ABSTRACTS AND NOTICES

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Aircraft Design

A New Tail-less Aeroplane. (Airc. Eng., Vol. 3, No. 33, Nov., 1931, p. 274.) (Germany 5.1/23001.)

Some details are given of the tail-less type of aeroplane designed by Lippisch on the basis of glider experience.

Coefficients of Aeroplane Performance. (A. Koyemann, Z.F.M., Vol. 22, No. 10, 28/5/31, pp. 300-301.) (Germany 5.1/23002.)

Five quantities are specified on which comparison of performance should be based, as follows :—

(1) Airscrew efficiency.
(2) Maximum lift/Minimum drag.
(3) Ratio of so-called " detrimental drag " to number of passengers.
(4) Ratio of glider weight to total weight.
(5) Ratio of power plant weight to power.

Approximate formulæ are given showing the effect of these quantities on various aspects of the performance.

Amplitude of Vibrations on an Aeroplane in Flight. (Aviation, Vol. 30, No. 10, Oct., 1931, pp. 591-592.) (U.S.A. 5.17/23003.)

A summary is given of a paper (S. J. Zand) read before the S.A.E. on measurement of amplitude of vibrations on an aeroplane in flight. Five records are reproduced; in the worst case the amplitudes appear to be about ten times those of the best case. An interesting diagram is given showing the amplitude of vibration against engine r.p.m. for four aeroplanes. In one case, synchronous speed is evidently reached and the record rises abruptly off the chart and descends still more abruptly beyond the critical speed.

Load Factors, Rationalisation for Aeroplanes in Flight. (J. S. Newell, S.A.E. Jrnl., Vol. 30, No. 1, Jan., 1932, pp. 31-34.) (U.S.A. 5.18/23004.)

Four attitudes are specially considered, inverted flight, terminal nose dive, pulling back at high speed and small angle of attack (c.p. back), and pulling back at low speed and high angle of attack (c.p. forward).

Curves are plotted showing the variation of load factor with decreasing velocity after pulling back, and show a load factor of 10 on pulling back at 200 m.p.h. In terminal nose dive a load factor of nearly 25 is shown.

Variation of load on spars with angle of incidence and distribution of pressure over tail surfaces in a dive are shown graphically.

Numerous data are tabulated. A general discussion follows.

Aerofoils—Aerodynamic Characteristics. (R. T. Anderson, N.A.C.A. Tech. Note No. 397, Nov., 1931.) (U.S.A. 5.2/23005.)

A group of six aerofoils in common use in America was tested from $-32°$ to $+32°$ incidence to afford data for calculation of stresses in inverted flight. The results are given in tables and curves. As might be expected the asymmetry of the lift, drag and moment curves increases with camber.

Aerodynamic Characteristics of Slotted Wings. (C. J. Wenzinger and J. A. Shortal, N.A.C.A. Rept. No. 400, Nov., 1931.) (U.S.A. 5.2/23006.)

Photographs show the wing and the mounting of the auxiliary aerofoil, and a diagram shows the setting up in the vertical tunnel. Twenty combinations of slot width and position were selected and the characteristics are given in twenty diagrams each containing six curves of lift and drag. The maximum increase of stalling angle was 30° with a slight decrease of lift. In one particular slot position an increase of 25° in incidence and 23° in lift was obtained. From the diagrams the best combination can be selected for given requirements.

Wing Loads imposed by Gusts. (H. G. Küssner, Z.F.M., Vol. 22, No. 19, 14/10/31, pp. 579-586, and No. 20, 28/10/31, pp. 605-615, 225th D.V.L. Rept.) (Germany 5.25/23007.)

The nature and magnitude of gusts met with in the atmosphere are discussed. An example of an anemograph is reproduced and a sectional representation of the velocity field in a gust is given in twelve contour diagrams representing conditions at intervals of one second. A record of bending in a wing made during a six-hours' cross-country flight is reproduced and the points show heavy scattering about the mean deflection in steady flight. The latter decreases slowly with consumption of fuel and reduction of flying weight. Eleven more detailed records show the change in deflection from second to second over periods of from two to thirty seconds. Periods of quite roughly six seconds from peak to peak of the bending diagram indicate a period of six seconds in the gusts. The variation in the deflection reaches ± 25 per cent. as a rough figure. Two photographs are given of the recording apparatus used, and five record strips are reproduced.

Comparison of Weights of Trilateral and Quadrilateral Girders. (E. Seydel, Z.F.M., Vol. 22, No. 12, 29/6/31, pp. 362-366.) (Germany 5.25/23008.)

Expressions are formed for the weights of struts and spars under bending and torsion and a formal minimum is obtained. The comparative results are plotted graphically and it is found that in certain ranges of the diagram the triangular form may be the lighter, and in other ranges heavier. A comparison is also shown between frames of rectangular and rhomboidal section.

Systematic Comparison of Weights of Three-dimensional Frame-works. (J. Cassens, Z.F.M., Vol. 22, No. 12, 29/6/31, pp. 357-362.) (Germany 5.25/23009.)

Systematic formulæ are worked out for each member of trilateral and quadrilateral prismatic frame girders. Numerical values are worked out for six cases.

Three-dimensional Buckling of Typical Strut Dispositions in Aircraft. (A. Tiechmann, Z.F.M., Vol. 22, No. 17, 14/9/31, pp. 525-526.) (Germany 5.25/23010.)

Sketches are given of a number of typical dispositions of struts and joints. The condition for buckling at any point is reduced to the vanishing of the determinant. The constituents of the determinant are tabulated for seven types of framework, which are shown in diagrammatic sketches, and are derived from the systems of symmetrical linear equations which represent the conditions for equilibrium of the framework.

Exact Calculation of Wing Ribs built on several Parallel Spars, partly Cantilever and wholly Cantilever, with an Indirect Loading. (E. Sänger, Z.F.M., Vol. 22, No. 20, 28/10/31, pp. 597-603.) (Germany 5.25/23011.)

A wing with seven parallel spars and seven ribs in the half span is shown in perspective and diagrammatically, with distribution of loads. Equations are formed for stresses in the ribs. Four numerical cases are worked out and tabulated. Influence lines are shown graphically, with numerical values, for three types of wing.

Development of Military Aircraft Design. (H. Ritter, Aviation, Vol. 30, No. 11, Nov., 1931, pp. 626-629.) (U.S.A. 5.51/23012.)

The technical qualities desirable in bombing aircraft are specially considered. The importance of silence in large bombers is emphasised. The only actual proposal put forward is the gearing down of the airscrew.

Seaplane and Ship. (W. v. Gronau, Z.F.M., Vol. 22, No. 17, 14/9/31, pp. 519-524.) (Germany 5.51/23013.)

A discursive article on the role of the seaplane and marine transport, with a descriptive account of the qualities desired and the conditions to be met.

Amphibians, Construction. (G. H. Handasyde, Airc. Eng., Vol. 3, No. 33, pp. 275-278.) (Great Britain 5.52/23014.)

A description is given of the methods of construction of hulls and seaplanes applied by the Saunders Roe Company. Thirteen photographs are given.

Undercarriages and Brakes

Dynamical Investigation of Aeroplane Landing Carriage Springs and Dampers. (P. Langer and W. Thomé, Z.V.D.I., Vol. 75, No. 45, 7/11/31, pp. 1388-1389.) (Germany 5.55/23015.)

A rotating wheel carrying a track enables rolling tests to be carried out at a fixed position. Different types of spring and damping were fitted. Systematic measurements were made of strain displacements of the gear under varying falls and shocks, and under shocks repeated periodically.

The numerical results are recorded graphically showing strain displacements as a function of height of fall, and in the case of repeated shocks as functions of time.

Hydraulic Brakes. (R. W. Brown, Airc. Eng., Vol. 3, No. 34, Dec., 1931, pp. 301-304.) (Great Britain 5.58/23016.)

Descriptive accounts are given with illustrative sketches of several types of hydraulic brake on the market. Elementary calculations of pressure, torque and reduction of landing run are carried out.

Airscrews

Experimental Runs with a High-speed Railway Carriage driven by Airscrew. (F. Seewald and W. Feucht, Z.F.M., Vol. 22, No. 22, 28/11/31, pp. 667-671.) (Germany 5.61/23017.)

Constructive details, sketches of plan and elevation and five photographs of the carriage, with and without the external fairing, and its appearance on the experimental 8 km. track are given.

Two airscrews are mounted, one a propeller screw and one a tractor with equipment for measurement of thrust and torque. The power required is of the same order as for an aeroplane, say 500 to 1000 h.p. (A wind channel of 7in. diameter and a wind speed of 200 km. per hour would require 4000 h.p.).

Two 250 h.p. B.M.W. IV. engines were used, one on each screw. The acceleration speed curves for the 8 km. are shown with the forward screw only in operation and with both screws. The speeds reached were 117 km. per hour at about $4\frac{1}{4}$ km., and 175 km. per hour at about $5\frac{1}{2}$ km. The duration of travel at full speed in the latter case is $1\frac{1}{2}$ km. in 30 seconds, allowing a kilometre for braking and coming to rest. About twenty test runs were made in October, 1929, more than ten years after construction of the carriage. The tests so far are regarded as preliminary to further and more accurate work. No detailed results are given.

A projected alternative arrangement is shown in sketches of side elevation and plan, with the tractor screw mounted on a long horizontal column well in advance of the rest of the carriage and comparatively free from interference.

Experimental Investigations of Airscrews with Adjustable Pitch. (H. Reissner and M. Schiller, Z.F.M., Vol. 22, No. 18, 28/9/31, pp. 551-557, 256th D.V.L. Report.) (Germany 5.64/23018.)

The pitch is adjusted by turning the blade as a whole about a radial axis. Non-dimensional characteristics are defined for thrust, torque, and efficiency. A new set of three derived non-dimensional characteristics is obtained by elementary transformations. Using these new coefficients functional relations are shown graphically between flying velocity, thrust and moment at different blade settings. The results are plotted graphically.

In a worked out example the required thrust characteristic is assumed and plotted on the same scale as the thrust coefficient of the airscrew for different blade settings, and the whole problem is worked out numerically for specified data.

Racing Airscrews. (D. L. H. Williams, Flight, Vol. 23, No. 44, 30/10/31, pp. 1086a-1086e.) (Great Britain 5.654/23019.)

A descriptive technical account is given of the various problems arising in the design of racing airscrews. A photograph shows a forged aluminium blank and the finished airscrew. Curves are given of efficiency against diameter, and r.p.m., thrust, and spiral angle of slip stream against flying speed.

Vibration Phenomena in an Airscrew. (F. Seewald, Z.F.M., Vol. 22, No. 12, 29/6/31, pp. 369-374. Part II. of 219th D.V.L. Rept.) (Germany 5.66/23020.)

In continuation of the descriptive account of D.V.L. activities Part II enumerates possible sources of vibration and resonance in airscrews, and each is discussed briefly.

For Part I, describing work on seaplane floats, see Abstract No. 20/22018.

A Spring Airscrew Hub. (Airc. Eng., Vol. 3, No. 33, Nov., 1931, pp. 279-280.) (Great Britain 5.65/23021.)

A brief description is given of an airscrew hub with torsional damping designed by Major B. C. Carter. The article is illustrated by photographs of parts and of the assembled hub, and by two scale drawings.

Instruments

Aircraft Instruments, Damping Liquids. (M. R. Houseman and G. H. Keulegan, N.A.C.A. Rept. No. 398, Nov., 1931.) (U.S.A. 6.104/23022.)

From author's summary.—Data are given on the kinematic viscosity, in the temperature range $-50°$ to $+30°$C., of pure liquids and of solutions of animal oils, vegetable oils, mineral oils, glycerine, and ethylene glycol in various low freezing point solvents.

Cathode Ray Oscillograph. (J. B. Johnson, J. Franklin Inst., Vol. 212, No. 6, Dec., 1931, pp. 687-718.) (U.S.A. 6.104/23023.)

The elementary theory of the deflection of a stream of electrons from a cathode by electrical and magnetic fields is given. Diagrammatic sketches and sectional drawings are given showing the development of the cathode ray tube, particularly in their application to oscillograph work. The deflection of the ray is measured by the travel of the point of incidence on a fluorescent screen. Photographs reproduce records of the discharge of a condenser, the oscillations due to the closing of an electrical circuit, electrical wave shapes at $8\frac{1}{2}$ million cycles to the second, hysteresis of iron, distortion of amplifier tubes, etc., etc. Continued development and refinements have made the apparatus an instrument of reasonable size and cost for high frequency measurements of every sort. For application to the cathode ray compass see Abstract No. 21/22536.

Linear Time Axis for a Cathode Ray Oscillograph. (A. L. Samuel, Bell. Tele., No. B.605, 1931.) (U.S.A. 6.48/23024.)

Author's abstract.—The usefulness of a cathode ray oscillograph tube of the type of the Western Electric No. 224B, is enhanced by any circuit that will provide a linear time axis. A number of methods of accomplishing this result have been described from time to time. One method used in the Bell Telephone Laboratories employs a hot-cathode three-element gas-filled tube in the usual "sweep" circuit. This method possesses advantages in reproducibility, ease of control and synchronisation. A brief description of the tube is given together with a simple analysis of the behavour of the circuit. Methods of coupling the sweep circuit to the oscillograph tube, of synchronising the sweep frequency and of improving the linearity are discussed. A complete portable laboratory oscillograph outfit is shown as an illustration of one form that the device may assume. This set is for use within the audible frequency range.

A Rapid Record Oscillograph. (A. M. Curtis and I. E. Cole, Bell. Tele., No. B.609, 1931.) (U.S.A. 6.48/23025.)

A rapid record oscillograph has been developed and has been in use for a year in the study of telephone vibration. The film is capable of development

within a minute of exposure, a matter of importance in such applications as sound ranging of enemy artillery.

Problems of Air Navigation. (R. v. Mises, Z.A.M.M., Vol. 11, No. 5, Oct., 1931, pp. 373-381.) (Germany 6.51/23026.)

The problem of laying a course by taking into account the velocity of the wind, which is variable, is dealt with, chiefly by graphical methods.

The Braun Altimeter. (Luftwacht, No. 10, Oct., 1931, p. 466.) (Germany 6.6/23027.)

It is proposed to determine height by variation in gravity indicated by changes in the cone angle of a high speed conical pendulum.

(The minute change of gravity, of the order of 1/2000 per mile of altitude, in comparison with aeroplane accelerations of a much higher order even on the calmest day and under the smoothest control, seem to render the proposal impracticable).

Stability and Control

Effect of Load Distribution along Span on Rolling Stability. (M. Knight and R. W. Noyes, N.A.C.A. Rept., No. 393, Nov., 1931.) (U.S.A. 7.2/23028.)

The distribution of lift along the span was altered by (1) change of profile, (2) twist (increasing and decreasing incidence along span), (3) sweep-back.

The variations of lift by these three methods and the resulting effect on the rolling moment are recorded graphically and in tables. Generally speaking, taking the performance over the whole flying range, extreme departures from the normal wing are disadvantageous.

Effect of Lift Distribution on Longitudinal Stability. (C. Töpfer, Z.F.M., Vol. 22, No. 12, 29/6/31, pp. 366-368.) (Germany 7.2/23029.)

It might be expected that the airscrew blast would increase the effectiveness of the elevator by increasing the reaction. Full scale tests, however, show the contrary effect. The explanation given by the author is that the downwind angle may be twice as great in the slip stream as in a glide without engine at the same incidence. The change in the distribution of lift along the wing is shown in a diagrammatic sketch, and the resulting effect in producing longitudinal stability is shown graphically.

Rudder Bias Gear. (Flight, Vol. 23, No. 49, 4/12/31, p. 1188, and Airc. Eng., Vol. 3, No. 34, Dec., 1931, pp. 313-314.) (Great Britain 7.25/23030.)

In case of one engine of a multi-engined machine cutting out, heavy continuous rudder would be required from the pilot to maintain directional equilibrium. A description is given with diagrammatic sketches and diagrams of characteristics of a gear designed to relieve the pilot of the continuous effort by giving the rudder a permanent bias.

Calculation of Landing Speed. (R. Pouit, L'Aeron., No. 150, Nov., 1931, pp. 385-386.) (France 7.3/23031.)

Assuming the aerodynamic characteristics of the aeroplane, elementary differential equations of steady motion are formed and solved for different values of the vertical component of velocity at the instant of landing. The maximum permissible vertical velocity is determined by the capacity of the shock absorbers of the landing carriage, and when the latter has been specified the landing speed can be selected from a family of curves.

Engines

Flame Progress in Engine Cylinder. (C. F. Marvin and R. D. Best, N.A.C.A. Rept. No. 399, 1931.) (U.S.A. 8.13/23032.)

Flame travel was measured stroboscopically on a small low compression ratio engine fitted with a flat head of low turbulence. The average flame speed observed was 67 feet/sec. From the effect of change of engine speed it was inferred that turbulence affects flame travel mainly by local action in the neighbourhood of the flame front.

The Effect of the Rate of Mixing of Air and Fuel Gas on the Combustion in Flues and Furnaces. (J. W. Cuthbertson, Chem. & Ind., Vol. 50, No. 51, 18/12/31, p. 451T.) (Great Britain 8.13/23033.)

Flow investigations were carried out with NH_4Cl smoke. The combustion is affected by air turbulence and friction.

Sensitive Flames. (G. B. Brown, Phil. Mag., Vol. 13, No. 82, Jan., 1932, pp. 161-195.) (Great Britain 8.13/23034.)

A comprehensive survey is given of work on sensitive flames. Further experiments are carried out and include experiments on jets, the instability of which involves a suitable Reynolds number. In this connection the principle of dynamic similarity is formed experimentally. Photographs are reproduced, some of which illustrate types of instability in jets.

Coal-dust Explosions. (Z.V.D.I., Vol. 75, No. 28, 11/7/31, p. 903.) (Germany 8.13/23035.)

The danger of spontaneous coal-dust explosions is increased by a pre-heating of roughly 50°C. In the manufacture of powdered fuel precautions should be taken against electrostatic charging.

Injection and Combustion in Heavy-Oil Engines. (Autom. Ind., No. 15, Oct., 1931, p. 550.) (U.S.A. 8.13/23036.)

According to recent German research, the auto-ignition point is not changed when passing from liquid to vapour. Earlier views that there is a rise in ignition temperature are traced to the presence of cracked products in the vapour. Free vapour injection in an oil engine should reduce ignition lag and experimental confirmation is desirable.

Flame Temperatures. (W. T. David, W. Davies and J. Jordan, Phil. Mag., No. 80, Nov., 1931, pp. 1043-1057.) (Great Britain 8.13/23037.)

Mixtures of H_2 with CO were exploded in a spherical bomb by an electric spark and the temperature was measured by a platinum rhodium thermocouple of .0005in. diameter, both spark and thermocouple being centrally placed. The temperatures and pressures were recorded optically in the period before any marked rise of pressure. The temperatures were calculated from specific heat and combustion data. With CO the measured temperatures were 200°C. below the calculated figure over the whole range of mixture strengths. With hydrogen for weak mixtures the measured temperatures are higher and for rich mixtures lower than the calculated values.

The authors explain this discrepancy by assuming that the fresh products of combustion are in an abnormal and unstable state during the early period of ignition and are capable of exchanging energy with the wire, which indicates a different temperature than that of the gas as defined by the molecular energy.

Engine Combustion, Spectroscopic Studies. (L. Withrow and G. M. Rassweiler, Fuel, Vol. 10, No. 11, Nov., 1931, pp. 472-480.) (Great Britain 8.13/23038.)

In a preliminary spectrographic study of combustion in a petrol engine special attention was paid to the after-glow spectrum, which may indicate either actual combustion or merely an excited state of freshly oxidised molecules.

Fourteen recent references are given.

Ignition of Carbonic-Oxide-Air Detonating Gas. (G. I. Finch and H. H. Thompson, Proc. Roy. Soc., No. A.823, Nov., 1931, pp. 343-351.) (Germany 8.13/23039.)

According to the thermal theory the ignition of an explosive gaseous mixture by an electric discharge depends primarily on the heating of a sufficient volume of gas to a sufficient temperature.

Many well-established facts appear to contradict this conclusion. The photo-ignition of hydrogen-chlorine mixtures and the ignition of certain gas mixtures by adiabatic compression point to the influence of factors apart from an increase in translatory molecular energy.

The authors conclude from their experiments on the ignition of CO/air mixtures by a high frequency electric discharge that a reduction in frequency increases the proportion of energy usefully expended in the production of suitably activated molecules, of which a sufficient concentration determines ignition.

New Method of Measuring Temperatures of a Flowing Gas. Application to Specific Heat Determination at High Temperature. (M. Chopin, Ann. d. Phys., Sept., 1931, p. 101.) (France 8.14/23040.)

The gas is passed successively through two sharp-edged orifices and the respective pressure drops noted. Subject to some small corrections, the ratio of the absolute gas temperature is proportional to the ratio of the pressure drops. By placing the first orifice at a point where the gas temperature can be accurately measured an absolute determination of the second temperature follows.

Values were found for the specific heats of N_2 and CO_2 at constant pressure and temperature up to 1000°C. The values are in substantial agreement with Nernst and Wohl.

Torsional Vibration—Damping Devices. (E. Sander and J. Barraja-Frauenfelder, S.A.E. Jrnl., Vol. 29, No. 6, pp. 458-469.) (U.S.A. 8.36/23041.)

The elementary principles of torsional vibration are stated and the usual methods of damping are classified. Descriptive details are given of a hydraulic throttling damper applied to a 10-cylinder marine Diesel. Sectional elevation and plan are given for a hydraulic coupling for a six-cylinder Diesel, and two photographs show the internal arrangement. Torque diagrams are reproduced with and without damping and show a reduction of torsional oscillations, from approximately double the torque variation, to negligible proportions. Resonance curves are reproduced showing a high peak without the damper, and a comparatively small rise with the damper.

In a discussion a number of further torque curves are reproduced and the experiences of designers in meeting the problem are described.

Cooling

The Principles of Heat Transfer. (S. Erk, Z.V.D.I., Vol. 75, No. 30, 25/7/31, p. 970.) (Germany 8.4/23042.)

A summary is given of the physical quantities entering into the theory of heat transfer by a fluid in motion. A list of eight physical quantities is given from which are formed five non-dimensional quantities, of which the most familiar

is Reynolds' numbers, velocity x linear size/kinematic viscosity. A closely analogous quantity is Péclet's number, velocity x linear size/thermometric conductivity. (Thermometric conductivity is equivalent to the ordinary conductivity divided by the product of the density and specific heat.) The introduction of such non-dimensional quantities is a powerful method of generalising and simplifying the mathematical analysis and of bringing out the fundamental physical relations.

High-temperature Liquid Cooling of Aero Engines. (H. Weidinger, Flugsport, No. 22, 28/10/31, pp. 482-484.) (Germany 8.442/23043.)

German experiments with ethylene glycol show that the engine performance is not appreciably affected by raising the mean radiator temperature to 140°C. with less cooling medium, smaller radiator circuit, and reduced head resistance. Special jointing material is required in the radiator circuit, and special fuels are required, such as 80 per cent. Benzol. Glycol vapour under certain conditions is inflammable.

Piston Cooling. (French patent No. 683902, 25/10/29, H. Junkers, L'Aeron., No. 150, Nov., 1931, p. 387.) (France 8.42/23044.)

A hollow steel piston head carrying the piston rings is attached by a single central screw to a light alloy skirt, a flat joint between the two allowing for radial expansion. The crown of the steel head is supported on an elastic insert which serves to break up the liquid filling for better heat dissipation.

High-temperature Cooling of Engines. (H. Weidinger, Z.F.M., Vol. 22, No. 18, 28/9/31, pp. 541-546.) (Germany 8.442/23045.)

Three fluid media are considered.

Ethylene glycol ($C_2H_6O_2$) has a sharply-defined boiling point (197°C.) and a low freezing point (−37°C.), both of which are advantageous. The comparatively low ignition temperature (116°C.) requires special precautions. It is hygroscopic, and mixes with water in all proportions. With 10 per cent. water the boiling point falls to 140°C. but the the ignition point rises to 130°C. Precautions against absorption of water are not difficult to maintain. On trials of 42 hours total duration, extending over 11 weeks, the absorption of water in one filling of glycol was only 4 per cent. with reduction of b.p. to 160°C.

The cooling medium No. 82 of the I.G.F. has entirely similar properties.

The Prestone cooling medium, tested successfully in U.S.A., has also very similar properties apart from the low ignition point, stated to be 116°C., without specifying the method of measurement.

Details of the mounting on test bench and in aeroplane are given with a diagram and six photographs. The results of numerous tests are recorded graphically.

Fuels, Detonation, Etc.

Safety Fuel "Ferrier." (Luftwacht, No. 10, Oct., 1931, p. 466.) (Germany 8.64/23046.)

The safety fuel is employed by certain French air lines and appears to be a special paraffin oil (so called white oil) of definite distillation limit doped with ethyl lead. The fuel requires a vaporiser as it is not sufficiently volatile for use in a normal carburettor. Its high flash point and low vapour pressure render ignition by an open flame or spark practically impossible.

Peroxide and Gum in Gasoline. (J. A. C. Yule and C. P. Wilson, Ind. & Eng. Chem., Vol. 23, No. 11, Nov., 1931, pp. 1254-1259.) (U.S.A. 8.64/23047.)

A linear relationship was obtained between the gum content (determined by Norris and Thole method) and the amount of active oxygen present in petrol. A so-called peroxide number is obtained by shaking the petrol with a solution of ferrous sulphate and titrating with titanous chloride solution, and is expressed by the gram equivalent of active oxygen per 1,000 litres.

The test is sensitive and oxidation can be detected long before it has proceeded far enough to give trouble in practice.

Most of the gum obtained is produced during evaporation and depends on the time taken. In an engine the time is relatively short, and considerable gum contents determined by the slow evaporation methods are permissible.

The authors do not discuss the effect of peroxide or active oxygen on the H.U.R.C.

Photographic Study of Detonation. (Autom. Ind., Vol. 63, No. 15, 10/10/31, p. 551.) (U.S.A. 8.654/23048.)

Recent French experiments indicate that detonation in an engine is due to combustion initiated by flame travel and completed by a wave of explosions. The intensity of the detonation depends on the proportion of chemical energy liberated by this second method of combustion.

The fuel under examination is burnt in a special combustion chamber and a series of flame photographs are taken with gradually rising initial temperature of the mixture. In the normal combustion records the flame track is clearly seen. As the temperature rises the flame record becomes less distinct and disappears at the so-called detonation temperature.

It is stated that fuels rated in this apparatus gave equivalent results in an engine.

Single-jet Carburettor. (H. Quillery, C.R., Vol. 193, No. 17, 26/10/31, pp. 703-706.) (France 8.701/23049.)

The object of the design is to give a mixture strength of 12/1 at full power, 15/1 at cruising, and 2/1 at starting, by employing only a single jet. Moreover, these relationships are to be maintained at altitude.

Two butterfly throttles are employed, one in the air intake before the jet and one behind the jet. The jet itself is of the submerged type employing diffuser air.

The butterfly throttles are linked together, one of the members being under aneroid control with compensation for temperature and pressure.

Starting up and slow running are effected by control of the float chamber pressure.

Diesel, Etc.

The Motor-car Diesel Engine. (Z.V.D.I., Vol. 75, No. 36, 5/9/31, pp. 1123-1126.) (Germany 8.25/23050.)

A summary is given of papers presented at V.D.I. Congress, 27/6/31.

Fuel Injection with Spark Ignition. (E. S. Taylor and G. L. Williams, S.A.E. Jrnl., Vol. 30, No. 1, Jan., 1932, pp. 24-30.) (U.S.A. 8.705/23051.)

A discussion is given of the test engine and of the injection valves used in the test. Controlled turbulence was found necessary for smooth operation. Distillation curves are given of three fuels—aviation fuel, hydrogenated fuel, and fuel oil. Fuel consumption and B.M.E.P. are exhibited graphically as functions of the injection timing for the three types of fuel. The same quantities are exhibited as functions of the fuel ratio for best performance timing.

The H.U.C.R. is also shown as a function of injection timing. A summary is given of the conclusions, of which the more interesting are the possibility of using hydrogenated fuel of low volatility and high anti-knock value; and the further possibility of obtaining useful results from ordinary low-grade Diesel fuels along the same lines.

Fuel Pumps

Hydraulics of Fuel-injection Pumps for Compression-ignition Engine. (A. M. Rothrock, N.A.C.A. Rept. No. 396, Nov., 1931.) (U.S.A. 8.705/23052.)

Formulæ are derived for computing the instantaneous pressures realised, considering either compressibility alone or more accurately taking into account the compressibility, elasticity, and inertia of the fuel, using the methods of Prof. Sass.

Fuel Pumps. (French patent No. 683963, 26/10/29, H. Junkers, L'Aeron., No. 150, Nov., 1931, p. 387.) (France 8.741/23053.)

In the Bosch fuel pump injecting begins at a fixed crank angle, but the length of the delivery is controlled by a groove cut in the rotating plunger.

In Junkers' specification a second groove is cut to control the beginning of the injection, which is timed later as the load becomes lighter.

Anti-aircraft Ranging and Gunnery

Anti-aircraft Guns. (Army Ord., Vol. 12, No. 69, pp. 174-177.) (U.S.A. 9.77/23054.)

See abstract No. 19/21372. Further photographs of modern equipment are given, including the 105 mm. a.a.c. gun with a vertical range of 42,000 feet, firing at fifteen rounds per minute. A battery of four 3in. a.a.c. guns on special mountings is shown in action, and another photograph shows in greater detail the truck with extensible base girders and towing car.

Best Use of Training Grounds for Aerial Machine-gun Practice on Towed Targets and Bombing Practice. (Capt. Mauriot, Rev. F. Aer., No. 27, Oct., 1931, pp. 1231-1240; and No. 28, Nov., 1931, pp. 1328-1336.) (France 9.77/23055.)

The best utilisation of the available ground area is discussed, and abacs are given for determining the danger zones for various types of machine gun and bombing practice.

Materials

Properties of Steels—Use of Probability Curves. (S.A.E. Jrnl., Vol. 30, No. 1, Jan., 1932, Supplement, p. 11.) (U.S.A. 10.101/23056.)

Among the sectional reports issued with this number the use of probability curves to indicate test properties of steels is defined and illustrated.

A large number of samples is tested and the results are grouped in a probability curve of which the abscissæ are the physical properties measured, tensile strength, elongation, etc., while the ordinates are the number of test pieces falling within certain ranges.

Where a third variable enters, such as drawing temperature, three curves are drawn corresponding to maximum and minimum values and value of greatest frequency.

Further details are given in the Journals of January 1928, p. 55, and December 1931, p. 488.

Appearance of Blow-holes due to Gaseous Oxides in Aluminium Alloys. (R. Sterner-Rainer, Z. für Metallk., Vol. 22, No. 10, Oct., 1931, pp. 274-282.) (Germany 10.231/23057.)

Nitrogen, oxygen, carbon dioxide, carbon monoxide, sulphur dioxide, and even hydrogen and watergas may be included in the molten aluminium. Methane and ethylene, which occur in most flames, are easily soluble in aluminium at 800°C. The other constituents of aluminium alloys, such as copper and silicon, also absorb gases readily. The best method of determining the included gases not actually in chemical composition is melting in a vacuum. Photographs are reproduced of a number of specimens showing porosity due to included gases. A summary is given of the methods employed to avoid the inclusion of gases, particularly as practised in Germany and America. The addition of a regulus, 1/10 per cent. of a mixture of CCl_4, $MnCl_4$, AmFl, is recommended.

Photographs of different aluminium alloys are shown, with and without treatment with the regulus. The improvement is striking.

Constitution Al-Fe-Si Alloys Rich in Aluminium. (V. Füss, Z. für Metallk., Vol. 22, No. 8, Aug., 1931, pp. 231-236.) (Germany 10.231/23058.)

Triangular co-ordinates are used to represent the proportions of metals present. Chemical combinations of iron and silicon, FeSi, Fe_2Si_3, are conveniently shown by straight lines. Sixty microphotographs are reproduced indicating the structure of the alloy with different proportions of the constituents. The article is concerned with metallurgical constitution and not with mechanical properties.

Lautal Riveting. (O. Repp, Z.F.M., Vol. 22, No. 5, 14/3/31, p. 152.) (Germany 10.23/23059.)

A summary is given of the results of tests of lautal riveting, with specification of the material, disposition of the rivets, and conditions of tests.

Autogenous and Electric Welding of Monel Metal. (F. Schüppel and W. Kästner, Z. für Metallk., Vol. 22, No. 10, Oct., 1931, pp. 286-289.) (Germany 10.28/23060.)

A sound joint can be made with monel metal by welding with certain precautions. The weld may reach the strength of the original metal. Tables of tensile strengths are given and microphotographs illustrate the changes of structure. Corrosion tests of welds with a number of corrosive solutions are also described.

" Arcatom " Welding Process. (S. Sandelowsky, Z.V.D.I., Vol. 75, No. 44, pp. 1361-1364.) (Germany 10.28/23061.)

An application is made of Langmuir's principle of dissociating a jet of hydrogen in an electric arc with reunion beyond the electrodes at a temperature of 4,000°C. The incandescent jet thus produced is applied to welding as conveniently as an ordinary jet flame. The apparatus is illustrated and a photograph of a typical weld is reproduced along with two microphotographs of the structure of the material in the weld and near the weld. A number of test results are given in a numerical table and graphically. The temperature of the flame lies between that of the electric arc and the ordinary jet flame.

Corrosion: Protection of Metal Parts of Aircraft. (H. Sutton, J.R. Aer. Soc., Vol. 36, No. 253, Jan., 1932, pp. 1-23.) (Great Britain 10.125/23062.)

Data are drawn from a wide range of official experience, and a number of photographs are reproduced illustrating cracks and fractures associated with corrosion. Brief specifications are given of methods employed for the protection of steel, including organic coatings and cadmium, zinc and steel plating.

Protection of aluminium and aluminium alloys is dealt with separately. The effectiveness of alclad is confirmed, and its stability outweighs decisively its inferior initial strength. Alternate methods of anodic treatment are described, and the advantages of stainless steel cathodes are stated. Anodic treatment requires to be supplemented by protective coating.

In the protection of magnesium alloys, electro deposits of zinc and cadmium plating appear to aggravate corrosion in contact with salt solutions. Anodic treatment has not proved satisfactory. Immersion in acid chromate solutions supplemented by cellulose enamel has merits. Substantially the protection of magnesium against the effect of sea water is unsatisfactory.

A discussion follows, and the points raised received detailed reply.

Corrosion: Protection of Magnesium Alloys. (H. Sutton and L. F. Le Brocq, Engineering, Vol. 132, No. 3440, 18/12/31, pp. 771-772.) (Great Britain 10.262/23063.)

The protection of magnesium alloys is discussed along the same lines as in the previous abstract, in considerably extended detail.

Requirements of Aeroplane Coatings. (J. L. McCloud, Ind. & Eng. Chem., Vol. 23, No. 12, pp. 1334-1339.) (U.S.A. 10.262/23064.)

A systematic method of testing the value of protective coatings, particularly for duralumin, is laid down, and examples of the changes in tensile strength and elongation are plotted against hours of exposure. A number of technical data are given in connection with eleven test curves reproduced. Eight references are given.

Theory of Metallic Corrosion. (G. D. Benbough, A. R. Lee and F. Wormwell, Proc. Roy. Soc., No. A.823, pp. 308-343.) (Great Britain 10.125/23065.)

A method of corrosion by oxygen absorption previously applied to zinc is applied to purified iron and to two samples of mild steel. For weak KCl solutions an exponential rate was found, and for strong solutions a linear rate. The rate appears to be controlled by the precipitated corrosion products.

In comparison with zinc the iron and steel samples corroded more quickly in water with a certain conductivity, but less quickly in dilute KCl solution. The difference is attributed to the corrosion products.

A number of photographs are reproduced and numerous experimental curves are plotted.

Resistance of Galvanic Deposits on Iron and Light Alloys to Sea-water Corrosion. (E. K. O. Schmidt, Z.F.M., Vol. 22, No. 5, 14/3/31, pp. 141-147, 209th D.V.L. Rept.) (Germany 10.125/23066.)

A fine spray or fog of sea water was maintained in contact with different specimens. For the protection of iron and steel, cadmium plating gave consistently good results. Lead oxide, chromium plating, zinc galvanising and cadmium and zinc in conjunction all gave defective results. In the case of light alloys cadmium plating again proved the most satisfactory, but it involves special difficulty in plating duralumin and lautal. On electron it gave poor results. Rubber coating gave variable results but was not satisfactory.

Photographs show about 40 examples of corrosion.

Seven references are given.

Porosity of Electro-plated Chromium Coatings. (W. Blum, W. P. Barrows and A. Brenner, Bur. St. J. Res., Vol. 7, No. 4, Oct., 1931, pp. 697-711.) (U.S.A. 10.262/23067.)

From authors' abstract.—Various methods for detecting porosity of chromium coatings were found to yield consistent results. Very thin deposits

contain round pores. As the thickness is increased the porosity decreases to a minimum, after which an increase in thickness is usually accompanied by the formation of cracks, either parallel or random.

Deposits on nickel are less porous than those on other base metals. This difference is at least partly due to the greater ease of securing a bright finish on nickel prior to the chromium plating.

Non-metallic Materials

Tests of Wire Nails and Wooden Joints. (W. Stoy, Z.V.D.I., Vol. 75, No. 43, 24/10/31, pp. 1337-1341.) (Germany 10.42/23068.)

Elementary principles of the stresses under shear are considered, and the results of numerous tests are tabulated and plotted graphically. Photographs illustrate typical failures under shearing forces.

Technique of Bending Wood. (A. Prodehl, Z.V.D.I., Vol. 75, No. 39, 26/9/31, pp. 1217-1222.) (Germany 10.42/23069.)

Systematic investigation was carried out by the author by bending wood in various machines. The stresses are discussed in terms of elastic theory, and the numerical results are shown graphically. Scattering of the experimental bends is shown by shaded areas surrounding a curve of mean values. Typical fractures caused by overstrain are illustrated by photographs.

Wind Tunnels, Testing Apparatus, Etc.

Testing Apparatus and Machines. (Rev. Sci. Insts., Vol. 2, No. 11, Nov., 1931, pp. 665-737.) (U.S.A. 11.4/23070.)

The article is illustrated by nearly seventy photographs of apparatus dealing with strength of materials, microphotographs, spectrographs, colorimeters, thermometers, barometers, etc.

Wind Tunnel Tests. (J. Andrade, Autom. Eng., Vol. 21, No. 287, Nov., 1931, pp. 542-544.) (Great Britain 11.16/23071.)

A paper read before the Soc. Automotive Engineers, U.S.A., on the application of wind channels to testing motor car resistance. The influence of the ground is allowed for by introducing a mirror image model. The underlying assumption that there is no motion across the plane of symmetry may not be entirely justifiable. The motion of particles of lampblack suspended in a layer of kerosene on a flat board in the vertical plane of symmetry can only be considered a qualitative time mean, but is sufficient to indicate general flow in regions of excessive turbulence. The use of the wind channel will certainly provide useful data, which could scarcely be obtained otherwise, in a rapid and convenient way.

Airships, Etc.

Atmospheric Humidity and Static Lift of Airships. (W. G. Bird, J.R. Aer. Soc., Vol. 35, No. 251, Nov., 1931, pp. 973-1039.) (Great Britain 12.1/23072.)

The author examines in numerical detail the usual approximations applied to determine the density of the atmosphere and of the lifting gas in an airship under different conditions of temperature, density and humidity. All the expressions are carried to a further approximation, and in most cases the percentage error is found to be negligibly small. The remaining factors are of a more practical nature, such as the estimation of the volume of a partially-filled gas bag, and the structural weight of a completed airship. The latter is a trouble well known to designers of all classes of machinery and structures, and arises from

the fact that while the specified quantities may be taken as fairly accurate, unspecified items have a disconcerting way of adding to the total structural weight. The dynamical effects of rain and the dead weight of rainwater adhering to the surface are also considered and found to be small. Numerical examples are worked from experience with R.100.

The formulæ derived are put in a form convenient for design-room calculation. C.G.S. units are used throughout, and the units usually employed are criticised as being inconsistent and inconvenient. A table of conversion from the former is given.

Drag of Airships, Deceleration Tests. (F. L. Thompson and H. W. Kirschbaum, N.A.C.A. Rept. No. 397, Oct., 1931.) (U.S.A. 12.2/23073.)

The drag is taken as proportional to the square of the velocity and the characteristic area is taken as the $2/3$-power of the volume.

On these assumptions the distance run without engine should be proportional to the reciprocal of the velocity. Numerous readings are plotted on this basis for seven American airships under different conditions. For steady conditions points representing experimental readings are grouped fairly closely about straight lines, from the slope of which the drag coefficient is readily calculated. Corrections for airscrew resistance are discussed. Acceleration tests were also carried out. These depend on knowledge of the effective thrust.

The airspeed was measured in the usual manner by Pitot tube with the head placed at a sufficient distance from the hull to render interference negligible. The drag coefficients varied from 0.023 for the Los Angeles to 0.049 for the Puritan. On another test the resistance coefficient of the Puritan was found to be 0.044, a difference of about 10 per cent. not definitely accounted for, which may be due to departure from axial motion by a small pitch or yaw angle.

Primary Stresses in the Hull of a Rigid Airship. (L. Chitty and R. V. Southwell, J. Roy. Aer. Soc., Vol. 35, No. 252, Dec., 1931, pp. 1103-1136.) (Great Britain 12.2/23074.)

The simplifying assumptions are made that the frame has parallel longitudinals and that the sections are polygons. Axial displacements, only, of the nodes produced by axially imposed forces are considered. Each ring is taken as rigid in its own plane. It is assumed that the displacements vary in geometrical progression from ring to ring. The paper is chiefly concerned with determining the factor of decrease and a related quantity correcting the displacements of any three consecutive joints in the same ring. By this method " normal " solutions are obtained and general solutions are constructed from " normal " solutions. The general solutions are worked out largely in the form of trigonometrical series. Numerical values are obtained and tabulated for coefficients entering into the general solutions and the stresses required to maintain the assumed unitary displacements are obtained. These numerical values may be multiplied by a factor to obtain displacements and stresses under any assigned loads. A graphical representation is also given of the displacements over six bulkheads.

The object of the paper is to obtain an approximate general guide for designers, and not an accurate solution for a particular case.

Elastic Theory of the Rigid Airship. (E. Seydel, L.F.F., Vol. 9, No. 2, 25/8/31, pp. 57-84.) (Germany 12.3/23075.)

The manuscript of the late H. Muller-Breslau has been edited posthumously for D.V.L. An outline of the methods employed is given by the editor. Simple assumptions are introduced as to the shape and elastic properties of the framework and these are generalised step by step in the subsequent sections. All the loadings are symmetrical in the vertical plane of symmetry. The rings are assumed

initially to be rigid, and only the diagonal members are considered elastic with simplifying assumptions. Cylindrical and conical cells are discussed. Generally speaking, one set of members only is considered elastic initially. Approximate strains and stresses are calculated. Further groups of members are then considered elastic, and the step by step process can be continued so long as the resulting equations remain tractable. The editor considers that the method might be extended finally to the case where the rings are considered deformable. The paper as it stands is an important contribution to the methods of airship frame calculation.

It is stated that the appropriate section of the D.V.L. will collect in a future paper all the methods of airship stress calculations hitherto recognised.

Power Plant of the Graf Zeppelin. (F. Sturm and M. Schirmer, Z.V.D.I., Vol. 75, No. 38, 19/9/31, pp. 1189-1192.) (Germany 12.2/23076.)

Two photographs and a diagram are given of the engine installation and drive. A specification is given of the airscrew with the estimated efficiency. Air speed and power-gas consumption are shown graphically against engine r.p.m. with 4 and 5 engines with and without gearing. The maximum speed is plotted against total power and the consumption of power gas against speed.

U.S. Airship "Akron." (Aviation, Vol. 30, No. 11, Nov., 1931, p. 621.) (U.S.A. 12.3/23077.)

On September 23rd the U.S. airship *Akron* made a trial trip of 3 hours 47 minutes. Crew and passengers numbered 113. $1,515,000 has been allotted for construction of a new shed 1,138 feet long. Total cost of the airship base, with barracks, service buildings, railroad track, and helium purification plant, is $5,000,000.

(Aviation, No. 12, Dec., 1931, p. 669.)

The *Akron* has been accepted by the U.S. Navy in spite of a two-knot deficiency in top speed, which it is hoped may be corrected by selection of suitable airscrews.

The contract for the second airship comes into effect automatically.

An additional shed is being constructed near San Francisco.

(Airc. Eng., Vol. 3, No. 33, Nov., 1931, pp. 271-273.)

A summary is given of information recently become available with reproduction of photographs of the airship in various stages of construction and of details of accessories.

Wireless

Ultra Short Waves, Direct Crystal Control. (H. Straubel, Phys. Zeit., Vol. 32, No. 23, 1/12/31, pp. 937-941.) (Germany 13.3/23078.)

An application of crystal control to short wave-lengths, of less than 40-50 m., leads to difficulties from subsidiary periods in the crystal. Determinations of the periods of tourmaline crystals were made at frequencies of 130,000 to 150,000 Hertz. by sprinkling lycopodium powder on the surface and observing the formation of the nodal lines. In testing a particular crystal an 80 per cent. falling off in the control is recorded, from 10 m. wave-length to 2 m. Details are given of laboratory methods and of experiences in carrying out tests.

Short Radio Waves, Propagation over North Atlantic. (C. R. Burrows, Bell Tele. No. B.593, 1931.) (U.S.A. 13.32/23079.)

The annual variations in the intensity of reception are recorded against time of day and frequency of transmission by means of contour lines. Selection of the best frequencies is thus made immediately possible.

Causes of disturbance are considered in the paper and in the discussion.

Short-wave Directive Antennæ; Developments. (E. Bruce, Bell Tele. No. B.587, Sept., 1931.) (U.S.A. 13.6/23080.)

Author's summary.—Part I discusses the relative importance of the factors which limit the intelligibility of short-wave radio telephone communication. The more important of these factors are inherent set noise, external noise (static, etc.), and signal fading. The possibility of counteracting these limitations through antenna directivity is indicated.

Part 2 describes an antenna system which maintains a desirable degree of directivity throughout a broad continuous range of frequencies. The cost of this antenna is more favourable than that of many types of fixed frequency antennæ of equal effectiveness.

New Methods of Frequency Control employing Long Lines. (J. W. Conklin, J. L. Finch and C. W. Hansell, Proc. Inst. Rad. Engs., Vol. 10, No. 11, Nov., 1931, pp. 1918-1930.) (U.S.A. 13.3/23081.)

Authors' abstract.—The practical difficulties encountered in commercial operation of short-wave transmitters, due to the great number of radio-frequency stages required for crystal control, are summarised. Methods are described for meeting these difficulties through frequency control by long radio-frequency transmission lines, which have inherently large volt-ampere capacity and which make possible a considerable reduction in operating costs and improvement in reliability. Methods for applying the lines to the control of oscillator frequencies by using them as relatively constant low power factor resonant circuits and as aperiodic means for feeding regenerative energy from anode circuits to grid circuits are described. A method is given for obtaining both the advantages of crystal oscillators as frequency standards and the economies and reliability of long line transmitter frequency control.

Improved Audio-frequency Generator. (E. G. Lapham, Bur. St. J. Res., Vol. 7, No. 4, Oct., 1931, pp. 691-695.) (U.S.A. 13.5/23082.)

Author's abstract.—An audio-frequency generator for use in radio-frequency measurement is described. The variable audio-frequency output is the beat note between two sources of radio-frequency; the one a piezo oscillator, the other a variable oscillator. The output is continuously variable from 50 to 1,500 cycles per second. The entire unit is assembled very compactly and the essential parts are mounted in a temperature-controlled compartment. The calibration curve is practically linear over a range of 50 cycles per second, and repeated calibrations indicate that it is constant to better than 0.1 cycle per second over the entire range.

New Broadcasting Installation in Berlin. (G. Lubszynski and K. Hoffmann, Proc. Inst. Rad. Eng., Vol. 10, No. 11, Nov., 1931, pp. 1955-1970.) (Germany 13.31/23083.)

A descriptive account is given of the lay-out of the new broadcasting centre in Berlin opened in January, 1931, illustrated by 15 photographs and diagrams.

Polarisation phenomena of Low-frequency Waves. (Shogo Namba, Proc. Inst. Rad. Engs., Vol. 10, No. 11, Nov., 1931, pp. 1988-1999.) (U.S.A. 13.6/23084.)

An elementary theory is given and a number of experimental data are recorded, showing examples of elliptic and linear polarisation, varying with the mutual bearings and distances of the stations and with the time of day.

Polarisation of High-frequency Waves and their Direction-finding. (S. Namba, E. Iso and S. Ueno, Proc. Inst. Rad. Engs., Vol. 10, No. 11, Nov., 1931, pp. 2000-2019.) (U.S.A. 13.6/23085.)

An elementary theory is given with a description of the apparatus, illustrated by a photograph and diagrams. Numerous experimental data are recorded, showing very wide variations in the apparent bearing, with time of day, and complete failure of the readings at sunrise and sunset.

Photo-electric Cells, Application to Colorimetry. (H. E. Ives and E. F. Kingsbury, Bell Tele. No. B.600, 1931.) (U.S.A. 13.5/23086.)

The photo-electric qualities of various cells for different wave-lengths are represented graphically; the problem of combining these to form a direct reading indicator of the total intensity is discussed. Subsidiary details of amplification are also considered. A number of physical difficulties remain.

Television Reception. (R. Barthélémy, Rev. Gen. de l'Electricite, 4/7/31, pp. 3-12; and 11/7/31, pp. 52-59.) (France 13.7/23087.)

Part I deals principally with the characteristics of the luminescent Neon tube under variable load.

There is, in effect, a hysteresis loop in the curve of luminous intensity plotted against the applied voltage (which appears in the figures diagrammatically as a triangular area.) If the voltage is allowed to fall below the point of extinction of the lamp there is a lag in the time of relighting as the voltage rises which prolongs the dark interval in the intermittent image so as to impair seriously the visibility.

As a choice of a lesser defect, the voltage is maintained just above the point of extinction by a bias e.m.f. Although the tube now glows continuously, decrease of intensity at the minimum has the effect of a faint permanent lighting superposed on the image and is substantially ignored by the eye.

Diagrams of connections are given and a brief account of the mechanical arrangements for scanning.

The range of the experiments was 2 or 3 k.m. Specifications are given of useful working values of frequency voltages, resistance, reactance and capacity in the component parts.

A brief note with a diagram of connections is given of Baird's alternative arrangement by coupling with a transformer, which the author finds incapable of equally fine analysis for a wide range of frequencies.

Part II deals with the fundamental problem of synchronisation. After reference to the possibilities and inherent difficulties of the use of synchronous alternating current generators and motors, and equally of motors synchronised by electro-magnetic control, the author describes his own solution.

After each complete scanning cycle, a radio signal is sent out on a wave-length within the television band. This actuates an oscillator, in the locality of the receiver, with amplitude independent of the frequency but rigorously in the same phase as the signal.

The oscillator used by the author consists of a Neon lamp, a condenser, and a resistance, constituting a so-called " relaxation system."

The released oscillation acts only within the interval between the lighting and extinction of the Neon lamp, an interval easily reducible to less than the time

of a scanning cycle, which is about 1/16th second, and no further reaction occurs till the next signal is received.

The oscillation is amplified suitably and is applied as a synchronising force to a special motor which automatically runs up to synchronous speed.

The advantages of this method appear to be analogous to the application of the pendulum to the escapement instead of to the drive, which make possible the modern clock.

The author claimed that these two applications offer an adequate solution of the practical problem of radio television without land wires, and in giving a demonstration of results already achieved anticipated a wider practical range in the near future.

Piezo Oscillators, Quartz Plate Mountings and Temperature Control. (V. E. Heaton and E. G. Lapham, Bur. St. J. Res., Vol. 7, No. 4, pp. 683-690.) (U.S.A. 13.81/23088.)

From authors' abstract.—Unless the movement of the quartz plate in the holder is restricted the frequency will change with each slight jar. A long rectangular quartz plate, oscillating in its extensional mode, may be clamped centrally perpendicular to its length between two keys, one in the face of each electrode, with constant frequency of one part in 300,000. For frequencies above 100 k.c. the damping of the keys is too great.

A satisfactory holder for mounting a cylindrical quartz plate for "thickness oscillation" may be made by clamping the plate between three screws, mounted radially 120° apart in a ring so that they press into a V-shaped groove cut round the cylindrical surface of the quartz plate midway between the faces. The electrodes are spaced on either side of the quartz plate by pyrex washers. The frequency in this mode has been found constant to one part in 1,000,000 in a portable standard with the addition of temperature control of the oscillating circuit.

Air Survey

Air Survey. (Aero Digest, Vol. 19, No. 6, Dec., 1931, p. 74.) (U.S.A. 14.14/23089.)

A note is given on the use of a five-lens camera in air survey. The work was carried out at 20,000 feet by use of an improved film with special filter which extended the range beyond ocular visibility. Special photogrammetric apparatus was used for reduction of the outer of the five films. It is stated that the time of survey was reduced to a ninetieth and the cost to a thirtieth.

Acoustics

Measurement of Sound Transmission. (A. E. Knowler, Phil. Mag., No. 80, Nov., 1931, pp. 1039-1042.) (Great Britain 15.2/23090.)

By an improvement in the method described in a previous paper (See Abstract No. 16/13539) the sound emitted by a loudspeaker and reduced by transmission through a partition is compared directly with the sound emitted by an unobstructed loudspeaker and reduced to sensibly equal intensity by a shunt. The corresponding process is repeated from the other side of the partition. The shunt is calibrated to give intensity reductions of $\frac{1}{2}$, 1, 2, 2, 5, 10, 20, 20 and 20 decibels, giving steps of $\frac{1}{2}$ decibel from 0 to 80 decibels. Various precautions are described. Five types of partition were used, single and double fibre boards with and without lime mortar dressing, and a $4\frac{1}{2}$ in. brick wall set in cement mortar. The numerical results are plotted graphically and show that the double fibre board, both sides being dressed with mortar, gives the greatest reduction of intensity.

New Method of Sound Frequency Analysis. (T. Theodorsen, N.A.C.A. Rept. No. 395, 1931.) (U.S.A. 23091.)

The elementary mathematical theory is given of a previous method of analysis by superposing a known voltage of controlled frequency on the grid of two matched vacuum tubes with 180° phase difference.

To illustrate the principle of the new method a known voltage of controlled frequency is imposed on a circuit containing a hot wire resistance. The total heating loss is the integral of the square of the sum of the vector currents taken over a sufficient time to contain many complete cycles of the lowest frequency, thereby eliminating the variable phase effect.

By the harmonic property of sine and cosine functions all products of currents of different frequencies vanish on integration through a complete cycle and the loss is proportional to the sum of the squares of the individual effective values.

If the frequency f of the superimposed current I differs sensibly from all other frequencies then a term RI^2 is added to the losses, but if its frequency f approaches another frequency f_1 then an additional term appears, $2RII_1$.

If f and f_1 are nearly equal then the term $2RII_1$ is only added for a cycle in which they are nearly in phase, and slowly passes through all values to $-2RII$ when they are 180° out of phase, with frequency $f-f_1$ which can be made arbitrarily small. In this way a slow frequency beat can be produced and observed.

In application the variable voltage is obtained from a commercial beat frequency oscillator. As a hot wire resistance the filament of a vacuum tube is found particularly suitable, being of the desired dimensions with temperature fluctuation producing corresponding changes in the plate current. The sound energy is transformed into electrical energy in the usual way. A full specification of the apparatus is given with diagrams of connections. A number of diagrams are reproduced showing distribution of energy in the different frequencies. It is pointed out that the records are defined with equal sharpness at all frequencies examined.

Sound Generated by a Rotating Airscrew. (E. T. Paris, Phil. Mag., Vol. 13, No. 82, Jan., 1932, pp. 99-111.) (Great Britain 15.34/23092.)

A brief summary is given of the mathematical methods and results, expressed in terms of Bessel functions, of E. J. Lynam and H. A. Webb (1919) and the more recent discussion by M. D. Hart (1930). The author determines experimentally the distribution of sound intensity emitted by a single-engined bomber with 700 h.p. engine, a two-bladed airscrew of 4.5 m. diameter, and a chord pitch of 3.2 m. The engine was run at 1,750 r.p.m.; the airscrew was geared down in the ratio 0.477, giving a blade frequency of 27.8 Hertz. The microphone was placed 230 m. from the airscrew on level open ground, and the aeroplane was swung by successive angles of 15°. The results are tabulated and plotted graphically. Curves are derived from various hypotheses of the writers referred to, and a formula is constructed representing the principal observed characteristics of the sound intensity distribution curve on a semi-empirical basis.

Accidents

Serious Flying Accidents, Causes. (Guet, Rev. F. Aeron., No. 28, Nov., 1931, pp. 1337-1357.) (France 16.05/23093.)

The proportion of accidents in subsidised lines and in the Air Forces is tabulated for each year, 1921 to 1930, and the results are shown graphically.

Two classifications are given :—

(i.) The nature of the accident, with twelve sub-divisions; and

(ii.) the initial cause of the accident, with seven sub-divisions.

Whereas from 1921-26 engine failures were the principal cause, in 1927-30 accidents due to bad atmospheric conditions were predominant.

Helicopters, Etc.

New Type of Gyroplane. (A. Klemin and B. P. Ruffner, Airc. Eng., Vol. 3, No. 34, Dec., 1931, pp. 305-306.) (U.S.A. 17.05/23094.)

The original article from " Aviation Engineering " is reproduced with additions and amendments. The aerodynamical relations of lift, drag and pitching moments are tabulated against disc angle of attack for different types of blade.

See Abstract No. 21/22624.

Gliding and Meteorology

Flight of Birds and Flight of Aircraft. (A. Magnan, S. Tech. Aeron., Bulletin No. 74, June, 1931.) (France 23095.)

The structure of the atmosphere is discussed with reference to ascending currents, turbulence and periodicity, particularly the disturbances caused by buildings, forests, mountains and other obstructions, and by radiation and convection. Types of the resulting velocity fields are sketched diagrammatically. The anatomical construction of the wing is discussed and illustrated by numerous photographs of birds in flight. The aerodynamical effects are considered descriptively, and illustrated in sketches. Applications of elementary principles are made to the flight of birds in ascending currents and to seabirds skimming across the crests of waves presumably taking advantage of the differential velocity field.

A brief account is given of mechanical flapping devices. Gliding flight in rising currents is reviewed briefly and illustrated chiefly by extracts from recent German work. Miscellaneous aeronautical and aerodynamical matters are considered in a conventional manner.

Gliding, Eleventh Rhön Competition, Report. (W. Georgii, Z.F.M., Vol. 22, No. 5, 14/3/31, pp. 129-140.) (Germany 17.4/23096.)

The report shows that the standard of gliding is rising. Heights of 500 to 1,640 m. above the starting point were reached, and durations of $7\frac{1}{2}$ to $8\frac{1}{2}$ hours. Numerous diagrammatic sketches are given of the formation of cumulus clouds, with point to point records of the trajectory followed by the glider, giving height against time. No new principles are disclosed but the remarkable manner in which rising currents are utilised both under cumulus clouds and over hill ridges is illustrated in great detail. Similar records exhibit the progress of a line squall across the country and the manner in which it is utilised for cross-country flying.

Measurement of Vertical Wind Velocities in the Atmosphere. (K. O. Lange, Z.F.M., Vol. 22, No. 17, 14/9/31, pp. 513-519.) (Germany 19.1/23097.)

A large number of data are incorporated in eight graphical charts showing the path of pilot balloons over the country round the aerodrome at Darmstadt and under cumulus clouds. A photograph exhibits air streamlines of a current of air passing over a model of a mountain with a sharp summit and a well-defined lee.

Forms of Stratified Clouds. (S. Mal, Beitrage, Physik, d. freien Atmosphäre, Vol. 17, 1930, pp. 40-68. Sir G. T. Walker, Jrnl. R. Met. Soc., Vol. 57, No. 242, Oct., 1931, p. 413.) (Great Britain 19.1/23098.)

A number of excellent illustrations of cloud forms in unstable layers of the atmosphere are reproduced.

German observations of the temperature distribution and of the direction of the velocity field are collected, and offer direct experimental evidence that the modes of instability are substantially those predicted by Rayleigh in his mathematical analysis of Bénard's experimental work. This explanation was introduced into British Meteorology by D. Brunt, " Nature," 1925, p. 300.

Release of Energy by Convection. (D. Brunt, Jrnl. R. Met. Soc., Vol. 57, No. 242, Oct., 1931, pp. 431-432.) (Great Britain 19.1/23099.)

The proof that the energy released by convection of ascending air is equal to the area of the tephigram receives an elementary geometrical proof which shortens the usual argument and gives an intuitive view of the analytical processes involved.

Ice Prevention

Prevention of Ice Formation on Fuel Tank Vents. (T. Theodorsen and W. C. Clay, N.A.C.A. Tech. Note No. 394, Oct., 1931.) (U.S.A. 19.15/23100.)

Reported cases of freezing over of vents in fuel tanks during flight led to the present investigation in the Langley refrigerating wind channel. A temperature of 28°F. was selected as giving the most severe test. Nine photographs of frozen-over vent pipes are reproduced. It was found that a pipe pointing downwind was practically immune from freezing over and this arrangement is recommended.

Matters affecting Pilots

Psychological Aspects of Aviation. (G. Sgarbi, Rev. Aeron., Vol. 7, No. 11, Nov., 1931, pp. 259-293.) (Italy 19.29/23101.)

The paper outlines a scheme of psychological examination of the pilot with reference to the relation between external stimuli, physical condition and motor reactions.

Gas and Dust Masks. (P. Polaczek, Z.V.D.I., Vol. 75, No. 46, 14/11/31, pp. 1411-1414.) (Germany 19.37/23102.)

The technique of modern gas and dust masks is discussed and various types of mask are shown in nine photographs and the principles are illustrated in diagrams.

Catapults

Launching by Catapult. (Wing-Commander L. J. Wackett, Flight, Vol. 23, No. 44, 30/10/31, pp. 1086f-1086h.) (Great Britain 20.14/23103.)

An elementary theory of catapult acceleration is worked out. A numerical example is given.

Illumination

Aerodrome and Route Lighting. (K. W. Mackall, Airc. Eng., Vol. 3, No. 33, Nov., 1931, pp. 285-290.) (U.S.A. 21.06/23104.)

A useful summary is given of American practice in aerodrome and route lighting with fourteen diagrams of distribution of light intensity and four photographs and a sketch of equipment.

Illumination Practice, Recent Development. (H. Lux, Z.V.D.I., Vol. 75, No. 45, 7/11/31, pp. 1377-1381.) (Germany 21.095/23105.)

The tungsten filament lamp has low illuminating efficiency, over 97 per cent. of the energy supplied being transformed into heat and only 3 per cent. into visible light. According to recent work (Pirani, Z.T.P., Vol. XI, 1930, p. 482) the phenomenon of luminescence exhibited by certain gas-filled tubes with hot cathodes gives an illuminating efficiency of 30 per cent., a result which may be considered as revolutionary.

Fog Penetration

Enfeebling of Visible and Ultra-red Rays through Artificial Fog and its Effect on Visibility. (W. Külb, Ann. d. Phys., Vol. 11, No. 6, 1931, pp. 679-726.) (Germany 21.22/23106.)

The effect of various artificial fogs on radiations with wave lengths between .4μ and 4μ was investigated. The reduction in radiation intensity is less for the longer wave lengths. The possibility of taking exact bearings depends, however, not only on the absorption but also on the scattering of the radiation. Moreover, the type of receiver employed is of importance, and at the present moment the superiority of ultra-red rays in foggy weather cannot be considered as established.

Aerodynamics and Hydrodynamics

New Laboratory Equipment for the Study of Fluid Wakes. (H. Bénard, L'Aeron., No. 147, Aug., 1931, pp. 291-293.) (France 22.1/23107.)

A descriptive account is given of the optical and cinematograph installation at the Sorbonne Laboratory for the study of the wake left behind an object moving in a fluid with a free surface. Examples of film records are reproduced, and the determination of the poles of eddies is discussed.

Motions Reproducible by Process of Coloured Filaments between Two Surfaces. (D. Riabouchinsky, C.R., Vol. 193, No. 16, 19/11/31, pp. 645-647.) (France 22.1/23108.)

Hele Shaw's experiment exhibiting potential flow by means of coloured filaments in a thin layer bounded by parallel plates, was modified by Mme. Popovitch-Schneider by constrictions of the channel in such a way as to produce irrotational circulation round a cylinder and round a wing profile (see Abstract No. 21/22640). In the present note Prof. Riabouchinsky develops the appropriate generalisation of Stokes' analysis in a lucid manner. The results suggest further constrictive modifications of Hele Shaw's original experiment. Six references are given.

Solutions of Boundary Layer Equations. (V. M. Falkner and S. W. Scan, Phil. Mag., No. 80, Nov., 1931, pp. 865-896.) (Great Britain 22.1/23109.)

The equations are transformed to non-dimensional variables involving the stream function, the length along the surface measured from the branching point of the surface streamline and the distance along the normal to the surface. The method of Blasius is extended and a wider range of solvable cases is obtained which includes Blasius' results and a particular case is given by Dr. Thom. The discussion is restricted to the region in which the flow remains steady. Within this region it appears to predict velocity and frictional forces with considerable accuracy.

Statistical Interpretation of v. Karman's Discussion of Turbulence on the Assumption of Kinematic Similarity. (F. Noether, Z.A.M.M., Vol. 11, No. 3, June, 1931, pp. 224-231.) (Germany 22.1/23110.)

V. Karman's assumptions are briefly summarised and applied to the transformation of the two-dimensional equation of viscous fluid motion. From the three terms of the transformed equation two ratios of functions are derived which must be constant. These two relations determine the amplitude of the periodic movements and the mean length through which momentum is transferred (Prandtl's " Mischungsweg ") in terms of the first and second derivatives of the axial velocity with reference to the transverse co-ordinate. The author proceeds to examine types of solution of the differential equation in series of terms, each

term representing a double row of vortices moving axially. None of the solutions need necessarily satisfy the differential equation, but their sum must do so.

Admitting the instability of such disposition the author considers the passage of a discrete eddy from one row to a neighbouring row, and constructs expressions for the probability of such a transference and finally obtains relations with respect to the mean statistical value of the velocity which are of the same form as v. Karman's.

No suggestion is made that the difficulties have been definitely solved or that the expressions can be given any formal numerical basis, but the statistical form is put forward as a correct interpretation of the principles underlying v. Karman's work.

Generalisation of v. Karman's Application of Kinematical Similarity to Turbulent Motion. (A. Betz, Z.A.M.M., Vol. 11, No. 5, Oct., 1931, p. 391.) (Germany 22.1/23111.)

The author points out that if discrete eddies are displaced across the stream they carry with them not only their linear momentum but their angular momentum. Making certain assumptions as to the dimensions and vorticity of the discrete element thus transported he finds an independent relation for determining the controlling linear dimension. On the assumption that the linear dimensions of the eddy and the mean distance through which it is transported are proportional this relation becomes on reduction identical with v. Karman's relation which defines the Reynolds number by the ratio of the first and second differential coefficients of the axial velocity with reference to the transverse co-ordinate.

Motion of a Viscous Fluid in the Neighbourhood of a Disc Oscillating Round its Axis. (A. Foch and J. Bariol, C.R., Vol. 193, No. 9, 9/11/31, pp. 835-839.) (France 22.1/23112.)

A pendulum oscillating in glycerine set up a motion of the surrounding fluid which could be observed by the motions of small suspended air bubbles. At a Reynolds number of 60 photographs with an exposure of several oscillations showed perfectly circular trajectories co-axial with the disc. On prolonging the exposure for some twenty or thirty periods a slight centrifugal pumping effect became evident. This latter phenomenon explained the divergence of the values obtained for the coefficient of viscosity from those obtained in a capillary tube. By gradually decreasing the amplitude of the oscillations the values converged sensibly to agreement with the capillary tube method. Above a Reynolds number of 60 a definitely turbulent state set in.

Formation of Vortices from a Surface of Discontinuity. (L. Rosenhead, Proc. Roy. Soc., Vol. 134, No. A.823, 3/11/31, pp. 171-192.) (Great Britain 22.2/23113.)

Kelvin and Rayleigh showed that a plane surface of separation between two bodies of fluid moving uniformly in opposite directions parallel to the surface is unstable and that a small sinusoidal disturbance will grow symmetrically. In the present paper it is shown that if the disturbance ceases to be small in the mathematical sense it also ceases to be symmetrical, and the peak of the wave has a component of motion in the direction of the fluid on the convex side of the surface. This ultimately leads to the rolling up of the surface of separation into a series of loops. The method employed is to assume that the surface of separation is replaced by a row of small discrete vortex centres. Analytical methods are similar to those employed by v. Karman (see Lamb, 5th edition, pp. 207-211) in discussing the stability of single and double rows of discrete vortices. Step by step numerical approximations are made and it is shown that

the line of vortices rolls up periodically in a manner familiar from experiment. The result is of fundamental importance as a step towards reconciling observed fluid motions with the results of rational hydrodynamics.

Cylindrical Vortex Tubes of Finite Section. (J. Rossignol, C.R., Vol. 193, No. 17, 26/10/31, pp. 700-703.) (France 22.4/23114.)

The object of the paper is to determine to further approximation the actual contour of the two cylinders of vorticity under their reciprocal influence.

A 1-1 relation is assumed between points on the approximate circular cylinder and the corresponding points on the slightly deformed contour. The distance between the centres of vorticity is assumed to be large compared with the dimensions of the contours. The distance between the corresponding points is assumed to be a function of θ, the polar angle of the circle referred to the rotating axis through the centres of vorticity. Using the fact that the contours must be lines of flow in the relative motion the condition for constant vorticity is expressed immediately as the sum of three integrals and of an algebraic term. The surface of vorticity is at once expressed by equating to zero the integral of vorticity taken over the difference of area of the circle and contour.

The condition that the centre of vorticity of the contour remains fixed on a rotating axis gives two further integral conditions. Combining these results a condition of compatibility is formed, a solution of which by successive approximations will determine the deformation of the approximate circle towards the actual contour.

Recent Measurements of the Air Resistance of a Cylinder. (W. Linke, Phys. Zeit., Vol. 32, No. 22, 15/11/31, pp. 900-914.) (Germany 22.4/23115.)

Previous experiments are reviewed and semi-empirical formulæ obtained are discussed. The author's experimental installation is described and illustrated with photographs and diagrams. The distributions of pressure round the central section of the cylinder are plotted graphically in comparison with the results of other experimenters. The change of the type of flow with increasing Reynolds numbers receives separate discussion. Twelve references are given.

Circulation Caused by Vibration of Air in a Tube. (E. N. da C. Andrade, Proc. Roy. Soc., Vol. 134, No. A.824, 2/12/31, pp. 445-470.) (Great Britain 22.5/23116.)

The object of the research in the first place is directed to improving the measurement of the velocity of sound in tubes taking into account the viscosity of the air and the retarding effect of the walls. The method of rendering the motions visible is, however, of much wider application in aerodynamics. Particles of cigarette smoke after passing through a drying tube were found to be the most satisfactory indicators. The prediction of Rayleigh that cyclic motion would take place between the nodes is fully confirmed and illustrated by remarkable photographs. The motion in the neighbourhood of vibrating rods and spheres is investigated by the same method, which reveals the setting up of eddy systems in the immediate neighbourhood of the vibrating body. These motions are also illustrated by extremely clear photographs. It was further found that when the indicating particulars exceeded a certain size the lag in their motion caused them to act as independent vibrating bodies and to set up circulations of the same type. The equations of motion are discussed from a dimensional point of view and a non-dimensional criterion is obtained and compared with experiment. The agreement with dimensional conditions may be regarded as satisfactory. The observations lie well on the predicted straight line with two stray points and a slight shift of the origin from the expected position. The effect of the vortex images in the walls is neglected, as it is relatively small.

The experimental method must be regarded as a powerful instrument for investigation of fluid motions by visual observation of the actual phenomena.

Interference Effects of a Centre Plate on an Aerofoil. (K. E. Ward, N.A.C.A. Note No. 403, Dec., 1931.) (U.S.A. 22.4/23117.)

The aerofoil was cut across the plane of symmetry and the two ends were separated by small, medium and large cross pieces, or "fillets." A slight reduction in drag was obtained, possibly from increased effective aspect ratio and decreased induced drag. With the centre plate fitted the drag was slightly increased as compared with the simple wing, but was rather less than the drag with the fillets except in the case of large fillets at low incidence.

Thirty-three references are given to effects of interference and cutting away portions of the wing, so that presumably these tests are intended to take their place in this category. The immediate practical application is not very clear.

Elasticity of Materials

Influence of Rate of Deformation on Resistance to Deformation. (W. Tafel and E. Viehweger, Z.V.D.I., Vol. 75, No. 49, 5/12/31, pp. 1479-1483.) (Germany 23/23118.)

Numerous measurements of the relation between rate of plastic strain and resistance to plastic strain are given in numerical tables and graphically. The physical interpretation of the results is discussed.

Buckling of a Cylindrical Shell under Torsion. (K. Sezawa and K. Kubo, Aer. Res. Inst., Tokyo, Rept. No. 76, Dec., 1931.) (Japan 23/23119.)

The problem is dealt with experimentally and mathematically. The method of mounting the cylinder and applying the load is described and illustrated with photographs, and a large number of experimentally observed deformations are plotted against angular position for different torsional loads. In every case a whole number of wave lengths was obtained experimentally, but different groups of wave lengths may be superposed.

In the mathematical analysis reference is made to Schwerin's work (Congress for App. Mechanics, Delft, 1924), but doubts are expressed as to the validity of the assumptions on which his solutions are based. These difficulties are avoided by taking the results of Southwell and Skan (Proc. Roy. Soc. A.105) for a flat plate regarded as a cylinder of infinite radius. The equations connecting the applied torsion and resulting stresses of the cylinder are formed in the usual way. Solutions are assumed giving the displacements as periodic functions of the axial length and the radial angle, and an equation of compatibility is obtained in the form of a determinant of the third order. On expanding the determinant an equation of the eighth power is obtained in the axial and radial periods and involving the resultant shear stress as a parameter. By simplifying approximations this is reduced to a form comparable with Southwell's formula. The angular period gives the values 1, 2, 3, etc., and for each of these on plotting the resultant shear against the axial period a minimum value is obtained for the shear, which is the critical value sought. The comparison of the theory with experiment was found to be satisfactory for short values of the cylinder and increasingly divergent for greater axial lengths.

Deformation Tests carried out on Two 16,000-ton Liners. (O. Lienau, Z.V.D.I., Vol. 75, No. 28, 11/7/31, pp. 899-903.) (Germany 23/23120.)

Measurements were carried out on the upper deck near the centre of the ships over a space of roughly 15 × 10 metres while the ship was pitching. The deck plates were found to be under continuous bending stress. The deflections were asymmetrical and differed appreciably from those predicted by laboratory experiments on simplified structures.

Overstrain of Metals. (T. C. Dickson, Army Ord., Vol. 12, No. 69, Dec., 1931, pp. 188-195.) (U.S.A. 23/23121.)

In reviewing Lieut.-Col. Macrae's volume, published by H.M.S.O., occasion is taken to contribute a number of experimental data obtained by the reviewer

on the load extension diagram of gun steels. Each diagram is divided into four ranges, denoted as the " elastic," " slip," " yield " and " semi-plastic " ranges. Some tabulated data are also given.

Miscellaneous—Unclassified

Bird Flight. (R. R. Graham, J.R. Aer. Soc., Vol. 36, No. 253, Jan., 1932, pp. 24-58.) (Great Britain 23122.)

A considerable amount of information is given as to the disposition of wings and individual feathers in a variety of birds. The remarks are illustrated by numerous sketches and the data are tabulated for a list of 65 birds. The elementary qualitative mechanical explanation of aerodynamic phenomena is indicated graphically.

Mechanical Solution of Second Order Linear Differential Equations. (E. C. Bullard and P. B. Moon, Proc. Camb. Phil. Soc., Vol. 27, No. 5, 31/10/31, pp. 546-552.) (Great Britain 23123.)

The method depends upon electro-magnetic relations including the oscillation of a current-carrying coil and circuit with a battery and variable resistance. The elements of the circuit are so arranged as to make the constants proportional to those of the problem of which solution is sought. The sources and magnitudes of errors are discussed.

A Chemically Inert Valve for High Vacua. (H. C. Ramsperger, Rev. Sci. Insts., Vol. 2, No. 11, Nov., 1931, pp. 738-749.) (U.S.A. 23124.)

The seal consists of a cup containing fused silver-chloride which is pressed against the ring section of a tube by a screw control. The small amount of travel necessary is permitted by expansion of a sheet silver bellows or concertina. The valve is free from grease, which is not always chemically inert, and has proved satisfactory in practice.

Colorimetric Systems. (J. Guild, Trans. Opt. Soc., Vol. 32, No. 1, 1931, pp. 1-36.) (Great Britain 23125.)

The question of the selection of standards for a three-colour system of colorimetry is discussed. The basis is strictly physical, defined by reference to wave lengths, and based on the fact that any three primaries with which it is possible to match white may be used to match any spectral radiation.

Equivalent Colour Stimuli. (D. B. Judd, Jrnl. Opt. Soc., Am., Vol. 21, No. 11, Nov., 1931, pp. 699-728.) (U.S.A. 23126.)

As is usual in dealing with physiological facts, mean values of excitation curves must be taken from a number of observers without any striking physiological peculiarities. Alternative colour standards are reviewed and compared.

Altitude Flying in Formation. (I. A. Woodring, U.S. Air Services, Vol. 16, No. 12, Dec., 1931, pp. 35-38.) (U.S.A. 23127.)

Descriptive technical details are given of equipment and training for flying in formation at altitudes up to 30,000 feet.

A German Freight Carrier. (Airc. Eng., Vol. 3, No. 33, Nov., 1931, pp. 291-292.) (Germany 23128.)

A technical description is given, with specification and principal characteristics of a Junkers 7-ton freight carrier, and seven photographs of a complete machine and of details of construction.

Preparation of Scientific Papers. (J. Sci. Insts., Vol. 8, No. 11, Nov., 1931, pp. 365-368.) (Great Britain 23129.)

Excellent rules are given for the form of mathematical expressions. In particular the use of brackets as separators is recommended where any ambiguity exists.