaneous Ignition Temperature of Inflammable Gas-Air Mixtures. Part II—Pentane. (D. T. A. Townend and M. R. Mandlekar, Proc. Roy. Soc., Vol. 143, No. A.848, 4/12/33, pp. 168-176.) (8.28/27557 Great Britain.)

The ignition temperature of pentane depends on mixture strength and pressure. An increase of pressure always lowers the ignition temperature. The effect is disproportionately large for certain mixture strength and for a pressure between 1 and 3 atmospheres. At higher pressures the effect is small and continuous.

The effect of tetra-ethyl lead is to raise the critical pressure. The phenomenon appears to be connected with the formation of intermediate products which require further study.

Seven references.

Measurement of Auto-Ignition Temperature in High Speed Internal Combustion Engines. (K. Schnauffer, Z.V.D.I., Vol. 77, No. 34, 26/8/33, pp. 927-931.) (8.28/27558 Germany.)

An electrically heated glow electrode of nickel steel is placed in the combustion chamber along with the sparking plug. Ignition is recorded by ionisation currents produced by the flame. Auto-ignition with the spark cut off is thus clearly indicated even when the resulting explosion is too weak to operate the engine.

Experiments were conducted with petrol, benzol and mixtures of the two (50 per cent.). The auto-ignition temperatures did not vary by more than 40°C. for the two extremes, being of the order of 900, 940 and 920°C. Testing in the laboratory by the ignition pot method, the auto-ignition temperatures are of the order of 300°C. for petrol and 600°C. for benzol.

The higher readings in the engines are connected with the shorter lag required to ensure ignition near dead centre. The presence of exhaust residue also increases the auto-ignition temperature in this case.

Variation in Ignition Timing and Shape of Voltage Curve as Revealed by the Cathode Ray Oscillograph. (H. Viehmann, Autom. Tech. Zeit., Vol. 36, No. 17, 10/9/33, pp. 426-430. D.V.L. Report, No. 335.) (8.28/27559 Germany.)

A comparison between the voltage curves of a coil and magneto ignition system shows general similarity. The time interval between break of primary and breakdown of spark gap (generally reached at 6,000 volts) varies between 10^{-4} and 1.5×10^{-4} seconds for each system. Variations in power with the two systems were traced to the contact breaker, which gave appreciable differences in time of break for the same mechanical setting when the engine was operating at speed.

Four references.

Engines—Design and Strength of Components

Light Alloy Pistons for Internal Combustion Engines. (E. Mahle, Werft-Reederei-Hafen, Vol. 14, No. 18, 15/9/33, pp. 255-256.) (8.32/27560 Germany.)

Various forms are shown of alloy pistons from 100 to 200 mm. diameter for ships' Diesel engines. Accuracy of workmanship and good surface finish are essential for successful operation.

Influence of Firing Order on the Torsional Vibration of In-Line Engines. (M. Scheuermeyer, Autom. Tech. Zeit., Vol. 36, No. 16, 25/8/33, pp. 401-404, and No. 17, 10/9/33, pp. 431-433.) (8.36/27561 Germany.)

In the usual calculation for vibration frequency, one half of the reciprocating masses is assumed to participate in the vibration. The assumption leads to a mean frequency. Actually the varying acceleration of the masses imposes considerable variation in frequency during a revolution.

The author shows how these variations can be minimised by altering the firing order. The secondary harmonics can be eliminated, but the principal harmonics operate over an increased range.

Six references.

The Friction Vibration Damper. (G. Jendrassik, Z.V.D.I., Vol. 77, No. 37, 16/9/33, pp. 1009-1012.) (8.36/27562 Germany.)

Elementary dynamical principles are discussed and rules for design are given. With properly dimensioned parts adequate damping is maintained over a wide range of variation in the coefficient of friction.

Free Vibrations and Critical Speeds of Shafts and Spars. (C. Minelli, L'Aerotecnica, Vol. 13, No. 8, Aug., 1933, pp. 997-1011.) (8.36/27563 Italy.)

From the form of the differential equations conditions for dynamical similitude are formed and an analogy is drawn between the conditions for dynamical similitude in bending and in torsion.

Radially and Axially Loaded Ball Bearings with Large Number of Balls. (A. Meyer, Z.V.D.I., Vol. 77, No. 37, 16/9/33, p. 1018.) (8.37/27564 Germany.)

In a double row ball bearing the usual cage is replaced by an intermediate row of distance balls held by a tension ring. The bearings are in production with satisfactory results.

One reference.

Engines—Cooling

Heat Transfer Phenomena in Boiling Water. (Z. Instrum., No. 7, July, 1933, p. 298.) (8.40/27565 Germany.)

Determinations were made at the Reichsanstalt on the heat transfer coefficient between steam bubbles and the surrounding liquid. At the instant of bubble formation the flow of heat is about 4 calories per cm.² per sec. per 1°C., a remarkably high figure which falls to less than 0.3 by the time the bubble reaches the surface.

Instruments for Measuring Heat Transfer. (Z.V.D.I., Vol. 77, No. 26, 1/7/33, p. 719.) (8.40/27566 Germany.)

A brief note is given on the general problem. Reference is made to an exploring thermo-couple in a spherical case, the time for a temperature rise from 300° to 400° being noted by stop watch.

A flat cylindrical housing is described and illustrated by side and plan sketches and is more convenient for measuring heat transfer at flat surfaces.

Jacket Heat of High Speed Internal Combustion Engine. (E. Drucker, Z.V.D.I., Vol. 77, No. 33, 19/8/33, pp. 912-913.) (8.40/27567 Germany.)

The thermal loading of the jacket is defined as the rate of heat loss divided by the surface of the cylinder exposed to hot gases at mid-stroke. This factor increases nearly linearly with piston speeds above 3 m. per sec. and more steeply at lower speeds. There is a general similarity between Diesel and carburettor engines.

Seven references.

The Development of Air-Cooled Engines with Separate Fan Cooling. (R. Lohner, Autom. Tech. Zeit., Vol. 36, No. 14, 25/7/33, pp. 351-357, and No. 15, 10/8/33, pp. 375-383. D.V.L. Report, No. 324.) (8.42/27568 Germany.)

The blast from a fan is directed by guides over the hottest parts of the cylinder. This controlled cooling gives greater reliability and allows of larger cylinders than is feasible with cooling by the undirected slipstream.

This factor is more important to the designer than reduction in head resistance and in the power lost in cooling the engine.

Four references.

Engines—Lubricants and Lubrication

The Viscosity and Congealing of Lubricating Oils. (M. Bourdiol, Pub. Sc. et Tech., No. 27, 1933.) (8.50/27569 France.)

A simple form of viscosimeter is supplied with air at variable pressure to drive the oil through the capillary tube. Accurate measurement of small deliveries is attained by displacement of a solution of calcium chloride in a second capillary tube.

Measurements of castor and mineral oils extended over the temperature range -20° to 30° . It is easy to prevent castor oil from freezing at -20° , at which temperature its viscosity is considerably less than that of most mineral oils.

The process of congealing was observed by microscope. With decreasing temperature certain stearides first separate out and act as nuclei for subsequent congealing. If these stearides are removed the liquid state remains relatively stable down to -20°C .

Oxidation Resistance of Lubricating Oils. (Autom. Tech. Zeit., Vol. 36, No. 14, 25/7/33, p. 367.) (8.54/27570 Germany.)

The stability of the oil is judged by the acidity before and after treatment with hydrogen peroxide. Vegetable oils are completely modified and form jellies.

Lubrication of Diesel Engines, Especially Ships' Engines. (E. Goos and K. Krekeler, Z.V.D.I., Vol. 77, No. 30, 29/7/33, pp. 828-830.) (8.58/27571 Germany.)

The high speed double acting two-stroke engine leads to corresponding reduction in weight of engine plant and in space occupied. Specific weights have decreased from 250 to 15lb./h.p., and the overall length of a 3,600 h.p. has diminished from 40ft. to under 10ft. The compact construction has led to lubrication difficulties. It is necessary to use oils which leave little residue, especially when lubricating the piston. A high viscosity oil, refined with SO_2 is recommended and this oil should be introduced in carefully metered quantities at distributed points. The piston lubrication is thus kept separate from that of the rest of the engine for which low viscosity oil is introduced through the crankshaft in the usual manner. If the lubricating oil is to be used for piston cooling a highly refined low viscosity oil free from deposits is required.

Oil Consumption. (Autom. Ind., Vol. 69, No. 9, 26/8/33, pp. 232-236.) (8.58/27572 U.S.A.)

Oil rings built up from several pieces are effective in reducing oil consumption and formation of carbon. A dry sump engine installation is described in which measurements of oil consumption with different oils can be rapidly carried out.

Engines—Fuels

Ethyl Alcohol as a Motor Fuel. (K. R. Dietrich, Autom. Tech. Zeit., Vol. 36, No. 20, 25/10/33, pp. 519-520.) (8.606/27573 Germany.)

Objections to ethyl alcohol are low calorific value, poor starting quality, hygroscopic nature and corrosive properties.

Blends with petrol and benzol are largely free from these defects. The following blend is in general use in Germany:—

	%
	by weight.
Alcohol	15
Benzol	40
Petrol	45

Experiments on aircraft with this fuel are in progress.

Two references.

The Suitability of Various Fuels for the Starting of Engines. (Prof. Wawrziniok, Autom. Tech. Zeit., Vol. 36, No. 18, 25/9/33, pp. 464-469, and No. 19, 10/10/33, pp. 496-499.) (8.649/27574 Germany.)

The starting quality largely depends on the vapour pressure and the latent heat of the fuel. Mixtures of alcohol and petrol may have a higher vapour pressure than that of either constituent by itself. Cold mixtures with high latent heat require intense ignition sparks.

Fourteen references.

Engines—Injection and Exhaust Systems

The Injection Problem of the Diesel Engine, with Special Reference to Operative Speed Range. (R. Retel, L'Aéron., No. 173, Oct., 1933 (Supplement), pp. 93-105.) (8.705/27575 France.)

The operation over a speed range of the compression ignition engine with airless injection is largely a question of fuel pump characteristics. Efficient operation over a wide speed range is difficult, a serious disadvantage in comparison with the carburettor.

Penetration and Duration of Fuel Sprays for a Pump Injection System. (A. M. Rothrock and E. T. Marsh, N.A.C.A. Report, No. 455, 1933.) (8.705/22.2/27576 U.S.A.)

A diagrammatic sketch shows the general arrangement of the photographic apparatus and pump. Details are shown in sectioned sketches. Specimen films are reproduced showing the stem lift of the injection valve and the growth of the jet. The numerical results are shown in twelve graphical charts, which give penetration as a function of initial pressure and time.

Five references.

Photomicrographic Studies of Fuel Sprays. (D. W. Lee and R. C. Spencer, N.A.C.A. Report, No. 454, 1933.) (8.705/22.2/27577 U.S.A.)

Seventy-five instantaneous photographs of jets and sprays are reproduced, under injection pressures varying from $1\frac{1}{2}$ to 280 atmospheres and chamber pressures varying from 0.0013 to 14 atmospheres.

Photographs taken with high magnification show short lengths of jet at different distances from the nozzle, while those with low magnification show considerable lengths of jet. The latter give a general view, the former more detail. The break up of the jet takes a large number of different intermediate forms, knowledge of which is essential for discussion of ignition and combustion.

Twelve references.

Acoustical Theory of Exhaust Silencers with Perforated Baffle Plates. (A. H. Davis, Phil. Mag., Vol. 16, No. 107, Oct., 1933, pp. 787-793.) (8.721/27578 Great Britain.)

The elementary theory of resonators in series is applied to a silencer with perforated baffle plates and approximate expressions are found, which indicate the suppression of all but low pitch sounds.

No quantitative experimental results are available for a comparison, but qualitative observation appears to confirm the general conclusion.

Measurement of Power Available in Engine Exhaust. (C. Waseige, L'Aéron., No. 171, Aug., 1933, p. 189.) (8.722/27579 France.)

The author is of the opinion that the utilisation of exhaust energy in a turbine is more than offset by the increased back pressure. An experimental layout is described for measurement of the factors entering into the problem.

Engines—Pumps

Performance of Oil Pumps. (E. W. Steinitz, Z.V.D.I., Vol. 77, No. 29, 22/7/33, pp. 785-788.) (8.743/27580 Germany.)

The importance of centralised lubrication for prime movers, machine tools, etc., has been recognised in Germany for years. Oil pumps of great reliability have been produced. Selected designs are described and illustrated showing tell-tale arrangements for visual indication of oil flow. The old tube indicator in which the oil on its delivery passes through a water plug still holds first place for reliability and safety.

Reference is made to grease lubrication from a central pumping plant.

Engines—Gears, Couplings, etc.

The Wear of Toothed Wheels. (M. Fink, Z.V.D.I., Vol. 77, No. 36, 9/9/33, pp. 978-979.) (8.761/27581 Germany.)

Initial stages of wear are associated with oxidation of the material by oxygen dissolved in the oil, even when the gear wheels are totally immersed. The author states that a graphite emulsion in the oil forms a protecting layer which reduces oxidation.

Nine references.

Sandner Hydrostatic Coupling. (W. Allerding, Werft-Reederei-Hafen, Vol. 14, No. 17, 1/9/33, pp. 242-244.) (8.765/27582 Germany.)

The internal primary and external secondary are coaxial. Gear wheels are mounted round the periphery of the secondary, in mesh with a single central gear wheel mounted on the primary. Load on the primary sets the secondary gear wheels in rotation on their own axes, under which they act as oil pumps

and set up a back pressure, bringing them to rest relatively to the secondary, which then receives a direct drive.

Relief valves in the pumping circuits are set to release the pressure when it exceeds a value corresponding to the maximum permissible load. The secondaries then rotate on their axes against high damping faces. Sketches and photographs show the simple general arrangement.

Armament

Firing Control of Anti-Aircraft Batteries. (A. Kuhlenkamp, Z.V.D.I., Vol. 77, No. 35, 2/9/33, pp. 949-952.) (9.11/27583 Germany.)

American practice is described. Regret is expressed that the Versailles Treaty forbids such weapons to Germany.

Armament. (P. Léglise, L'Aéron., No. 166, March, 1933, p. 59.) (9.11/27584 France.)

A small cannon is shown mounted on a light tripod, discharging a projectile from one end and burnt gases from the other end. The stability of the mounting indicates very complete compensation of the recoil.

Aerodynamics—Instability of (Streamline) Projectiles. (Riabouchinsky (summarised by P. Léglise), L'Aéron., No. 166, March, 1933, p. 55.) (9.16/27585 France.)

A streamline model which has a surface of rotation is mounted on an axis passing through the centre of gravity at right angles to the axis of rotation. It takes up a motion of autorotation from any position at rest.

Aerodynamics of an Arrow. (G. J. Higgins, J. Frank. Inst., Vol. 216, No. 1, July, 1933, pp. 91-101.) (9.16/27586 U.S.A.)

The drag coefficient is taken as constant over any slight changes in orientation during flight. A trajectory is determined for measured values of the physical quantities involved and is shown graphically. The initial velocity is 180ft. per sec., the range 650ft., highest point of flight nearly 200ft.

An approximate formula is fitted closely to the observed trajectory by adjustment of the coefficients. The effect of changes in the physical quantities is also shown graphically.

Two references.

New System of Mapping Field of View. (M. Jannin, L'Aéron., No. 172, Sept., 1933, pp. 214-215.) (9.17/27587 France.)

The meridians become sine curves with equally spaced amplitudes, and the circles of latitude equi-distant straight lines. The transformation is not conformal, but equality of small corresponding areas is maintained. The hemisphere projects into the section of an oblate ellipsoid.

Representations of the field of view of four machines are reproduced.

Concentration of Bomb Hits from a Flying Formation. (E. Lanciani, Riv. Aeron., No. 6, June, 1933, pp. 373-388.) (9.33/27588 Italy.)

A sketch shows a formation of three aeroplanes in echelon at fifty metres interval fore and aft and half span interval transversely. A speed of 50 m./s., a spacing of 100 metres, and heights of 1,000 and 1,500 m. are specified.

The grouping of three bombs is given in terms of the containing rectangle, which varies from 10 m. × 15 m. to 30 m. × 50 m. Five photographs from the air show the bombs in groups of three.

Materials—Characteristics, Defects and Treatment

Influence on Aircraft Construction of Recent Research on Materials. (P. Brenner, Z.F.M., Vol. 24, No. 18, 28/9/33, pp. 497-504. D.V.L. Report, No. 346.) (10.00/27589 Germany.)

A survey is made of progress in metallurgy, plywoods, built-up spans and welded joints, in reference to possible lightening of construction. Corrosion tests show the improvement in protective measures. X-ray photographs of welds show faults not perceivable from external inspection.

Twenty references.

Effect of Very Low Temperature on Tensile Properties of Metals. (W. J. de Haas and Sir R. Hadfield, Phil. Trans. Roy. Soc., Vol. 232, A.715, 6/12/33, pp. 297-332.) (10.100/27590 Great Britain.)

Temperatures of -182°C ., -253°C ., and -269°C ., are produced by the evaporation of liquid air, hydrogen and helium. The first was applied in the Hadfield-Dewar series of experiments previously published. The second is employed for the most part, and the third for a few cases in the present series.

The results of tensile and Brinell tests are tabulated. Analyses are given of forty-one test pieces comprising pure iron, four carbon steels and thirty alloy steels. In general all metals show increasing tensile strength, but iron loses ductility almost completely, while all the other metals show increased ductility. Steels, alloyed with other metals, especially nickel, retain their ductility. The apparatus and method of test are described.

Four references.

[A bibliography is given in the Dewar-Hadfield paper; Jnl. Iron and Steel Institute, 1905, p. 147.]

Internal Stresses in Large Forgings. (G. Kirchberg, Z.V.D.I., Vol. 77, No. 27, 8/7/33, p. 732.) (10.100/27591 Germany.)

The experiments were carried out by the A.E.G. on cylindrical turbine forgings, approximately 20ins. diameter and 40ins. long. A series of rings and discs were cut out of the forgings, and from their dimensions, both before and after cutting, internal stresses were calculated using the method of Sachs (Z. für Metallkunde, Vol. 19, 1927, p. 352). The results show maximum stresses of the order of six tons per square inch. This is less than the usual practical allowance.

The Behaviour of Metallic Substances under Static and Alternating Stresses. (P. Ludwik, Z. Metallk., Vol. 25, No. 10, Oct., 1933, pp. 221-228.) (10.100/27592 Germany.)

The behaviour of metals under stress is intimately connected with changes in the lattice structure of the constituent crystals. The beneficial effect of a preliminary stress on the ultimate fatigue limits is important.

Fifteen illustrations and thirty-five references.

Spark Tests of Commercial Steels. (R. W. Buzzard, Bur. Stan. J. Res., Vol. 11, No. 4, Oct., 1933, pp. 527-540.) (10.100/27593 U.S.A.)

From author's abstract:—

The sparks are formed by the action of an abrasive wheel with a peripheral speed of 5,000 feet per min. Typical spark streams of plain carbon steels, a variety of alloy steels—including S.A.E. steels—nitrided steel, and cast iron are described and illustrated. A supplementary study was made of the appearance of the metal pellets collected from the spark streams of the various types of steel.

Four references.

Niresist, a High Grade Cast Iron. (Z.V.D.I., Vol. 77, No. 42, 21/10/33, p. 1142.) (10.100/27594 Germany.)

The cast iron contains monel metal and ferro chrome and has an austenitic structure. It is easy to work, almost non-magnetic, and resists corrosion and heat much better than ordinary cast iron.

One reference.

Determination of Effective Young's Modulus. (R. R. Wiese, Aero Digest (Aviation Engineering), Vol. 23, No. 3, Sept., 1933, pp. 40-42.) (10.100/27595 U.S.A.)

Experimental values of the deflection, at points along a composite metal beam and the tangent at the node, are plotted graphically. Deflections measured from the tangent are proportional to the differential coefficient of the ratio M/I . Working back from these values by graphical methods, the effective value of E is obtained from point to point.

In a numerical example the tabulated values at given points show fairly consistent values of Young's Modulus for a steel spar.

The Fatigue Strength of Screwed Bolts and Means for Improvement. (A. Thum and H. Wiegand, Z.V.D.I., Vol. 77, No. 39, 30/9/33, pp. 1061-1063.) (10.104/27596 Germany.)

The notching effect of the thread reduces the strength of a screwed bolt by one-half. It is essential that the bolt be screwed home tight, so as to impose a preliminary compression. With a loose nut the fatigue limits are much lower, on account of play in the screw threads under manufacturing tolerances. Various forms of lock nuts are described. In some designs a tapered thread is employed in the nut. In this way the stressing on the nut can be rendered more uniform.

Seven references.

Welded Tube Construction. (A. Hilpert and O. Bondy, Z.V.D.I., Vol. 77, No. 26, 1/7/33, pp. 701-706.) (10.140/27597 Germany.)

Numerous examples of light and heavy welded tube structures are illustrated by sketches and photographs. Crushing tests to destruction by flattening and axial buckling are also shown. An official test specification is quoted, and curves of permissible loading are given.

Advantages and disadvantages are considered, lightness and economy of material compensating the increased cost.

Stainless Steel for Aircraft. (P. Brenner, Z.V.D.I., Vol. 77, No. 42, 21/10/33, p. 1135.) (10.140/27598 Germany.)

An austenitic steel (18 per cent. cr. and 8 per cent. Ni.) has been used in America for aircraft construction. The material is made into strips which are spot welded to form various built-up spar sections. Although this steel becomes liable to corrosion when heated to 600°C., no trouble is incurred in practice owing to the small area of the spot weld and the short time of heating.

Krupps in Germany have developed a new steel (V. 2a and V. 4a extra) which can be welded without difficulty and does not corrode at the welds, provided a temperature of 700°C. is not exceeded.

Hardness Behaviour of Duralumin. (H. O'Neill, J. F. B. Jackson and G. S. Farnham, Phil. Mag., Vol. 16, No. 108, Nov., 1933, pp. 913-929.) (10.231/27599 Great Britain.)

The hardening and softening changes under heat treatment were investigated by the Meyer ball test. The composition of the alloy is specified, and quenching,

ageing, re-heating before and after ageing, and rolling processes are tabulated with hardness figures before and after cold rolling.

X-ray determinations of the molecular lattice were made. The conclusions are not susceptible of concise summary.

Six references.

The So-Called Incubation Period in the Self-Hardening of Duralumin. (W. Fraenkel and R. Hahn, *Z. Metallk.*, Vol. 25, No. 8, Aug., 1933, pp. 185-189.) (10.231/27600 Germany.)

Samples of duralumin were kept at 500°C., and then quenched in water. The mechanical properties, e.g., Brinell hardness and tensile strength, improve with time during self hardening, generally reaching a maximum 20 hours after quenching. The lag, in some cases as much as two hours before the observable beginning of the process, is called the incubation period and could not be correlated with other physical properties of the alloy.

Experiments on Repeated Hardening of Duralumin Rivets and on the Influence of the Hardening Temperature. (M. Abraham, *Z. Metallk.*, Vol. 25, No. 9, Sept., 1933, pp. 203-205. D.V.L. Report 353.) (10.231/27601 Germany.)

The repeated hardening has a negligible effect on the subsequent period of age-hardening. This period is primarily settled by the temperature at which the age-hardening proceeds. A storing temperature of 8°C. is recommended, instead of the more usual ice-box treatment. This keeps the rivets in a workable condition for 10 hours—a usual working day.

Nine references.

Aluminium Alloys. (Werft-Reederei-Hafen, Vol. 14, No. 20, 15/10/33, pp. 283-289.) (10.231/27602 Germany.)

A summary is given of the Aluminium Conference in Hamburg (14/9/33), and includes application to naval and aircraft oxidation and protection from corrosion, welding, rolling, riveting and pressing processes.

Photographs show examples of German products.

Corrosion Tests with Hydronalium. (P. Brenner, *Z. Metallk.*, Vol. 25, No. 10, Oct., 1933, pp. 252-258.) (10.231/27603 Germany.)

Hydronalium is an Al. alloy containing magnesium up to 7 per cent., and is similar in composition to the alloy "magnalium" introduced about 30 years ago. Improvements in technique have now led to the production of a consistent material highly resistant to corrosion by sea water. The present price is high.

Thirteen references.

A New Light Alloy Specially Suited for Pistons. (Autom. Tech. Zeit., Vol. 36, No. 20, 25/10/33, p. 517.) (10.231/27604 Germany.)

A new aluminium alloy containing 14 per cent. silicon with small additions of Ni., Cu. and Mg. has been developed successfully in the U.S.A. This alloy has a thermal expansion which is 18 per cent. less than that of the normal alloys and closely approaches that of Ni. cast iron, which is in common use for cylinder liners. Pistons made of the new material require correspondingly less clearance cold.

Excellent results are claimed in car and aero engine practice.

Research on Protective Fluxes of Magnesium when Melting and Casting. (M. Hardouin, Pub. Sc. et Tech., No. 28, 1933.) (10.232/27605 France.)

The viscosity of the molten flux is as important as its fusibility and density. Good results have been obtained with fluorides as melting fluxes and borates as casting fluxes.

Krupp Nitriding Process. (Z.F.M., Vol. 24, No. 14, 28/7/33, p. 405.) (10.260/27606 Germany.)

The Krupp patent (No. 386510) covers the use of certain alloy steels in connection with the ammonia nitriding process. According to information supplied by the patentees, the nitrided layer, apart from hardness, improves other mechanical properties of the steel, such as fatigue limits and ultimate tensile strength. The treated steel shows high resistance to corrosion, but is attacked by inorganic acids.

Nature of Polish Layers. (J. A. Darbyshire and K. R. Dixit, Phil. Mag., Vol. 16, No. 108, Nov., 1933, pp. 961-974.) (10.262/27607 Great Britain.)

The polished surfaces of ten conducting metals and two non-conductors, Se and Si, were examined by electron diffraction. In all cases an amorphous layer was observed resembling supercooled liquid. The conductors showed the minimum interatomic spacing, but the non-conductors retained the normal spacing. Nine references.

Determination of Timber Beams with Two Flanges. (W. Prager, Z.F.M., Vol. 24, No. 19, 14/10/33, pp. 521-523.) (10.400/27608 Germany.)

A typical stress strain diagram for timber under simple axial stress shows asymmetry about the zero point with smaller breaking load under tension than under compression. This is taken into account in calculating the breaking couple under bending moments. Simplified formulæ are developed, and numerical values are plotted graphically.

Two references.

The Strength of Pinned Joints in Wood, Using Various Forms of Mortice. (P. T. Landsem, Z.V.D.I., Vol. 77, No. 37, 16/9/33, pp. 1015-1016.) (10.404/27609 Germany.)

This is a review of American work carried out by the National Committee on Wood Utilisation. The choice of mortice depends largely on whether the work is assembled in the factory on site, and whether a permanent or dismountable connection is required. Apart from this, the mortices illustrated are equally effective.

Three references.

Elastic Tube Connection without Welding. (Flugsport, Vol. 25, No. 14, 5/7/33, pp. 291-292.) (10.404/27610 Germany.)

The joint ends of the pipe are expanded conically and clamped on a double conical washer of petrol-resisting rubber by a screw cap, or by wire levers as applied to bottle stoppers.

Synthetic Resins. (O. Kraemar, Z.F.M., Vol. 24, No. 14, 28/7/33, pp. 387-393, and No. 15, 14/8/33, pp. 420-426. D.V.L. Report, No. 340.) (10.404/27611 Germany.)

A survey is given of aeronautical applications of bakelite and similar materials of which phenol formaldehyde is the chemical basis. Application to instruments, electrical fittings, mountings and insulators is common practice.

"Mikaita" is the trade name given in U.S.A. to a composite material made up of bakelite reinforced internally by layers of embedded fabric; it has been

applied to airscrews with some success. The favourable influence of the embedded material on the type of fracture is shown by photographs in comparison with the "short" fracture of pure bakelite. Test results showing the physical properties are given in tables in comparison with pine and with birch plywood.

Sixteen references.

Annealing of Glass. (L. H. Adams, J. Frank. Inst., Vol. 216, No. 1, July, 1933, pp. 39-71.) (10.406/27612 U.S.A.)

Internal stresses are discussed on a purely mechanical basis in terms of the elementary relations of mathematical elasticity. Stress optical relations supply accurate tests for residual stresses. The conditions for any desired degree of annealing can be determined precisely, without reference to internal constitution of the vitreous materials.

Thirty-five references.

Testing Apparatus and Methods of Testing

The Small D.V.L. Wind Channel. (F. Seewald, Z.F.M., Vol. 24, No. 20, 28/10/33, pp. 559-562. D.V.L. Report, No. 341.) (11.10/27613 Germany.)

The channel has an open jet 1.2 m. diam. and a closed rectangular wind circuit with guide vanes at the four angles. Details are given of a six component balance which gives measurements of three forces and three couples rapidly. The substantial suspension required for sufficiently stiff mounting of the model has no serious influence.

Three photographs show the general arrangement of the balance chamber, details of the balance, and a model suspended in three jets.

Two references.

Full-Scale Wind Channel. (S. J. de France, N.A.C.A. Report, No. 459, 1933.) (11.10/27614 U.S.A.)

A brief descriptive account is given with a specification of performance. Four photographs show the building and three views of the jet and test chamber.

Wind channel test results are plotted with flight tests for comparison, and show very close agreement between lift curves, but discrepancies between the drag curves—which are small at low incidence but increase with incidence.

Near stalling speed, both lift and drag curves indicate that stalling sets in at lower incidence in flight tests.

Present Position and Tendencies of Experimental Aerodynamics. (A. Eula, L'Aerotecnica, Vol. 13, No. 8, Aug., 1933, pp. 1021-1037, and No. 9, Sept., 1933, pp. 1181-1192.) (11.10/27615 Italy.)

A brief description is given of various types of wind channels. The appearance of turbulence affects the results of hydrodynamical theory based on non-turbulent flow, and methods of rendering turbulent motion visible are required. Reference is made to remarks of Prandtl on instability of fluid motion.

Correction for Rolling Moments of a Wing in a Wind Channel of Circular Section. (M. Biot, Z.F.M., Vol. 24, No. 15, 14/8/33, pp. 410-411.) (11.16/27616 Germany.)

Following Prandtl, the method of images is used to form and express analytically the external distribution of images. The effect on the rolling moment is obtained by integration and is found to be of the order of three per cent. in a numerical example.

Seaplane Research. (H. M. Garner, J.R. Aer. Soc., Vol. 37, No. 274, Oct., 1933, pp. 829-863.) (11.22/27617 Great Britain.)

A concise but comprehensive survey is given of the special problems arising in water-borne aircraft and the methods devised for their investigation. Some account is given of existing tanks and of experimental results, of which typical examples are reproduced.

The measurement of water resistance on hulls and floats has long been carried out in water tanks on lines generally similar to tests of ships' hulls, much complicated by the gradual transference of drift and resistance from water to air and from hull or floats to wings. The principles underlying scale correction are discussed briefly. The same complication applies to problems of stability, for which formal mathematical expressions have been developed comparatively recently, on lines generally similar to the theory of stability of an aeroplane completely air-borne.

Landing shocks and impact pressures of waves have received much attention in Germany, and the methods developed there have been studied and applied in this country. The nature of transmission and absorption of shocks of brief duration raises important problems in the theory of structures, which require investigation, and methods of measurement have been developed.

A critical discussion was opened by the Director of Scientific Research, and the views of the scientific and technical staff of the Service and the constructors were elicited.

Drive and Measuring Instruments for Self-Propelled Ship Models. (Summary.) (Ing. Schmierschalski, Werft-Reederei-Hafen, Vol. 14, No. 14, 15/7/33, pp. 201-202.) (11.22/27618 Germany.)

A comparison is made of types of self-contained equipment designed for such tests. The great difficulties imposed by the small scale of the apparatus have been overcome, and an accuracy of one to two per cent. is suggested.

A comparison is made of the Hamburg, Vienna and Washington equipments. Calibration and running characteristics are reproduced from the Hamburg Institute.

A photograph shows a compact general arrangement.

Gamma Ray Testing. (G. E. Doan, J. Frank. Inst., Vol. 216, No. 2, Aug., 1933, pp. 183-216, and No. 3, Sept., 1933, pp. 351-384.) (11.47/27619 U.S.A.)

The upper limit of X-ray penetration of steel is from 8-10 cm., and for deep penetration use is made of gamma rays.

A summary is given of elementary physical theory of radiography and a comprehensive list of radio-active materials is given in tabular form. A photograph shows a lead screen and two photographs show the mounting of test pieces. Radiograms are reproduced to illustrate the relative penetration and scattering of X-rays and gamma rays.

Loss of energy by absorption, and times of exposure required, are shown graphically as functions of the thickness of the test piece. The rate of action of photographic films is increased 35-fold and the exposure times reduced inversely by using thick screens of calcium tungstate in contact with the film. Exposure times are shown graphically as less for X-rays for thickness of steel less than 4 in., and less for γ -rays above this thickness. Flaws occupying 2 per cent. of the depth in an object 4 in. thick are detected.

In routine testing a number of specimens should be arranged round the source of γ -rays and the source can be removed from a finished group to another group ready mounted for test, such continuous multiple operation greatly reducing costs.

Photographs show test specimens mounted for inspection, including large steel castings, and radiograms show specimens of films. A cost analysis is given.

Forty-five references.

Comparison of X-Rays. (L. S. Taylor, G. Singer and C. F. Stoneburner, Bur. Stan. J. Res., Vol. 11, No. 2, Aug., 1933, pp. 293-308.) (11.47/27620 U.S.A.)

From authors' abstract.—The X-ray output per effective (rms.) milliampere of tube current is found for full wave and constant potential to be nearly the same at any given value of the effective (rms.) voltage. The X-ray quality, as expressed by a full absorption curve, is found to be the same for all wave forms having the same effective (rms.) value, and regardless of peak values. It is thus possible to express the quality of any radiation in terms of the effective voltage used to excite it.

Ten references.

X-Ray Tube with Rotary Anode. (H. Wendt, Z.V.D.I., Vol. 77, No. 31, 5/8/33, p. 853.) (11.47/27621 Germany.)

The anode consists of a copper cylinder with a tungsten cone rotated at 2,000 r.p.m. by eddy currents in a rotary magnetic field. Higher duty is obtained without additional cooling and without overloading the anode, the reflecting surface of which is changing continuously.

X-Ray Test of Ship Materials in Dock. (Schatzmann, Werft-Reederei-Hafen, Vol. 14, No. 15, 1/8/33, pp. 207-209.) (11.47/27622 Germany.)

Two general and three detailed photographs show high tension cables led to ships in dock, and the disposition of the apparatus for testing boilers, brackets, and tubes. Three typical X-ray photographs are reproduced.

Six sections cut from a defective bracket are shown for comparison with the X-ray photograph which revealed the defect.

Airships

German Engineering Conference, Friedrichshafen, May, 1933. (W. Parey, Z.V.D.I., Vol. 77, No. 27, 8/7/33, pp. 725-731.) (12.10/27623 Germany.)

The principal lecture, dealing with airship development, advocated improvements in aerodynamic performance of medium-sized hydrogen airships. The use of helium at present is a severe handicap.

Wireless

Audio-Frequency Atmospheric. (E. T. Burton and E. M. Boardman, Proc. Inst. Rad. Eng., Vol. 21, No. 10, Oct., 1933, pp. 1476-1494.) (13.1/27624 U.S.A.)

From authors' abstract.—Various types of musical and non-musical atmospherics occurring within the frequency range lying between 150 and 4,000 cycles have been studied. Dependence of atmospheric variations on diurnal, seasonal and meteorological effects are discussed. Characteristics of audio-frequency atmospherics are shown in oscillograms and graphs.

Seventeen references.

Automatic Recorder of Ionosphere Heights. (T. R. Gilliland, Bur. Stan. J. Res., Vol. 11, No. 4, Oct., 1933, pp. 561-566.) (13.30/27625 U.S.A.)

A description is given of the apparatus, with a photograph and diagram of connections. Examples of continuous records are reproduced, and the diurnal changes in the ionised layers are discussed.

Five references.

Measurements of Heights of Ionosphere. (T. R. Gilliland, Proc. Inst. Rad. Eng., Vol. 21, No. 10, Oct., 1933, pp. 1463-1475.) (13.30/27626 U.S.A.)

From author's abstract.—This paper is a report of continuous measurements of the virtual heights of the ionized regions of the upper atmosphere. Records are shown which indicate the variability, especially at night. The changes are so abrupt and irregular that data taken over a longer period, and for other frequencies will be necessary before it is possible to establish the relative importance of such things as magnetic storms, meteor showers, sun spots or thunderstorms.

Seven references.

Report of Committee on Radio Propagation Data. (Proc. Inst. Rad. Eng., Vol. 21, No. 10, Oct., 1933, pp. 1419-1438.) (13.30/27627 U.S.A.)

From author's abstract.—The frequency range covered is 150 to 1,700 kilocycles, and distances up to 5,000 kilometres (3,107 miles).

The essential results are given in the figures. These comprise a series of graphs giving received field intensities under various conditions, and a series of graphs showing the limitations upon reception imposed by atmospheric and man-made noise and by fading.

Six references.

Attenuation of Overland Radio Transmission. (C. N. Anderson, Proc. Inst. Rad. Eng., Vol. 21, No. 10, Oct., 1933, pp. 1447-1462.) (13.32/27628 U.S.A.)

From author's abstract.—Data on the effect of land upon radio transmission have been obtained during the past few years in connection with various site surveys for the general frequency range 1.5 to 3.5 megacycles per second, and for various combinations of over-water and over-land transmission. Curves are developed which enable field strength estimates to be made for over-land transmission in the extended frequency range.

Eight references.

Calculation of Modulation Products in a Three-Electrode Valve. (A. C. Bartlett, Phil. Mag., Vol. 16, No. 107, Oct., 1933, pp. 845-847.) (13.5/27629 Great Britain.)

From author's abstract.—If to the grid of a three-electrode valve voltages of two different frequencies, f_1 and f_2 , are applied simultaneously, then, owing to the non-linear characteristic curve, the anode current will contain components of all frequencies of the form $mf_1 \pm nf_2$, where m and n are any integers. Such components are usually termed modulation products.

A modified form of Taylor's theorem is derived, which allows functions of cosines to be developed directly in series of cosines of multiple angles. This is applied to the determination of the modulation frequencies in a non-linear device such as the thermionic valve.

Harmonic Production in Thermionic Valves. (D. C. Espley, Proc. Inst. Rad. Eng., Vol. 21, No. 10, Oct., 1933, pp. 1439-1466.) (13.5/27630 U.S.A.)

Author's abstract.—Formulæ are obtained for the amplitudes of harmonic components and the direct-current change in the anode current of thermionic

valves operating with resistive loads. These expressions for components up to the sixth harmonic are given in terms of points taken from the load line on the anode-voltage anode-current characteristics at equally spaced intervals of grid voltage.

Two references.

Experiments on Methods of W./T. Communication in Long Range Flights. (P. v. Handel, K. Kruger and H. Plendl, H.F. Technik., Vol. 42, No. 1, July, 1933, pp. 11-20. D.V.L. Report, No. 330.) (13.6/27631 Germany.)

Long-distance wireless on short wave-lengths is subject to fading. In fixed stations great power, combined with directional antennæ at both ends, mitigates the fading. In aircraft or mobile stations generally the question of weight and size limits the feasible power.

The D.V.L. have obtained promising results by using alternately two antennæ, which are polarised to a different extent. Details of the circuits are given.

Performance Tests of Radio System of Landing Aids. (H. Diamond, Bur. Stan. J. Res., Vol. 11, No. 4, Oct., 1933, pp. 463-490.) (13.6/27632 U.S.A.)

From author's abstract.—Details are given of the final stage of development of the Bureau of Standards system of radio landing aids designed to assist aircraft in making safe landings during fog or other condition of low or zero visibility.

Performance data are given on the operation of the system over an extended period of time, which indicate its complete practicability for commercial use.

Three references.

Course and Quadrant Identification with Radio Range Beacon System. (F. W. Dunmore, Bur. Stan. J. Res., Vol. 11, No. 3, Sept., 1933, pp. 309-325.) (13.6/27633 U.S.A.)

From author's abstract.—Certain circumstances may arise, especially near the radio beacon, when a pilot may pass from one course or quadrant to another without his knowledge of it. When once so lost, he may wander many miles in an attempt to reorient himself, since the four courses are all practically identical, and two of the four quadrants between the courses give identical indications.

This paper describes a method of obviating this difficulty by transmitting a directive signal composed of one dot in a westerly direction, a similar signal of two dots in an easterly direction, three dots north and four dots south.

Four references.

Short Wave Beacon Control of Landing in Bad Weather. (H. Jacobshagen and E. Kramar, Z.F.M., Vol. 24, No. 18, 28/9/33, pp. 493-495.) (13.6/27634 Germany.)

A technical description is given of an experimental short-wave beacon at Tempelhof, illustrated by a photograph showing the frame and experimental shed, and by diagrams of field strengths and directions, etc.

Piezo-Electric Loud Speaker. (S. Ballantyne, Proc. Inst. Rad. Eng., Vol. 21, No. 10, Oct., 1933, pp. 1399-1408.) (13.81/27635 U.S.A.)

From author's abstract.—The present paper is concerned with a description of an electrophone unit adapted for the reproduction of the higher audible frequencies and suitable for use as a component of such a composite reproducing system.

The instrument is of the horn type and is driven by a piezo-electrically-active diaphragm built up of crystals of Rochelle salt (sodium potassium tartrate), in which the piezo-electric effect is enormously greater than that exhibited by other materials. It is, however, somewhat more capricious in its dependence upon temperature, humidity, polarisation and variation from specimen to specimen.

Six references.

Photography

Aircraft in Relation to Petroleum Technology. (H. Hemming, J.R. Aer. Soc., Vol. 37, No. 274, Oct., 1933, pp. 864-899.) (14.14/27636 Great Britain.)

Survey of unexplored country by air is far more rapid and less expensive than ground survey, and incorporates a wealth of detail quite unattainable by land survey—with any comparable expense in time and money.

Interpretation in terms of geological formation is referred to experts in petroleum geology, and questions of road, river, and railway transport to transport engineers. These requirements affect the rapidity, accuracy and scale of the air photographic work. Most of the examples are taken from practice in U.S.A. and Canada.

The problem of costs is analysed, and specifications of air equipment are given. Specimens of survey photographs are reproduced, with marking denoting the interpretation of surface characteristics. Air transportation is discussed, and a description is given of transport problems in practice—with examples of equipment and materials carried. Specimen costs are tabulated.

Five references.

Comparison of Photographic Developers. (R. Davis and G. K. Neeland, Bur. Stan. J. Res., Vol. 11, No. 3, Sept., 1933, pp. 379-407.) (14.60/27637 U.S.A.)

From authors' abstract.—In a study of several photographic developers, including the international sensitometric standard, p-aminophenol, it was found that the latter agent is not as satisfactory as certain metol-hydroquinone developers in two respects:—

- (1) The "toe" region of the characteristic curve is increased, accompanied by an increased inertia.
- (2) The recommended formula is not well chosen in that the solution is supersaturated.

Seventeen references.

Slide Rule for Setting Photographic Apparatus. (Capt. Petitot, Rev. F. Aer., No. 48, July, 1933, pp. 739-760.) (14.90/27638 France.)

A discussion is given of the numerous factors affecting the exposure and development of a plate according to colour and intensity of light, aperture, choice of emulsion, etc.

An abac is constructed to give rapid determination of exposure time in reference to time of year, state of sky, colour of subject and diaphragm. Subsidiary abacs give the height of the sun and intensity of lighting according to day and hour.

The methods are combined in a slide rule which contains, besides numerical graduates, scales of colour ranging from dull grey to snow, and clouds directly illumined, and of sky from bright sun to pearly overcast conditions. The length of shadows in relation to the height of the object is determined by the slide rule for the interpretation of photographs.

Recently Patented Camera Shutters. (W. Lind, Z.V.D.I., Vol. 77, No. 27, 8/7/33, pp. 733-736.) (14.90/27639 Germany.)

Details are given of improvements in the well-known Compur shutter. A high-speed shutter developed by Zeiss employs continuous rotation of three sectors.

Twenty-four diagrams.

Sound

The Theory of Hearing and Percussion Noises. (G. v. Békésy, Phys. Zeit., Vol. 34, No. 15, 1/8/33, pp. 577-582.) (15.20/27640 Germany.)

In a physiological experiment the drum of the living ear is excited directly by plucking. Observation of the resulting vibration determines frequency and damping. The formation of surface waves on the basilar membrane is inferred from experiments on the apparent direction of percussion noises and demonstrated directly by a model of the human ear.

Reflection of Sound Waves, Vertically Incident, by the Ground. (E. Eisner and K. Kruger, H.F. Technik., Vol. 42, No. 2, Aug., 1933, pp. 64-67. D.V.L. Report, No. 331.) (15.26/27641 Germany.)

The experiments were carried out from a small semi-rigid airship. A pneumatically operated whistle sent out notes of frequency 2,900 Hertz. The intensity of the echo was measured electrically by an impulse meter. The reflecting power of water, ice, meadow, and woodland are of the order 1, 1.1, 0.5, and 0.3. The results are influenced greatly by local air disturbances.

Four references.

The Problem of Air Sounding. (Cdt. Laboureur, Tech. Aéron., No. 128, 1933, pp. 121-125.) (15.26/27642 France.)

The author describes the Laboureur-Dubois altitude recorder which works on the Behm echo principle. The novel feature is the recording device which gives a continuous reading. Short sound impulses are emitted by the aircraft at regular intervals, each impulse starting a neon lamp. The returning echo extinguishes the lamp. The current flowing in the interval charges a condenser, the subsequent discharge of which gives a continuous current reading depending on the altitude.

It is stated that satisfactory air tests have been carried out and a series order placed by the French Air Ministry.

Noise Reduction

Frequency Analysis of Noises and Application of Method to the Investigation of Noise in Aeroplanes. (F. Eisner, H.F. Technik., Vol. 42, No. 2, Aug., 1933, pp. 53-64.) (15.3/27643 Germany.)

The method consists in superposing on the noise a so-called "search note" of pure sine form, the frequency of which is slowly varied. The resulting differing tones are analysed. The processes of reception and analysis may be separated conveniently by recording the noise on a sound film. Sections of the record can be used to reproduce the noise for the corresponding time interval and to analyse it as convenient.

Sixteen references.

Silencing of Sounds in Pipe Lines. (G. Buchmann and W. Willms, Schelltechnik, Vol. 6, p. 12, 1933; Phys. Ber., Vol. 14, No. 19, 1/10/33, p. 1503.) (15.38/27644 Germany.)

Various forms of silencing by interference, acoustic filters, and variation of exhaust cross-section are discussed. A practical application of the latter is described, which gave a noise reduction of 22 Phon (decibels) on a pumping installation.

Wall Thickness—Maximum Permeability of an Ultra-Sonic Sound. (E. Hiedemann and H. R. Asbach, Phys. Zeit., Vol. 34, No. 19, 1/10/33, pp. 734-735.) (15.38/27645 Germany.)

In accordance with Rayleigh's theory and subsequent extensions thereof, the optimum thickness is shown to be an integral multiple of the half wave-length by optical methods.

Six references.

Astronomical Air Navigation. (M. A. Bastide, Rev. F. Aer., No. 48, July, 1933, pp. 761-774.) (15.5/27646 France.)

A note is given on methods of astronomical fixes from aircraft proposed by three Italian writers. In particular, a specimen set of observations and numerical reductions is reproduced as prepared by Capt. A. Biseo for a flight from Freetown, Liberia, to Pernambuco, and the points are shown on a map.

One fix is obtained at sunrise and another at mid-day. On reaching the latitude of Fernando Island the latitude is followed till the island is sighted and a new departure taken for Pernambuco.

The flight was realised later by an Italian squadron under General Balbo.

Accidents and Precautions

Flame Traps. (F. Kuhn, Autom. Tech. Zeit., Vol. 36, No. 13, 10/7/33, pp. 336-339.) (16.00/27647 Germany.)

Flame traps consisting of sieves or tubular bundles can be inserted in the induction pipe or in the carburettor intake. The former gives better protection with a marked drop in power, but no complete immunity, and consequential fires may be set up if liquid fuel is present by leakage.

The experiments were carried out on a six-cylinder engine by ignition in one of the cylinders near the end of the induction stroke. The back-fire was propagated at very high speed, probably on account of the high turbulence of the mixture. Momentary pressure rises of the order of 30lb. per sq. in. were observed in the induction pipe.

Flame Traps Using Porous Material. (F. Mörs, Z.V.D.I., Vol. 77, No. 35, 2/9/33, pp. 960-961.) (16.00/27648 Germany.)

The patented flame trap is designed for welding plants using oxyhydrogen or oxyacetylene gas. A cartridge charged with porous material saturated with salt crystals is inserted in the vent. A blow-back perforates a tinfoil diaphragm and the flame is extinguished in the trap before the gas escapes into the air. A fresh cartridge must then be inserted, but the same filling would serve for a number of blow-backs.

Aircraft—Unorthodox

Aerodynamical Principles of the Lifting Airscrew. (M. Schrenk, Z.F.M., Vol. 24, No. 15, 14/8/33, pp. 417-419; No. 16, 28/8/33, pp. 449-454; and No. 17, 14/9/33, pp. 473-481. D.V.L. Report, No. 345.) (17.00/27649 Germany.)

The author states that the formulæ previously developed are not definitely related to the physics of the problem, nor in a form suitable for designers, and professes to fill the gap by the method of the present paper. Well established methods are followed and known results obtained so far as mathematical analysis is applicable.

The author divides the total losses into three parts, the loss due to the induced resistance, the loss due to the axial "slip" and the loss due to asymmetry. The total losses are checked by test measurements and investigations into the sources of error are facilitated by the sub-division.

Constant reference is made to English work and it is not easy to find any fundamental departure therefrom. It may be agreed with the author that knowledge of the physical phenomena is highly imperfect in respect of the actual aerodynamical conditions and consequently of the imposed forces and that further investigations are urgently required.

High Speed Autogiro. (J. A. J. Bennett, Z.F.M., Vol. 28, No. 17, 14/9/33, pp. 465-470.) (17.05/27650 Germany.)

The usual approximations are made and expressions for lift and resistance are formed. The condition of zero aerodynamical moment is expressed in terms of a double integral which is expanded in a rapidly convergent series. Some of Lock's results are quoted and numerical values are computed and plotted in diagrams which show the effect of varying the parameters of design. The conclusion is reached that above 250 km./hrs. the autogiro requires much less power than a comparable aeroplane.

[This appears to assume the validity of the approximations made when the flying speed approaches the mean peripheral speed of the autogiro blades.]

Boomerang and Autogiro. (J. Mottez, L'Aéron., No. 172, Sept., 1933, pp. 207-213.) (17.05/27651 France.)

An elementary aerodynamical theory of the boomerang is constructed. The hinging of the wing spars at the axle eliminates gyroscopic precession of the axis of the autogiro.

Stipa Aeroplane. (L. Stipa, Riv. Aeron., No. 7, July, 1933, pp. 13-37.) (17.30/27652 Italy.)

The body is hollow and presents the appearance of a circular wind channel. The experimental characteristics of two model bodies are given graphically and sectioned sketches show the dimensions in side and end elevations.

A full size aeroplane has been built and the engine is installed near the mouth of the wind channel, with the airscrew rotating in the entry. General arrangement sketches and nine photographs show details of construction, engine installation and the complete machine. Comparative weights, power, surface and performance are tabulated in comparison with three other aeroplanes of similar engine power.

The range of speed of the Stipa is slightly higher, but the average performance appears to be rather lower.

Photographs show models with two, three and four airscrews mounted in parallel wind channels passing through the aeroplane structure.

Equilibrium of Tailless Aeroplanes. (G. A. Mokrzycki, L'Aéron., No. 171, Aug., 1933, pp. 73-75.) (17.30/27653 France.)

The elementary expression for variation of pitching moment is written down and graphical charts show the experimental relation between incidence and moment, and the condition for equilibrium.

One reference.

Principles Underlying the Construction of Rotary Wings. (C. B. Strandgren, L'Aérophile, No. 7, July, 1933, pp. 209-215.) (17.30/27654 France.)

In the apparatus designed by the author the sustentation is produced by paddle wheels rotating about a transverse axis. The paddles are mounted on independent axes and oscillate so as to vary their effective incidence through a small controllable angle. (See Abst. 27526.)

Piskorsch Rotary Wing Aircraft. (Flugsport, Vol. 25, No. 18, 30/8/33, pp. 397-398, and No. 19, 13/9/33, pp. 409-410.) (17.30/27655 Germany.)

The model described resembles the Rohrbach proposal (see Abstract 27654). Instead of being arranged, however, on the circumference of a cylinder the wing elements form part of a conical surface, the angle of the cone being variable. In addition the individual wing elements are elastic so that they can assume automatically an effective angle of incidence. No details as to the mechanism are given but it appears that horizontal, vertical and hovering flight will be possible without the provision of an additional propeller.

Aircraft Carriers

French Aircraft Carriers. (Rev. F. Aer., No. 48, July, 1933, pp. 821-831.) (18.00/27656 France.)

A brief description of the "Commandant-Teste" and the "Béarn" is illustrated with 14 photographs showing the vessels and details of equipment and operations—flying off deck, hoisting in, hoisting up a towed "apron," and stowing.

Maritime Aviation—Leaving and Landing on the Parent Ship. (Lt. Barjot, Rev. F. Aer., No. 51, Oct., 1933, pp. 1083-1104.) (18.3/27657 France.)

Launching by catapult is discussed. Landing on deck requires powerful braking. Modern forms of wing flaps such as the American Zap and the French Pouit construction are described and machines with these devices are illustrated.

Thirteen references.

Meteorology and Physiology

The Clearance of Fog in Industrial Buildings. (A. Lichte, Z.V.D.I., Vol. 77, No. 40, 7/10/33, pp. 1089-1095.) (19.10/27658 Germany.)

In many industrial undertakings work has to be carried out in the presence of open tanks containing heated liquids. Under these conditions fogs are liable to form, especially in cold weather. The author uses the steam diagram to determine the quantity and temperature of ventilating air required to disperse a fog.

Six references and seventeen diagrams.

Determination of Cloud Velocities. (L. Martinuzzi, L'Aerotecnica, Vol. 13, No. 7, July, 1933, pp. 890-903.) (19.10/27659 Italy.)

The elementary geometry is given of nephoscope observations and of reduction of oblique observations to zenith (angular) velocities. The subsequent application to determinations of wind velocities at various altitudes is of importance to air navigation.

Eight references.

Treatment of Air Sickness. (A. Gymnich, Z. F. M., Vol. 24, No. 19, 14/10/33, pp. 523-525.) (19.20/27660 Germany.)

A descriptive account is given of the circumstances under which air sickness appears. Medical examination tests and classification of pilots are discussed and prophylactic measures are considered.

Respiration of the Pilot as Affected by Physical, Technical and Toxiological Conditions. (E. Gillert, L.F.F., Vol. 10, No. 3, Oct., 1933, pp. 87-144.) (19.20/27661 Germany.)

The problem is fully discussed in 87 pages. The pilot is affected by low pressure apart from deficiency of oxygen and a limit of endurance may be taken as about 14 km. Even at lower altitudes continued oxygen breathing is harmful. Under these conditions the comfort of the pilot and his freedom from physical and mental strain become important factors.

Two hundred and eighty-nine references.

The Physiological Effect of Speed on the Pilot. (A. L. Flamme, Rev. F. Aér., No. 51, Oct., 1933, pp. 1139-1151.) (19.29/27662 France.)

Many unexplained accidents, including those attributable to error of judgment, are due to a temporary breakdown of the pilot's nervous system. Much stricter medical examinations are required. Gastro-intestinal reactions should be specially studied as an important index of the physiological effect of high speeds.

Orientation in Aircraft by Means of the Senses. (A. Gemelli, L'Aerotecnica, Vol. 13, No. 10, Oct., 1933, pp. 1294-1324.) (19.29/27663 Italy.)

The importance of the labyrinth of the ear in judging changes of direction is considered to be over-rated and no judgment of orientation or direction is to be attributed to the human senses. The homing of pigeons remains unexplained. Flying by instrument will become more general in the future.

Sixty-eight references.

Lighting

Transparency of Fogs. (Z. Instrum., No. 7, July, 1933, p. 304.) (21.22/27664 Germany.)

Experiments with artificial fogs at the Reichsanstalt confirm the greater fog penetration of infra red rays with increasing wave length in the range 0.6 μ to 9 μ .

Aerodynamics and Hydrodynamics

Experimental Researches by Marey on Motion in Air and Water. (P. Noguès, Pub. Sc. et Tech., No. 25, 1933.) (22.10/27665 France.)

Jules Marey (1830-1904) was the first to apply accurate instruments to physiological investigations. In his studies of the motion of birds and insects the registration was carried out by highly ingenious mechanical instruments. These

were later replaced by photographic methods which anticipate the modern cinema. Subsequently the work was extended to the motion of air and water by photographing small particles suspended in the current.

Extension of Hele-Shaw's Method to Cyclic Motion. (Riabouchinsky (summarised by P. L eglise), L'A eron., No. 166, March, 1933, p. 58.) (22.10/27666 France.)

In Hele-Shaw's well-known experiment on the flow of a viscous fluid between plates set close together, the motion is a cyclic. By constricting the channel and the flow on one side of the aerofoil section, the flow is diminished on that side and a cyclic component round the section is set up.

The velocity field can be measured from the photographs of the observed streamlines, and the pressure field and lift calculated.

Flow of Viscous Fluid Behind a Body. (Parts I and II.) (S. Goldstein, Proc. Roy. Soc., Vol. 142, No. A.847, 1/11/33, pp. 545-573.) (22.10/27667 Great Britain.)

In Part I the viscosity is taken to be small, and the approximations and methods of Blasius and Prandtl are applied to obtain first and second approximations. A third approximation along these lines is shown to fail.

The results, applied to the case of a flat plate, are computed, tabulated, and compared with experiments by Fage. There is close agreement immediately behind the tail, but at half the plate length down-stream there is serious divergence, which may be due to instability and breakdown of laminar flow.

In Part II the viscosity is not assumed to be small, and reference is made to Filon's analysis (see Abstract 5106). The body is of arbitrary shape and consideration is given to the wake far down-stream. Approximations are introduced at an earlier stage than by Filon, and justified *  posteriori*, lead to the same results. Filon's results are confirmed, in particular the failure of the attempt to obtain a third approximation for the moment when there is cyclic flow round the body. The moment is found to be logarithmically infinite, and Goldstein explains this by the displacement of the wake by the circulation field.

Flow of Viscous Fluid Past Rotating Bodies. (T. E. Garstang, Proc. Roy. Soc., Vol. 142, No. A.847, 1/11/33, pp. 491-508.) (22.10/27668 Great Britain.)

Following Stokes, Oseen and Lamb, neglecting the so-called inertia terms, the solution depends on that of a subsidiary linear differential equation with constant coefficients. The solution is found in terms of series of Legendre functions with arbitrary coefficients which are determined by the body conditions. Lift and drag are found to be independent.

The results, which have been arrived at by two different methods, are in contradiction with experiment and with the Kutta-Joukowski theorem for a perfect fluid. It is concluded the Oseen approximations fail when the coefficients are determined for the conditions at the boundary of the body.

A Development of the Michell Theory of Lubrication. (T. Kobayashi, J. Soc. Mech. Eng., Japan, Vol. 36, p. 246; Phys. Ber., Vol. 14, No. 19, 1/10/33, p. 1505.) (22.10/27669 Japan.)

The load-carrying capacity and frictional resistance are calculated, using Michell's theory modified to account for end and oil-groove effects.

Stability for Three-Dimensional Disturbances of Viscous Fluid between Parallel Walls. (H. B. Squire, Proc. Roy. Soc., Vol. 142, No. A.847, 1/11/33, pp. 621-628.) (22.15/27670 Great Britain.)

The assumptions are made that the disturbances can be expressed as a sum of disturbances periodic in time and space, and that the squares of the disturbing velocities and their derivatives may be neglected. With these simplifications a fourth order differential equation is obtained. From the form of the equation it is inferred that the critical value for a two-dimensional disturbance is smaller than for a three-dimensional disturbance.

Still considering only two-dimensional disturbances, if the transverse component (v) is zero, the motion remains in equilibrium from (u) disturbances parallel to the stream (as is, indeed, physically obvious).

Cavitation and Rapid Local Changes of Density. (Riabouchinsky (summarised by P. Léglise), L'Aéron., No. 166, March, 1933, pp. 56-58.) (22.15/27671 France.)

Photographs and sketches illustrate the elementary theory, the mounting of the experiment and the formation of cavitations for a sphere, a disc with sharp edge and a rectangular plate with sharp edges.

In the case of air, lycopodium powder renders visible the formation of tubes of vorticity, which act very much like the cavitations found in water.

Researches on Guttulation (Atomisation) in Diesel Jets. (Werft-Reederei-Hafen, Vol. 14, No. 15, 1/8/33, pp. 209-212.) (22.2/27672 Germany.)

The application of pressure jet injection has made remarkable progress, which depends largely on effective sub-division of the fluid and distribution of the drops in the explosion space. In one method the drops are sampled by exposure of a surface wetted with glycerine in the line of the jet. Photographs of samples magnified to 50 diameter are reproduced. The drops are counted and their diameters measured. The frequency of each size of drop is plotted against the diameters. A family of frequency curves shows the distribution under different working conditions.

In another method the drops are photographed as they stream past a camera. The process of splitting a drop is illustrated diagrammatically in two sketches.

Reference is made to research in U.S.A. and a diagram is reproduced showing the jet space divided into a number of zones by contour lines of equal distribution of fuel.

Three references.

Eddies Produced by Jets in Slow Motion. (H. Bouasse, Pub. Sc. et Tech., No. 26, 1933.) (22.2/27673 France.)

Eddies of various types were formed experimentally by jets with free emission or impact on surfaces and the course of their development studied. Elementary formulæ are developed for the size, shape and motion of the eddies formed. While these are purely empirical, any mathematical physical investigation should be guided in choice of approximations by the general form of these expressions.

The author states that he has never observed an eddy which was not formed by rolling up of sheets of fluid and regards this as a challenge to the theory of vortices presented by rational hydrodynamics. After Reynolds' manner, he insists on the need for visual observation of fluid motion.

Laminar Diffusion of a Jet. (H. Schlichting, Z.A.M.M., Vol. 13, No. 4, Aug., 1933, pp. 260-263.) (22.2/27674 Germany.)

A small circular jet issuing at right angles to an infinite plane wall, from an orifice therein, is assumed to extend by viscous diffusion only, without instability of the steady flow. A form of solution of the differential equations of viscous fluid motion is assumed and indeterminate coefficients are determined by the boundary condition. Numerical values are tabulated and shown graphically.

A solution of the two-dimensional problem is given without the analysis, and the velocity distribution is given graphically for comparison with the circular jet.

(Apparently paradoxical results are obtained with respect to the total flow across planes parallel to the plane boundary. Without a detailed examination it is not possible to assess their significance nor to see whether they arise from the simplifying assumptions made at the beginning.)

Turbulent Flow Through Fine Eccentric Clearances. (R. J. Cornish, Phil. Mag., Vol. 16, No. 108, Nov., 1933, pp. 897-912.) (22.2/27675 Great Britain.)

Observed values are plotted graphically and compared with the known mathematical solution for laminar flow and with empirical formulæ for turbulent flow. The latter are based on v. Karman's empirical formula, which has since been considerably modified.

Ten references.

Rotating Flow in Pipes. (E. Traub, Ann. d. Phys., Vol. 18, No. 2, Sept., 1933, pp. 169-192.) (22.2/27676 Germany.)

A description is given of the technical apparatus for imposing a rotational component of motion on flow through a pipe. The distribution of axial velocities is heavily affected. A series of measurements is plotted and agrees well with a semi-empirical equation due to V. Bjerknes. When a rotational component is superposed the axial velocity rises from zero at the boundary to a maximum at a fraction of the radius and falls again to a minimum at the axis, where a cusp may be formed. When the tube contracts a double maximum may be formed in the curve of axial velocity distribution along the radius.

Reference is made to water spouts and an application to the stabilising of an electric arc is discussed.

Nineteen references.

Generation of Turbulent Flow in Pipes. (H. Kurzweg, Ann. d. Phys., Vol. 18, No. 2, Sept., 1933, pp. 193-216.) (22.2/27677 Germany.)

Following Schiller and Naumann, the entry to the pipe has a sharp edge at which a sheet of intense vorticity is generated, passes into the pipe, and breaks up into eddies.

A rational expression is formed for the circulation round each eddy in terms of the observed mean velocity, contraction and eddy spacing. This quantity, divided by the kinematic viscosity, forms a non-dimensional parameter which is stated to have a critical value, 1170, independently of variations in the parameters involved, and in the other physical parameters introduced by the mounting of the experiment.

(The phenomenon is fundamentally different from that presented by Osborne Reynolds's experiment with smooth entry and laminar flow down to the critical point, and the criteria are not related, apart from the fact that both cases are problems of instability of viscous fluid motion, and this imposes certain common characteristics on the form of the expressions involved.)

Thirteen references.

Flow Phenomena in Rough Pipes. (J. Nikuradse, Forschungsheft, No. 361, July/Aug., 1933.) (22.2/27678 Germany.)

Pipes were roughened artificially by attaching sand grains of different average sizes to the surface. The average amplitude of the roughening is denoted by a linear quantity k , and the ratio r/k was introduced by R. V. Mises as a non-dimensional parameter in a generalised coefficient of resistance. The present report covers experiments on roughened pipes for six different values of the new parameter, which are compared with flow in "smooth" pipes. At higher Reynolds numbers the usual expression for coefficient of resistance as a function of Reynolds number which is independent of r/k , gives six distinct unicursal curves.

A new formula introducing the parameter r/k has been devised by the author and reduces all six sets of observations to a single unicursal curve. The velocity distributions are also discussed and Karman's well-known expression exhibiting the velocity as proportional to the $1/n$ th or power of the distance from the wall, where n may be 7, 8, or a higher power as Reynolds number increases. The value of n is shown to be a function of r/k , as well as of Reynolds number.

Turbulent Layer on Curved Surface. (H. Wilcken, Ingenieur Archiv., Vol. 1, No. 4, Sept., 1930, pp. 357-376.) (22.2/27679 Germany.)

Two channels of rectangular section, 90 mm. \times 650 mm. were bent (on the flat) through semicircles of mean radii 450 mm. and 150 mm., so that the experiment deals with flow through a curved channel rather than with flow over a curved surface in the usual sense. The radial velocities are kept small by the flattening of the section. Extensive explorations of the pressure and velocity fields are exhibited graphically.

Much business is made of Prandtl's "mixing path" and the associated parameters, including the "apparent viscosity" which has a more definite physical meaning, and an elaborate transformation is carried out of Prandtl's semi-empirical relations to cylindrical co-ordinates. Comparisons are made with experimental measurements on flat plates.

Eight references.

Skin Friction of Various Surfaces. (S. D. Gehmann and S. D. Mallory, J. Frank. Inst., Vol. 216, No. 3, Sept., 1933, pp. 339-350.) (22.3/27680 U.S.A.)

Measurements were made of the skin friction in an air current of various fabrics and surface, with a view to improving the drag of the outer cover of an airship.

The method consisted in suspending a test cylinder inside a rotating cylinder, the clearance being of the order of $\frac{1}{4}$ in. The test cylinder is covered with the material to be investigated and its deflection under torsion control is a measure of the skin friction. The dimensions of the apparatus are controlled by consideration of flow stability as has been demonstrated by Taylor.

The experiments indicate that after a certain limiting value of skin friction has been approached any further improvement becomes increasingly difficult. Provided the material is light and does not flap, existing airship covers approach this limit.

Law of Resistance of Small Spheres in Viscous Media. (T. Sexl and E. Wasser, Phys. Zeit., Vol. 34, No. 15, 1/8/33, pp. 605-608.) (22.3/27681 Germany.)

In a previous article by Wasser (Phys. Zeit., Vol. 34, p. 257) the Cunningham formula has been discussed incorrectly. The correct development is of importance in molecular physics and sub-electronic phenomena.

The Turbulent Layer in Two-Dimensional Flow with Rising and Falling Pressure. (E. Gruschwitz, *Ingenieur Archiv.*, Vol. 2, No. 3, Sept., 1931, pp. 321-346.) (22.3/27682 Germany.)

Measurements were made of the velocity field about a wing profile and show a characteristic jump in the velocity gradient at the surface when the observing station moves downstream through the critical point at which turbulence sets in. It is stated that the desired results were not obtained in a simple form. Further measurements were therefore made of the velocity field near a flat plate and are exhibited graphically for a range of channel wind velocities.

All series show the characteristic jump in the velocity gradient, the critical point advancing nearer the leading edge as the channel velocity is increased. The pressure field is also explored. The apparent viscosity is plotted and shows a characteristic maximum of convection of momentum. Elaborate reductions of the results are made in terms of the parameters of Prandtl's theory.

Improvements in the Schlieren Method. (H. G. Taylor and J. M. Waldram, *J. Sci. Inst.*, Vol. 10, No. 12, Dec., 1933, pp. 378-389.) (22.4/27683 Great Britain.)

The method utilises differences in the refractive index from that of air, to produce an optical trace on a screen of the flow of gases. This includes the flow of hot air through a cold atmosphere, which has recently found considerable application in aeronautics.

A description is given of the apparatus used, with various improvements. The necessary elements of optics are briefly referred to. Eight photographs of flow are reproduced.

Twenty-nine references.

Lift on Flat Plate Near Wall. (S. Tomotika, T. Nagamiya and Y. Takenouti, *Aer. Res. Inst.*, Tokyo, Report 97 (Vol. 8, No. 1), August, 1933.) (22.4/5.20/27684 Japan.)

The mathematically more general problem of a plate between two plane boundaries has been very fully discussed by Rosenhead (*Proc. Roy. Soc.*, A.132, 1931, pp. 127-152), in examination of T. Sasaki's work on the same lines. A discrepancy was explained by the omission of a constant of integration and numerical values were computed for small ratios of the parameter such as usually occur in practice. Formal expressions for the effect of a single wall were found as limiting values when one of the two boundaries is taken to infinity.

Elliptic functions are necessarily introduced by the methods of conformal transformation and the whole paper is in effect a discussion of the appropriate elliptic functions and their transformations. In the present paper the limiting case of a single plane boundary is worked out *ab initio*. The work follows Rosenhead's analysis very closely until the new boundary condition is brought in. The analysis then becomes more specialised. Forms suitable for work computations are developed and numerical values are plotted and tabulated.

Theory and Application of the Mach-Zehnder Interference Refractometer. (H. Schardin, *Z. Instrum.*, Vol. 53, No. 9, Sept., 1933, pp. 396-403, and No. 10, Oct., 1933, pp. 424-436.) (22.4/27685 Germany.)

A brief account is given of the principles and construction of the refractometer. Disturbances of the air by a passing projectile, by a hot wire, etc., disturb the initial parallel arrangement of the interference fringes.

Two photographs show the disturbance produced by a horizontal heated wire and by a moving projectile. The isothermal surfaces deduced in the former

case are shown graphically. The pressure distribution along the path of a sound wave is shown graphically for four time intervals.

In Part II the theory of the refraction pattern from a linear source and the application of polychromatic light are discussed.

The relation between the refractive index, density and temperature of air is expressed in a simple form for small changes of the variables. Application to the disturbance of the field interference fringes by the passage of a projectile is illustrated by a worked out numerical example. Other applications are considered.

Hydrodynamics. (Bénard and Journaud (summarised by P. L'église), *L'Aéron.*, No. 166, March, 1933, p. 60.) (22.45/27686 France.)

Following Terada, Journaud has carried out experiments on a layer of viscous fluid flowing over a plane and heated from below. The mode of instability takes the form of elongated rectangular prisms with transverse cyclic motion.

(This mode is referred to in "Nature," February, 1925, p. 300, paragraph (c).)

Thermal Convection of Liquid. (Y. Hudino, Aeronautical Research Institute, Tokyo, Report No. 96 (Vol. 7, No. 15), July, 1933.) (22.45/27687 Japan.)

Examples of natural formations of polygons in mud are shown in three photographs. Experimental reproduction of the conditions in the laboratory yield analogous results, some of which are shown in thirteen photographs. An account is given of the experimental apparatus and the action of the convection currents is discussed qualitatively.

Measured wave lengths of the mode of instability are tabulated. The ratio of wave length to total depth, including the bottom layer of sediment as well as the free fluid is about 1.5, instead of 2.5 as indicated by Rayleigh's analysis. The conditions are, however, much different. There is a layer of water over the layer of silt and the temperature is raised to boiling point with evolution of bubbles.

Two references.

Patterns in an Unstable Layer of Air. (A. Graham, *Phil. Trans. Roy. Soc.*, Vol. 232, A.714, 13/11/33, pp. 285-296.) (22.45/27688 Great Britain.)

Photographs show a number of types of pattern obtained with unstable layers of fluid and observed in the atmosphere.

(No reference is made to the mathematical physical theory developed by Rayleigh, Low, Brunt and Jeffrey, without which the patterns observed by Bénard and many others remain mere experimental curiosities.)

Materials—Elasticity and Plasticity

Motion of a Rotor on Flexible Shaft and Bearings. (D. M. Smith, *Proc. Roy. Soc.*, Vol. 142, No. A.846, 2/10/33, pp. 92-118.) (23.00/27689 Great Britain.)

The equations of motion are formed for a single concentrated mass, for discrete masses and for a distributed mass.

The differential equations are linear generally, linear with reference to rotating axes, or periodic functions of time only. The consequent types of instability are classified.

Some rules for practical design are given.

Anharmonic Vibrations. (J. P. Den Hartog, J. Frank. Inst., Vol. 216, No. 4, Oct., 1933, pp. 459-473.) (23.10/27690 U.S.A.)

A brief review is given of previous work on vibration in systems where stress is not proportional to strain and approximate solutions are given for two new examples, one of which corresponds to a double acting braided rubber (Sandow) shock absorber.

Six references.

Experimental Solution of the Torsion Problem. (H. Cranz, Ing. Arch., Vol. 4, No. 5, Oct., 1933, pp. 506-509.) (23.10/27691 Germany.)

The author applies the electrical analogy due to Kelvin and Tait to the solution of torsion problems. The section to be investigated is sketched on paper and covered by a glass tank containing water, and the boundaries are delineated by metal electrodes at prescribed potentials. Alternating current is passed through the tank and equi-potential lines are marked out by means of a pointer and a vibration galvanometer. The feeding electrodes are arranged so as to satisfy the boundary condition.

The apparatus is shown in a figure with a diagram of connections. Two examples are shown graphically.

Six references.

An Experimental Solution of the Torsion Problems. (H. Quest, Ing. Arch., Vol. 4, No. 5, Oct., 1933, pp. 510-520.) (23.10/27692 Germany.)

The soap film analogy is applied. The slope of the film is measured directly by a refracted beam of light, calibrated from observations on films of circular boundary.

Nineteen figures illustrate the apparatus and show examples.

Ten references.

Optical Path Difference in Stressed Glass. (R. W. Goranson and L. H. Adams, J. Frank. Inst., Vol. 216, No. 4, Oct., 1933, pp. 475-504.) (23.15/27693 U.S.A.)

A beam of plain polarised light passes through the stressed plate, emerging as elliptically polarised light, and passes through a quarter wave compensating plate which transforms it back to plane polarised line in a different plane from the incident beam.

Readings for a divided circle of the angle between the planes of the incident and emergent beam can be averaged to within $.10^\circ$, corresponding to 0.05 millimicrons, or about 1/100th of the error with a graduated quartz wedge. The elementary optical theory is given.

The apparatus is shown in a photograph and sketches. Examples of readings are tabulated.

Twenty-three references.

Intermittent Buckling Stresses in the Elastic Range in Thin Rods with Articulated Support at Both Ends. (C. Koning and J. Taub, L.F.F., Vol. 10, No. 2, 6/7/33, pp. 55-64.) (23.30/27694 Germany.)

Under the conditions investigated, the Euler load may be safely exceeded if the time of impact is short enough. As long as the impact loads are below the Euler limits, the stresses reach a limit irrespective of time of impact. Above the Euler load the stresses increase indefinitely with increase in time of impact.

Experimental and Theoretical Investigation of Longitudinal Oscillations in Rods and Tubes. (E. Giebe and E. Blechschmidt, *Ann. d. Phys.*, Vol. 18, No. 4, Oct., 1933, pp. 417-456, and No. 5, Nov., 1933, pp. 457-485.) (23.30/27695 Germany.)

The quartz rods and tubes applied as resonators in high frequency measurements have transverse dimensions which are not small compared with the half waven-lengths of the vibrations, and Rayleigh's results require appropriate extension to include the harmonics thus set up, which are in no simple numerical relation to the fundamental. This is carried out for isotropic rods of nickel and nickel alloys. The differential equations are formed and solved and the numerical results are tabulated and compared with experiments. The results for tubes are in the closest agreement with experiment up to 800,000 Hez. Excellent agreement is also obtained with rectangular and cylindrical rods.

In analogy with the methods applied to tubes and cylinders, the coupling between the longitudinal and lateral natural periods is expressed in terms of kinetic energy only. The mathematical expressions are written down and solved for the compound frequencies. These are found to exist in three distinct series.

The calculated frequency spectrum is exhibited in tabular form graphically in comparison with observed values. Remarkable agreements are shown, and discrepancies are explained by the presence of harmonics known to be physically possible but not coming within the scope of the analysis. The coupling coefficient is determined and shown graphically. The results have application to piezo-electric frequency control.

Twenty-two references.

Weights of Typical Beam Sections. (J. Cassens, *Z.F.M.*, Vol. 24, No. 13, 21/7/33, pp. 359-363, and No. 14, 28/7/33, pp. 381-383.) (23.30/27696 Germany.)

Seven typical sections are considered. From the elementary geometry of the sections formulæ are prepared which facilitate the calculation of weight and bending moments and the best dimensions for a given purpose. Built-up girders are discussed with respect to the increase of weight involved in design for uniform load factors in comparison with design for uniform factors of safety.

A table giving simple formulæ involving the load factor and a graphical chart gives numerical coefficients, which facilitate numerical computations.

Four references.

Miscellaneous

The Use of Rubber in Rail Car Wheels. (P. Kramer and G. Reutlinger, *Z.V.D.I.*, Vol. 77, No. 35, 2/9/33, pp. 955-958.) (27697 Germany.)

The rubber is inserted between the steel tyre and the wheel and allows a certain amount of lateral displacement. There is considerable reduction of impact at the rail joints, of noise, wear of the rails, and rate of deterioration of the permanent way. This would allow of lighter construction of the permanent way or alternatively of heavier traffic and higher speeds on existing tracks.

Five references.

Aerodynamic Characteristics of Automobile Models. (R. H. Heald, *Bur. Stan. J. Res.*, Vol. 11, No. 2, Aug., 1933, pp. 285-291.) (27698 U.S.A.)

Sketches and photographs are shown of old style models and new highly-faired models.

Test data are tabulated for resistance and for lateral forces for different angles of yaw. A reduction of about 22 per cent. in air resistance is shown.

Eleven references.

The Fundamental Purpose of the War Car (Tank) in Modern Warfare. (R. Mertz, *Autom. Tech. Zeit.*, Vol. 36, No. 19, 10/10/33, pp. 481-483.) (27699 Germany.)

War cars (tanks) are divided into three classes—for reconnaissance, open warfare, and trench warfare. The relative merits of track and wheel propulsion for reconnaissance are discussed. The fitting of both drives is not considered good. The same judgment applies to the so-called amphibian types, the compromise seriously detracting from the fighting capacity of the tank.

Short-wave wireless sets for inter-communication and reporting to Headquarters have become practicable.