ABSTRACTS AND NOTICES FROM THE SCIENTIFIC AND TECHNICAL PRESS

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GENERAL AIRCRAFT DESIGN

Aircraft Design. (Il. Flug-woche, Vol. II, Parts V-VI.) (5.1/10910 Germany.)

Descriptive article, 19 photographs and diagrams exhibiting various types of metal construction, wing and hull construction, sections, used, etc.

Aircraft Design. (Air Corps Information Circular.) (5.1/10911 U.S.A.)

Specifications are given of the constructional details of an aeroplane (type P.T.3 training aeroplane) and of the loading tests. The deflections for the various loadings are given.

Aircraft Design. (Il. Flug-woche, Vol. II, Parts V-VI, August, 1929 (Anon.), pp. 81-98.) (5.1/10912 Germany.)

Descriptive article giving photographs of metal aircraft by Junkers, Dornier and Rohrbach, as they appeared each year from 1915 onwards. 74 photographs are reproduced, the three last showing the 12-engine, Dornier Do X.

Small Seaplane for Submarine Service. (Flug-woche, Vol. II, Parts V-VI, p. 119.) (5.1/10913 Germany.)

With reference to a submarine seaplane of secret construction stated to be exhibited by the Air Ministry at Olympia a photograph is given of a Heinkel " W.30 " single-seater built as early as 1917 for the same purpose.

The Cantilever Biplane. (H. Hoch, Luftfahrt, No. 12, 1929, p. 187.) 5.214/10914 Germany.)

Two small types of cantilever biplane are described. From the analysis, it follows that for the same strength the biplane construction is at least as favourable from the point of view of resistance lift and weight as the cantilever monoplane. The main advantage of the cantilever biplane construction over the braced biplane is the avoidance of all indeterminate members in the structure and the possibility of a large stagger affording good view, easy entry and easy exit especially for parachute descent. The wings for the smaller sizes can easily be dismountable.

Unsymmetrical Forces in Aircraft Frames. (R. Vogt, Z.F.M., Vol. XX, pp. 274-276, 14th June, 1929.) (5.29/10915 Germany.)

Asymmetrical stresses arising from operation of ailerons and rudder should be computed in fixing a load factor, the necessary data being obtained from wind-channel tests or based on theoretical considerations.

In particular the asymmetrical stresses imposed by uneven landing are shown by experiments to be exceptionally great, and the absorption of shock stresses should be traced to the most severely strained members.

Vibration of a Continuous Beam under Axial Loads. (135th Report of the D.V.L., H. G. Kussner, L.F.F., Vol. IV, June, 1929, Part II, pp. 63-67.) (5.29/10916 Germany.)

The problem considered is the selection of a stay point which will make the critical speed as high as possible.

The differential equation of the free oscillations is linear, of the fourth order, with constant coefficients, the solution of which is obtained in the usual way. Numerical values are computed and tabulated. Graphical representations exhibit clearly the relation between the frequency and the position of the stay point.

On the Vibration of beams under the Action of Moving Loads. (H. H. Jeffcott, Sc.D., Phil. Mag., No. 48, July, 1929, pp. 66-97.) (5.29/10917 Great Britain.)

The method described is one of successive approximation and is applicable to all cases in which the damping forces and the effective forces due to the acceleration of the masses involved exercise a relatively small influence on the deflexion of the beam in comparison with that produced by the applied forces.

Coupled Vibrations of Aeroplane Wings. (134th Report of the D.V.L., H. G. Kussner, L.F.F., Vol. IV, 1929, Part II, pp. 41-67.) (5.3/10918 Germany.)

The methods of complex algebra are used to discuss plane oscillations (two dimensional). The effects of camber and thickness are neglected and the combination of wing and aileron is thus reduced to a broken line, expressed by the first five terms of a power series taking as variable the ratio of abscissa to chord. The instantaneous ordinate of a vibrating point is thus expressed as a quintic function of the abscissa multiplied by a periodic term. The numerical values of the interpolation coefficients are tabulated. Approximate expressions are likewise found for the distribution of vortex filaments located in the surface of the wing, variable in time, and associated with variable circulation, and an expression is found for the vertical velocity (induced) in the form of a series. The developments are lengthy and involve the tabulation of over a hundred numerical ratios. The normal velocity of the oscillating wing is equated to that of the air flow. The air forces and moments are then expressed, and approximate formulæ obtained, involving the tabulation of a further group of nine coefficients for nine values of a parameter.

The effect of the position of the elastic axis is examined, and transformations to the elastic axis are given, which simplify the expression for moments and forces.

Linear differential equations are obtained for this simplified plane motion of the second order, with constant coefficients, and immediately soluble by standard methods. Separating real and imaginary parts of the eliminant determinant, two equations are obtained for the two unknowns, the angular frequency and the critical speed. The influence of damping by elastic hysteresis in the material is brought in. It is stated emphatically that the damping force does not depend on the time rate of elastic deformation, but only on the maximum deflection and is always small for small strains. The four principal parameters of the resulting motion are the equivalent mass, the position of the " elastic axis," the radius of inertia of the wing and the position of the c.g. A special solution with zero frequency gives a constant torsional strain, and the critical speed at which it occurs is proportional to the square root of the distance of the elastic axis. Numerical examples are worked out and the relation between critical speed and

" stiffness ratio " between bending and torsional stiffness of the wing under various conditions with and without aileron, with and without elastic damping, etc.

As numerical examples, a model with free aileron of $\frac{1}{4}$ chord, gave a critical speed of 31 m/s with stiffness ratio 0.8 and 28 m/s with a stiffness ratio of 3.0. With fixed aileron the critical speed had not been reached at the maximum available wind speed of 43 m/s.

The extension of the method to three dimensional problems depends on integro-differential equations, and is reduced to the previous method by various reductions and approximations. Elaborate tables of numerical examples are given, and the method appears to predetermine the critical speed for wing vibration with a sufficient degree of accuracy for practical purposes.

Methods of Recording Rapid Vibrations. (H. Thoma, V.D.I., No. 19, 11/5/29, pp. 639-642.) (5.3/10919 Germany.)

The vibrations to be measured are caused to influence the plates of a small condenser forming part of a high frequency oscillation circuit. After suitable rectification the resulting current is recorded on an oscillograph. By this means it is possible to record vibrations of frequencies up to those occurring in the highest audible notes. The apparatus is of importance in studying critical vibrations since it records high frequency components of small amplitude.

On the Criteria for the Stability of Small Motion. (R. A. Frazer and W. J. Duncan, The Royal Society, Proceedings of, Vol. CXXIV, No. A.795. 1/7/29, pp. 642-654.) (5.3/10920 Great Britain.)

When a dynamical system receives a small disturbance from a state of rest or steady motion, the ensuing small motion is governed by a system of linear differential equations. In order to determine the stability, the conventional procedure is to examine the signs of certain " test functions," which can be constructed in succession from the coefficients of the determinantal equation by Routh's well-known rules (see Routh's " Rigid Dynamics," Vol. 2. 6th ed., p. 228). However, the series of test functions for a determinantal equation of general degree are not stated by Routh in an explicit form; and the expressions would, in fact, be exceedingly cumbersome. An alternative is to use for the stability criteria the signs of certain " test determinants." This method, which is very convenient in practice, is not described in works on dynamics known to the writers, and may be novel. The present paper contains a brief account of these determinants and of certain other simple forms of test function.

Airplane Spins and Wing Slots. (Lieut. Carl Brown Harper, U.S.N., S.A.E. Journal, Vol. XXV, No. 1, July, 1929, pp. 25-33.) (5.313/10921 U.S.A.)

The importance of accurate fit of the auxiliary airfoil to the corner of the leading edge of the wing is discussed, and the author narrates several experiences in flight tests, one of which seemed likely to terminate fatally because, as determined afterward, friction prevented the slot on one wing from opening as readily as that on the other. In another test, ice that accumulated on the plane did not prevent the slot opening.

When slots on the Vought Corsair were unlocked in a spin, that on the low wing opened with a bang and brought the plane out of a spin in half a turn. In a dive, the slots can be opened full-out at 140 m.p.h. air-speed by jerking the control stick back with both hands.

A list of Navy planes being fitted with slots, and a list of permissible airplane manœuvres in the Navy, are given.

Pressure Distribution on a Slotted R.A.F. 31 Airfoil in the Variable Density Wind Tunnel. (Eastman N. Jacobs, Langley Memorial Aeronautical Laboratory, Technical Notes, National Advisory Committee for Aeronautics, No. 308, June, 1929.) (5.313/10922 U.S.A.)

Full-scale investigation of slotted aerofoils has been limited to a few test flights. In view of the small size of the slot and auxiliary aerofoil used in tests of slotted wing models and of the viscosity effects in the slots, a large-scale effect might be expected. In the variable density wind tunnel at air densities of approximately 1 and 20 atmospheres the full-scale maximum lift is somewhat lower than the maximum lift indicated by low-scale tunnel tests on the slotted R.A.F. 31 airfoil, but the lift does not drop off so suddenly above the stalling point. The full-scale maximum lift of the slotted R.A.F. 31 airfoil is high for a moderately thick airfoil having good high-speed characteristics and no abrupt break in lift above the stalling point.

Aeroplane with Longitudinal Control by Wing Flaps. (Masami Ono., Z.F.M., Vol. IX. 1929, pp. 224-227.) (5.313/10923 Germany.)

Diagrams of lift for various flap settings are given, and the longitudinal moments are worked out. Experimental flying was carried out on a man-carrying glider, and the controls were found satisfactory. Further experimental flights are projected.

Apparatus for Measuring Small Pressures at a Distance. (A. Simon and F. Feher, Zeitschrift fur Elektrochemie, p. 162-165, Vol. XXXV, No. 4, 1929.) (5.32/10924 Germany.)

Variations in the level of a tilted mercury gauge are measured by the change of resistance produced in a wire immersed in one of the limbs. Variations in current are measured on a milliammeter and an accuracy of .2 milliamperes is obtained.

Resistance in Curved Pipes. (H. Lorenz, Phys. Zeit. XXX, 1929, pp. 228-230.) (5.32/10925 Germany.)

An elementary account is given of the phenomena to be expected in presence of the field of inertia forces due to the curvature of the pipe axis.

Step by step methods yield numerical results for the resistance which are stated to be in good approximate agreement with the observed results of Brightmore, Proc. Inst. Civ. Eng. Vol. 169, p. 315, 1907, and of Davis, Trans. Am. Soc. Civ. Eng. Vol. 69, pp. 63 and 109, 1909.

Discharge Coefficient for Nozzles and Orifices in Pipes. (Jakob and Kretzschner, V.D.I., June 29th, 1929, page 935.) (5.32/10926 Germany.)

The experiments were carried out with air for Reynolds' numbers ranging from 10^5 to 13×10^5. The orifice was placed in pipes ranging from 125 to 1,000 mm. internal diameter, the orifice ratio ranging from .05 to .85. For this test the Reynolds' number covered the range 10^5 to 7×10^5.

For both types of air meters the discharge coefficient increases with the Reynolds' number, and there is not much to choose between the two methods for measuring airflow.

Measurement of Friction at High Reynolds' Numbers. (H. Nerbs, Zeitschrift fur Angewandte Mathematik und Mechanik, Vol. VIII, p. 6, pp. 421-423, 1928.) (5.32/10927 Germany.)

The experiments were carried out on the outer skin of an ocean liner, a portion of .357 meters' surface being arranged moveably so that the force of friction could be measured directly. The Reynolds' numbers were in the neigh-

bourhood of 5×10^8. The results show a displacement of the dimensionless shearing force diagram given by the Prandtl-Karman theory, the difference amounting to .0011. Further experiments are planned to determine the effect of surface roughness.

Remarks on Frictional Resistance and Pressure Fall. (S. Farassenbo, Phys. Zeit. XXX, 1929, pp. 403-407.) (5.32/10928 Germany.)

Empirical formulæ involving fractional powers of the depth are used to evaluate the centrifugal pump effect of a rotating disc in a viscous fluid. A similar method is applied to flow in a shallow trough. The resulting formula is compared with a formula of v. Karman's, and with five sets of observations by two independent observers. The agreement gives practical importance to the results, but little in the way of a physical theory.

Notes on the Resistance of a Disc Rotating in a Fluid. (Zeitschrift fur Angewandt Mathematik und Mechanik. Vol. VIII, p. 6, pp. 460-679.) (5.32/10929 Germany.)

The relationship between the resistance of the disc and the height of the containing vessel for a constant clearance between disc and wall is investigated, as well as the effect of clearance for a constant height of vessel. The resistance of the disc is practically independent of the height of the vessel. Very small changes in the lateral clearance produce very large effects.

Streamline Flow through Curved Pipes. (C. M. White, Proc. Roy. Soc. A.123, No. 792, 6th April, 1929, pp. 645-663.) (5.32/10930 Great Britain.)

The author establishes experimentally an important extension of the results of Dean by showing that the diameter of the coil enters into the condition for dynamical similarity. For spirally laminar flow the non-dimensional relation between resistance and the parameters of flow is unicursal for all ratios of pipe diameter/coil diameter, but for turbulent flow there are different points of discontinuity for different values of the ratio (Fig. 9, p. 660).

Criterion for Turbulence in Curved Pipes. (G. I. Taylor, Proc. Roy. Soc. A.124, No. 794, 4th June, 1929, pp. 243-249.) (5.32/10931 Great Britain.)

The author has devised a simple but lucid modification of Dean's experiments by injecting a filament of coloured fluid at a point at least one turn of the helical curve away from the inlet.

White's results* were confirmed quantitatively as to the first appearance of turbulence, and a criterion was also obtained for the disappearance of initial turbulence. This confirms that the ratio pipe diameter/helix diameter affects the dynamical similitude, which was to be expected from first principles, but which escaped Dean on account of the somewhat narrow range of his observations.

(*a*) *The Accelerated Motion of a Cylindrical Body through a Fluid.* (H. Glauert, R. & M. 374.)

(*b*) *The Hydrodynamical Forces on a Cylinder Moving in Two Dimensions.* (H. Lamb, R. & M. 377.)

(*c*) *Hydrodynamic Forces Active on a Cylinder in Motion.* (W. G. Bickley, P. Roy. Soc., Vol. A.CXXIV, No. 794, 4th June, 1929, pp. 296-303.) The particular case of a plane lamina was solved by Carafoli, see " Abstracts " No. 6, p. 20 (8318) (Comptes Rendus CLXXXIV, pp. 804). Similar results are obtained for a cylinder by Glauert and in a more usual and general way by Lamb. Bickley further generalises the formulation

* See foregoing abstract, also Nos. 7209 and 7196, page 20, issue No. 5.

and solution, using methods similar to those employed by Fuchs and Hopf's " Aerodynamics " for the less general problem without rotation. As previously remarked, these results are important in forming a mathematical theory of rotary derivatives. (5.32/10932 Great Britain.)

Two-Dimensional Potential Problems Concerning a Single Closed Boundary. (W. G. Bickley, Phil. Trans. A.228, pp. 235-274, 5th June, 1929.) (5.32/10933 Great Britain.)

A collection of elementary methods of conformal transformation, applicable to problems in electrostatics, electromagnetics, and hydrodynamics.

Numerous English references but no foreign ones are given.

Discharge Coefficient of Standard Nozzles. (H. Mueller and H. Peters, V.D.I., July 6th, 1929, page 966.) (5.32/10934 Germany.)

The discharge coefficient was measured, using water as the calibrating fluid. The coefficient depends on the Reynolds number and varies from .95 to .98 for a range of Reynolds numbers from 3×10^4 to 10^6.

Tests on the Theory of the Swimming Fish. (Service Technique de L'Aeronautique, Technical Bulletin No. 58, May, 1929.) (5.32/10935 France.)

Comparative tests between submarine models and living fishes show that both the resistance of the fish and the power required for a given speed are very much less than one would expect from consideration of the Law of Similarity.

Survey of D.V.L. Tests on the Flying Qualities of Aircraft 1927-28 (*130th D.V.L. Report*). (W. Hubner, Z.F.M., No. 8, 29/4/29, pp. 189-195.) (5.322/10936 Germany.)

A descriptive account is given of the methods of analysing aircraft performance, and comprises the influence of construction and shape on stability and controllability in turns, rolls and spins.

1. The distribution of the loading on the wings and control surfaces is considered from a number of points of view along with changes effected by curvature of the control surfaces, change in their area, change of their position relatively to the centre of moments and by application of controlling forces.

2. Stability is briefly discussed from a practical point of view; where the modern theory gave predictions differing from test results the discrepancy was usually traced to the supply of incorrect data.

3. *Control.*—The influence of the change of chord of rudder and elevator surface is discussed and practical rules are given. The rounding off of the wing tips is of appreciable importance.

4. *Manœuvrability.*—A general discussion. The importance of slight restoring forces with neutral controls is emphasised.

5. *Spinning.*—A descriptive account is given of the principal causes, and reference is made to recent British work.

In conclusion the development and improvement of methods of test from every point of view arising from the demands of practice are taken as the principal problem of the full-scale test section of the D.V.L.

Determination of Structural Airplane Drag. (Air Corps Information Circular, No. 629, Nov., 1928.) (5.322/10937 U.S.A.)

Level flying tests were carried out on 33 aeroplanes and the drag was deduced in each case by a simple formula from the results. The total drag was analysed into wing drag and structural drag. The results of the various step by step calculations are tabulated in 38 steps, the final column giving the structural drag coefficient.

Losses Due to Shocks in the Flow of Gases through Sudden Widenings in Tubes. (W. Nuzzelt, Zeitschrift des Vereines Deutscher Ingenieure, No. 22, 1st June, 1929, pp. 763-764.) (5.325/10938 Germany.)

Calculation shows that the true loss in the case of gases is smaller than that calculated from the Carnot formula for inelastic media. The difference increases with increase of initial velocity. For inelastic media the whole of the friction work reappears as heat. In the case of gases the resultant expansion due to heat causes the partial reconversion into kinetic energy. The apparent loss in flow energy is, therefore, less in the case of gases.

Pressure Distribution over Horizontal and Vertical Tail Surfaces. (R. V. Rhode, N.A.C.A. Report No. 307.) (5.3341/10939 U.S.A.)

The investigation on the tail surfaces of a pursuit airplane F6C-4 in violent manœuvres was conducted by the N.A.C.A. at the request of the Navy Bureau of Aeronautics for the purpose of determining the maximum loads likely to be encountered on these surfaces in flight. The information is needed for bringing existing loading specifications into closer agreement with actual flight conditions. The observed pressure distribution and the existing specifications do not conform satisfactorily in critical conditions, and in some cases were excessive.

An acceleration of 10.5g. was recorded in one manœuvre in which the pilot suffered severely.

Navy specifications for the structural design of tail surfaces are included as an appendix.

Contribution to the Vortex Theory of Propellers. (T. H. Troller, Zeitschrift fur Angewandte Mathematik unde Mechanik, Vol. VIII, p. 6, pp. 426-430, 1928.) (5.41/10940 Germany.)

In order to utilise wing profiles in the design of propellers it is necessary to know the air speed relatively to the blade. This latter is the resultant of two components; the speed of the propeller blade and the induced velocity of the air in the propeller jet. The latter can be obtained approximately from impulse considerations using a method due to Prandtl. A more accurate calculation can be made by considering the inductive effect of the thrown off vortices. The resulting integrals have been solved by the author for a series of pitches and ratios of the radial distance of a point of the vortex and of the point under consideration, and the resultant graphical solutions are shown diagrammatically. The results show that the simpler solution proposed by Prandtl represents the facts with sufficient accuracy in most cases. Only under very special conditions where the assumptions of Prandtl obviously do not apply is there any marked difference between the two methods.

On the Vortex Theory of Screw Propellers. (S. Goldstein, Proc. Roy. Soc. A.123, No. 792, pp. 440-465, 6th April. 1929.) (5.41/10941 Great Britain.)

The author succeeds in evaluating the velocity field due to the "fixed" vortex lines lying along the blades and to the spiral trailing vortices which form their continuation. The usual simplifying assumptions are made, so that the results hold accurately only for lightly loaded blades, with neglect of the profile resistance in determining the best distribution of thrust. The highly complicated integrals involving Bessel functions together with certain expansions in series have required heavy computations in preparing the necessary numerical tables.

The best distribution of circulation along the blade is given graphically along with Prandtl's approximate solution for 2, 3, 4, ... 10 blades. There is considerable discrepancy, which, however, affects the efficiency less seriously. Formulæ are given for thrust, torque and efficiency, but are not tabulated.

Construction of Airscrew Polar Diagrams. (Th. Troller, Z.F.M., Vol. XX, pp. 303-306, June, 1929.) (5.41/10942 Germany.)

The formulæ of Bienen, Karman, Helmboldt, Konig and Madelung are reduced to a family of curves giving the lift per unit length of blade for any chord and radius. A line is drawn through a set of elements corresponding to an actual blade and arithmetical summation of the elements gives a useful approximate result with great rapidity. In this way polar diagrams are produced for the blade as a whole, with corrections for induced drag. At each stage of the working out, the results are drawn out graphically.

A worked out example is given in illustration.

New Possibilities on Flying on One Engine in the Case of Twin-Engined Aeroplanes. (D. S. de Lavand, Comptes Rendus, Serial No. 7, July 22nd, 1929, pages 144-146.) (5.41/10943 France.)

By fitting a free-wheel between engine and airscrew the former can rotate with the engine at rest. A propeller of 4.4m. diameter and .8 pitch ratio absorbing 500 h.p. at 1000 r.p.m. when stopped offers a drag of 150 kg. wgt. at a wind speed of 40 m./sec. The same propeller would rotate freely at 600 r.p.m. with a drag of 50 kg. wgt.

Landing and Braking of Airplanes. (Louis Breguet, N.A.C.A., Tech. Memo. No. 507, April, 1929.) (5.55/10944 U.S.A.)

Landing manœuvres may be divided into three phases:—

1. Gliding descent.
2. Levelling off near the ground.
3. Making contact with the ground, taxying and stopping.

The ultimate run on the ground can be shortened by increasing the drag of the machine whilst in the air and by fitting brakes to the landing wheels. The air drag is controlled mainly by the action of the propeller and by such devices as slotted wings. The braking effect on the ground depends enormously on the nature of the surface of the areodrome and the type of tail skid fitted.

A Criticism of (German) Constructional Practice. (A. R. Weyl, Z.F.M., Vol. XII, p. 301, June, 1929.) (5.6/10945 Germany.)

The unprofitable nature of German aeroplane construction and operation is attributed to the prevalence of experimental designs carefully worked out in every detail before construction begins. The author recommends the speedier production of a type by means of estimated figures and rough sketches, the pushing through of full scale tests as quickly as possible and the incorporation of modifications based on flying tests. The resulting type is then to be manufactured in series, with corresponding economy of labour and material. The methods recommended approximate to the main production of the U.S.A.

Navigation, Meteorology and Instruments

Pressure Element of Constant Logarithmic Stiffness for Temperature Compensated Altimeter. (W. G. Brombacher and F. Cordero, N.A.C.A. Report No. 310.) (6.33/10946 U.S.A.)

An evenly divided altitude scale is secured by using a mechanism between the pressure element and pointer which gives the required motion of the pointer. A temperature-compensated altimeter was constructed at the Bureau of Standards for the Bureau of Aeronautics of the Navy Department which contained a manually operated device for controlling the multiplication of the mechanism to the extent necessary for temperature compensation. The introduction of this device made

it difficult to adjust the multiplying mechanism to fit an evenly divided altitude scale. To meet this difficulty a pressure element was designed and constructed which gave deflections which were proportional to altitude. Roughly, the required multiplication of the deflection of a pressure element at 20,000 feet is twice, and at 40,000 feet four times that at sea level. It is evident that the difficulty of securing an evenly divided altitude scale increases with the range of altimeters.

Radio-Echo Altimeter for Aircraft. (Automotive Industries, 8/6/29, p. 885.) (6.336/10947 U.S.A.)

The altimeter uses an oscillating receiver, the reflecting signal being picked up by the same instrument which sent out the wave. Every time the aeroplane changes altitude by half a wave length the beat note goes through a complete tone cycle, the number of cycles determining the altitude.

The Basis of Air Navigation. (W. Immler, Z.F.M., Vol. XX, 1929, pp. 217-224.) 6.36/10948 Germany.)

A routine devised for astronomical observations in submarines is well adapted for aircraft. The use of abacs and nomagrams reduces arithmetical operations to simple addition and subtraction.

Lighting of Night Routes. (M. J. Luber, Berlin, Z.F.M., Vol. XX, 1929. Part 10, pp. 246-250.) (6.62/10949 Germany.)

Maps of the routes from Berlin to Konigsberg and from Berlin to Hanover, show the placing of main and intermediate light beacons. Eleven photographs and diagrams show the types of lamp and lamp mountings, the intensity of illumination and the range of visibility as a function of candle power for different absorption coefficients. Neon lights are found particularly suitable for service as their small consumption of energy permits continuous lighting with a minimum of attention.

A New Sound Direction Finder. (Chr. v. Hofe, Zeitschrift fur Instrumentenkunde, Serial No. 7, July, 1929.) (0.761/10950 Germany.)

This instrument is made by the firm of Goerz to the designs of Col. D. Max Maurer, of the Austrian Army, with $\frac{1}{4}^{\circ}$ direction error, range approximately 6 times that of normal ear. The accuracy of direction is obtained by admitting a sound coming from the left only to the left ear, from the right to the right ear and directly from the front to both ears. The shielding of the ears is obtained by combining a paraboloid of revolution for the receiver with an ellipsoid of revolution for the connection to the ear.

The Valid Range of Pressure Head Measurements with Magnification by Venturi Tube. (Report of Kaiser Wilhelm Aerodynamical Laboratory, H. Peters, Z.F.M., Vol. XX, 1929, pp. 90-92.) (6.381/10951 Germany.)

A theoretical discussion is given. Empirical factors are introduced, and are plotted graphically in three diagrams against pressure, velocity and angle of obliquity.

STABILITY, CONTROL, ETC.

Study on the Length of Run Required when Taking-off and Landing. (A. Brissot, Bulletin Technique No. 59, May, 1929.) (7.17/10952 France.)

The length of run required on landing depends largely on the state of surface and is not a characteristic of the aeroplane. A variation in the coefficient of friction equal to .01 will cause a change in the landing run between 10 and

20 per cent. On the other hand, a change of .1 in the ratio of drag to lift at the angle of attack corresponding to the tail touching the ground causes the variation of approximately 50 per cent. in the length of run. The effect of wind is studied and a series of equations is developed in order to reduce the phenomena of landing and take-off to standard conditions.

AIRCRAFT ENGINES, FUELS, LUBRICANTS, ETC.

Cambridge Rotational Accelerometer. (Engineering, Vol. CXXVIII, pp. 260-262. 1929.) (8.22/10954 Great Britain.)

A description is given with diagrams and elementary mathematical relations. The instrument is particularly applicable to measurement and recording of torsional oscillations in engine shafts, and should prove a powerful means of analysis.

Determination of Ignition Points of Liquid Fuels under Pressure. (By J. Tausz and F. Schulte, Z.D.I., 31/5/24, translated in Technical Memorandum No. 299, National Advisory Committee for Aeronautics, January, 1925.) (8.51/10955 U.S.A.)

The ignition point of fuels determined by the pot method depends on the pressure of the air and generally falls with a rise in temperature. For a sample of petrol the ignition point fell from 500°C. at atmospheric pressure to 290°C. at 500lbs. pressure, and of lubricating oil from 480° at atmospheric to 280° at 300lbs. pressure. A theory of ignition based on the formation of peroxides is put forward.

Catalytic Oxidation of Hydrocarbons. (British Patent No. 298, 704, July 22nd, 1927, I. G. Farbenind, A.G.) (8.512/10956 U.S.A.)

Oxidation of paraffins by oxygen gases is effected in the presence of catalysts such as metals, metallic oxides or salts, or salts or organic acids, accelerated by the conjoint use of organic nitrogenous bases, aniline, pyridine, quinoline, toluidine, butylamine, amylamine and hexylamine, with Mn soap and Cerium oxide or stearate. The products consist mainly of mixtures of aliphatic carboxylic acids, alcohols and esters.

Hydrogenation of Petroleum Promises Revolutionary Development for American Industry. (L. D. Kirkpatrick, Chemical and Metallurgical Engineering, No. 6, June, 1929, pp. 332-333.) (8.512/10957 U.S.A.)

Hydrogenation, as developed by the I.G. Farbenindustrie for German coal, has been adapted to petroleum on a commercial scale by the chemical engineers of the Standard Oil Co. (New Jersey). By a high-pressure, high-temperature, catalytic process, crude fuel and heavy residues can be converted into gasoline or other petroleum products. Carbon formation is eliminated and the production of fixed gases reduced to a minimum. Thus the chemical engineer conserves oil resources by scientific methods.

The Problem of Engine Fuel Requirements. (James M. Shoemaker, Aviation, Vol. XXVI, No. 26. 29/6/29, pp. 2274-2277.) (8.514/10958 U.S.A.)

The Army and Navy, co-operating with the Ethyl Corporation found that higher concentrations of ethyl fluid than a few c.c. per gallon are not entirely satisfactory. The alternatives were (1) to find a new and better anti-knock compound; or (2) to improve the anti-knock quality of the D.A.G. (Domestic Aviation Gasoline) in use by the Navy. The former not yet being available it was decided to concentrate on improving the gasoline, which by itself is now equal, as regards anti-knock, to that previously doped with ethyl fluid.

Variation of Temperature of Spontaneous Combustion of Fuels with Addition of Various Substances. (A. Grebel, Comptes Rendus, July 8th, 1929, pp. 90-92.) (8.514/10959 France.)

The ignition temperatures were obtained by the Pott method using the Krupp form of igniter. Amongst the substances tried were lubricating oil, nitrobenzene, analine, iron carbonyl and lead tetra-ethyl.

The organic metallic compounds differed from other substances in first raising and then lowering the ignition temperature as the proportion increased.

Combustion Control by Cylinder Head Design. (R. N. Janeway, S.A.E. Journal, Vol. XXIV, May, 1929, pp. 498-512.) (8.514/10960 U.S.A.)

Detonation depends primarily upon the temperature attained by the residual unburned gas. The knock tendency, which originates in the pressure-time characteristic of combustion, can be controlled only by applying chamber design to increase the heat transfer from the unburnt gas to the walls; a method of calculation is explained in detail. To obtain smoothness without loss of power, the volume of charge must be distributed about the firing position, so as to obtain as nearly as possible uniform acceleration in the rate of pressure rise up to the maximum rate, without excessive increase in the explosion time. The reduced explosion times lower the heat loss and tend to increase detonation. Turbulence increases heat transfer. The off-set head (Ricardo type) subjects the last portion of the burning charge to intense cooling which is beneficial in avoiding knock.

Summary of Knock-Test Methods, Automotive Research. (S.A.E., Vol. XXV, No. 1, July, 1929, pp. 80 contd. 85.) (8.514/10961 U.S.A.)

Methods of testing for detonation and matching fuel are described; better correlation of results could be obtained by a closer study of :—

(a) Engine temperature (manifold, cylinder wall, cylinder head);
(b) Atmospheric conditions (air, temperature, pressure and humidity);
(c) Knock intensity (character and frequency).

The Ignition Lag during Auto-Ignition and Explosions. (Max Brunner, Helv. Chim. Acta, 12, 295-304, 1929, No. 2, abstracted in Phys. Berichte, August, 1929, p. 1578.) (8.514/10962 Germany.)

The delay period is due to disactivation of re-action centres by active portions of the surface of the containing vessel. The work is a continuation of that on chain re-actions first published by Christiansen and Kramers (2. Phys. Chem., 104, 451, 1928).

The Ignition of Detonating Gas by H_2 Atoms. (Haber and Schweinitz, Bess. Akad. Wiss., Berlin, Ber. 30, pp. 499-506, 1928.) (Science Abstracts A, Vol. XXXII, Part 8, p. 729.) (8.514/10963 Germany.)

The H_2 atoms were obtained by the Langmuir method using an electric arc. A mixture of molecular and atomic H_2 (1 per cent.) ignited when coming in contact with o_2 after a certain time lag.

The results are in agreement with the theory of chain re-action previously proposed by Haber.

Effects of Knock Suppressing and Knock Inducing Substances on the Ignition and Partial Combustion of Certain Fuels. (R. E. Schaad and C. E. Boord, Industrial and Engineering Chemistry, No. 8, p. 756, August, 1928.) (8.514/10964 U.S.A.)

Knock suppressors and inducers had no noticeable effect on the ignition curves of toluene, isoamylacetate and kerosene as determined by a direct current break spark. When using a hot platinum wire for ignition, the knock suppressors raised and the inducers lowered the current required for ignition.

Poppet Exhaust Valve Design. (Messrs. Bissele and Williams, S.A.E. Journal, No. 2, August, 1929, pages 142-147.) (8.56/10965 U.S.A.)

To keep the valves sufficiently cool and to avoid excessive warping, pitting, scoring, etc., ample valve seat, it is desirable to have valve head as nearly stream line as possible, valve stem of large enough diameter to conduct heat away rapidly, stem hollow and containing a cooling solution or a solid that melts at normal operating temperature, a high conductive rod or tube case in the stern and valve guide design to conduct the heat away.

Special alloy metals as valve inserts counteract stern expansion and maintain constant clearance with the tappet, and as caps or inserts for the stern taps resist the effects of heat and hammering.

Theory of Heterogeneous Catalytic Reactions. (A. A. Balandine, Zeit. fur Phys. Chem., 2 Abt. B., pp. 289-316, March, 1929.) (Science Abstracts A, Vol. XXXII, Part 8, p. 728.) (8.57/10966 Germany.)

It is proposed that active parts of a solid surface help the course of the re-action by orientating the re-acting molecules. The action of these parts is held to be similar to that of crystallisation nuclei.

The Lubrication Film in Bearings and its Measurements by Interference. (R. Wolff, Z.V.D.I., No. 34. August, 1929, p. 1199.) (8.41/10967 Germany.)

In the hydrodynamic theory of lubrication the thickness of the film and the orientation of the shaft can be calculated from the viscosity of the oil. For small loads there is a satisfactory agreement between theory and practice. For heavy loads, however, the thickness of the film and the position of the shaft in the bearing differ considerably from their predicted values. For thin films the pumping action of the shaft is completely overshadowed by adhesive forces of the bearing, the effect of which is felt for some distance into the film.

Automatic Viscosimeter. (Automotive Industries, 8th June, 1929, p. 882.) (8.42/10968 U.S.A.)

A small portion of the oil delivered by the pump of the engine lubricating system is diverted into a regulating chamber through a pressure adjusting valve and flows back to the crankcase at a constant rate through a capillary tube. The pressure drop, proportional to the viscosity, is recorded on a gauge. Should the oil become too thin, the pointer enters a danger sector.

Effect of a Centrifugal Supercharger on Fuel Vaporisation. (C. Fayette Taylor, S.A.E. Journal, Vol. XXV, July, 1929, No. 1, pp. 49-54.) (8.62/10969 U.S.A.)

Consecutive runs were carried out on a six-cylinder Chrysler automobile engine with normal and supercharged carburettors, the temperature and pressure in the intake manifold being identical in the two cases. The supercharged carburettor gave an increase in power of the order of 10 per cent., and a reduced consumption of the same order. The improvement becomes more marked with a less volatile fuel and this is attributed to improvement in distribution.

The Packard Aero Diesel Engine. (From Oil Engine Power, Vol VII, No. 6, p. 328-330, Mechanical Engineering, Vol. LI, No. 8, p. 618, August, 1929.) (8.59/10970 U.S.A.)

A diagrammatic view of the nine-cylinder Packard Diesel engine is given. It is an air-cooled radial having a single valve in the head which alternatively acts as exhaust and inlet valve. A fuel pump is fitted to each cylinder and operated by a cam, the mechanism being similar to a valve operating mechanism.

The firing pressures are stated to be above 1000 lbs./sq. in. for a weight of less than 3lbs. per h.p., without exhaust or inlet pipes.

The Weiss Fuel Distributor for Oil Engines. (Automotive Industries. Vol. LXI, No. 2, July 13th, 1929, page 47.) (8.59/10971 U.S.A.)

The fuel is kept under a steady pressure of 1500lbs./sq. in. and distributed to the various cylinders by means of a rotary valve operated at suitable engine speed. The space surrounding the distributor disc is normally filled with oil from the reservoir under pressure.

When the hole in the distributor disc begins to register with one of the radial grooves in the distributor head, oil flows into a cylinder formed in the disc hub, where it forces a piston against a spring. Communication between the cylinder and the fuel tank is then shut off and a moment later a passage is opened into one of the engine cylinders.

Efficient Combustion in Oil Engines. (Automotive Industries, Vol. LXI, No. 3, July 20th, 1929. F. Joachim, pages 81-86 and 97.) (8.59/10972 U.S.A.)

The five controlling factors are:—

(1) Spraying characteristics of fuel oil (penetration, cone, angle, distribution).
(2) Vapour pressure.
(3) Ignition temperature.
(4) Ignition lag.
(5) Combustion reaction.

The spraying characteristics depend to some extent on the type of injection valve employed. The Domer valve in use on the Packard Aero engine Diesel is described, the atomisation and distribution being governed by the diameter and angle of the valve seats. The atomisation is a maximum at the beginning and end of injection, and is coarser during the intermediate stage.

New Cleaner for Airplane Engines. (U.S. Air Services, No. 6, June, 1929, Andrew R. Boone, pp. 62-63.) (8.631/10973 U.S.A.)

The intake air comes into contact with a series of helical vanes and is put in a whirling motion. Water entering the device follows the outer walls to a ring at the rear where it is discharged through a tube to the bottom.

Dust and dirt are drawn outward by a series of scavenging plates inclined to the current, and carried toward a centre tube which runs the length of the device, catches the dirt, and carries it out to the air.

Drag and Cooling with Various Forms of Cowling for a "Whirlwind" Radial Air-Cooled Engine—1. (Fred. E. Weick, N.A.C.A. Report, No. 313.) (8.38/10974 U.S.A.)

Several forms and degrees of cowling were tested on a Wright "Whirlwind" J-5 engine mounted in the nose of a cabin fuselage. The cowlings varied from the one extreme of an entirely exposed engine to the other in which the engine was entirely enclosed. Cooling tests were made and each cowling modified, if necessary, until the engine cooled approximately as satisfactorily as when it was entirely exposed. Drag tests were then made with each form of cowling, and the effect of the cowling on the propulsive efficiency determined with a metal propeller.

The propulsive efficiency was found to be practically the same with all forms of cowling. The drag of the cabin fuselage with uncowled engine was found to be more than three times as great as the drag of the fuselage with the engine removed and nose rounded. The conventional forms of cowling, in which at

least the tops of the cylinder heads and valve gear are exposed, reduce the drag somewhat, but the cowling entirely covering the engine reduces it 2.6 times as much as the best conventional one. The decrease in drag due to the use of spinners proved to be almost negligible.

The use of the cowling completely covering the engine seems entirely practical as regards both cooling and maintenance under service conditions. It must be carefully designed, however, to cool properly. With cabin fuselages its use should result in a substantial increase in speed.

Mixture Ratio and Ignition in the Oil Engine. (Prof. P. Meyer, Zeitschrift des Vereines Deutscher Ingenieure, No. 24, 15/6/29, pp. 824-826.) (8.59/10975 Germany.)

The different mixtures of exhaust gases obtained from carburettor and injection engines operating with the same fuel show that the types of combustion are distinct. In the injection engine during the early stages of combustion free carbon is liberated which will only burn later in considerable excess of air. In the carburettor engine, carbon and hydrogen appear to burn simultaneously as the fuel molecule decomposes.

Airplane Requirements for Polar Exploration. (Society of Automotive Engineers, Vol. XXV, No. 1, July, 1929, p. 67.) (8.3/10976 U.S.A.)

40 per cent. of the cooling surface is covered. A small shutter opening was left in the cowling around the crankshaft to cool the engine, but it is usually kept closed.

An adjustable heating system from the exhaust heats the air before and after passing through the carburettor, and just enough heat is supplied in this way to get effective working without increasing the size of the jets. For starting in very cold weather the entire engine is covered with a fireproof canvas cover, including the oil lines, oil tanks and carburettor. From the bottom of this covering a tube of the same material extends to the snow and a blowtorch is placed under it. Even in the coldest weather with a high wind it is possible to heat the engine to a temperature of 120 deg. Fahr. in 45 min.

Atmospheric Humidity and Engine Performance. (Discussion of Arthur W. Gardiner's Annual Meeting Paper, S.A.E., Vol. XXV, July, 1929, pp. 78-79.) (8.61/10977 U.S.A.)

Better correlation of power runs is obtained by allowing for the vapour pressure of the water present in the atmosphere. The water displaces oxygen and in this way causes a reduction in heat content of charge.

Correction of Engine Tests for Humidity. (D. B. Brooke, N.A.C.A. Tech. Report No. 309.) (8.61/10978 U.S.A.)

Three series of tests were made with a sufficient variety of jets, fuels, etc., to eliminate chance disturbances.

All the results support the conclusion that the falling off in power with increasing humidity is accounted for by the effective diminution in oxygen content, up to a maximum of nearly 10 per cent. of the indicated power.

In making the correction, the fuel flow values must be multiplied by the same coefficient as the power values.

This new information is an important contribution towards freeing the discussion of the effects of atmospheric conditions on engine performance from dependence on empirical brake power equations, and putting the whole problem on something like a physical basis.

Method of Starting Small Compression Ignition Engines. (G. Jendrassik, V.D.I. —Serial No. 29—July 20th, 1929, pages 1027-28.) (8.82/10979 Germany.)

By an arrangement of cams the inlet valve of the oil engine (compression ratio 12/1) is opened very late when starting, the suction temperature is increased and the compression temperature may be as much as 160°C. higher. The well-known firm of Ganz & Co., Budapest, have applied the principle to railcar engines which start well in cold weather.

MATERIALS

Elastic Limit of Steel at High Temperatures. (A. Schulze, V.D.I., No. 29, July 20th, 1929, p. 1032.) (10.11/10980 Germany.)

Boiler plate steel is usually tested at room temperature, and the boiler is designed so that with reference to the elastic limit a factor of safety of at least two exists. Tests above 300°C. are difficult, for the elastic limit drops, the yield range becomes less pronounced, and the results depend markedly on the rate of loading and on the duration of load. Standard methods show that for certain classes of steel the relation between elastic limit and ultimate tensile is reasonably constant for temperatures up to 500°C.

If the steel is subjected to fatigue the results require modification.

The Torsion of a Cracked Shaft. (W. M. Shepherd, Engineering, No. 3313. 12/7/29, p. 39.) (10.11/10981 Great Britain.)

The paper investigates the effects on the torsional properties of a shaft, of a crack in an axial plane extending from the surface a short distance towards the axis. It is necessary that the boundary of the cross-section should consist of one or more fairly simple curves whose equations are known.

In a notable paper published in Phil. Trans. 1899, Prof. Filon, F.R.S., investigated a similar problem. The reductions in torsional rigidity due to a crack determined by the two methods are in good agreement. A crack about 1/7th diameter in depth reduces the torsional rigidity to about $\frac{3}{4}$ of its normal value.

High Purity Magnesium Produced by Sublimation. (H. E. Bakken, Chemical and Metallurgical Engineering, No. 6, June, 1929.) (10.2102/10982 U.S.A.)

Magnesium kept at a temperature of 600°C. for 5-6 hours under an absolute condenser pressure of approximately .3 mms. of mercury produces rapid sublimation of the pure metal, passing directly from the solid to the vapour state, and being deposited in the condenser in a coarsely crystalline form. Impurities present in the original charge having a higher boiling point remain behind in the residue. By suitable temperature control volatile impurities such as sodium can be distilled off. The method yields a purity of 99.99 per cent. on a commercial scale of production. The density at 20° of the extruded magnesium is 1.7381.

Strength of Tubing under Combined Axial and Transverse Loading. (L. B. Tuckerman, S. N. Petrenko and C. D. Johnson, Bureau of Standards, Technical Notes, National Advisory Committee for Aeronautics, No. 307, June, 1929.) (10.2103/10983 U.S.A.)

The tubing tested varied from 1in. to 2in. in outside diameter and the thickness from about 1/70th to about 1/5th of the outside diameter. The material was duralumin and alloy steel to American Government specifications. A semi-empirical method combines in a single chart the test results for the alloy steel tubing; as a result the design stresses in certain ranges may be raised by as much as 100 per cent. The charts for duralumin and chrome-molybdenum tubing are different, and separate charts will, no doubt, be required for other materials with different stress-strain characteristics.

Curves showing Column Strength of Steel and Duralumin Tubing. (Orrin E. Ross, Technical Notes, National Advisory Committee for Aeronautics, No. 306, May, 1929.) (10.2103/10984 U.S.A.)

A set of column strength curves simplifies the determining of the size of a strut in an airplane structure, given the load, and the checking of the strength, given the size.

Corrosion Embrittlement of Duralumin VI. The Effect of Corrosion, accompanied by Stress of the Tensile Properties of Sheet Duralumin. (Henry S. Rawdon, Bureau of Standards Technical Notes, National Advisory Committee for Aeronautics, No. 305, May, 1929.) (10.2103/10985 U.S.A.)

The corrosion of plane duralumin sheet material is accelerated by static tensile stress. Corrosion accompanied by repeated flexural stressing of the specimen is a searching test, but does not change the intercrystalline character of the attack. Superiority is claimed for a new anti-corrosion product called alclad (N.A.C.A. Technical Note No. 259), formed by rolling, into sheet, a slab of duralumin with aluminium sheets on the two opposite faces. The thickness of the two aluminium surface layers is approximately 5 per cent. of the 14-gauge duralumin sheet, the tensile strength of the composite sheet being slightly less than duralumin of the same thickness:—

Ultimate tensile strength	55,000 lb./sq. in.
Elongation (2 inches)	19 to 22 per cent.

Manufacture of Beryllium in Germany. (Chemical and Metallurgical Engineering, June, 1929, No. 6. p. 380.) (10.2104/10986 U.S.A.)

Beryllium is produced according to the process of Goldschmidt and Stock by electrolysis of a beryllium and barium fluoride mixture with a water-cooled iron cathode at about 1,300°C. The melting point of the metal is above 1,285°, hence the difficulties of manufacture. The Siemens and Halske Company has undertaken further development of the process.

The natural beryllium ore ocurring in numerous localities in appreciable quantities can be converted to the electrolytic salt. Electrolysis now produces pieces several pounds in weight and of very high purity. In America sodium beryllium chloride is electrolyzed at 200°C., and the flaky metallic product is smelted in a subsequent process. Economically there seems to be little between the two methods. The price of the metal produced in a new Siemens and Halske plant designed for one ton a year, will be 1 mark per gram, until increased consumption and lower costs for the electrolytic salt (the primary factor) allow of a reduction.

The pure metal, because of its great permeability, is suitable (17 times more so than aluminium) for the passage of short-wave radiations, such as X-rays and the like. Its hardness and price militate against its use as general structural material. In America one looks to satisfactory light alloys of beryllium and aluminium. In Germany attention is directed chiefly to alloys with heavy metals, which show remarkable improvements. Bronzes of copper containing a few hundredths per cent. of beryllium have a high electric conductivity and chemical resistance. They can be worked cold, and can be given a steely hardness, on subsequent warming offering excellent structural material for severe chemical and mechanical service. Additions of 0.01 to 0.02 per cent. of beryllium to a smelt of " electrical " copper are superior in many respects to phosphorus for deoxidation. Ferrous alloys containing beryllium offer further development.

How Chemical Engineering has Improved Aircraft. (G. E. Walker, Chemical and Metallurgical Engineering, No. 6, June, 1929, p. 348.) (10.5/10987 U.S.A.)

Chemical engineering places new materials at the disposal of the designer. As example, " micarta," a synthetic resin, is suitable for the construction of laminated airscrews; beryllium alloys promise still lighter structural materials.

Testing Apparatus

A Wind Tunnel Device for the Observation of Two-Dimensional Flow. (A. Martinot-Lagarde, Comptes Rendus, No. 25, June 17th, 1929, pp. 1596-1597.) (11.11/10988 France.)

The wind tunnel is of 20 × 20 cm. cross section, and fitted with glass sides. The model to be investigated stretches across the tunnel, and the flow round it is rendered visible by interposing wires which are heated electrically. The heating of the air does not cause more than 2 per cent. variation in the aerodynamic forces, whilst the sheets of heated air are visible for a distance of 14 cm. On shining a light in a suitable direction the sections of heated air act as cylindrical lenses, and cause variations on a photographic plate placed in a suitable position.

Speed Drag Tests in Variable Density Tunnel. (E. N. Jacobs, U.S.A. Technical Note No. 312.) (11.12/10989 U.S.A.)

Allowing for different degrees of turbulence the resistance of a sphere is a unicursal function of Reynolds' number, irrespective of the combination of the variables, length, density and velocity. The results are exhibited in curves.

Joint Report on Standardisation Tests on Model Aerofoil in Different Wind Tunnels. (W. S. Diehl, U.S.A., N.A.C.A. Report No. 309.) (11.16/10990 U.S.A.)

By far the most important correction is the Prandtl correction for interference of the walls.

If this correction fails to bring readings into agreement it is concluded that the technique of measurements is faulty.

A New Type of Spring (Sliding Spring). (D. Wolkowitsch, Comptes Rendus, No. 19, 6/5/29, pp. 1228-1230.) (10.57/10991 France.)

A U-shaped wire is wound round a cylinder, the wings of the U being normal to its surface. If such a spring is subjected to an axial force deformation is produced, not by torsion but by shear, the energy absorbed per unit mass being higher than in any other type of spring.

Constant Work of Fracture as an Explanation of Fracture through Fatigue, etc. (Prof. Dr. Ing. Durrer. V.D.I., No. 24, 15/6/29, pp. 830-832.) (10.62/10992 Germany.)

When a specimen is broken under tension the work of fracture per unit volume can be obtained from the extension, the load, and the variation in cross section of the specimen. Under periodic loads the internal work is measured by the hysterosis loops. Ljungberg, working at Stockholm, states that ultimate fracture occurs when the sum of the hysterosis loops equals the work of fracture under pure tension. The important conclusion follows that the work of fracture is a constant. The quotient of the work of fracture by the hysterosis loop gives the number of reversals at which fracture occurs.

Electromagnetic Testing for Mechanical Flaws in Steel Wire Ropes. (T. F. Wall, D.Sc., D.Eng., Member, Journal Inst. E.E., Vol. LXVII, July, 1929, No. 391, pp. 899-911.) (11.23/10993 Great Britain.)

A " search band of magnetic flux," in combination with a search-coil system, determines changes in the permeability of the cable, arising from broken strands, etc.

The advantages of alternating as compared with direct current for the excitation of the magnet system are discussed.

A complete wire-rope testing equipment on these lines has been installed in one of the Carlton Main Company's collieries in South Yorkshire.

Limit Wear Load Tests. (Progress Report No. 14 of the A.S.M.E. Special Research Committee on Strength of Gear Teeth, Mechanical Engineering, July, 1929, pp. 520-523.) (11.23/10994 Great Britain.)

The original tests on the Lewis gear-testing machine determined the load and speed relationship required just to break an electrical circuit through the tooth faces. This led to the formulation of equations for the separation due to errors in the profiles and the intensity of the resulting impacts. (Progress Reports Nos. 4 to 10). The calculated separation was accurate within the range which might be expected on the testing machine. Progress Report No. 11 gives an analysis of the limit wear loads and the results of tests where signs of distress appeared on the tooth surfaces.

The present report covers a series of tests made at different pitch-line velocities with loads sufficient to cause signs of distress. The failure of the surface of the materials taken as a measure of the actual impact loads enables the equations developed in the earlier reports to be checked independently, and the results give confidence in their qualitative accuracy. They also indicate the value of ability to be cold worked in materials used for gears. Some light is thrown on pitting. Incipient pitting on heavily loaded gears is probably caused by the shearing out of the weaker particles of the material. If the loads do not exceed the fatigue limit for the sound material, the pitting will cease. If the loads are beyond the fatigue limit, the pitting will continue until the profiles are destroyed.

X-Ray Investigations on Defects in Materials. (Dipl. Ing. C. Kantner and Dipl. Ing. A. Herr, Zeitschrift des Vereines Deutscher Ingenieure, No. 24, 15/6/29, pp. 811-816.) (11.24/10995 Germany.)

By means of a combination of densographic and steriometric methods it is possible to determine the following facts in all materials which are transparent to X-rays:—

(1) The position and extent of faults caused by bubbles, tears, foreign bodies, etc.

(2) Differences in constitution due to variation of thickness, density, arrangement of fibres, etc.

(3) Accurate measurement of the extent of the variation inside the material.

Apparatus is described which is suitable for carrying out these tests under workshop conditions.

AIRSHIPS

Analysis of Aerodynamic Experiments Carried on in Flight on Board the Dirigible "Mediterranee." (P. Stapfer.)

Experiments on the Strength of the Structural Members of the Dirigible "Mediterranee." (R. Marzin, Bulletin Technique No. 57, March, 1929.) (12.2/10996 France.)

The dirigible "Mediterranee," formerly the Nordstern, was handed over by the Germans to the French in 1921. The ship has a maximum length of 131 metres and a volume of 22,500 cu. metres. It is driven by four Maybach engines of 400 h.p. each. Aerodynamic experiments were carried out in the summer of 1925 and the structure of the airship was tested to destruction in the following year. The aerodynamic experiments were limited to the experiment of pressure distribution both over the hull and the control surfaces. The pressure distribution over the meridian and tail of the airship appears to be abnormal and the ship on the whole slightly unstable. In the tests carried out on the structure the ship withstood considerably bigger loading than is likely to occur in practice. Considering that these tests were carried out five years after the surrender of the ship the results must be considered as favourable. The report gives complete tables and photographs.

Dirigible Fuel Costs. (C. B. Fritsche, Automotive Industries, 8/6/29, p. 884.) (12.12/10997 U.S.A.)

Discussing the metal-clad airship before the aeronautical division of the A.S.M.E. at St. Louis the pay load of the airship was estimated as 3½lbs. per h.p., whilst that of a 57-ton flying boat only amounted to 2-2/3 ozs. per h.p. The small power per passenger mile of a super-airship will cost little more for fuel than touring in a large motor car.

The Maximum Height of a Balloon. (F. Linke, Z.F.M., Vol. XX, pp. 276-278, June, 1929.) (12.33/10998 Germany.)

Meteorological balloons of easily distended rubber have no height limit and will rise until the cover bursts. Man-carrying balloons may be considered as having a constant volume of gas, the density of which diminishes by escape of gas with reduced atmospheric pressure. The maximum height attainable depends on the ratio total weight/gas volume and on the density of the atmosphere at the equilibrium height. Tables give winter, summer and mean heights for given values of the weight/volume ratio.

Mooring Masts and Landing Trucks for Airships. (Lieut.-Commander C. E. Rosendahl, U.S.N., S.A.E. Journal, Vol. XXV, July, 1929, No. 1, pp. 34-38.) (12.41/10999 U.S.A.)

Better terminal facilities for airships will be provided by substituting a stub mast for the present high mooring mast. The advantages of the stub mast over the high mast are not only a considerable reduction in cost but also the access to the ship is made much simpler and easier. Repairs can be carried out in the open and by supporting the rear of the ship on a tractor orientation is facilitated. The stub mast itself can be made mobile and in this way the whole ship can be transported into the hangar by purely mechanical means.

Progress of Helium Extraction in U.S.A. (Engineering, Vol. CXXVIII, pp. 251-252, 1929.) (12.62/11000 Great Britain.)

An account is given of the development of the helium extraction industry in the United States. At Fort Worth from 1921 to 1925 the output rose to 1¼ million c. ft. per month, the cost falling to $24 per 1,000 c. ft. The content of the natural gas thereafter fell to a half, the output to a quarter, while the cost doubled. Comparative figures from other sources are:—

Gas Field.	Helium Content.	Output per month.	Cost per 1000 c. ft.
Amarillo ...	1¾ per cent.	1.35 million c. ft.	14 – 11 dollars.
Kentucky Oxygen & Hydrogen Co.	2 per cent.	.7 million c. ft.	62 – 23 – 18 dollars.

The total estimated volume of helium in United States fields is 7,000 million cubic feet. The annual requirements are estimated at 10 million cubic feet.

The Kentucky Company maintain that the real costs of the Government supply from Fort Worth are $189 per thousand cubic feet and for Amerillo $51.

The available supply now exceeds the demand. The new airships of 6,500,000 cu. ft. each will require supplies in the beginning of 1931 and the middle of 1933 respectively.

Details of the available transport and storage facilities are given, and of purifying and recovering plant. Wastage by diffusion is about 10 per cent. monthly.

WIRELESS

Radio Developments Applied to Aircraft. (J. H. Dellinger and H. Diamond, Washington. D.C., Mechanical Engineering, July, 1929, pp. 509-513.) (13.1/11001 U.S.A.)

The need is felt for methods and equipment which will reduce the weather hazards of air transportation. Through research work carried out by the Bureau of Standards weather and landing conditions can be communicated to pilots in flight; by course navigation, flying services can be maintained regardless of fog. Applications of radio to aircraft are described.

Design of Turret Reed Course Indicator for Aircraft Radio Beacon. (F. W. Dunmore, Department of Commerce, Bureau of Standards Research Paper No. 28.) (13.4/11002 U.S.A.)

The reed indicator, weighing about 2lbs., consists of a pair of metal reeds compensated for temperature capable of vibrating between a pair of small electromagnets connected to the output terminals of the airplane receiving set. The free ends of the reeds carry white vanes held in alignment for a beacon course.

Receiving Sets for Aircraft Beacon and Telephony. (Messrs. Pratt and Dramond, Department of Commerce, Research Paper No. 19.) (13.4/11003 U.S.A.)

The sets were developed concurrently with a double modulation type of directive radio beacon, reed type of visual indicator and a vertical airplane pole antenna.

With adequate shielding of the engine and ignition system, satisfactory daytime beacon signals were received, at a distance of 100 miles with an antenna 10 feet high.

The Production of Short Wave Undamped Vibrations by the Use of a Magnetic Field. (A. A. Slutzkin and D. S. Steinberg, Ann. d. Phys. (5) I., 658-670, 1929, No. 5, Physikalische Berichte, January, 1929, No. 12, p. 1145.) (13.7/11004 Germany.)

The intensity of the oscillation depends largely on the angle between the magnetic field and the axis of symmetry of the double electrode valve used. Wave lengths down to 7 cms. were obtained. Tables show the relations between wave length, anode potential, heating current and intensity of magnetic field.

Relation between Aeroplane Height and Range of Short Waves. (H. Fassbender and G. Kurlbaum, Report of the D.V.L. Wireless Section, Z. f. Hochfrequentechnik, Vol. XXXIII, Feb., 1929, Part 2, pp. 52-55.) (13.7/11005 Germany.)

Wave lengths of 3.7 metres were used, from ground level up to 2,700 metres. On the supposition that the earth's surface damps out completely all parallel waves the short wave horizon is identical with the visual horizon. This supposition gives a limit roughly comparable with the experimentally observed range.

The Propagation of Short Waves from Small Power Sending Outfits. (K. Kruger and H. Plendl, Jahrb. d. drahtl. Telegr. 33, 85-92, 1929, Nr. 3, Abstracted in Physikalische Berichte, January, 1929, No. 12, p. 1148.) (13.7/11006 Germany.)

An attempt was made to maintain continuous communication with small power sending units using short waves for distances up to 600 miles between land stations and between a land station and an aeroplane. It was found that certain communication could be kept up during the day for distances up to 400 miles.

using a 2-watt undamped quartz oscillator with a wave length of 50m. The strength of the signals was independent of the height and direction of the aeroplane.

Absorption of Hertzian Waves in Ionised Gases. (H. Danzer, Ann. d. Physik, Vol. II, Part 1, 1929, pp. 27-62.) (13.7/11007 Germany.)

Author's Abstract.

1. A new sensitive receiver for Hertzian waves on the bolometer principle is described.
2. The absorption and reflection of Hertzian waves of about 4cm. wave lengths by intensely ionised gases (Ne. A.N.H.O. Air) is investigated.
3. The life of free electrons present in the discharge of the gas is measured by the absorption effect.
4. The observed results are interpreted physically.

Short Wave Experiments on the Trans-Atlantic Flight of the "Graf Zeppelin." (123, D.V.L. Report Luftfahrtforschung, No. 4, Vol. III, 22/4/29, pp. 87-88.) (13.9/11008 Germany.)

Communication from the L.Z.127 was kept up for a distance up to 6,000 kilometres on a wave length ranging from 20 to 60 metres, the output of the sending station being of the order of 200 watts. Choice of the correct wave length is of the greatest importance to prevent fading, the optimum wave length varying both with distance and time of day.

Recent Work on Selenium. (E. E. Fournier D'Albe, D.Sc., F.Inst.P. Television, July, 1929, p. 233.) (13.8/11009 France.)

A new type of selenium cell has been brought out under the name of radial visor bridge with the remarkable property of following oscillations of light and giving audible notes up to 8,000 cycles. The bridge consists of a thin glass surface on which a gold grid is fused by a special process, with interdigitated combs which form the electrodes. On this a thin layer of selenium is spread forming the actual sensitive surface, and varying considerably in size for special purposes, the standard bridge having a surface of 27 mm. × 50 mm. The spreading of the thin layer of selenium on a transparent base makes the utmost quantity of the material accessible to light, and leaves the smallest quantity as an inert shunt, so that the ratio of light to dark current is as high as possible. The whole is enclosed in a glass gas-filled container with screw socket. The Radiovisor Bridge thus prepared is permanent, reliable and capable of voltages up to a thousand of any resistance from about half to ten megohms or more passes, in darkness, a current from 1 up to 250 microamperes, if necessary. A standard bridge of about 4 megohms will give a change between current in darkness and in light of the order of 100-150 microamps.

Fire Prevention

Means for Fighting Fires on Aircraft. (J. Sabatier, Bulletin Technique, No. 56, Jan., 1929.) (16.21/11010 U.S.A.)

The recent fire prevention rules of the French Air Ministry have reduced the number of fires in the air from over 8 per cent. of all accidents in 1926 to 3 per cent. in 1927. The main cause of fire was faulty carburation causing back firing into the carburettor. Air intakes should be absolutely tight so that the flame can pass only into the open atmosphere outside the cockpit. All petrol pipes in the neighbourhood of the carburettor should be free from joints. Wire gauzes inserted in the induction pipe cool the flame and extinguish it before it reaches the carburettor and though not infallible are known to stop the flame

in a large percentage of cases. All aircraft without a fire-proof bulkhead should be scrapped. Carbon-tetrachloride fire extinguishers should have sufficient capacity to extinguish the fire for a reasonable time and allow hot portions of the fabric to cool. Besides these immediate recommendations a schedule of research work is given ranging from the oil injection engine to the strength of tubes and tanks under vibration.

Catapults

The Heinkel Launching Catapult (Anon.). (Luftwecht, No. 8, p. 372, August, 1929.) (18.4/11011 Germany.)

This catapult, fitted to the North German Lloyd steamer "Bremen," is worked by compressed air and will launch a machine up to $3\frac{1}{2}$ tons. The length of the run is approximately 90 feet and it can be orientated in any direction. The maximum acceleration is 3g. The catapult can be tested previous to launching by operating on a flywheel.

General Conditions of Flight

Changes of Blood Circulation under Excess Pressure. (116th Report of the D.V.L., W. Kaiser, Z.F.M., Vol. XX, 1929, pp. 96-97.) (19.2/11012 Germany.)

A chart shows the time-pressure curve over a period of three hours, with initial, final and four intermediate stages during which observations were made. Twelve oscillograms are reproduced.