ABSTRACTS AND NOTICES FROM THE SCIENTIFIC AND TECHNICAL PRESS

No. 11. DECEMBER, 1929

Issued by the

Directorates of Scientific Research and Technical Development, Air Ministry

(Prepared by R.T.P.)

AIRCRAFT DESIGN

Measurement of the Greatest Static Forces in Aeroplane Structures. (Rieger, Z.F.M., Vol. XX, Part 17, p. 439, 14th September, 1929.) (5.21/11291 Germany.)

A routine is given for applying a new Zeiss levelling instrument to determining deflections in aeroplane structures.

Oscillations in Aircraft. (Summaries of papers by Kussner, Essers and Liebers, V.D.I., Vol. LXXIII, No. 41, 12/10/29, pp. 1487-1488.) (5.211/11292 Germany.)

A symposium of papers was presented at Göttingen on the 23rd of May, 1929, on mechanical vibrations, particularly on vibration of wings in flight, vibrations of airscrews, measurement of noise, vibration of fuel in pipe lines, and the effect of vibration on fatigue limits and ultimate strength. With wing vibrations resonance may occur at certain flying speeds, the prediction of which is somewhat vague. Airscrew vibrations are practically independent of air forces, but the problem is complicated by wing interference.

Wing Oscillations in a Steady Wind. (F. Nagel, L.F.F., Vol. III, No. 5, May, 1929, pp. 111-136.) (5.211/11293 Germany.)

A clear descriptive account is given of the problem, and a mathematical statement is formulated. The differential equations of motion are formed and reduced to standard form. The coefficients of these equations are expressed in terms of the constants of the wing dynamical and aerodynamical, and approximate numerical values are evaluated for typical cases.

The solution for small motions yields the usual linear system with constant coefficients and the corresponding discriminants. The oscillations of a stabilising fin and elevator are worked out numerically. The discriminants, including Routh's discriminant, are expressed and discussed, and a graphical representation gives the point at which instability sets in.

Comparison is made with the observations of a pilot on a full scale machine, the values for the critical velocity being 71 m/s calculated, 80 m/s observed, ratio 1.13.

The oscillations of a wing are also worked out numerically.

Investigation of Wing Oscillations in a Wind Tunnel. (137th Report of D.V.L. (Frau) I. Essers (Nee Kober), L.F.F., Vol. IV, Part 4, July, 1929, pp. 107-132.) (5.211/11294 Germany.)

A clear descriptive account is given of the mean bending and torsional axes of a wing, and the influence of bending and torsional strain on the effective incidence, and through it on the partial differential coefficients of lift and moment.

The constructional details of a model wing and the method of mounting it are described and illustrated, along with the recording apparatus. Ten wing types were investigated, of which very full details are tabulated, both as to dimensions and elastic and inertial constants.

The conditions for stability are quoted from Blenk and Liebers, for the more general case where the bending and torsional oscillations are coupled. There are six conditions in all, the solution of each giving a particular value of the flying speed v. The lowest of these six values is the critical flying velocity above which forced oscillations are set up.

A numerical example is fully worked out for one of the wings, and the critical value is found to occur with the vanishing of Routh's discriminant, which just changes sign.

The following comparisons of calculation with experiment are given :—

Wing No.	4.	6.	7.	8.
Critical Speed—				
Calculated	25.8	25.5	26.4	29.7
Observed	33-35	32	34	35-37
Ratio Obs./Cald.	1 :29	1 :26	1 :29	1 :21

The following are the principal factors :—

1. Position of C.G. should be near the " elastic axis."
2. The torsional stiffness should be high.
3. Aileron flaps decrease the critical speed. Ailerons balanced dynamically decrease the critical speed.
4. The natural periods of torsional and bending oscillations should differ as much as possible.

The natural period of the main frame should differ from that of the wings.

About 150 oscillograms are reproduced, illustrating the influence of various factors.

Plate Girders with Very Thin Webs. (H. Wagner, Z.F.M., Vol. XX, Nos. 8-12.) (5.29/11295 Germany.)

No. 8, Sections I-IV, pp. 200-207.—These articles arose out of the author's activities with Rohrbach and were in part delivered at Aachen on Prof. Karman's invitation.

I. The ratio of the loading to the square of the unsupported width is recognised as an important criterion.

II. A descriptive non-mathematical account is given of the nature of the stresses and strains under various conditions of loading, premises and assumptions are stated, and an example is given.

III. The differential equation of the diagonal field is formed, and the plane tensile field and the resulting deformation are discussed.

IV. The stress distribution in a rectangular bay with stiffening pieces along the edges for given deformation of the stiffeners, and the imposed stresses, with a worked out example.

No. 9, pp. 227-233. V, Web between Stiff Spars.—The cases are discussed where the spars are parallel, vertical or oblique and not parallel, the stresses are calculated, and the effects of external forces considered.

No. 10, *pp.* 256-262, VI.—The loads on vertical stiffeners are discussed for central and eccentric loading, the theoretical and effective buckling loads are compared and a criterion obtained.

No. 11, *pp* 279-282, *VII.*—On proceeding to the limit of zero thickness discrepancies are found between theory and experiment. The web element is discussed along with the influence of attachment to the spars, and the estimation of experimental errors.

No. 12, *pp.* 306-314, *VIII.*—Discussion of cross buckling. Generalised diagonal field. Boundary conditions, example with flexible spars. Simplifying assumptions.

The articles constitute a short treatise on the subject, the ratio, load/square of supported span, appearing as a fundamental criterion throughout.

Betz's Method for the Determination of Profile Drag. (G. Delanghe, Tec. Aer., Vol. XX, No. 92, pp. 106-129.) (5.31/11296 France.)

A clear synthesis of scattered aeronautical papers by Betz, Schrenk, and others (See Abstracts No. 9, 10481, p. 13).

Some Experiments on Autorotation of an Airfoil. (Shatswell Ober, N.A.C.A. Tech. Note No. 319, Sept., 1929.) (5.315/11297 U.S.A.)

The rate of autorotation of a monoplane airfoil is reduced by sweepback, ceasing entirely when the sweepback is 30°. Previous results on the increase in rate of rotation with decrease in aspect ratio are confirmed. A serious increase in rate and range of autorotation with increasing yaw is shown.

Continuity or Discontinuity in Hydrodynamics. (M. A. Metral, La Technique Aeronautique, No. 93, 15/7/29, pp. 132-144.) (5.32/11298 France.)

The discrepancies between the results of formal hydrodynamics and observed fluid motion are discussed with a view to co-ordinating observed results by means of an extended theory employing statistical methods and periodical forms.

No definite proposal is made.

Derivation of the Equations of Viscous Fluid Motion from the Superposition Rule for Finite Strains in Imperfectly Elastic Materials. (H. Hencky, Ann. d. Physik, Vol. II, Part 6, 1929, pp. 617-630.) (5.32/11299 Germany.)

In an imperfectly elastic body strain under a given system of stresses increases with time. Conversely to maintain the incompletely developed strain at its instantaneous value, the applied stresses must be decreased with time.

The latter phenomenon is called relaxation, and is defined for simple strain by the relation

Rate of change of stress = modulus × rate of change of strain-stress/unit-time.

The superposition of stresses and strains is no longer commutative. (Handworterbuch der Naturwissenschaften. See Article "Elasticity," section VI., para. 2).

These relations are discussed, and it is shown that on making the shear-modulus increase and the time of relaxation decrease while their product remains constant, the Navier-Stokes equations are obtained in the limit.

It is agreed that no physical fluid can attain this ideal limit, hence the stress field cannot be the rate of strain field multiplied by an appropriate scalon factor, notably at high velocities.

The main application by the author is a challenge of the validity of the mathematical investigations by "Prandtl and his school" of the instability of the boundary layer.

(Abstractor's Note.—Even if the author's conclusions are correct they do not rule out in principle the current investigations of instability of viscous

fluid motion, but no doubt their incorporation would make the mathematical detail still more complicated and intractable).

Hydrodynamics (Mathematical) Stability of Fluid Motion, Karman Street of Vortices in a Channel of Finite Breadth. (L. Rosenhead, Ph.D., Phil. Trans. Roy. Soc., A.665, 17/6/29, pp. 275-329.) (*cf.* also Abstr. No. 10029, issue No. 8, p. 22, K. Terazawa, Report Aeronautical Research Institute, Oct., 1928, and Abstract No. 10478, issue No. 9, p. 13, from H. Villat's paper.) (5.32/11300 Great Britain.)

The present paper is a complete mathematical account of the effect of parallel channel walls, symmetrically placed, on the two-dimensional motion of a double row of vortices equally spaced and of equal intensity but of opposite signs in the two rows.

The complex function of which the real and imaginary parts give the velocity potential function and the stream function respectively is expressed in terms of theta elliptic functions, Weierstrassian functions being also used in obtaining certain transformations.

The results are remarkable.

Taking 2a as the width of the street, 2b as the spacing of the vortices in the same row, and 2c as the width of the channel from the form of the differential equations, it is clear that dynamical similitude depends only on the ratios a/c and b/c.

Taking these as co-ordinates the critical values separating regions of stability from those of instability are plotted in Fig. 9.

From b/c=0 to b/c=0.815 there is a unique value of a/c for stability, giving a unicursal curve of critical values. From b/c=0.815 to b/c=1.419 there are two critical values of a/c giving two branches of the curve enclosing an area of stability, which broadens out until, at b/c=1.419, it extends over the whole width of the diagram, and for this and higher values of b/c all values of a/c give stability.

Double Row of Vortices in a Closed Channel. (L. Rosenhead, Com. Rendus, Vol. CLXXXIX, No. 10, Sept., 1929, p. 397.) (H. Villat, pp. 397-398.) (5.32/11301 France.)

Rosenhead criticises Villat's conclusions (C.R. 188, p. 1129, 1929) that the solution in elliptic functions does not approach the original solution of v. Karman where the distance between the walls becomes indefinitely great compared with the distance between the two rows of vortices, and quotes Prof. Synge (Proc. Roy. Irish Assoc., A., 37, p. 8).

Villat, after appreciative comment on Rosenhead's paper (Phil. Trans. Roy. Soc., June, 1929) maintains that his own paper, announced but not yet published, will exhibit a discontinuity between the expression in the two cases. (See Abstracts No. 9, 10477 and 8, pp. 12 and 13 and foregoing Abstract).

Induced Drag. (C. B. Millihas, Aviation, U.S.A., Vol. XXVII, No. 7, 12/8/29, pp. 364-366.) (5.32/11302 U.S.A.)

A concise summary and exposition for designers of the theory of induced drag, as applied to design.

The practical difficulties are given due weight.

The Formation of a Cavity in a Perfect Fluid. (C. Schneider, Ann. d. Physik, Vol. II, Part 3, 350-356, 1929.) (5.32/11303 Germany.)

The observed free surfaces produced by streams impinging at 315 m/s and 470 m/s on a long circular cylinder, perpendicular to its axis, are close to but on different sides of the free surface given by conformal transformation.

The Experimental Hydrodynamic Department of the Carlsruhe Technical College. (Prof. W. Spannhake, Z.V.D.I., No. 36, 7/9/29, pp. 1280-1282.) (5.32/11304 Germany.)

The performance of pumps and turbines is studied by means of models. A turbine wheel, 180 mms. in diameter, under test conditions showed an efficiency practically the same as a full-sized wheel of 460 mms. diameter. In a model 23 cms. in diameter, the performance of a turbine 7 metres in diameter was predicted satisfactorily. It is intended to extend the laboratory for aerodynamical investigations.

(i) *Resistance of Turbulent Flow in Channels with Rough Walls.* (ii) *Distribution of Velocity with Turbulent Flow in a Straight Channel.* (M. F. Treer, Phys. Zeit., Vol. XXX, No. 17, Sept., 1929, pp. 539-542 and pp. 542-551.) (5.32/11305 Germany.)

1. The experiments were carried out with air sucked through a long channel with a series of obstructions in the shape of bulkheads pierced with square apertures slightly less than the channel dimensions. No clear distinction is made between roughness in the sense of grain and manufactured irregularities which are large compared with the grain of the materials.

The empirical formulæ of Ombeck and Blasins are used for comparison, and are plotted along with the experimental results on a logarithmic scale against Reynolds' numbers. At low Reynolds' numbers there is serious scattering in the observed values, but, in general, the run of the curves is unicursal for all degrees of " roughness " and follow Ombeck's empirical relation.

2. Parabolas are fitted to the crown of each curve of distribution. The discrepancy at the boundary is treated separately; no satisfactory empirical curve is found for it, but various attempts seem to lead back to Prandtl's well-known empirical formula, which gives a parabola of the nth degree, where n is about 7 or 8.

Further experiments are carried out on rough plates of five different aspect ratios parallel to the stream, and the results are plotted in logarithmic scales, comparisons being afforded between a large number of results by different experimenters.

No really new results or conclusions appear to be attained.

Cinematograph Records of Spin. (P. Raethjens, Z.F.M., Vol. XX, No. 16, pp. 413-418.) (5.322/11306 Germany.)

A descriptive account is given of the phenomena of spinning, and a scheme is outlined of simultaneous double cinematograph recording from the two ends of a base line of 440 metres, with a focal length of 30 cm. as compared with a single direct observation of the wing span of 10 metres with a focal length of 7.5 cm., as in the Hubner and Pleines method (Abs. and Not. No. 8, p. 26, ref. 9906), the accuracy being ostensibly increased in the ratio of 170.1.

The two latter authors appended a reply to and criticism of various claims and statements in Raethjens' paper.

The Effect of Heat Transmission on Fluid Friction in Pipes. (C. S. Keevil, W. H. McAdams, Jour. of Chem. Eng., Vol. XXXVI, No. 8, August, 1929, pp. 464-467.) (5.325/11307 U.S.A.)

Interesting experimental data are given of the effect of the drop from pipe to mean oil temperature on the distribution of velocity across the pipe section and the mean resistance coefficient.

The coefficient of resistance decreases steadily with increase of heat transfer both for laminar and turbulent flow.

Six Component Measurements on Wings with Dihedral Sweepback and Wash out at Göttingen. (H. Blenk, 119th Report of D.V.L., L.F.F VoL III, No. 1, Feb., 1929, pp. 27138.) (5.33/11308 Germany.)

The work arose out of spin investigations in which measurements of various forces and moments were not available over the required range. The effects of dihedral sweepback and washout as forces and moments as here given will be used to investigate their influence on spin characteristics.

The various quantities are defined, and theoretical relations between them based on aerofoil theory are developed and compared with experiment.

The results are exhibited graphically in thirty-seven diagrams.

Variable Pitch Airscrews. (S.A.E., September, 1929, p. 313.) (5.43/11309 U.S.A.)

Some of the Navy machines are fitted with an automatic pitch control device controlled by the air speed so that the pilot can cruise on full throttle.

With geared airscrews care should be taken that reduction in slip stream does not interfere with engine cooling.

Full-Scale Tests of Wood Propellers on a VE-7 Airplane in the Propeller Research Tunnel. (Fred. E. Weick, N.A.C.A., Report No. 301, April, 1929.) (5.45/11311 U.S.A.)

Three wooden airscrews which had been previously tested in flight on a VE-7 airplane and of which models had also been tested in a wind tunnel were tested again on a VE-7 airplane in the 22-foot tunnel. The results of these tests are in fair agreement with those of the flight and model tests.

Measurements were made with tail surfaces and wings removed. The effect of the tail surfaces is negligible; the wings reduce the maximum efficiency about 5 per cent.

Full-Scale Wind Tunnel Tests of a Series of Metal Propellers on a VE-7 Airplane. (Fred. E. Weick, N.A.C.A., Report No. 306, March, 1929.) (5.45/11312 U.S.A.)

The airscrew had five different effective pitches with five different settings of the adjustable blades. It was mounted on a VE-7 airplane in the 20-foot research tunnel. The efficiencies were from 4 to 7 per cent. higher than those of standard wood airscrews under the same conditions. The results are given in convenient form.

Lorraine Reduction Gear for Aero Engines. (Autom. Tech. Zeit., No. 28, 10/10/29, pp. 630-631.) (5.451/11313 Germany.)

An epicyclic reduction gear with roller bearings throughout is lubricated by splash from an oil bath. The level of the oil is maintained by means of a feed pump.

The Goodyear "Air Wheel." (Aviation, Vol. XXVII, 7, 17/8/29, p. 357.) (5.57/11314 U.S.A.)

The Goodyear "Air Wheel" has the casing fitted directly to the hub. The standard size, 22 × 10in., replaces the 30 × 5in. aircraft tyre. The tyre, inflated to 20 lb. pressure, sustains a static load of 1,600 lb.; the area of contact with the ground is 80 sq. in., about 2.5 that of the 30 × 5in. casing. Advantages claimed are better cushioning in landings, better support in snow, ice, sand and mud; better streamlining, less weight and increased security in landing cross-wind or with deflated tyres.

Airworthiness Code. (A. B. Crofoot, Automotive Ind., Vol. LXI, No. 13, 28/9/29, pp. 450-455.) (5.6/11315 U.S.A.)

Changes introduced into the revised Federal Airworthiness code are commented on at some length.

Structural requirements, accommodation for pilot and passengers, fire prevention and protection, piping, tankage, cowling, intake and exhaust pipes, cooling system, airscrew clearances, load factors, controls, are dealt with.

Several conditions are imposed by means of formulæ. The general effect is to increase the margin of safety required.

Aircraft for Passenger Transport. (C. N. Monteith, Mech. Eng. U.S.A., Vol. LI, No. 8, Aug., 1929, pp. 581-584.) (5.6/11316 U.S.A.)

A careful discussion of seating, safety belts and parachutes, vision and lighting, heating and ventilation, noises and vibration, air sickness, comfort and entertainment, and operation.

The Low Wing or Junkers' Type in Commercial Aviation. (L'Aeron., No. 123, Aug., 1929, p. 263.) (5.6/11317 France.)

In forced landings the wing interposed between the ground and the passenger compartment, absorbs most of the energy of impact, and has in many cases saved the passengers from serious harm.

This type of construction is therefore recommended for civil aviation work.

Sound-proofing of Airplane Cabins. (V. L. Chrisler and W. F. Snyder, Bur. St. Journal of Research, Vol. II, No. 5, May, 1929, p. 897.) (5.61/11318 U.S.A.)

A report on determining the structure which will give the maximum amount of sound insulation for a given weight.

Various small structures were tested at frequencies varying from 150 to 1,120 cycles per second.

During a test flight under operating conditions the noise in a treated cabin was about the same as in a railway coach in motion.

The most effective panelling consisted of a sheet of aluminium .025in. thick, a layer 2in. dry zero blanket, a sheet of 5/16in. " insulite," an additional layer of 2in. dry zero blanket, and, inside, a protective coating of perforated sheet aluminium. The object is not to decrease the transmission materially but to absorb the sound transmitted into the cabin.

NAVIGATION AND INSTRUMENTS FOR

Weather Phenomena and Directional Observations of Atmospherics. (S. W. Dean, Bell Tele. Lab., Reprint B.408, August, 1929.) (6.2/11319 U.S.A.)

The question is raised as to whether a system of stations for the directional observation of static would be of assistance in weather forecasting, especially in following the progress of storms in regions where there are no stations for weather observations.

Weather during Flight of Graf Zeppelin. (Editorial, U.S. Air Services, Vol. XIV, No. 10, Oct., 1929, pp. 25-26.) (6.25/11320 U.S.A.)

The rapid passage of the airship from Japan to San Francisco is attributed to the supply of meteorological information from the U.S. Weather Bureau, San Francisco, which enabled a synoptic chart to be constructed. The course selected followed the belts of high wind velocity round a " high " in N.E. direction, and subsequently round a " low " in W.S.W. direction.

A Source of Error in the Sun Compass. (H. Maurer, Berlin, Z.F.M., Vol. XX, Part 7, 15/4/29, pp. 170-172.) (6.345/11321 Germany.)

The Boyken sun compass has been used in the north polar regions with success. For course setting in lower latitudes the simplicity of direct reading is lost and a correction must be calculated for the spherical triangles involved. For example, starting near Plymouth a westerly course at 100 knots is set along latitude 50° through Mainz, Prag, Lemberg, and Kiew. Without correction the pilot would pass over Weissenburg, 49°, Ischl, 47°, Kragujevac, 44°, and Philippopolis, 42° latitude.

Portable Detector Developed for many Combustible Gases. (J. K. Mabbs and W. B. Rowland, Chem. and Met. Eng., No. 8, Vol. 36, August, 1929, pp. 490-492.) (6.511/11322 U.S.A.)

The burning of a combustible gas at the surface of a heated filament in one arm of a Wheatstone bridge causes an increase in temperature and resistance, throws the bridge circuit out of balance. and deflects the galvanometer needle. The deflection depends on the concentration of the gas. Certain combustible gases attack the filament, and the instrument loses its sensitivity. Metals of the platinum group raised to a sufficiently high temperature before exposure to the gases are not affected.

A Design for a Humidity Slide Rule. (George F. Davidson, B.Sc., Jour. of Sci. Instruments, Vol. VI, No. 10, Oct., 1929, pp. 318-320.) (6.7/11323 Great Britain.)

Author's Summary.—A slide rule is described by means of which the dew-point, the pressure of water-vapour and the relative humidity, may be rapidly and accurately obtained from the readings of the ventilated wet and dry bulb hygrometer.

The Rotor Bearings of Electricity Meters. (W. Lawson, J. Inst. Elec. Eng., Vol. LXVII, No. 393, Sept., 1929, p. 1147.) (6.751/11324 Great Britain.)

An accumulation of experimental and statistical data is brought under review.

Section (1). Principal features of design and methods of examining the condition of jewels.

Section (2). Movements of pivots under load which contribute to wear.

Section (3). The condition of bearings after service, the frequency of defects in the bottom jewel and the variety of forms revealed by the microscope. Possible explanations and lines of laboratory research are suggested.

Section (4). Experiments with agate pivots working in sapphire cups.

Section (5). Formulation of opinions.

Transmission of Sound through Wall and Floor Structures. (V. L. Chrisler and W. F. Snyder, Bur. St. Journal of Research, Vol. II, No. 3, March, 1929, pp. 541-559.) (6.76/11325 U.S.A.)

A report on sound transmission through (1) masonry walls and floors; (2) compound walls and floors with a masonry core; (3) stud walls.

The results are given for five frequency bands covering a range from 250 to 3,365 cycles per second. Transmission tests were also made for impact noises. Specifications for the construction of the various panels used are appended.

Stability, Control, Etc.

The Stability of a Spin. (A. v. Baranoff, 118th Report of the D.V.L., L.F.F., Vol. III, No. 1, Feb., 1929, pp. 19-20.) (7.16/11326 Germany.)

Reference is made to Bairstow's demonstration of the connection between autorotation, stalling incidence, and spin, and to Hopf's demonstration of the

importance of the moment of inertia about the cross-axis (pitching axis), and finally to the extensive English investigations.

The general problem, however, remains substantially unsolved in respect of the stability of a spin.

It is proposed to use the English material to study the methods of restricting the tendency to go into a spin and of facilitating the coming out of a spin.

The general equations of steady motion in a spin are established, and small departures are assumed, resulting in a system of linear differential equations with constant coefficients, solved in the usual way; the eliminant of the eight arbitrary constants is a determinant of the eighth degree as in the general theory of instability where the symmetrical and asymmetrical oscillation and divergences are coupled.

This reduces to the sixth degree by neglecting changes of flying speed and moments of inertia due to a small change of direction. Further simplifications are applied and the six arbitrary constants of integration are determined.

The discriminants of stability in terms of these coefficients are discussed.

The results are given graphically in six diagrams showing the relations as families of curves.

The spin is rendered less stable by increasing the directional fin and rudder, as was previously known.

A method not yet applied is to decrease the slope of the coefficient of the aerodynamical moment about the longitudinal axis with respect to the angle of yaw.

Unfortunately large values of the slope are unavoidable with existing types of construction.

Stable Spin. (R. Fuchs and W. Schmidt, L.F.F., Vol. III, Part 1, 27/2/29, pp. 1-18, 117th Report of D.V.L.) (7.16/11327 Germany.)

A comprehensive generalisation and extension of the treatment in Fuchs and Hopf's Aerodynamics is given, and a numerical example is worked out for a Junkers A.35 aeroplane. The relevant relations between groups of three variables are given graphically, as families of curves in 32 diagrams. The latest test results have been used. Consideration is restricted to spin without cross-wind, in which case a spin may be completely stable.

In glides at small incidence a series of stable motions may be arbitrarily improved by the elevator setting, but in glides above the stalling angle only a limited range of steep paths is possible, and the motion is highly stable. A distinction is made between steep spins at incidence just beyond stalling and flat spins at incidence far beyond stalling.

The possibility of a spin is closely restricted by the following measures which are open to constructors.

1. The lift curve of energy sections should have an increasing lift coefficient up to as high an incidence as possible, and the inevitable drop at stalling angle should be as little abrupt as possible.
2. The moments of inertia of the whole aeroplane about the longitudinal axis and normal axis should be as large as possible.
3. The c.g. should be as far forward as possible.
4. The directional stabilising fin and rudder should be as large as possible and exposed to the relative air stream from any direction, including a rising cross-wind.

These recommendations are given only in reference to the restriction of spin possibilities.

Three German and ten English references are given.

Airplane Stability. (Lieut. Cdr. L. B. Richardson, U.S.N., S.A.E. Journal, Vol. XXV, No. 3, Sept., 1929, pp. 225-232.) (7.21/11328 U.S.A.)

A useful elementary account with eight diagrams showing graphically some of the more important aerodynamical relations.

Airplane Design. (R. H. Upson, S.A.E. Journal, Vol. XXV, No. 3, Sept., 1929, pp. 198-201.) (7.21/11329 U.S.A.)

The official summary states that the paper is mathematical and analytical, and establishes conditions of design for a spin-proof aeroplane. E. A. Warner, in discussion, emphasised the limits of mathematical methods.

Trim and Equilibrium of Aeroplanes. (M. Guibert, L'Aeronautique, Vol. XI, No. 125, Oct., 1929, pp. 339-346.) (7.21/11330 France.)

The moments of the resultant air force about a selected point are plotted against the incidence for various elevator settings. These are shown to be approximately hyperbolas, of which one branch corresponds to an oscillation, the other to a divergence. Various useful numerical values are obtained by their use.

There is no discrimination between damped and increasing oscillations.

Aircraft Engines

Power Plants—Design Tendency in U.S.A. (S.A.E., Sept., 1929, p. 201.) (8.0/11331 U.S.A.)

In designing an aeroplane power plant, the primary considerations are weight and reliability. Overhauls are expensive, and in a particular case the increase in weight of a 200 h.p. engine from 400 to 500 lbs. is considered justified if thereby the time between top overhauls can be increased from 150 to 180 hours, that between major overhauls from 300 to 360 hours, and the total life from 3,000 to 3,650 hours.

The proper cowling of air-cooled engines should be considered both by the engine builder and the designer of the aircraft.

In the field of liquid-cooled engines, great expectations are placed on the use of ethylene glycol as a cooling medium.

Higher compression ratios can be used, which, together with the higher temperature of the induction system, produce a marked increase in fuel economy. At the same time the weight of cooling fluid is less, the radiator smaller and the head resistance considerably less. These advantages far outweigh the small diminution in power due to reduced vol. n.

As a further development it is suggested that the cylinder jackets could act as their own radiators, thus dispensing with a separate radiator altogether.

The Fairchild-Caminez Engine. (Autom. Tech. Zeit., No. 22, 10/8/29, p. 479.) (8.14/11332 Germany.)

The mechanics of this engine (which, instead of a crankshaft, employs a special cam contour), have been investigated in Part 14 of this publication. (See Abstract No. 10467). This analysis showed a large variation in torque, which may be the cause of the heavy vibration observed when mounted in an aeroplane. Production has been discontinued, after heavy experimental outlay.

Damping Device for the Prevention of Torsional Oscillations in Crankshafts. P. M. Heldt, Autom. Tech. Zeit., No. 25, 10/9/29, pp. 554-555.) (8.22/11333 Germany.)

The Chrysler vibration damper acts by friction between two fly wheels under constant pressure applied by a spring, with a variable pressure depending on the speed superposed by a stressed rubber band, the combination producing effective damping and a wide speed range.

The Frictional Forces of Hot-Running Connecting Rod Bearings and their Influence on the Bending Stress of Connecting Rods. (Dr. Ing. K. Seyderhelm, Z.V.D.I., No. 35, 31/8/29, pp. 1237-1240.) (8.23/11334 Germany.)

The connecting rod bearing was subjected to a steady load equal to that occurring in practice and the frictional forces determined under various conditions with no lubrication. White metal bearings were chiefly investigated, and the coefficient of friction determined for various widths of bearing. With these bearings periodical seizure and freeing of the bearing by melting out the metal occur. Small particles of white metal may cause jamming, and this will introduce additional loading on the connecting rod, which should be considered in the design. Whilst with reasonable lubrication the coefficient of friction of a bearing may be as low as .002 partial seizure may give a coefficient as high as 3.42.

Practical Success of the Needle Bearing. (Dr. Ing. R. Koner, Autom. Tech. Zeit., No. 22, 10/8/29, pp. 477-479.) (8.24/11335 Germany.)

Needle bearings have found successful application for big ends and little ends, cam-shafts. In gearbox design they lead to a substantial saving of weight. The advantages are such that several manufacturers of ball and roller bearings are now taking up the manufacture of the new type.

The Nitration of Engine Cylinders. (Autom. Tech. Zeit., No. 22, 10/8/29, p. 482.) (8.24/11336 Germany.)

The German firm of Krupp has published detailed instructions for obtaining the best results from the successful nitration process. The thickness of the hardened outer layer is of the order of 1 mm.

The Variation of Piston Play under Working Conditions. (Autom. Tech. Zeit., No. 24, 31/8/29, pp. 531-535.) (8.24/11337 Germany.)

In the American Nelson Bohnalite piston the expansion of the piston-head is controlled by the insertion of invar steel strips. For the larger sizes some means of controlling the skirt expansion will have to be devised.

Drag and Cooling with Various Forms of Cowling for a "Whirlwind" Radial Air-Cooled Engine, II. (Fred. E. Weick, N.A.C.A., Rep. No. 314, Feb., 1929.) (8.32/11338 U.S.A.)

N.A.C.A. Technical Report No. 313 on the cowling and cooling of a "Whirlwind" J-5 radial air-cooled engine covered tests with a cabin fuselage. The present report covers tests with several forms of cowling, individual fairings behind cylinders, individual hoods over cylinders, and a new N.A.C.A. complete cowling, all on an open cockpit fuselage. Drag tests were also made with an engine nacelle with and without the new complete cowling.

The reduction in drag with the complete cowling is twice as great for smaller bodies, as for the cabin fuselage. Individual fairings and hoods did not prove effective in reducing the drag. The results of flight tests on an AT-5A airplane (appendix to N.A.C.A. Technical Report No. 313) have been analysed and found to agree well with the results of the wind tunnel tests.

Heat Flow in Aircraft Engine Pistons. (C. F. Taylor, M.E., and M. S. Huckle, S.B., Aviation, No. 12, Vol. XXVII, 21/9/29, pp. 629-643.) (8.32/11339 U.S.A.)

The inside of the piston was cooled by means of an air current, and it is concluded that the crankcase air acting in a similar manner will dissipate one half of the quantity of heat leaving the piston.

High Temperature Liquid Cooling. (G. W. Frank, S.A.E. Jour., Vol. XXV, No. 4, Oct., 1929, pp. 329-343.) (8.331/11340 U.S.A.)

The investigation is divided into five parts, which include dynamometer test of Curtiss V-1570 and D-12 engines, endurance test and flight tests of D-12 engine and a dynamometer test of a high compression-ratio D-12 engine. The engines and cooling system used, the results obtained and troubles experienced are given in detail, with curves, sketches and views of the airplanes.

Extremely low fuel consumption was obtained, and the results show that the ratio of installed weight to power of a liquid-cooled airplane engine is considerably reduced by using this system of cooling.

Full-Scale Investigation of the Drag of a Wing Radiator. (Fred. E. Weick, N.A.C.A., Technical Notes No. 318, Sept., 1929.) (8.35/11341 U.S.A.)

Tests were made on the left lower wing of the 1927 Williams racer in the twenty-foot Propeller Research Tunnel. The radiator doubled the minimum drag of the portion of the wing which it covered and reduced the lift slightly.

Notes on the Design of the N.A.C.A. Cowling. (W. H. McAvoy, Aviation, Vol. XXVII, No. 12, 21/9/29, pp. 636-638.) (8.38/11342 U.S.A.)

The N.A.C.A. cowling is still in an experimental state, and care has to be taken in applying it to other engines than the "Whirlwind." The effectiveness of the cowling depends on the vertical deflector plates placed round the cylinders as well as on the size of the opening through which air is discharged along the fuselage, which determine the quantity of air blowing through the cowling. Excess air causes a considerable increase in drag. As a rough guide 2 sq. in. per h.p. of engine is given. When the cowling is first installed the temperature of the engine should be obtained by means of thermo-couples and the deflector plates modified accordingly. It is not possible to judge the thermal state of the engine by measuring the oil temperature.

New Methods of Using Fuels of High B.P. in Explosion Engines. (H. Ellerbusch, Auto. Zeits., Vol. XXXII, Part 26, pp. 571-575, 20th September, 1929.) (8.5/11343 Germany.)

Evaporating plates are cast separately and fitted to the cylinder heads. Apertures of half the cylinder diameter give the best results and off-setting the aperture towards the exhaust valve improved the output and fuel economy.

The forms of induction piping and cones found to give the best observed results are shown.

There are 15 sketches and photographs and a table of results obtained from five fuels.

It is stated that the disadvantage of heavier fuels usually put forward in discussion were completely avoided.

The Life History of Absorbed Atoms and Ions. (J. A. Becker, Bell Telephone Laboratories, Reprint No. B.412, Aug., 1929.) (8.51/11344 U.S.A.)

Adsorbed particles may exist on the surface either as positive adions (adsorbed ions), negative adions or adatoms, according to the fields of force near the metal surface, and the particles at their distance of nearest approach. The ratio of adions to adatoms can be determined from thermionic experiments. The adsorbed ions produce electrical fields, which extend to 10 or more atom diameters, and may attain enormous values close to the surface appreciably altering the electron work function, the evaporation energy, the ratio of ions to atoms that evaporate from one and the same surface and the ionisation potential of the adsorbed particles. Within a certain range of temperature, the adsorbed particles migrate over the surface like a two-dimensional gas. Adatoms and adions have

vastly different chemical properties from ordinary atoms. The length of time that an atom remains on the surface before evaporation is determined.

Specific Heats of Petroleum Vapours. (W. H. Bahlke and W. B. Kay, Ind. and Eng. Chem., Vol. XXI, No. 10, October, 1929, pp. 942-945.) (8.51/11345 U.S.A.)

The specific heats of the vapours of five petroleum distillates have been determined at atmospheric pressures from a temperature just above complete vaporisation up to 350°C. The results can be expressed by empirical equations which fit the experimental data with an average deviation of 1.33 per cent. for distillates of specific gravity from 0.9 to 0.68 at 15.55°C.

Equilibrium Combustion of a Mixture of Carbon Monoxide and Hydrogen. (C. C. Nunter, Jour. Soc. Chem. Ind., 1929, 48, pp. 35-38. Fuel, No. 10, Vol. VIII, October, 1929, p. 505.) (8.51/11346 Germany.)

Hydrogen and carbon monoxide are oxidised more slowly at high temperatures when the two gases are involved in the water gas equilibrium than when they are oxidised independently.

Ignition Temperatures of Mixtures of Carbon Monoxide with Air. (M. Prettre and P. Lafitte, Comp. Rend., 1929, 188, 1403. Fuel, No. 10, Vol. VIII, October, 1929, p. 505.) (8.51/11347 Great Britain.)

In mixtures containing between 10 and 40 per cent. of carbon monoxide the ignition temperature is approximately constant and equal to 655°C. With increase in mixture it rises; in the presence of water it falls.

Influence of Nitrogen Peroxide on the Combination of Hydrogen and Oxygen. (H. W. Thompson and O. N. Hinshelwood, Proc. Roy. Soc., 1929, A.124, 219. Fuel, No. 10, Vol. VIII, October, 1929, p. 506.) (8.51/11348 Great Britain.)

Nitrogen peroxide produces activated hydrogen peroxide which initiates a chain reaction by means of which the necessary energy is transferred to the reacting molecule.

Combustion and Explosion Reactions. (F. Haber, Zeitschr. Angew. Chem., 1929, 42, 570. Fuel, No. 10, Vol. VIII, October, 1929, p. 505.) (8.51/11349 Germany.)

This leading continental authority on physical chemistry describes the modern theories of combustion and the nature of chain reactions and activation. In applying this mechanism to the combustion of hydrogen it is considered that hydroxyl groups are formed. Such a group meeting a molecule of hydrogen will form a molecule of water and atomic hydrogen. The hydrogen atoms will produce fresh hydroxyl groups as they meet oxygen molecules.

Sixth Report of Benzole Research Committee. (Fuel, No. 10, Vol. VIII, October, 1929, p. 505.) (8.51/11350 Great Britain.)

By adding a small quantity of tri-cresol (.03 per cent.) the deposition of gums can be almost entirely prevented, and the stabilised benzol made equal to the best quality acid washed benzol as engine fuels. Unsaturated compounds are a source of potential trouble, and precautions must be taken when storing to keep out impurities which may produce acceleration of gum formation. Dilution with petrol reduces the gumming markedly. Oxidation tests are described for the stability of a benzol.

Fuel Vapour Pressures and the Relation of Vapour Pressure to the Preparation of Fuel for Combustion in Fuel Injection Engines. (W. F. Joachim and A. M. Rothrock, N.A.C.A. Report No. 321, Sept., 1929.) (8.51/11351 U.S.A.)

The change of vapour pressure with temperature for any fuel increases rapidly up to critical temperature, and beyond it remains constant for given ratio of mass of vapour to mass of liquid per unit volume. At high temperatures the fuel vapours form new hydrocarbons which, in some cases, on condensation, form a fuel of different composition from that originally placed in the bomb. Fuel mixtures do not follow Dalton's law of partial pressures, but give greater or less vapour pressures than either of the unmixed fuels. The vapour pressures at high temperatures indicate the compression temperatures required to produce rapid vaporisation for combustion.

Apparatus and Methods for the Separation, Identification and Determination of the Chemical Constituents of Petroleum. (E. W. Wachburn, Johannes H. Bruun and Mildred M. Hicks, Bur. St. Jour. of Res., Vol. II, No. 3, March, 1929, pp. 467-488.) (8.51/11352 U.S.A.)

This paper contains a description of :—

1. A rectifying still with a 20-plate column and with means for independently controlling and measuring the temperatures of the plates.

2. All-glass rectifying stills for vacuum distillation.

3. Various types of molecular stills by means of which distillation can be carried out at any temperature at which the vapour pressure at the distilling surface is not lower than the degree of vacuum attainable.

4. Methods and apparatus for fractionation by crystallisation or melting.

5. An apparatus for combustion analysis, with special provisions for purifying the oxygen employed, with all rubber connections eliminated. With the aid of this apparatus the formula for any hydrocarbon up to C100 can be determined.

The Kinetics of the Oxidation of Ethylene. (H. W. Thompson and C. N. Hinshelwood, Proc. Roy. Soc., Series A, Vol. CXXV, No. A.797, pp. 277-291.) (8.51/11353 Great Britain.)

The oxidation of ethylene between 400° and 500°C. is probably a chain reaction. The rate is affected by the total pressure approximately as in a reaction of the third order, the effect depending much more on the partial pressure of the ethylene than of the oxygen. It is suggested that the first stage in the reaction is the formation of an unstable peroxide; if this reacts with more oxygen the chain ends, but if it reacts with ethylene unstable hydroxylated molecules are formed which continue the chain. Bone's interpretation of the complete course of oxidation as a process of successive hydroxylation is essentially correct. The reaction is retarded by an increase in the surface exposed to the gas. From a consideration of the temperature coefficient and the influence of foreign gases on the rate of reaction it is concluded that the chains are probably not of great length.

Viscosity of Diesel Engine Fuel Oil under Pressure. (Mayo D. Hersey, N.A.C.A., Tech. Notes No. 315, September, 1929.) (8.51/11354 U.S.A.)

The viscosity of Diesel fuel oil was found to increase between zero and 1,200 lbs. per sq. inch 5 times at 20°C., 2½ times at 50°, and twice at 100°.

Gaseous Combustion in Electric Discharges. (G. I. Finch and D. L. Hodge, Proc. of the R. Society, No. A.798, Oct., 1929, pp. 532-542.) (8.514/11355 Great Britain.)

(i) The combustion of moist "detonating gas" mixtures is determined by a prior ionisation of the constituent molecules of the gas. (ii) At freely sputtering

cathodes (a) steam molecules within the cathode zone condense on, and form clusters with sputtered metal atoms; (b) the combustion promoting activity of such clusters is somewhat less than that of a sputtered metal atom free from moisture; (c) such clusters promote combustion by neutralising the electrostatic forces of repulsion existing between positively charged ions. (iii) Combustion occurring at non-sputtering cathodes is (a) proportional to the number of separate individual moisture particles (clusters) within the cathode zone, such number depending upon the number of steam molecules within the cathode zone and contained in unit volume, and (b) effected by the overcoming of electrostatic forces of repulsion between positively charged ions by negatively charged moisture. (iv) At both classes of cathode a small amount of combustion is due to the direct union of ions of dissimilar charge, the negative ions consisting for the most part of oxygen molecules which have captured electrons.

Effects of Knock-Suppressing and Knock-Inducing Substances on Ignition and Partial Combustion of Certain Fuels. (R. E. Schaad and C. E. Boord, Ind. Eng. Chem., 21, 756-62, 1929. Chemical Abstracts, Vol. XXIII, No. 17, 10/9/29, p. 4335.) (8.514/11356 U.S.A.)

With hot bar ignition the minimum current to insure inflammability for a number of fuels increased on the addition of dope and decreased on the addition of knock inducers, while ignition by break spark was not sensibly affected.

Lubricating Oil and Knocking in the I.E. Engine. (S. Kyropoulos, Autom. Tech. Zeit., No. 28, 10/10/29, p. 619.) (8.514/11357 Germany.)

There is no direct connection between the quality of oil and detonation. If the oil takes part in the combustion to a marked extent the effective mixture strength of the fuel is reduced, and this leads to over-heating and detonation.

Action of Iron Catalysts on Mixtures of Carbon Monoxide and Hydrogen. (E. Audibert and A. Raineau, Ann. Off. Natl. Combustibles Liquides, 1928, No. 3, D. F. Smith, U.S. Bureau of Mines. Full abstract in Ind. and Eng. Chem., Vol. XXI, No. 9, September, 1929, pp. 880-885.) (8.516/11358 U.S.A.)

The gaseous mixture $CO + H_2$ in contact with catalysts containing ferric oxide at 150 atmospheres pressure is converted into (1) liquid and gaseous hydrocarbons, saturated and unsaturated; (2) aliphatic alcohols. The yield of organic liquid is from 15 per cent. to 17 per cent. by weight and 30 per cent. by heat value. The calorific value is 9,000 calories per kilogram, and two-thirds distils below 180°C.

The composition of the catalyst is arbitrary, little is known about the catalytic effect of the various constituents and further work may lead to important results.

German Fuels. (H. Bahr, Autom. Tech. Zeit., No. 24, 31/8/29, pp. 521-528.) (8.516/11359 Germany.)

The production of synthetic fuels by the Berger, Fischer and Methanol processes has reached a considerable figure, competing in price with natural oil fuel. Great attention is being paid to improvements in the yield of the plant.

The Heating of Carburettors. (P. Hardy, L'Aeron., No. 119, April, 1929, pp. 115-120.) (8.53/11360 France.)

Various types of air intake heaters employed on the Continent are described and illustrated with heating by jacket water and by exhaust heat.

Carburettors and their Accessories. (Leglise, L'Aeron., June, 1929, p. 187, quoted in Automotive Abstracts VII, 8, p. 238.) (8.53/11361 France.)

Representative French carburettors are fully described and illustrated with special attention to warming and regulation for altitude.

Tubes for Fuel and Oil Lines on Cars. (Autom. Tech. Zeit., No. 22, 10/8/29, p. 482.) (8.541/11362 Germany.)

Fuel piping of copper has to be turned inside to resist corrosion by American fuels containing sulphur and other corrosive products.

Relation between Resistance and Heat Transfer in Flow through Tubes. (L. Schiller and Th. Burbach, Phys. Zeit., Vol. XXX, No. 15, pp. 471-472.) (8.543/11363 Germany.)

To obtain complete similitude, it is not sufficient to have equal Reynolds' numbers. A new non-dimensional quantity, Péclet's number, is defined as $Pe' = \bar{u}d\rho c/\lambda$, where $\bar{u}$ = mean axial velocity, d = diameter, ρ = density, c = specific heat, λ = thermometric conductivity.

Péclet's and Reynolds' numbers must both be equal for similitude, dynamical and thermodynamical.

Heat Transfer from Fluid to Pipe. (Schiller and Burbach, V.D.I., Vol. LXXII, pp. 1195-1196, 25th Aug., 1928.) (8.543/11364 Germany.)

An excellent summary of the development of the subject.

Reynolds gave an equation which was based on the convection of heat and momentum in a constant ratio, from the fluid to the boundary.

Prandtl independently analysed the flow into a laminar boundary layer with a turbulent zone. The actual distribution remained unknown, but the velocity at the inner surface boundary layer was estimated at 0.056 of the mean axial velocity. Six years later G. I. Taylor found the value 0.56, by coincidence exactly ten times greater, which illustrates the uncertainty of the numerical results. Recently the empirical parabola of the 7th degree assigned to the distribution of the mean axial velocity has led to more consistent results, the discrepancies being from 20 per cent. to 40 per cent.

Nusselt's method modified by the authors is considered as putting the matter on a more physical basis.

For dynamical similitude it is necessary to introduce not only Reynolds' number but a non-dimensional quantity called Péclet's number and defined in the equation:

$$Pe' = \bar{u}d\rho c/\lambda$$

Further, similitude can only be expected at corresponding lengths from the reservoir.

The author's semi-empirical expression embodies these modifications, and may be used for comparison with any set of experiments.

Where the tube is " rough " and the resistance varies as the square of the velocity, mean values of the velocity and density are inserted, and reduce the expression to Prandtl's form for highly turbulent flow.

Flame Propagation in Gaseous Mixtures. (V. Naigai, Jour. Fuel Society of Japan, 1929, 8, 17. Fuel, No. 10, Vol. VIII, October, 1929, p. 506.) (8.57/11365 Japan.)

Flame propagation is due to activation of the molecules in front of the flame which react with oxygen, and depends on the nature of the mixture but not on the spontaneous ignition temperature of the constituents.

Ignition of Firedamp by the Heat of Impact of Metal against Rock. (M. J. Burgess and R. V. Wheeler (Safety in Mines Res. Brd., Paper No. 54, 1929, 25 pp. of B., 1929,-41), British Chemical Abstracts, B, Vol. XLVIII, No. 43, 25/10/29, p. 841.) (8.57/11366 Great Britain.)

Ignition of mixtures of methane and air was never obtained by sparks on impact, but was always due to a heated area of the rock produced by the cutter.

Spectrum Chemical Analysis of Motor Fuel Combustion. (Capt. W. C. Thee, S.A.E. Jour., Vol. XXV, No. 4, Oct., 1929, pp. 388-392.) (8.57/11367 U.S.A.)

A comprehensive account is given of the development and present status of our knowledge of the combustion of motor fuels in the engine, as deduced from the spectra themselves, with but little regard to theories. Spectrograms and references are given that are intended to suggest and facilitate further investigations by both practical and theoretical spectroscopists.

Iron-spark reference-spectra are shown for the measurements of the lines and bands on the spectrograms. Each spectrogram is analysed, and an explanation is offered for each observed phenomenon. The positive-band spectrum of ionised nitrogen is identified near the electrodes of the spark-plug.

The three most sensitive lines of lead are identified in the spectra of fuels containing ethyl fluid, and the possibility of developing a method for estimating the concentration of lead in fuel is suggested.

Heat Given Out by a Horizontal Wire or Pipe in Liquids and Gases. (Dr. Ing. W. Nuszelt, V.D.I., Vol. LXXIII, No. 41, 12/10/29, pp. 1475-1478.) (8.57/11368 Germany.)

The experiments of Griffiths and Jakeman on the loss of heat from the external surface of a hot pipe (Engineering, Vol. I., 23, 1927, p. 1) and those of Davis on natural convective cooling influence (Phil. Mag., Vol. XLIV, 1922, p. 920) are interpreted in terms of a non-dimensional equation first put forward by the author in 1915 to cover the cooling of horizontal wire in air.

Normal Speed of Flame in Gaseous Mixtures Rich in Nitrogen. (H. Passauer, Feuerungstechnik, 1929, 17, 7/5/28. Fuel, Vol. VIII, October, 1929, p. 506.) (8.57/11369 Great Britain.)

A new method of measuring the speed of flame propagation is described and the previous work is reviewed. The effect of various gases, methane, carbon-monoxide, etc., is investigated.

Ignition Speed of Inflammable Liquids in Air. (Mache, Z.V.D.I., No. 35, 31/8/29, p. 1241.) (8.57/11370 Germany.)

The ignition velocity of the liquid is measured directly by causing the flame to travel along the surface over a measured distance; in this way the velocities of alcohol water mixtures and petrol carbon tetrachloride mixtures were investigated. The effect of temperature on the speed of the flame was also studied in the case of benzol, petrol, ether, acetone and pentone. For this group of fuels the effect of temperature is small. In the case of alcohol and toluol, however, the velocity of propagation practically doubles for a 5° rise in temperature, reaching a limit of 1.5 metres a second at 25°C. Adding carbon tetrachloride to petrol reduces the speed of flame propagation from 1 metre a second to .4 metre a second for a 40 per cent. solution.

The Junker Diesel Engine. (Auto. Eng., September, 1929, p. 341.) (8.59/11371 U.S.A.)

Two pistons work in a common cylinder barrel, bore 80 mm., effective stroke 300 mm., the lower piston being connected by a short rod to a central crank, the

upper piston by two side rods to two supplementary cranks. Each line of cylinder has three cranks without intermediate bearings.

In the original slow speed design the scavenge ports were at the bottom and the exhaust ports at the top of the liner; the arrangement has been reversed for high speed design.

The pump supplies the correct charge of fuel by direct injection under the proper pressure through a single jet of the "open valve" type, *i.e.*, without spring-loaded needle valve, and controls the timing. There is a plunger for each cylinder line, with its own cam, and the charge is adjusted to the load by altering the effective stroke.

The cylinder volume rating is 15 b.h.p. per litre, for normal output 45 b.h.p. at 1,000 r.p.m., piston speed 985 ft./sec., and, at the same speed, 19 b.h.p. per litre for the maximum output of 57 b.h.p. At 1,500 r.p.m., piston speed 1,477 r.p.m., the rating is 22 b.h.p. per litre. The endurance is not stated.

New Ignition Point Adjustment for the Bosch Magneto for Aero Engines. (Flug., No. 9, September, 1929, pp. 8-9.) (8.91/11372 Austria.)

Spark control over the whole speed range is not wanted on aircraft, but late spark timing when starting up and manœuvring on the ground and early timing in flight. Automatic ignition devices on magnetos depend on centrifugal action and are subject to failure under vibration. The Bosch magnetos are fitted with two separate contact breakers, one of which gives late and the other normal advance timing with a simple throw-over switch, so that no rotation of the contact breaker with long and heavy controls is required.

The Scintilla Magneto. (Flug., No. 8, August, 1929, p. 7.) (8.91/11373 Austria.)

The main advantages of the Scintilla magneto consist in the small moment of inertia of the rotating parts, small weight of instrument and the possibility of fitting automatic control to the ignition timing without increasng the bulk of the machine.

The article describes the latter feature in detail.

The New Lodge Plugs. (Flight, 27/9/29, p. 1056c.) (8.92/11374 Great Britain.)

To withstand the exceptional heat conditions a new plug, type X170, was fitted to the Victoria Rolls Royce Schneider trophy engine, with mica as insulating material, cooled by a copper sleeve in thermal contact with the base of the plug. The central electrode is of special non-scaling steel alloy with a copper core for cooling purposes.

Champion Aviation Plug. (Auto. Ind., Vol. LXI, No. 7, August, 1929, p. 241.) (8.92/11375 U.S.A.)

The restricted bore permits extra exposure of the central electrode and short projection of the primary insulator without impairing ability to withstand heat and oil or freedom from fouling, and further makes it possible to apply one size of plug to practically all radial air-cooled and high compression water-cooled engines.

Bosch Centrifugal Force Starter for Aero Engines. (Flugsport, No. 20, 2/10/29, pp. 385-388.) (8.82/11376 Germany.)

The American eclipse inertia starter is being manufactured by the firm of Bosch under license. The article describes various types.

ARMAMENT

Fall of a Stone in Water after Impact. (F. M. Exner, Phys. Zeit., Vol. XXX, No. 14, July, 1929, pp. 458-462.) (9.33/11377 Germany.)

Stones of circular cylindrical shape with flat ends were mainly considered. The velocity (root mean squares) imparted to the water is taken as that of the stone multiplied by a constant empirical factor. No account is taken of loss during elastic impact, and an equation is derived equating the work done by the resistance to the rate of imparting kinetic energy to the water, with the striking velocity as the initial velocity.

An equation is derived from these assumptions giving tabulated values of velocity against time for different sizes. As the equations have been compared with observed values they may be of some value as empirical expressions. No attempt is made to obtain a hydro-dynamical solution.

MATERIALS

Inhibitors as a Means of Reducing Corrosion. (E. L. Chappell, Chem. and Met. Eng., No. 9, Vol. XXXVI, September, 1929, p. 539.) (10.15/11378 U.S.A.)

Chemical inhibitors added to an acid solution prevent or diminish acid attack upon metals without greatly affecting the action on oxides or salts.

A rust solvent, commercial muriatic acid plus an inhibitor, is useful for the removal of scale from water jackets and radiators of internal combustion engines. The effect is possibly due to the inhibitor substance being deposited along with hydrogen on the bare metal surface as a protective layer, invisible but effective. (See " The Electrochemical Action of Inhibitors in the Acid Solution of Steel and Iron," E. L. Chappell, B. E. Totheli and B. Y. McCarthy, Ind. & Eng. Chem., June, 1928).

Welding Research. (Editorial, Automotive Indus., Vol. LXI, No. 13, pp. 439-441.) (10.18/11379 U.S.A.)

Notes from a symposium of papers by members of the American Welding Society.

Application of Monel Metal. (John Ireland, B.Sc., Trans. N.E.C. Inst. E. and S., No. 8, Vol. XLV, October, 1929, pp. 373-399.) (10.2/11380 Great Britain.)

Monel metal has the composition :—
68 per cent. nickel,
29 per cent. copper,
3 per cent. chiefly manganese and iron with small quantities of carbon, etc.
It has greater strength and toughness than the commercial range of alloy steel, and retains considerable strength at 400°C. It is comparatively easy to work, cast, weld, forge, machine and draw. Large quantities are used in the repair of iron castings and during the war in repairing the machinery of interned German ships. It resists corrosion, and ball bearings of this material have operated successfully in sea water.

Non-Ferrous Metals and Alloys. (S.A.E. Journal, No. 3, Vol. XXV, September, 1929, p. 305.) (10.2/11381 U.S.A.)

Stellite, about 45 per cent. cobalt, 30 per cent. chromium, 15 per cent. tungsten and small quantities of manganese, silicon, iron and carbon, has better red hardness than high speed steel but is not so tough. It is used extensively for cutting tools and dies.

Cemented tungsten carbide is a mixture of 80 to 97 per cent. tungsten carbide, and the balance of cobalt is pressed into shape and heated in an atmosphere of hydrogen sufficiently for the cobalt to sinter the tungsten carbide particles together. The product is approximately as hard as sapphires. It requires no heat treatment nor can it be appreciably softened by overheating.

Elkonite is a mixture of tungsten and copper used chiefly for welding electrodes. It combines high electrical conductivity and high resistance to wear.

Tungsten is used for make and break contacts for nearly all battery ignition systems. It is essential to control the grain size to get satisfactory service. Tungsten filaments for lamps stand considerable mechanical shocks without breaking.

Helium, alloyed with iridium, is used in make and break contact points for currents exceeding 4 amps and in all aircraft magneto contact breakers. On account of its high price the amount of metal used is cut down to the minimum.

Leading-in Wires for Incandescent Lamps.—The wires consisting of a core of iron nickel alloy (44 per cent. nickel, 56 per cent. iron) coated with copper, have the same coefficent of thermal expansion as glass.

Tungsten Carbide Tools. (S.A.E. Journal, Vol. XXV, No. 3, September, 1929.) (10.21/11382 U.S.A.)

Metallic tungsten powder, produced from oxide by reduction in a hydrogen furnace, is mixed with the correct amount of carbon and kept at a certain temperature. Cobalt powder is mixed with the carbide, and the mixture is formed into a bar by hydraulic pressure in a steel mould. The bar is sintered at red heat before handling and shaping operations. Thereafter a second sintering operation produces permanent temper, which cannot be drawn, unlike steel. The process was devised by the German Osram Lamp Co.

An extensive bibliography of tungsten carbide tools is added.

Protection of Heat-Treated Aluminium Alloys against Corrosion. (P. Brenner, 131st Report of D.V.L.L.F.F., Vol. III, No. 6, May, 1929, pp. 137-141; E. Rackwitz and E. K. O. Schmidt, 132nd Report do. do., pp. 142-152; K. Matthias, 133rd Report do. do., pp. 153-160.) (10.27/11383 Germany.)

Coats of varnish and protective paint are liable to crack and peel. Three photographs exhibit different cases.

Metallic deposits of nickel, copper and chromium must be completely free from pores and cracks, since these metals are electro positive with respect to aluminium. Sprayed metallic coatings are even less reliable.

A new method of protection has been devised in U.S.A. Two thin sheets of pure aluminium are pressed on to the faces of a sheet of duralumin and the composite sheet is treated at 500°C. as for simple duralumin sheet.

Remarkable figures of resistance to corrosion were obtained in U.S.A. and are confirmed largely by D.V.L. tests, which are shown graphically. The method appears to be the most effective available protection.

Beryllium. (Aviation, Vol. XXVII, No. 10, 7/9/29, p. 513.) (10.2104/11384 U.S.A.)

An alloy of 60 per cent. beryllium with aluminium has good ductility and tensile strength of about 80,000 lbs. per sq. inch. The estimated total cost of production might reasonably be reduced to something between 1½ and 3 dollars a pound.

Alloys for Engine Castings. (Aviation, Vol. XXVII, No. 10, 7/9/29, p. 512.) (10.2101/11385 U.S.A.)

At Cleveland Aeronautical Exhibition a paper was presented by T. G. Welty, of the Aluminium Co. of America, on light alloys in engine design, particularly

two aluminium alloys known as 195 and 132. No. 195 is a comparatively new casting alloy which can be heat-treated and is ductile. A half inch sand-cast bar can be bent through 90° without breakage. Alloy No. 132 has a low coefficient of expansion which permits of a reduction of piston clearance by about 20 per cent. The alloy contains 13 per cent. of silicon and is rather difficult to work. The forms in which it is employed must therefore be simple enough to permit the use of a permanent mould.

Practical Possibilities of Beryllium. (S.A.E. Journal, Vol. XXV, No. 3, Sept., 1929, p. 315.) (10.2104/11386 U.S.A.)

Beryllium has a density about that of magnesium, a strength and modulus of elasticity comparable with steel, a thermal expansion and melting point about that of cast iron, and resistance to corrosion greater than that of aluminium. The ductility is poor. Ductile aluminium alloys containing 60 per cent. beryllium, tensile strength 80,000 lb. per sq. in., density near that of magnesium are reported.

The estimated cost of large-scale production should bring the cost between $1.40 and $2.70 per lb., at which price the use of the metal becomes economically possible.

Work on Beryllium. (Scientific Publications of Siemens, Vol. VIII, Part 1.) (10.2104/11387 Germany.)

An account of the winning of the metal and the properties of its alloys with copper, nickel, iron and aluminium. Remarkable age-hardening effects were found in the copper, nickel and iron alloys. The production of metallic beryllium is expected to amount to over one ton in the year.

The Production and Uses of Beryllium. (Kurt Illig, Electrician, No. 2680, Vol. CIII, 11/10/29, pp. 426-427.) (10.2104/11388 Great Britain.)

An abstract of a paper presented to the American Electro Society on the work carried out by the Research Laboratories of Siemens, Berlin. The use of beryllium in light alloys is considered to be problematical. Small additions of beryllium to certain bronzes have produced beneficial results.

Beryllium in Alloys. (Autom. Tech. Zeit., No. 25, 10/9/29, p. 556.) (10.2104/11389 Germany.)

Beryllium in steel alloys prevents rust. Added to bronze in small quantities (approximately 5 per cent.) it produces considerable increase in tensile strength and increases notably the life of castings under vibration. Certain bronzes have shown a life of about five times that of the best spring steel under alternating stresses.

The Production of Beryllium. (Z.V.D.I., No. 36, 7/9/29, p. 1282.) (10.2104/11390 Germany.)

Beryllium is obtained electrolytically from a mixture of barium fluoride and beryllium oxyfluoride. One kilogram of beryllium requires roughly 100 kilowatt hours of energy, over three times that required for one kilogram of aluminium.

The process is to be carried out at about 14,000°C., a temperature which presents considerable technical difficulty.

Lautal as a Material for Airplane Construction. (Paul Brenner, N.A.C.A. Tech. Memo., No. 524, August, 1929.) (10.2106/11391 U.S.A.)

Lautal is a heat-treated aluminium alloy of composition—aluminium 94 per cent., copper 4 per cent., silicon 2 per cent., and impurities.

The density is practically that of duralumin, the strength less; but it can be welded without appreciable deterioration and large fuel tanks of welded lautal are lighter and tighter than normal riveted tanks.

Use of Light Alloys in Engines. (S.A.E., September, 1929, p. 316.) (10.23/11392 U.S.A.)

Wrought and heat-treated aluminium alloys constitute half of the weight and three-quarters the volume of modern aircraft engines.

A further saving in weight will be brought about by use of alloys rich in magnesium now being produced with greater hardness and more resistance to corrosion. But their behaviour under fatigue is uncertain and their rapid falling off in tensile strength with temperature unsuits them for highly stressed pistons.

The properties of beryllium now becoming commercially available have given a fresh impetus.

Chemistry of Minerals.—Corrosion of Aluminium by Ammoniacal Solutions. (J. Calvert, Comptes Rendus, Vol. CLXXXIX, No. 14, 30/9/29, pp. 485-6.) (10.27/11393 France.)

In continuation of a previous note (C.R. 185, 1927, p. 909; see also Abst. 10.27/10497, issue No. 9) the author gives figures for the loss of weight of aluminium metal preparations of varying purity by ammoniacal solutions. The general effect is the covering of the metal surface by a protective crust. At the end of two days there is no further serious decomposition.

Al-Alloy Corrosion. (S.A.E., Sept., 1929, p. 315.) (10.27/11394 U.S.A.)

Corrosion may occur by uniform solution of the surface of the metal, by pitting or localised corrosion or by intergranular corrosion.

With an al-alloy containing copper and magnesium silicide, intergranular corrosion can be largely prevented by water quenching.

In alclad, duralumin is faced with thin sheets of pure aluminium. The covering gives both mechanical and electrolytic protection. Satisfactory results in commercial use have been obtained by painting or varnishing aluminium alloys with paints after thorough cleaning before application and removing the grease with a mild chemical cleaner that does not attack the metal. Artificially formed oxide films act as a base for paints and varnishes. Bituminous paints with or without aluminium bronze powder give protection against the severe conditions affecting floats.

Light Alloys, Protection against Corrosion. (Luftwacht, No. 9, September, 1929, p. 415.) (10.27/11395 Germany.)

Following the successful alclad method of protection against corrosion, the original patentees of the duralumin alloy have produced a similar method of protection which is called duralplat. In this method the dural is covered with a thin sheet of a special duralumin alloy, K50, close contact between the two being provided by welding. This method of plating gives equal protection against corrosion, and adds to the mechanical strength of the product.

A New Metal; Substitute for Platinum in Radio Valve Manufacture. (The Electrician, Vol. CIII, 2676, Sept. 13th, 1929, p. 301.) (10.28-13.5/11396 U.S.A.)

The development of a new metal, known as " konel," which is credited with being much stronger than other metals at high temperature and which can be used extensively in the moving parts of internal combustion engines has been announced by the Westinghouse Electric and Manufacturing Co.

As a substitute for platinum in the manufacture of filament for radio valves, konel is stated to save approximately £50,000 per month. The price of platinum is approximately £36 per ounce; konel only costs a few shillings a pound.

Smoothness and Flatness as a Physiological and Physical Problem. (Dr. Ing. Dr. Med. G. Schmaltz, Z.V.D.I., Vol. LXXIII, No. 41, 12/10/29, pp. 1461-1467.) (10.6/11397 U.S.A.)

Roughness and scratches on the surface have a profound influence on the mechanical properties of a material. A new photographic method is described for investigating the nature of the surface of various materials, and the sensitivity of the nerves in the skin in estimating roughness is measured under various conditions.

Vibration of a Circular Plate Clamped Round the Circumference. (G. Franke, Ann. d. Phys., Vol. II, Part 6, 1929, pp. 649-675.) (10.61/11398 Germany.)

The solution of the differential equation and the boundary conditions are expressed in Bessel functions, and the latter reduced to a more convenient form for somewhat lengthy numerical computations carried out by the author. There are two independent series of solutions with even and odd numbers of nodal lines respectively.

Numerous Chladni figures were produced experimentally using glass, celluloid and paper discs.

With the two former materials the observed figures were always explicable as superposed simple solutions.

Twenty-five cases of mathematical solutions are drawn and the same number of photographs of experimental configuration are reproduced.

In the case of glass and celluloid there is good correspondence; with paper there are serious divergences.

The Relation between Fatigue Limit and Static Tests. (W. Harold, V.D.I., Vol. LXXIII, No. 36, 7/9/29, pp. 1261-1266.) (10.621/11399 Germany.)

Series of tests are collected and compared and empirical relations are sought. The expressions adopted appear to indicate the average relations required, but considerable scattering is shown in the figures. The object is to obtain fatigue limits by shorter methods than those involved in large numbers of stress variations.

In particular Stribeck's formula is examined. Ten diagrams give test points and empirical curves.

Testing Apparatus, Etc.

Investigation of Airflow in Open Throat Wind Tunnels. (Eastman N. Jacobs, N.A.C.A. Rep. No. 322, Sept., 1929.) (11.16/11400 U.S.A.)

A study of air pulsation in the six-inch open-throat tunnel.

The air pulsations were practically eliminated by using a moderately large flare on the exit cone in conjunction with leakage produced by cutting holes somewhat aft of the minimum diameter.

Magnetic Sounding of Shafts. (J. Peltier, Comptes Rendus, 188, pp. 701-703, March 4th, 1929.) (11.23/11401 France.)

By means of a loud speaker an artificial bubble 2 mm. in diameter and 7 mm. below the surface was indicated with certainty in a shaft 45 cm. long and 2 cm. in diameter.

On a Method of Testing Motor Benzol. (R. Brunschwig and L. Jacque, Comp. Rend., No. 14, 30/9/29, pp. 486-489.) (11.24/11402 France.)

The tendency for benzol to deposit gums on storing is tested by bubbling air through a heated sample and measuring the amount of gum formed by evaporation. It is considered that this method reproduces actual conditions and is to be preferred to other tests which depend on ultra-violet light exposure.

AIRSHIPS

The All-Metal Airship ZMC-2. (S.A.E. Journal, Sept., 1929, p. 318.) (12.12/11403 U.S.A.)

The two halves of the ship were built separately in a vertical position, so that most of the work could be done on the ground. The circumferential strips of duralumin were sewed together with tiny metal rivets by a special machine. When completed the halves were turned horizontally and jointed. The envelope, which contains no gasbags, was inflated with carbon dioxide from the bottom to force out the air. Helium was then introduced at the top while the carbon dioxide was pumped out at the bottom. When 40 per cent. of helium was revealed in the gas analysis, the gases were run through a caustic soda scrubber which effectively removed the carbon dioxide. This method cost about $2,000 compared with $70,000 for a plant to freeze out the air.

Notes on the Graf Zeppelin. (Alfred F. Masury, S.A.E. Journal, Vol. XXV, No. 3, Sept., 1929, p. 240.) (12.13/11404 U.S.A.)

The structure has great flexibility, so that load strains are well distributed between different sections. Novel navigating devices are provided. The height is estimated by echo method and the speed is recorded by the time required for the shadow to pass a given point on the ground. Five Maybach engines are fitted, designed to run for one thousand hours before minor overhaul, and two thousand hours before major overhaul. The engines are run-in for 400 hours before being fitted into the ship. The weight of one power unit developing 550 h.p. is 2,450 lbs. or slightly over 4 lbs. per h.p. The engines can be reversed by shifting the overhead cam gear. An oscillation damper is fitted between the propeller and crankshaft.

Functions Determining the Side Elevation of an Airship. (Milarch, Z.F.M., Vol. XX, No. 16, pp. 409-413, Aug., 1929—two consecutive articles.) (12.33/11405 Germany.)

A number of arbitrary curves are discussed and the relation between surface, volume and maximum cross section are worked out. The problem of the best curve is left open.

Mobile Mooring Mast. (Paper by C. S. Rosendahl, Editorial Review, Scientific American, Vol. CXLI, No. 4, Oct., 1929, pp. 338-340.) (12.41/11406 U.S.A.)

The three-legged steel mooring mast at Lakehurst has a triangular base of 60 feet a side, mounted on three Athey truss wheels, complete with electric generating units, fuel and water ballast storage, pumps and mooring winches.

For entering and leaving the shed the airship will be made fast to a rigid trolley running on rails parallel to the hangar.

The upper part of the mast is telescopic; a great saving in ground staff will be effected by these devices.

WIRELESS

An Investigation of Short Waves. (T. L. Eckersley, Journal I.E.E., Vol. LXVII, No. 392, Aug., 1929, p. 992.) (13.1/11407 British.)

Some thousands of bearings were taken by wireless signals on wave lengths lying between 10 and 50 metres, of eighty-eight stations, over a period of nine months.

The interpretation of the results is based on a preliminary discussion of scattering by the Heaviside layer.

High Precision Standard of Frequency. (W. A. Marrison, Bell Tele. Lab., Reprint B.402, Aug., 1929.) (13.1/11408 U.S.A.)

A new standard of frequency is described in which three 100,000-cycle quartz crystal-controlled oscillators of very high constancy are employed. These are interchecked automatically and continuously with a precision of about one part in one hundred million.

Piezo-Electric Measurements of Pressure and Acceleration. (J. Kluge and H. E. Linckh, V.D.I., Vol. LXXIII, No. 37, 14/9/29, pp. 1311-1314.) (13.21/11409 Germany.)

Application is made of the property of quartz that pressure produces electrical changes which are sufficient to affect an electrostatic valve volt meter.

The voltage current characteristic is shown graphically and is approximately rectilinear over a range.

The current pressure characteristic of the quartz is also shown graphically for different shunted capacities.

The quartz is cut into a cube with one face neutral, the others perpendicular to the optical and electrical axes. The quartz cube is mounted in a steel chamber with an amber bush carrying the lead to one electrode, the other electrode being earthed.

The pressure is applied through a steel sphere, bearing on a pressure plate. Interesting examples are given of measurements in such varied problems as the pressure of a cutting tool, the acceleration of a direct current armature, and the longitudinal pressure in a vibrating steel wire.

A bibliography of six references is given.

Modes of Vibration and Temperature Coefficients of Quartz Crystal Plates. (F. R. Lack, Bell Tele. Lab., Reprint No. B.403, Aug., 1929.) (13.21/11410 U.S.A.)

The characteristics of piezo-electric quartz crystal plates of the perpendicular or Curie cut are compared with parallel or 30-degree cut plates with reference to the type of vibration of the most active modes, the frequency of these modes as a function of the dimensions, and the magnitude and sign of the temperature coefficients of these frequencies.

Directional Distribution of Static (A. E. Harper, Bell Tele. Lab., Reprint B.409, Aug., 1929.) (13.4/11411 U.S.A.)

The utility of directional data on static is shown and two types of apparatus devised for such a directional investigation are compared. It is shown that a method which gives the direction of individual crashes is superior to integrating methods. The distribution of thunderstorms over the world is discussed, and comparisons are drawn between this distribution and the observed directional distribution of static. Probable geographical locations are assigned to the sources, based upon thunderstorm data and directional observations.

Errors in D/F. (P. Duckert, Z.H. Freq. Tech., Vol. XXXIV, No. 2, 1929, pp. 60-65.) (13.4/11412 Germany.)

Under certain meteorological conditions which are fortunately rare, unavoidable errors of the order of 5° may occur. A further source of error is introduced by the configuration of the coast. A considerable list of references is given.

Aeroplane Directional Receiver. (H. Gloeckner, 126th Report of D.V.L., L.F.F., Vol. III, Part 4, 22/4/29, pp. 99-110.) (13.4/11413 Germany.)

To meet the special requirements of aircraft D.V.L. collaborated with the Telefunken Gesellschaft in redesigning the existing marine apparatus and pro-

ducing a medium size experimental apparatus, mark 47N, with which a series of experiments was carried out on a Junkers F.13. On the results of these experiments the first real aeroplane receiver, mark 173N, was constructed by the T.G. in collaboration with D.V.L. The weight and bulk were reduced 40 per cent., from a total of 38 kg. to 23 kg. and from 95 dm.^{3} to 38 dm.^{3}.

A general arrangement diagram shows an audion valve, three magnifying valves on the low frequency side and four valves on the high frequency side, eight valves in all. On turning the frame through 360° two maxima and two minima occur. The electro-magnetic and electrostatic e.m.f.s are 90° out of phase, but this does not alter the directions of maximum and minimum reception. The sign of the direction so found is ambiguous and is determined by the direction of the cross e.m.f. required to compensate the 90° out of phase electro-magnetic e.m.f. On plotting the strength of the signal round 360°, the correct compensation gives a cardioid type of curve with a well-defined zero at the cusp, which fixes the sign. Correction for deviation is obtained by swinging the whole aeroplane on a wooden platform through 360° and observing the difference between the bearings obtained by wireless reading from the true bearing of the sending station for different wave lengths. The correction curve resembles the deviation curve of a magnetic compass on board a ship, and is conveniently expressed in sines and cosines of the bearing angle and its even multiples. Curves are given for five wave lengths on a Junkers F.13.

Applications are discussed in respect of the various difficulties that may arise, and illustrated on charts by actual flying voyages.

Shielding in High Frequency Measurements. (J. G. Ferguson, Bell Tele. Lab., Reprint B.405, Aug., 1929.) (13.6/11414 U.S.A.)

In this paper the purpose and usefulness of shielding in high frequency measurement are outlined. General principles of electrostatic shielding are developed as applied to simple impedances and to networks of impedances, particularly to bridge networks. Practical applications of these principles to the shielding of adjustable impedances, and in the construction of actual bridge circuits, are described.

Experiments on Directional Aerials with Short Waves. (W. Moser, Z.H. Freq. Tech., Vol. XXXIV, No. 1, July, 1929, pp. 19-26.) (13.7/11415 Germany.)

Experiments were carried out by the Telefunken Co. of Germany between Nauen and Buenos Aires on a wave length of approximately 15 metres on directional effects both at the sending and receiving station. The method finally developed is compared with the Marconi beam system.

Production of Very Short Electro-Magnetic Waves by the Barkhausen-Kurz Apparatus. (W. J. Kalmin, Ann. d. Phys., Vol. II, Part 5, 1929, pp. 498-514.) (13.7/11416 Germany.)

Successive advances in the development of valves enabled K. Kohl to produce waves of 30 cm. length with a grid potential of 600 volts. H. Hollman, with a French valve, produced waves of 16 cm. and observed a wave of 13.2 cm. at a grid potential of 400 volts. The author, using a Russian 10-watt valve supplied by Leningrad, established highly stable waves of 14.5 cm. of greater intensity than hitherto obtained; and a wave of 8 cm. and about equal intensity was maintained.

The observed grid current, anode current and receiver current are shown as functions of the H.T. voltage, under various conditions in each case showing several well-defined ranges of reception.

The Barkhausen-Kurz Short Wave Apparatus. (P. Knipping, Z.F. Hochfrequenz, Vol. XXXIV, Part 1, July, 1929, pp. 1-12.) (13.7/11417 Germany.)

The conditions under which the apparatus works are discussed in terms of ionisation and free electrons.

It is found that:—

1. A residuum of gas is necessary which, in operation, is concentrated at kathode and anode, while the space round the grid is free from gas molecules.
2. The primary electrons vibrate and are given off from the filament in phase with the oscillations.

The space change is disturbed in a phase corresponding to that of the electrons, since the rest of the electrons are always in phase with the previously existing oscillation.

The wave length is determined by characteristics of the electrons, along with the grid and anode voltages. It is independent of inductance and a capacity with antennæ.

3. The Barkhausen-Kurz valve, by virtue of the alternating field at the anode, and also at the diode in absence of a magnetic field, constitutes a sender of zero order, and the waves have spherical symmetry.

A bibliography gives 36 references.

Short Wave Sender with Quartz Crystal Control. (141st Report of D.V.L., Z.f. Hockfrequenst, P. V. Handel, K. Kruger and H. Plend, Vol. XXXIV, Part 1, July, 1929, pp. 12-18.) (13.7/11418 Germany.)

Several different arrangements of a quartz crystal in receiver circuits were tried with a view to application to aircraft.

It was found that a 2-watt sender of a suitable type mounted in an aeroplane had a range of 600 to 800 km. operating alike from the ground or in the air without perceptible effect at the receiving end, but that a receiver mounted in the aeroplane was seriously affected by noise, magneto disturbances and vibration, so that its use was quite impracticable.

It was found impracticable to employ in the receiver a quartz crystal control of the same frequency as that in the sender, as the reduction in loudness was excessive.

The solution proposed is an arrangement whereby the superposition of sender and receiver frequencies produces a high frequency harmonic which becomes audible in a normal audina valve.

Miscellaneous

Analysis and Statistical Statement of Aircraft Accidents. (H. Caspori, 136th Report of D.V.L., Z.F.M., Vol. XX, No. 16, Aug., 1929, pp. 423-427.) (16.0/11420 Germany.)

Methods of presentation are discussed and examples of tables and of graphical representations are given.

Rates of Descent of Falling Man and Parachute Pack. (U.S.A. Air Corps Information Circular, No. 628.) (16.11/11421 U.S.A.)

Five sets of curves are given from actual observations of velocities, four with dummy men and one with a dead weight, before the opening of the parachute.

The terminal speeds range from 85 m.p.h. to 119 m.p.h. in the first four cases, and reach 206 m.p.h. in the last case. The form of the curves of vertical displacement and velocity corresponds closely to that calculated on the assumption of resistance as the square of the velocity (*cf. Aeronautical Journal*, 1928, p. 929). The terminal velocities seem moderate.

Fire Extinguishing by Lather and by Solid Carbonic Acid. (A. Karsten, V.D.I., Vol. LXXIII, No. 37, 14/9/29, pp. 1322-1324.) (16.12/11422 Germany.)

A description is given with general arrangement drawings of apparatus for generating foam or lather aerated with gases not supporting combustion.

An account is also given of apparatuses which diffuse carbonic acid gas either by hand or automatically.

Spiral Tendency in Blind Flying. (T. Carroll and W. H. McAvoy, N.A.C.A. Tech. Notes, No. 314.) (19.111/11423 U.S.A.)

Twenty-six diagrams of flight paths are given all showing a tendency to fly in circles when deprived of visual registration.

The conclusion is drawn that pilots should consistently practise flying with instruments against the day when they are forced to do so by fog or cloud.

The Principles of Airport Layout (Dr. Ing. E. Dierbach, V.D.I., Vol. LXXVIII, Aug., 1929, pp. 1125-1130.) (20.0/11424 Germany.)

A descriptive account of the layout of airship and aeroplane sheds, seaplane docks, workshops, landing grounds, mooring masts, etc.

Equipment of Airports. (E. Dierbach, Z.V.D.I., Vol. LXXIII, No. 34, 24/8/29, pp. 1189-1192.) (20.4/11425 Germany.)

A description is given of methods of lighting aerodromes and obstacles.

Neon tubes, rotating beacons, fixed and mobile, fuelling tanks, wireless apparatus, docks and slipways for seaplanes.

Lighting a Typical Airport. (H. E. Lippman, U.S. Air Services, Vol. XIV, No. 10, Oct., 1929, p. 65, *et seq.*) (20.5/11426 U.S.A.)

A diagram of a typical field layout shows the disposition of the lights and a detailed descriptive account is given of the various lamps, beacons and flood-lights employed, with an analysis of costs.

Lighting of Airways and Airports. (H. E. Mahan (abstracted from A.I.E.E., J.48, pp. 379-382, May, 1929). Science Abstracts, Section B, No. 381, 25/9/29, p. 520.) (20.5/11427 Great Britain.)

Describes the lighting adopted for the U.S. national airways under the control of the Department of Commerce. Along the airways are placed revolving beacons at intervals of about ten miles. These consist of 24 in. projectors with 1,000-watt lamps. The beacon is supplemented by two " course " lights consisting of 500-watt projectors, one facing in each direction along the airways. To obtain the highest rating a port must have the following equipment:—(*a*) An airport beacon, (*b*) an illuminated wind direction indicator, (*c*) boundary lights, (*d*) obstruction lights, (*e*) hangar flood-lights, (*f*) a ceiling projector, and (*g*) a landing area flood-lighting system. Items (*a*) to (*d*) must operate all night.

The Flying Boat in a Seaway. (Luftwacht, No. 9, Sept., 1929, pp. 406-409.) (22.4/11428 Germany.)

A descriptive account of methods of using sea anchors to minimise stresses in a sea.