

ABSTRACTS AND NOTICES  
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*(Prepared by R.T.P.)*

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*Aircraft Design, etc.*

*High Performance Flying Boat.* (Aviation, Vol. 33, No. 8, August, 1934, pp. 246-249.) (5.10/29751 U.S.A.)

A descriptive technical account is given of the construction of the Pan American four-engine S.42 and illustrated by four photographs.

The performance is given as 182 m.p.h. with 4 × 650 h.p. for 38,000 lb. flying weight, climb 850 ft. per minute, 15,500 ft. in 47 minutes (world's record).

*Aerodynamical Effect of Filleting Wings and Body.* (H. Muttray, L.F.F., Vol. 11, No. 5, 25/10/34, pp. 131-139.) (5.11/29752 Germany.)

Eleven photographs show the general appearance and some details of four types of glider with filleting between wings and body. Seven polar diagrams show numerous test points on the polar and moment characteristics of wings only, and of complete models. In one case high wing and low wing characteristics are shown.

The low wing characteristic is less affected by the pilot's wind screen, etc., than the high decker. Filleting brings the polar of the whole machine almost up to that of the wings alone.

Nine references.

*Mutual Influence of Wings and External Fittings on the Pressure Side.* (H. Muss, L.F.F., Vol. 11, No. 4, 1/10/34, pp. 103-116.) (5.11/29753 Germany.)

The disturbance set up by a low drag body in the flow along the pressure side of a wing can be calculated numerically to a satisfactory approximation by compounding the circulation field with the flow field of the body alone. The reaction of the wing on the airflow round the body can be taken into account. Experimental methods are described and illustrated in considerable detail; in particular, a photograph of a battery of 29 manometers shows the method of observing pressure distribution.

A summary is given of the elementary theory of Joukowski's simple conformal transformation and of Geckeler's extension to more complicated cases. Numerical examples of building up disturbance fields are shown graphically for cylinders and surface of revolution, with applications to struts and steel fairings.

In general, close similarity in the run of the experimental and calculated curves is obtained, with useful numerical agreements apart from some discrepancies.

Seven references.

*British Commercial Aviation in 1934.* (Flight, Vol. 27, No. 1359, 10/1/35, pp. 33-36.) (5.14/29754 Great Britain.)

A brief summary is given of internal and Empire routes operated, with two maps.

*Airways of Alaska—Report of Progress by Pan American Airways.* (Aviation, Vol. 33, No. 8, August, 1934, pp. 240-241.) (5.14/29755 U.S.A.)

The development of airways in replacement of and competition or co-operation with government steamer services and dog team routes, offer special problems. Arctic weather conditions impose additional equipment and precautions.

The equipment of the maintenance and repair base at Fairbanks is described. The weather service is considered inadequate.

*World Airways, 1934.* (D. Sayre, Aviation, Vol. 33, No. 8, August, 1934, pp. 235-239.) (5.14/29756 U.S.A.)

A review of development is given with statistics of Pan American, Imperial Airways, Royal Dutch, Deutsche Luft Hansa, and Air France operations.

Competition, pooling agreements and subsidies are discussed.

*Flying Boats and Their Possible Developments.* (A. Gouge, Flight, Vol. 27, No. 1368, 14/3/35, pp. 282-283 and 288.) (5.154/29757 Great Britain.)

Lengthy extracts are given from a paper read at the North East Coast Institution of Shipbuilders and Engineers.

Rules are given for hull design in relation to impact on water at five angles. Reference is made to the usual devices for increasing size without ignoring the fundamental physical difficulty that masses of similar structures increase as the cube, and cross sections as the square of linear dimensions.

A design is outlined for a flying boat with a total flying weight of 300,000 lb., on the basis of curves extrapolated from the author's experience. The power required would be 24,000 b.h.p.

*Measurement of Amplitude and Frequency of Vibration on Aircraft.* (R. Papault, L'Aéron., No. 184, September, 1934, p. 81.) (5.17/29758 France.)

A light coil carrying continuous current is attached to the vibratory part, and the amplitude and frequency of vibration are determined from the current induced in a fixed coil. An electrical amplifying valve circuit is described, with response practically independent of the frequency.

An oscillation of 17 mm. amplitude and 15 cycles per sec. frequency produced a current varying between 45 and 110 milliamperes, as the mean distance between the coils was varied from 12 to 3 cm.

*Vibration Response of Aeroplane Structures.* (T. Theodorsen and A. G. Gellalles, N.A.C.A. Report No. 491, 1934.) (5.17/29759 U.S.A.)

From Authors' Abstract.—This report gives test results of experiments on the vibration-response characteristics of aeroplane structures on the ground and in flight.

In the ground tests a study was made of the vibration-response of the fuselage, wings and tail by applying sinusoidal forces and couples at different

parts of the fuselages of two aeroplanes. The amplitudes of vibration along the fuselage and wings at various frequencies were measured and plotted, and the important natural modes of vibration were determined.

In the flight tests vibration records were taken in the cockpits and the tails of two aeroplanes. The vibrograms obtained in flight tests were analysed and the amplitudes of the fundamental frequencies and the most important harmonics were plotted.

Six references.

*Drag of Tapered Cantilever.* (R. H. Upson and M. J. Thompson, *J. Aer. Sci.*, Vol. 1, No. 4, October, 1934, pp. 168-177.) (5.20/29760 U.S.A.)

Empirical expressions for so-called profile drag are taken from a mass of test data, while the induced drag is amenable to mathematical analysis. The semi-empirical expressions are integrated along the span of tapered wings and somewhat formidable expressions are obtained.

Numerical values are given in tables and graphs. A taper of 8:1 from root to tip appears to give the best combination for low structural weight and low drag, with reservations as to the effect on aileron control and losses at the junction of wing and body.

Eleven references.

*Effects of Cut-out on Wing Characteristics.* (T. Okamoto, *Aer. Res. Inst.*, Tokyo, Report No. 113 (Vol. 9, No. 5), October, 1934.) (5.20/29761 Japan.)

Three profiles with cut-outs of increasing length along the span and constant depth along the chord were compared with the original wing and a wing with shortened chord along the whole span.

Seven profiles with cut-outs of constant length along the span and increasing depth along the chord were compared with the original wing. A special model had portions cut out, both from leading and trailing edges.

Five Göttingen profiles and a Sloane modified profile were used.

A mass of test results is given graphically in 55 diagrams.

*Tests of 16 Related Aerofoils at High Speeds.* (J. Stack and A. E. v. Doenhoff, N.A.C.A. Report No. 492, 1934.) (5.20/29762 U.S.A.)

From Author's Abstract.—The tests were conducted at low incidences for speeds extending from 35 per cent. of that of sound to slightly in excess of the speed at which a breakdown of flow occurs. The corresponding Reynolds number range is 350,000 to 750,000.

The results obtained were applied to the design of three cambered aerofoils, which were tested as part of this investigation.

The results indicate that some further improvement in aerofoil shapes for high-speed applications may be expected.

Five references.

*Model Measurements to Find Best Form of Cockpit Cut-outs in Open Sector Aeroplanes.* (*Luftfahrtforschung*, Vol. 11, No. 3, 18/8/34, pp. 85-92.) (5.40/29763 Germany.)

Experimental information was sought on the form of cut-out giving the observer maximum protection from wind with minimum additional drag. The resistance coefficient was determined over the usual range of incidence, and the flow round the cockpit was studied by observing streamers. Stepped shields on a normal body produced an increase of drag corresponding to a mean resistance coefficient of about 0.2 over the surface of the step.

**Aircraft, Landing Gear**

*Drag of Aeroplane Wheels, Wheel Fairings and Landing Gears.* (W. H. Herrstein and D. Biermann, N.A.C.A. Report No. 485, 1934.) (5.50/29764 U.S.A.)

From Authors' Abstract.—Tests were made in the 7 × 10ft. wind tunnel and in the 20ft. tunnel. The results of the investigation show that the lowest drag recorded for any landing gear tested was 13lb., at 100 m.p.h. and 0° pitch, and that it might be possible to reduce this drag approximately 6lb. by totally encasing the wheels of this gear in fairings. The highest landing gear drag recorded was 98lb.

Eight references.

*Modern Wheel Brakes.* (Flight, Vol. 27, No. 1358, 3/1/35, pp. 4-7.) (5.58/29765 Great Britain.)

A survey is given of types in use—Bendix, Palmer, Dunlop and Vickers, with details of cable, pneumatic and hydraulic control. Diagrammatic arrangements are shown in five sketches.

**Airscrews and Marine Screws**

*Steering of Ships.* (K. Schaffran, W.R.H., Vol. 15, No. 16, 15/8/34, pp. 215-216.) (5.60/29766 Germany.)

Photographs show a right-handed model screw in a test tank with a rudder split horizontally on the line of the axis with two sections and with a rudder split into twelve parallel sections. In the former case the upper and lower halves are diverted right and left by the wake; in the latter the strips form a spiral surface and give an indication of the general direction of the spiral flow at different axial distances.

Three references.

*Systematic Tests of Water Screw Models.* (K. Schaffran, W.R.H., Vol. 15, No. 22, 15/11/34, pp. 324-327.) (5.612/29767 Germany.)

Twenty-five two-blade, 25 three-blade and 20 four-blade model water screws are shown with stepped increases of pitch and width. The dimensions are specified and two typical sets of blade sections along the blade are shown in sketches.

Four diagrams are drawn showing families of characteristic curves of efficiency thrust, torque and slip.

Elementary formulæ are given and two numerical examples are worked out.

Three references.

*Variable Pitch Airscrew.* (R. A. Capon (letter), Engineering, Vol. 139, No. 3611, 29/3/35, p. 345.) (5.64/29768 Great Britain.)

The utility of variable pitch airscrews depends on the aeroplane speed and speed range. In the past variable pitch was rarely worth the complication, at present it is useful in some cases; in future it may become indispensable.

*Variable Pitch Propellers.* (F. Gutsche, Z.V.D.I., Vol. 78, No. 37, 15/9/34, pp. 1073-1081.) (5.64/29769 Germany.)

The advantages of variable pitch for water and airscrews are discussed. Marine screws of variable pitch have so far received little application on account of possible damage by impact.

Successful variable pitch airscrews have been developed in America and France. Variation of pitch by elastic deformation of the propeller has led to

excessive loss of efficiency. The concomitant reduction of noise is of value in civil and military aircraft. The problem of decelerating fighting aircraft after a dive has received consideration in America.

Twelve references.

*Constant Speed Propeller.* (Aero Digest, Vol. 25, No. 6, December, 1934, p. 49.) (5.64/29770 U.S.A.)

A Hamilton firm has designed a governing device (operated by the machine gun synchronising gear) which keeps their variable airscrew at constant r.p.m.

*Reduction of Aerodynamic Resistance by Guide Surfaces.* (K. Frey, Z.V.D.I., Vol. 78, No. 33, 18/8/34, p. 290.) (5.644/29771 Germany.)

This is an abstract of more extensive work in *Forschung*, Vol. 4, 1933, p. 67, and Vol. 5, 1934, p. 105.

Guide surfaces suitably arranged in lattice round a blunt body may reduce the eddy resistance by over 80 per cent. Similar results are obtained in channels with a sharp bend or a sudden increase in cross-section.

Three references.

*Venturi Cowling for Water Screws.* (E. K. Rosscher, W.R.H., Vol. 15, No. 22, 15/11/34, pp. 328-330.) (5.644/29772 Germany.)

Photographs show a model and full-scale water screw with venturi cowling installed in a tug steamer. Diagrams illustrate Froude's momentum theory and show approximately the ideal streamlines.

Dimensions are given in a table, and figures of performance are shown graphically. Substantial improvement in performance is claimed.

*Twin-Cowled Water Screws.* (Landsberg, W.R.H., Vol. 15, No. 19, 1/10/34, pp. 268-270.) (5.644/29773 Germany.)

Photographs show three views of a 55 h.p. Diesel-engined tug fitted with screws running in cowls. The hydrodynamical boundary conditions resemble closely the aerodynamical conditions in the "Stipa" aeroplane.

The load was supplied by towing three passenger vessels lashed side by side, two headed in the reverse direction, and varying the load by working their screws against the direction of tow. Test results are shown in tables and curves.

The standstill pull was 2.3 tons and the maximum overall towing efficiency 50 per cent. at 9 km. per hour and 9/10ths ton pull.

### Instruments

*An Instrument for Drawing Evolute Curves.* (H. Hofer, Z.V.D.I., Vol. 78, No. 40, 6/10/34, p. 1170.) (6.0/29774 Germany.)

A simple drawing instrument is described, by the use of which a fairing of evolute curves can be traced graphically. It can be applied to the design of gear wheels and to the solution of certain transcendental equations. The quadrature of the circle is given as an example.

*Impulse Counter for Rapid Impulses.* (H. Alfven and P. Ohlin, Z.V.D.I., Vol. 78, No. 46, 17/11/34, p. 1342.) (6.0/29775 Germany.)

The ordinary mechanical relay fails to respond to impulses beyond a moderate frequency. An electric circuit using ordinary valves is described, which transmits only every tenth impulse to the counter.

Two references.

*Water Flow Measurements in Inclined Channels.* (Z.V.D.I., Vol. 78, No. 33, 18/8/34, p. 987.) (6.22/29776 Germany.)

The direction of flow across a section is estimated from the attitude taken up by light vanes which are freely pivoted. The position of equilibrium and the velocity along the vane are recorded. Surface integration over the cross section gives the total flow.

Two references.

*Measurement of Water Flow at a Hydro-Electric Power Station.* (J. M. Mousson, Z.V.D.I., Vol. 78, No. 46, 17/11/34, pp. 1343-1346.) (6.22/29777 Germany.)

A 42,000 h.p. Kaplan turbine is installed at Safe Harbour, U.S.A., with a total flow of about 250 m.<sup>3</sup>/sec. The flow was integrated over a section of the turbine intake from readings of 84 calibrated vane meters of German design. The estimated accuracy is within  $\pm \frac{1}{4}$  per cent. and agrees with the Gibson method within a fraction of 1 per cent.

Eleven references.

*The Relation Between Translatory and Rotary Viscosity.* (J. L. Snoek, Phys. Zeit., Vol. 35, No. 22, 15/11/34, pp. 911-914.) (6.225/29778 Germany.)

The coefficient of viscosity of solutions of substances with asymmetrical or polar molecular constitutions in the apolar solvents C-CO<sub>2</sub> and C<sub>6</sub>H<sub>6</sub> was determined experimentally and fundamental relations of the kinetic theory were verified.

Nine references.

*A New Electrical Indicator for High Speed Combustion Engines (Siemens).* (C. W. Fieber, Autom. Tech. Zeit., Vol. 37, No. 20, 25/10/34, pp. 523-528.) (6.252/29779 Germany.)

Deformation of the pressure diaphragm produces changes in electrical capacity. In calibrating the relation between condenser current and pressure, temperature effects must be taken into account.

Characteristic curves recorded by a Siemens oscillograph are reproduced.

Fifteen references.

*Frequency Limits of Belt Drive for Torsiograph.* (J. Geiger, Autom. Tech. Zeit., Vol. 37, No. 17, 10/9/34, pp. 453-454.) (6.271/29780 Germany.)

The 50 mm. standard cotton belt (length 170 mm.) is satisfactory up to frequencies of 3,500. By waxing the belt the frequency may be increased to 6,000, with a small correction for slip. At higher frequencies a direct drive is desirable.

*Measurement of Marine Screw Thrust.* (H. E. Saunders, Engineering, Vol. 139, No. 3599, 4/1/35, pp. 25-26.) (6.272/29781 Great Britain.)

A comprehensive survey is made of the literature on the subject and the devices used.

The precautions to be taken in obtaining and interpreting the results are discussed.

*Gearing in Watches and Instruments.* (H. Grenda, Z.V.D.I., Vol. 78, No. 40, 6/10/34, p. 1174.) (6.3/29782 Germany.)

Evolute gearing possesses great advantages and should replace cycloidal gearing as suitable tools become generally available.

*Italian Electro Cinema for Timing Aircraft.* (L'Aéron., No. 184, September, 1934, pp. 214-217.) (6.3/29783 France.)

Two synchronised electric chronometers are used in conjunction with two high speed double objective cinema cameras placed at the ends of a 3 km. base. Exposures are made at the rate of 100 per second. The instant at which the aircraft crosses the line at each extremity of the base can be determined to 1/500 second by reduction of the cinema and chronometer records.

*Flight Path Recorder "Quo Vadis" Made by Zeiss.* (Luftwissen, Vol. 1, No. 8, August, 1934, pp. 230-231.) (6.51/29784 Germany.)

In aerial topography it is essential that the surveying aircraft should maintain a steady flying path. An instrument installation is described which comprises ground speed, drift, height and direction indicators, and a mapholder with recording pen and driving motor. A camera obscura exhibits the downward field of view and a pointer is geared to travel across the field with the same speed and direction as the landscape.

One reference.

*A New Surface Extensometer.* (T. W. K. Clarke, J. Sci. Inst., Vol. 12, No. 3, March, 1935, pp. 84-91.) (6.56/29785 Great Britain.)

Two plane mirrors, mutually at right angles, are mounted on a test piece so that increase of the test length deflects one of the mirrors. A beam from the focus of a lens, incident on one of the mirrors and reflected from the other, gives a linear displacement in the field, which is proportional to the angular deflection and to the extension.

Methods of meeting the mechanical difficulties of construction and manipulation are discussed. Measurements of extension could be made to half a millionth inch, corresponding to 1/500 of the average maximum strain for steel on the test length of 0.2 inches.

*Results of Measurements of Accelerations in Aircraft Due to Gusts.* (R. Maletzke, Luftwissen, Vol. 1, No. 10, 15/10/34, pp. 279-283.) (6.73/29786 Germany.)

The gustiness of the air was estimated from the vertical acceleration of the aircraft recorded on a special instrument. The distribution of gusts near the ground was found to depend largely on the configuration of the land. At high altitude the proximity of clouds exerted an influence, which became marked during thunderstorms.

The data obtained are essential for glider pilots and are valuable to the pilots of passenger craft in determining the best altitude and path for smooth conditions, according to the time of day, the prevailing wind and the cloud formations.

*Acoustical Instruments.* (A. B. Wood, J. Sci. Inst., Vol. 12, No. 2, February, 1935, pp. 49-50.) (6.96/29787 Great Britain.)

A brief description is given of various noise meters and accessories on the market.

### ***Aircraft Flight***

*Siemens Autopilot.* (Flight, Vol. 27, No. 1359, 10/1/35, pp. 41-42.) (7.50/29788 Great Britain.)

A description is given, with four photographs of details and a diagram of connections and controls.

The installation includes course indicator, course setter, rate of turn selector, speed selector, pitot tube, pendulum, tele-compass, gyroscopes, electric generator and oil pump.



*A New Automatic Pilot.* (Flight, Vol. 27, No. 1368, 14/3/35, pp. 287-288.) (7.50/29789 Great Britain.)

A description is given of the Pollock Brown automatic control, with details of the special gyro mounting and transmission to the servo controls.

Photographs show the general arrangement and some details. A diagram shows the mechanical connections of the servo control.

*Servo-Control Flaps.* (E. G. Reid, J. Aer. Sci., Vol. 1, No. 4, October, 1934, pp. 155-167.) (7.54/29790 U.S.A.)

A statement is given of the elementary hydro-mechanical principles of the Flettner rudder and of derived types of flap, applied to aeroplane rudders. In general, the control moment required for the main rudder is much reduced.

General arrangements are shown in photographs and sketches. Measured moments about hinge or rudder post are shown graphically for different areas, shapes and relative angular settings of the flaps.

Eight references.

*Theory of Servo-Mechanisms.* (H. L. Hazen, J. Frank. Inst., Vol. 218, No. 3, September, 1934, pp. 279-331.) (7.54/29791 U.S.A.)

Coupled systems are shown diagrammatically in which a relative motion of controller shaft from a mean position sets in action a relay, which in turn applies a restoring moment.

The friction and inertia of the intervening mechanism, the relation of torque to angular displacement, etc., enter into the functional relations between time and control movement and torque.

Equations are formed for three types of control. A diagram of response is drawn for continuous control servo-gear.

Thirty-two references.

*Design and Test of High Performance Servo-Mechanism.* (H. L. Hazen, J. Frank. Inst., Vol. 218, No. 5, November, 1934, pp. 543-580.) (7.54/29792 U.S.A.)

Application of the theory of the previous article (see Abstract 29791) is made to servo-control, in which a d.c. vacuum tube amplifier feeds a small d.c. motor of low inertia, with high damping, which in turn drives a (mechanical) torque amplifier.

The mathematical theory is developed and details of design are given in sketches and a photograph.

With critical dead-beat damping the transient current following sudden applications of constant input lasted about  $1/10$  seconds.

Four references.

*The Junkers Double Wing.* (H. E. Billeb, Aeroplane, Vol. 48, No. 1241, 6/3/35, pp. 269-271, and Luftwissen, Vol. 2, No. 1, January, 1935, pp. 2-5.) (7.72/29793 Great Britain.)

A lengthy summary is given of the article in Luftwissen for January, 1935.

A small auxiliary wing is set in tandem, but slightly below the main wing. The experimental values of pressure distribution, lift, drag and moment coefficients are given graphically. Full-scale test figures are also given. The most notable point is the large increase in lift obtained by setting of the auxiliary wing at an angle with the main wing.

Methods of employing the double wing in practical design are described. It has found application in a series of successful commercial aircraft.



*Effects of Full-Span and Partial-Span Split Flaps on the Aerodynamic Characteristics of a Tapered Wing.* (C. J. Wenzinger, N.A.C.A. Tech. Note No. 505, September, 1934.) (7.72/29794 U.S.A.)

From Author's Abstract.—Aerodynamic force tests were made in the N.A.C.A. 7 × 10ft. wind channel on a highly tapered Clark Y wing equipped with various split flaps.

The investigation showed that with full-span split flaps the lift and drag characteristics of the tapered wing up to the stall are similar to those of a rectangular wing with flaps of comparable size, but that the stall of the tapered wing with full-span flaps occurs at progressively lower angles of attack with increasing flap deflection up to that for maximum lift. For partial-span tapered split flaps on a tapered wing the maximum lift and the drag at maximum lift is greater, and the lift-drag ratio at maximum lift is less, when the partial-span flap is located at the centre of the wing than when it is located at the tip portion.

Four references.

*Calculated Effect of Trailing-Edge Flaps on the Take-off of Flying Boats.* (J. B. Parkinson and J. W. Bell, N.A.C.A. Tech. Note No. 510, November, 1934.) (7.72/29795 U.S.A.)

From Authors' Abstract.—The results of take-off calculations are given for an application of simple trailing edge flaps to two hypothetical flying boats, one having medium wing and power loadings and consequently considerable excess of thrust over total resistance during the take-off run, the other having high wing and power loadings and a very low excess thrust.

Five references.

*Effects of Equal-Pressure Fixed Slots on the Characteristics of a Clark Y Aerofoil.* (A. Sherman and T. A. Harris, N.A.C.A. Tech. Note No. 507, October, 1934.) (7.72/29796 U.S.A.)

From Authors' Abstract.—A type of fixed open slot so arranged that no flow would pass through it at a lift coefficient corresponding to high-speed flight was investigated in the N.A.C.A. 7 × 10ft. wind tunnel to determine the possibilities of such a high-lift device for increasing the speed-range ratio of a wing.

The results of this investigation show that the condition of no air flow through the slot at the desired lift coefficient is attainable. The surface discontinuities produced by the slot openings have, however, such a large effect on the drag that such slots show little promise. An appreciable increase is produced in the maximum lift and the speed-range ratio can be as high as for the plain wing.

Six references.

### **Engines, Thermodynamics**

*New Researches on the Ignition Delay in Compression Ignition Engines.* (A. E. Thiemann, Autom. Tech. Zeit., Vol. 37, No. 23, 10/12/34, pp. 600-603.) (8.13/29798 Germany.)

A useful summary is given of American research. A short ignition delay is important in high speed operation, and is most readily obtained by a combination of high compression ratio and supercharge. Unfortunately this leads to high explosive pressures, to withstand which special bearing materials are required.

Seven references.

*Temperature and Latent Energy in Flame Gases.* (B. Lewis and G. von Elbe, Engineer, Vol. 159, No. 4129, 1/3/35, pp. 230-231.) (8.13/29800 Great Britain.)

In contradiction with W. T. David, the authors find that the observed flame temperatures of mixtures of air and H<sub>2</sub> or CH<sub>4</sub> approach within a few degrees

the calculated adiabatic temperatures (of the order of  $2,000^{\circ}$ ), while even for CO the discrepancy of 97 degrees represents only 5 per cent. of the energy in contrast with David's estimate of 20 per cent.

The sodium line reversal method is considered to be fully confirmed. The evidence is discussed and a reply by Professor David follows.

Twenty-five references.

*Ignition and Combustion in the Direct Injection Engine.* (W. Wentzel, Forschungsheft, No. 366, May/June, 1934, pp. 14-26.) (8.13/29799 Germany.)

The fuel is injected into the products of combustion of a previous explosion of  $H_2$  or  $C_2H_2$ . The proportion of these gases is such that the charge, heated and compressed by the explosion, contains 20 per cent.  $O_2$  and thus resembles atmospheric air.

Lag in the ignition of a specified fuel is mainly governed by temperature and little affected by density. The time of combustion is not affected by air temperature, provided the latter exceeds the ignition temperature by a sufficient margin. The results are in general agreement with available engine tests.

Thirty-one references.

*Combustion Chart and the Formation of Soot.* (G. Ackermann, Forschungsheft, No. 366, May/June, 1934, pp. 1-5.) (29801 Germany.)

In the injection engine incomplete combustion is accompanied by the formation of soot, although there is practically no CO in the exhaust. Charts are given for estimating the heat wasted from the  $CO_2$  and  $O_2$  content of the exhaust of a fuel of known composition.

Eight references.

*Precision Optical Pyrometer.* (M. Milford, R. J. Bracey, F. A. Cunnold and A. C. Egerton, J. Sci. Inst., Vol. 12, No. 3, March, 1935, pp. 80-84.) (8.14/29802 Great Britain.)

A platinum filament in a standard glass bulb is brought into optical coincidence with the observed hot body and heated by electric current until it matches. The current is measured to 0.01 per cent., corresponding to temperature difference of  $1/3^{\circ}C.$  at the m.p. of gold ( $1,063^{\circ}C.$ ).

Details are given of the optical system monochromatic colour filters, absorption screens, etc. Temperatures up to  $5,000^{\circ}K.$  were measured with the use of absorption screens.

### **Engines, Design and Performance**

*Development of Aero Engine Design—Notes on the Paris Salon.* (Luftwissen, Vol. 1, No. 12, 15/12/34, pp. 339-344.) (8.20/29803 Germany.)

A tabular list of engines is given.

Much progress has been made in large air-cooled engines (both radial and in line). Moderate supercharge (10,000 feet) is becoming general for medium and large sizes. The variable pitch airscrew is still in the experimental stage.

*The "Rapier" Aero Engines.* (Flight, Vol. 27, No. 1368, 14/3/35, pp. 266-269.) (8.20/29804 Great Britain.)

A descriptive account of the "Rapier" II and IV is given, with photographs and perspective drawings showing general arrangements and details. A specification gives principal dimensions and performance.

*Design and Construction of High Speed Two-Stroke Engines.* (H. J. Venediger, *Autom. Tech. Zeit.*, Vol. 37, No. 19, 10/10/34, pp. 495-502, and No. 20, 25/10/34, pp. 529-535.) (8.21/29805 Germany.)

Numerous two-stroke multi-cylinder installations are described, with scavenging by the crankcase or by an independent system of reciprocating or rotary blowers. The author is of the opinion that the crankcase compression engine 1-3 cylinders, not exceeding one litre total stroke volume, is ideal for small cars.

Suitable blowers are not yet available.

Ten references.

*Ignition and Combustion in the Diesel Engine.* (G. D. Boerlage and J. J. Broeze, *Forschungsheft*, No. 366, May/June, 1934, pp. 6-13.) (8.273/29806 Germany.)

In accordance with the old views of Rieppel on the importance of vapourisation and cracking, ignitability in the injection engine is determined by the tendency of a fuel to break up rather than by its affinity for oxygen.

Development of the injection engine is largely a question of mechanical design which affects profoundly the fuel mixture distribution in the cylinder and influences ignition lag. The use of dopes to reduce ignition lag does not increase the thermal efficiency as in the carburettor engine.

Nineteen references.

*Engine Installation in Tankers.* (E. Goos, *Z.V.D.I.*, Vol. 78, No. 47, 24/11/34, pp. 1361-1367.) (8.275/29807 Germany.)

Supercharging of the eight-cylinder single acting four-stroke Diesel engine (airless injection) is effected by the underside of the power piston, the piston rod passing through a stuffing box. The brake mean effective pressure is raised to 115 lb. per sq. in., with a consumption of less than 0.4 lb. per b.h.p. per hr.

*Mobile Electric Starting Battery—for Aero Engines.* (*Luftwissen*, Vol. 1, No. 8, 15/8/34, p. 229.) (8.284/29808 Germany.)

Batteries in trucks are used on the flying ground for starting aero engines, with electrical self-starters. The available ampere-minutes are increased indefinitely and the battery installed in the aircraft is relieved of its heaviest duty.

*Introduction of Fuels in the Carbon Dust Engine.* (K. Zinner, *Z.V.D.I.*, Vol. 78, No. 34, 25/8/34, pp. 1007-1010.) (8.290/29809 Germany.)

The carbon dust engine of Pawlikowski has been modified by adding an auxiliary chamber into which the dust is introduced during the induction stroke. The chamber communicates permanently with the combustion chamber of the engine. Transfer of the dust is, however, prevented by air currents till the piston has started the working stroke.

The author investigates the principle of this injection by means of a model, in which combustion does not take place. The dust is not stored under pressure, but is picked up by auxiliary air in a sort of carburettor and transferred to the auxiliary chamber through a normal valve operating late in the induction stroke. From the experiment it appears possible to adopt this principle on a full-scale engine.

Four references.

*High Speed Gas Engine.* (F. Hegenmuller, *Z.V.D.I.*, Vol. 78, No. 47, 24/11/34, p. 1380.) (8.293/29810 Germany.)

Small gas engines, with four or six cylinders, rated up to 60 h.p. and operating at speeds in the neighbourhood of 1,250 r.p.m. are successfully competing with Diesel engines, where cheap power gas is available.

*Steam Propulsion for Aircraft.* (Z.V.D.I., Vol. 78, No. 50, 15/12/34, p. 1456.) (8.294/29811 Germany.)

American experiments and designs are discussed. Flight tests were carried out with a 90 h.p. two-cylinder engine using steam at 77 atmospheres, total plant weight about 1,000lbs. Projected turbine plants of 1,000 h.p. show estimated weights of 3lb. per h.p.

The efficiency increases up to 30,000 feet and then decreases rapidly. Wing condensers are essential and these present great difficulties. The possibilities of steam power appear to be restricted to large units operating at relatively high altitudes.

Four references.

*Hydraulic Similarity in Steam Turbine Construction.* (E. Sorensen, Z.V.D.I., Vol. 78, No. 48, 1/12/34, pp. 1403-1410.) (8.294/29812 Germany.)

A special model test plant for speeds up to 12,000 r.p.m. and powers up to 300 h.p. has been installed in the Engineering Laboratory of the Dresden Technical High School. Systematic tests on blade form, leakage, etc., are in progress.

A discussion is given of the condition of dynamical similitude for comparison of full-scale and model experiments. High model speeds are required, and the separation of skin friction and ventilation losses presents difficulties.

Five references.

### **Engines, Design and Strength of Components**

*Damping of Torsional Oscillations of Engines.* (J. Geiger, Z.V.D.I., Vol. 78, No. 46, 17/11/34, pp. 1353-1355.) (8.36/29813 Germany.)

In the absence of an external damper, torsional oscillations are damped by mechanical and aerodynamical friction and by elastic hysteresis, mainly in the shaft. Quasi-damping is also produced by the detuning effect produced by the reciprocating masses.

With mild resonance the more important damping terms are due to friction, with severe resonance to hysteresis. In an eight-cylinder double acting two-stroke engine the damping due to hysteresis varied between 30 and 60 per cent. of the total, according to the severity of the critical.

For large shear strains hysteresis losses have been found to vary as about the 6.5th power of the strain. The strain varies inversely as the cube of the shaft diameter, hence, for large strains, hysteresis losses vary inversely as about the 20th power ( $3 \times 6.5$ ) of the shaft diameter and are very sensitive to changes of diameter.

With high amplitudes and stresses the total damping losses may amount to 12 per cent. of the power, with corresponding increase in fuel consumption.

Fourteen references.

*Removal of Critical Torsional Periods by Elastic Couplings.* (J. Geiger, W.R.H., Vol. 15, No. 23, 1/12/34, pp. 341-343.) (8.36/29814 Germany.)

Elementary considerations are given briefly. The particular case of an elastic coupling with non-linear torsion-couple characteristic is discussed graphically, and numerical results are given, also graphically, in illustration of the more important practical points of the problem.

*Bearing Metals for Diesel Engines.* (Autom. Tech. Zeit., Vol. 37, No. 18, 25/9/34, pp. 489-490.) (8.37/29815 Germany.)

Thin lead bronze bearings with a steel backing have given good results, provided the backing shell is thin enough to follow the deformation of the crank-

shaft. A radial arrangement of the lead crystals relatively to the backing gives good adhesion.

A Brinell hardness exceeding 30 increases the shaft wear. The life of these bearings is two or three times the life of ordinary white metal bearings, and the smaller amount of material more than compensates for the higher price of lead bronze.

*Production of Cracks in Water-Cooled Piston Rods of Diesel Engines.* (K. Daeves, E. Kamp and K. Holthaus, Z.V.D.I., Vol. 78, No. 36, 8/9/34, pp. 1065-1067.) (8.38/29816 Germany.)

Failure of piston rods is due to corrosion by the cooling water, concentrated at the position of highest stresses, where the straining of the material causes the cracking and peeling off of the protective oxide film. Positive protection is given by shrinking copper/nickel or chrome/nickel steel tubes inside the hollow piston rod.

Chemical treatment of the cooling water and the addition of oil emulsion reduce the corrosion.

Six references.

### **Engines, Cooling**

*Flow of Heat in Laminated Iron Cores.* (H. Bucholz, Z.A.M.M., Vol. 14, No. 5, October, 1934, pp. 285-294.) (8.40/29817 Germany.)

The equation of heat flow is written down with different coefficients of heat conductivity parallel and perpendicular to the lamination.

The solutions are given in the form of integral equations, and standard methods of reduction are applied.

A numerical example is worked out and exhibited graphically.

Four references.

*Formation of Drops.* (A. Adler, Phys. Zeit., Vol. 35, No. 21, 1/11/34, pp. 864-867.) (8.40/29819 Germany.)

Fluid was allowed to flow at controlled speeds through a fine tube, 1 mm. dia., with a plane nozzle face. The rate of detachment of drops, under gravity, was observed and plotted as a function of the weight. Three sets of experimental figures are tabulated and curves are drawn.

Four photographs show drops immediately after detachment. A thread of fluid may follow the principal drop and break up into smaller subsidiary drops under surface tension.

Seven references.

*Cooling of Finned Cylinders.* (A. E. Biermann and B. Pinkel, J. Aer. Sci., Vol. 1, No. 4, October, 1934, pp. 178-185.) (8.40/29818 U.S.A.)

Seventeen dimensioned section sketches show the type of cylinder fins tested in the wind channel.

The total heat radiated per degree per hour is plotted against fin width for a range of air speeds from 80 m.p.h. to 150 m.p.h. The same quantity is plotted against average fin space and against air speed in separate diagrams.

Reference is made to the theory of physical dimensions, and the heat flow equations are developed in semi-empirical form for application to the present problem.

Finally iso-lines of heat transfer are plotted against fin thickness and spacing so that the optimum fin disposition may be selected.

Five references.

*The Air Cooling of Motor Car Engines.* (W. Kamm and others, Z.V.D.I., Vol. 78, No. 43, 27/10/34, pp. 1253-1256.) (8.420/29820 Germany.)

For continuous operation, the internal temperature of the cylinder wall must not exceed 180°C. The use of alloy pistons limits the crown temperature to about 320°C. and the ring groove temperature to about 290°C. as determined by fusible plugs. Higher wall temperature invariably leads to piston seizures.

In the motor car (as distinct from aircraft) the cooling air must be supplied by a blower. To keep the work of this blower within reasonable limits the cylinders must be enclosed by a cowling designed to equalise the cooling. The best results have been obtained by blowing the air transversely to the (fore and aft) line of cylinders. The air stream enters at one side of the engine, passes between the cylinders and escapes at the other side. This involves a larger cowling and wider spacing of the cylinders.

Air-cooled engines are inherently noisy, by reason of valve clatter and piston clearance necessitated by the relatively wide temperature range. Effective regulation of the blower is difficult for slow running, hill climbing, cruising, etc. Air-cooled engines reach their operating temperature quickly, which is an advantage in cold climates and reduces wear. Air-cooled lorry engines are receiving attention from this point of view.

Seven references.

### **Engines, Lubricants and Lubrication**

*Refining Aviation Lubricating Oil.* (Aero Digest, Vol. 25, No. 6, December, 1934, p. 49.) (8.50/29821 U.S.A.)

The oil is treated with two solvents which cause separation of the valuable paraffinic constituents from the non-paraffinic and asphaltic materials. The latter are held to be mainly responsible for gumming of rings, sludging, and excessive deposition of carbon. The resulting solutions are easily separated by differences in density. The process, known as "Clearsol," is handled commercially.

*Production of Lubricating Oil in Germany.* (B. Scheifele, Z.V.D.I., Vol. 78, No. 31, 4/8/34, pp. 932-934.) (8.50/29822 Germany.)

Apart from synthetic oils a selective absorption process, by amyl alcohol, has been applied to extract lubricating oils from distillation residues of German crudes. Synthetic oils, mainly from condensation products of ethylene, have high viscosity and low pour points.

The cultivation of linseed and soya beans for oil production is encouraged.

*The Testing of Lubricating Oils by Surface Tension between Oil and Water.* (L. Ringuet, Pub. Sci. et Tech., No. 52, 1934.) (8.540/29823 France.)

The surface tension of the oil film is measured by the immersed ring method which detects readily 1/10 per cent. of oleic acid in a paraffinic oil. The artificial ageing of oil can be followed and the surface tension compared with that of used engine oils.

It is shown that the ageing is largely a question of oxidation.

*Lubricants for Car and Aircraft Engine.* (H. Vogel, Autom. Tech. Zeit., Vol. 37, No. 18, 25/9/34, pp. 474-480.) (8.540/29824 Germany.)

Certain lubricating oils which do not pass British Air Ministry specification tests give satisfactory performance on Continental air lines, which indicates that laboratory oil tests may be inconclusive. In practice the quality of an oil is judged by the time between engine overhauls. This is affected by the composition of the fuel and by the mixture strength.



Results of tests which do not reproduce equivalent conditions may be incapable of correlation with full-scale test results.

Eighteen references.

*Lubrication of Gear Boxes.* (E. Fraunhofer, *Autom. Tech. Zeit.*, Vol. 37, No. 19, 10/10/34, pp. 503-507.) (8.580/29825 Germany.)

The quality of the oil is judged by the rate of wear and pitting of the teeth under running conditions. Thermally or electrically polymerised oils (called extreme pressure lubricants in U.S.A.) give improved results.

The addition of sulphur and carbon tetrachloride to ordinary lubricating oils improves the quality. It is well known that the addition of stearates or fatty acids to the gearbox oil reduces leakage and noise but does not reduce wear. Reduction of noise is therefore not an indication of improved quality.

Two references.

*Oil Cooling Problem in Aircraft Engines.* (H. Caminez, *J. Aer. Sci.*, Vol. 1, No. 3, July, 1934, pp. 131-134.) (8.582/29826 U.S.A.)

The heat dissipated by the lubricating oil increases rapidly with r.p.m. and decreases with rise of oil temperature. It is essential that oils should operate at higher temperature without increased carbonisation and piston ring sticking. Good oils allow of smaller coolers with less air resistance.

### **Engines, Fuels**

*The Grading of Motor Oils from Carbon Residue with respect to the Conradson Number.* (J. Formanck, *Autom. Tech. Zeit.*, Vol. 37, No. 15, 10/8/34, pp. 398-400.) (8.640/29827 Germany.)

A 50 hrs. test in a four-cylinder water-cooled engine showed that the carbon deposits of a series of oils bore no relation to the Conradson number. The weight of the deposit in the engine depends on adhesion to the walls, which is influenced by the nature of the metallic surfaces and the temperature distribution. It is suggested that the test in its present form be dropped.

Four references.

*Present Views on Nature of Detonation in Otto Cycle Engine.* (C. F. Taylor and E. S. Taylor, *J. Aer. Sci.*, Vol. 1, No. 3, July, 1934, pp. 135-136.) (8.645/29828 U.S.A.)

Time-lag in auto-ignition accounts for discrepancies between the self-ignition temperature of fuels and knock tendency as determined in the laboratory and in an engine.

Six references.

### **Engines, Injection and Exhaust Systems**

*Effect of Moderate Air Flow on the Distribution of Fuel Sprays after Injection Cut-off.* (A. M. Rothrock and R. C. Spencer, N.A.C.A. Report No. 483, 1934.) (8.70/29829 U.S.A.)

From Authors' Abstract.—High-speed motion pictures were taken of fuel sprays with the N.A.C.A. spray-photographic apparatus to study the distribution of the liquid fuel from the instant of injection cut-off until about 0.05 second later.

The results show that in still air the dispersion of the fuel particles following injection cut-off was extremely slow and that the fuel tended to travel across the chamber from the injection nozzle. The best distribution was obtained by the use of air flow and a high dispersion nozzle.

Seventeen references.



*Coupling for Automatic Variation of Injection Timing. Compression-Ignition Engine.* (Autom. Tech. Zeit., Vol. 37, No. 19, 10/10/34, p. 513.) (8.705/29830 Germany.)

A simple automatic coupling is described. The injection timing is retarded at low engine speeds by centrifugal action. The so-called "slow speed" knock is suppressed and the engine runs quietly.

*Origin of Engine Noises and Means for their Reduction—With Special Reference to Diesel Engines.* (A. Schutte, W.R.H., Vol. 15, No. 21, 1/11/34, pp. 299-303.) (8.721/29831 Germany.)

There are three main sources of noise in ship installation—exhaust, induction or scavenge, and mechanical.

The air noises can be damped by the insertion of acoustic filters in the pipe line. A pipe fitted with small holes along the circumference passes high frequency sounds and damps low frequency sounds over a range determined by the size and spacing of the holes relative to the diameter of the pipe.

Another type of filter, consisting of a series of expansion boxes connected by short lengths of pipe projecting into each box, acts as a high frequency damper, according to the relation between the diameter and length of the connecting pipe and the capacity of the boxes. By a combination of these two types of silencers noises can be eliminated over the most objectionable frequency range.

Engine noise can be much reduced by careful designs of cams and piston clearance. As a last resource, in intractable cases the engine can be installed in a sound-proof compartment.

Seven references.

*The Silencing of Exhaust Gas Noises of Motor Car Engines.* (H. Martin, Z.V.D.I., Vol. 78, No. 43, 27/10/34, pp. 1257-1260.) (8.721/29832 Germany.)

The experiments deal mainly with the silencing of two-stroke engines. The loss in power in this case depends on the relation between the resistance characteristic of the silencer and the frequency.

Piezo electric measurements of air pressure in the exhaust confirm Kluy's theory of his filter silencer. The acoustical theory is analogous to alternating current theory.

Fourteen references.

*Engine Exhaust Collector Rings.* (J. Seamon, Aero Digest, Vol. 25, No. 6, December, 1934, pp. 32-36.) (8.721/29833 U.S.A.)

Collector rings must produce minimum back pressure, allow expansion of the cylinders and necessary mixture heater connection. Independent support from the aeroplane structure is often necessary.

Air heating on the Douglas DC2 is provided by an internal "intensifier" tube which supplies a small volume of very hot air.

Stainless steel and lately a nickel chrome alloy "Inconel" are the usual materials.

### **Engines, Pumps**

*S.P.C.A. Fuel Injection Pump for High Speed Engines.* (L. Blériot, L'Aéron., No. 184, September, 1934, pp. 217-219.) (29834 France.)

The injection pump resembles the Bosch type, but the top of the piston is symmetrical, with two chamfered sections separated by a channel. In this way both beginning and end of injection can be controlled, giving quick release, absence of side pressure and reduced barrel wear. The pump is fitted with spring loaded ball valves.

### Engines, Transmission

*Whaley Infinitely Variable Gear.* (Engineering, Vol. 139, No. 3611, 29/3/35, pp. 334-5.) (8.761/29835 Great Britain.)

The rotation of the primary shaft is converted into oscillatory motion by crank pin and connecting rod. The oscillatory motion is altered in a ratio controlled by a link motion of the familiar railway locomotive type and the secondary oscillation reconverted into rotary motion by a system of gear wheels. The motion transmitted by one gear wheel varies from zero to a maximum. By using double acting gear and by setting two gears at ninety degrees a comparatively steady rotatory drive is transmitted to the secondary at a mean angular speed, which is continuously variable through the whole range of feasible settings.

Sketches and photographs show details and assembly of an apparatus designed for an 8 h.p. electric motor.

*The Trilok Fluid Transmission Gear.* (A. Keuffel, Z.V.D.I., Vol. 78, No. 45, 10/11/34, pp. 1321-1322.) (8.761/29836 Germany.)

The Trilok fluid gear is a combination of torque converter and hydraulic coupling. Guide vanes capable of independent rotation on a free wheel mounting are interposed between the pump and turbine blades so as to form a closed circulating system. The gear transmits large starting torques as required in railway traction.

Two references.

### Armament

*New High Explosives.* (A. Stettbacher, Z.V.D.I., Vol. 78, No. 45, 10/11/34, pp. 1309-1310.) (9.03/29837 Germany.)

Nitro-cellulose derivatives of pentrinite and hexonite have been known for some time as highly explosive powders. Their manufacture on a commercial scale has recently been made possible. Suitably blended with nitro-glycerine they produce more violent explosions than picric acid or trinitrotoluol, particularly in underwater explosions (torpedoes and mines).

Two references.

*Torpedo and Bomb.* (M. Ajmone-Cat, Riv. Aeron., Vol. 10, No. 8, August, 1934, pp. 203-243.) (9.02/29838 Italy.)

The technical and tactical problems of bomb and torpedo aircraft in naval warfare are discussed in general terms.

*Air Torpedoes.* (R. Bonomi, Riv. Aeron., No. 1, January, 1935, pp. 47-55.) (9.2/29839 Italy.)

The progress made in the design and construction of torpedoes is reviewed and their use against ships, particularly in the Battle of Jutland, is discussed.

The launching of torpedoes from aircraft is a difficult technical problem and their possible success against naval forces is largely a question of special circumstances.

Bombing attacks have much greater latitude.

No technical details are given.

*Bombing During a Dive.* (C. Rougeron, Revue de l'Armée de l'Air, No. 65, December, 1934, pp. 1377-1416.) (9.3/29840 France.)

The errors in a normal bombing raid (horizontal flight at great altitude) are compared with those of low altitude bombing at the end of a high speed dive.

This method of attack has been practised in the U.S.A. and the author favours its adoption.

Two references.

*Ballistics.* (O. v. Eberhard, Z.A.M.M., Vol. 14, No. 4, August, 1934, pp. 199-202.) (9.33/29841 Germany.)

Methods of integrating the equations of motion with various forms of expression for air resistance are discussed and some particular transformations are given with an experimental expression for air density. No numerical applications are made.

Three references.

*Protection Against Fire and Gas Attacks.* (B. Schiefele, Z.V.D.I., Vol. 78, No. 31, 4/8/34, p. 934.) (9.4/29842 Germany.)

The ultimate destruction of wood by fire can be considerably retarded by suitable chemical treatment. A protective layer of gas, foam or other products is formed on the surface. To be effective, both the chemicals used and the method of application must be accurately controlled.

The absorbing material in a gas mask instead of being soaked is now built up on a porous foundation of the reagent. Cut feathers (so-called "down snow") produced efficient filters. Apparatus utilising silica gels has been designed for quick detection of obnoxious gases in small concentrations.

*Clementi Goerz Bomb Sights.* (Revue de l'Armée de l'Air, No. 63, October, 1934, pp. 1215-1219.) (9.62/29843 France.)

The bomber, having set the height and drift scales, keeps the target on the cross wire.

The bomb is released automatically when the sighting telescope reaches a predetermined sighting angle.

Four photographs.

### **Materials, Characteristics, Defects and Treatment**

*Influence of Magnetic Fields on the Hardness of Metals and Alloys.* (A. Schulze, Z.V.D.I., Vol. 78, No. 36, 8/9/34, pp. 1069-1070.) (10.104/29844 Germany.)

The original work of Herbert showed an appreciable effect of the magnetic field on the ageing of a specimen of 100°C. The Brinell hardness was lowered approximately 100 units in certain cases.

Recent experiments have failed to reproduce his results.

Eleven references.

*Cast Crankshafts.* (Autom. Tech. Zeit., Vol. 37, No. 20, 25/10/34, p. 522.) (10.120/29845 Germany.)

The material used by Fords is an iron alloy of the percentage composition:— Cu 2.6, Si 2.0, C 1.3, Mn 0.5, Cr 0.4, P 0.1, S 0.05, Fe rest.

Repeated heat treatment of the originally brittle casting produces a homogeneous material of great surface hardness. The cast shafts are cheaper than forged shafts and their greater hysteresis damping gives smoother running.

*Iron Oxide as Anti-Rust Pigment.* (A. Schneider, Z.V.D.I., Vol. 78, No. 34, 25/8/34, pp. 1001-1002.) (10.125/29846 Germany.)

The quantity of iron oxide formed during the heat treatment of malleable iron increases with the time of exposure to high temperature. The surface film consists of varying proportions of  $Fe_3O_4$ ,  $Fe_2O_3$  and traces of C, Si, etc. Lengthy

exposure to high temperature favours the formation of the grey magnetic  $\text{Fe}_2\text{O}_3$ , which is an excellent anti-rust pigment superior to existing paints with a white pigment base.

Two references.

*Rebuilding of Motor Tankship "Svithiod."* (W. Scholz, Z.V.D.I., Vol. 78, No. 36, 8/9/34, pp. 1059-1060.) (10.125/29847 Germany.)

Motor tankships undergo rapid corrosion; a covering of paint is cracked by the straining of the ship and rust is formed underneath the paint. The rate of corrosion is diminished by electrolytic deposition of copper on steel and by the use of pure iron (arnico) for the tank fittings.

In the case of the "Svithiod" extensive corrosion imposed rebuilding of the central tank portion.

Three references.

*Rustless Steels.* (H. Bohr, Z.V.D.I., Vol. 78, No. 40, 6/10/34, pp. 1172-1173.) (10.125/29848 Germany.)

Cheap chromium steels require greater precautions against corrosion than the more expensive Cr-Ni and Cr-Mo steels. A high surface finish (polish) delays the attack of corrosion in every case.

*Influence of Oxide Films on Wear of Steels.* (S. J. Rosenberg and L. Jordan, Bur. Stan. J. Res., Vol. 13, No. 2, August, 1934, pp. 267-280.) (10.125/29849 U.S.A.)

From Authors' Abstract.—Steels with 0.43, 0.81 and 1.36 per cent. carbon were tested. It was found that when the steels were hardened and subsequently tempered at low temperatures, the rates of wear were comparatively low; the wearing surfaces were smooth and were covered by a thin oxide film and the abraded particles consisted of  $\text{Fe}_2\text{O}_3$  and  $\text{Fe}_3\text{O}_4$ . When these steels were tempered above certain temperatures, the rates of wear were extremely high.

Tests indicated that a film of either ferric or ferrous-ferric oxide on the wearing surfaces of carbon steels results in a certain degree of protection against wear, probably by preventing actual metal to metal contact.

*Metallographic Investigations on the Destructive Effect of Cavitation.* (H. Schröter, Z.V.D.I., Vol. 78, No. 40, 6/10/34, pp. 1161-1162.) (10.125/29850 Germany.)

The destruction is attributed to impulsive pressures produced by the collapse of cavities.

Four references.

*Electric Spot Welding in Aircraft and Automobile Construction.* (K. Ruffin, Z.V.D.I., Vol. 78, No. 47, 24/11/34, p. 1389.) (10.140/29851 Germany.)

Stainless and austenitic steels can be spot welded together and the combination is widely used in American and Russian aircraft.

In welding light alloys careful regulation of current density is required to prevent the accumulation of a high resistance oxide film subject to explosive disruption accompanied by sputtering of the metal.

Three references.

*The Welding of High Tensile Steels According to Experiences Gained in Aircraft Construction.* (J. Müller, L.F.F., Vol. 11, No. 4, 1/10/34, pp. 93-103.) (10.140/29852 Germany.)

Two principal difficulties are experienced in welding high tensile steels:—

- (1) Cracks form in the metal in the neighbourhood of the weld during the welding process at temperatures between  $800^\circ\text{C}$ .— $1000^\circ\text{C}$ .

- (2) The material in the immediate neighbourhood of the weld becomes brittle after cooling down.

The cracks are mainly due to welding stresses, but are favoured by impurities in the steels (phosphorous and sulphur). Brittleness is associated with too rapid cooling of the work and by the presence of Mn and by excessive C content. Cracks and brittleness are not necessarily connected and may occur separately.

Eight references.

*Stainless Steel Working and Welding—Tube Bending—Radiator Soldering.* (D. G. Lingle, Air Corps In. Circ., Vol. 7, No. 696, 8/9/34.) (10.140/29853 U.S.A.)

Workshop specifications are given for annealing, drawing, spinning and welding stainless steel (one photograph).

Methods are given of bending steel and alloy tubes, filled or unfilled (one photograph, three curves of changes in wall thickness).

Directions are given for radiator core dipping in a high melting point solder bath (two photographs).

*Wrought Magnesium Alloys.* (W. E. Prytherch, Engineering, Vol. 139, No. 3611, 29/3/35, pp. 343-4; Engineer, 29/3/35, p. 324.) (10.232/29854 Great Britain.)

The mechanical and working properties of various binary, ternary and quaternary alloys are given briefly. The scaling difficulty can be met in different ways.

*Protective Value of Nickel and Chromium Plating on Steel.* (W. Blum, P. W. C. Strausser and A. Brenner, Bur. Stan. J. Res., Vol. 13, No. 3, September, 1934, pp. 331-355.) (10.262/29855 U.S.A.)

Authors' Abstract.—Exposure tests of plated steel were conducted in rural, suburban, industrial and marine locations. It was found that the thickness of the nickel layer is more important than any other factor. An intermediate layer of copper decreases the protective value of thin deposits, but is not detrimental in thick coatings, especially if they are chromium plated. The customary thin chromium coatings (0.0002 in. or 0.0005 mm.) increase the resistance to tarnish, but not the protection against corrosion.

Fifteen references.

*Weathering of Aluminium Alloy Sheet Materials Used in Aircraft.* (W. Mutchler, N.A.C.A. Report No. 490, 1934.) (10.262/29856 U.S.A.)

From Author's Abstract.—The report contains results obtained in an extensive series of weather exposure tests, which reveal the extent to which the resistance of the materials to corrosion was affected by variable factors in their heat treatment and by the application of various surface protective coatings.

The results indicate that the sheet materials are to be regarded as thoroughly reliable provided proper precautions are taken to render them corrosion resistant. Seventeen references.

*Eloxal Process—Electrolytic Oxidation of Aluminium and its Alloys.* (H. Schmitt, A. Jenny and G. Eissner, Z.V.D.I., Vol. 78, No. 52, 29/12/34, pp. 1499-1506.) (10.262/29857 Germany.)

A number of patents covering the electrolytic oxidation of aluminium have been pooled in the Eloxal process. The electrolyte consists mainly of chromic or oxalic acid and the oxide layer is formed by immersion or spraying.

The process receives extensive application in containers for milk, beer and preserves.

Six references.

*On the Formation of Protective Films on Copper.* (W. Haase, Z. Metallk., Vol. 26, No. 8, August, 1934, pp. 185-188.) (10.262/29858 Germany.)

The natural protective film on copper consists of cuprous oxide. The green patina observed on exposure to the atmosphere consists mainly of basic copper chloride and sulphate.

Photographs are reproduced showing different types of corrosion.

Twelve references.

*Formula for Determining Variation in Density of Timber with Variable Humidity.* (F. Kollmann, Z.V.D.I., Vol. 78, No. 48, 1/12/34, pp. 1399-1401.) (10.400/29859 Germany.)

It is important to determine the changes in weight which various timbers undergo in storage during artificial drying or in rail transit.

A physical investigation is made of the process underlying water absorption and a chart is constructed from which numerical estimates of density may be made.

*Instrument for Measurement of Moisture in Wood.* (J. Sci. Inst., Vol. 12, No. 3, March, 1935, p. 95.) (10.400/29860 Great Britain.)

A condenser is charged to 600 volts by hand generator and is then discharged through a block of wood of standard size with electrodes at definite positions. The rate of discharge is a measurement of the moisture, with a claimed accuracy of  $\frac{1}{2}$  per cent. for a range 3 to 18 per cent. moisture.

*Ceramic Insulating Materials for High Frequency.* (H. Handrek, Z.V.D.I., Vol. 78, No. 50, 15/12/34, pp. 1441-1449.) (10.406/29861 Germany.)

The new materials contain magnesium and titanium oxides. Titanium oxide porcelains have been obtained with a dielectric coefficient as high as 80 (compared with five for ordinary porcelain) and a temperature coefficient of opposite sign and roughly the same order as that of ordinary porcelain. A suitable combination of the two materials gives a capacity insensitive to temperature variations.

Fifteen references.

### **Testing Apparatus and Methods of Testing**

*The Toepler Striation Method Applied to Phenomena of Flow.* (H. Schardin, Z.V.D.I., Vol. 78, No. 46, 17/11/34, pp. 1351/1352.) (11.105/29862 Germany.)

The striation method of Toepler can be employed either as a pure shadow method or an optical system can be employed to reproduce the striations. Generally speaking, only the latter method gives quantitative results (see Abstract 29502).

In certain cases the simpler shadow method can be employed and Schmidt (see Abstract 26027) applies it to the estimation of the heat transfer between a heated tube and air.

Examples of both methods are reproduced.

*New Whirling Arm.* (Th. Troller, J. Aer. Sci., Vol. 1, No. 4, October, 1934, pp. 195-197.) (11.12/29863 U.S.A.)

The arm has a radius of 32 feet and a maximum velocity of 170 m.p.h. (75 m. per sec.). The cyclic flow set up by the arm is heavily damped by gauze screens with openings for the passage of the test object.

Constructional details are given with two photographs and three sketches.



*A Belt Method of Representing Ground.* (A. Klemin, *J. Aer. Sci.*, Vol. 1, No. 4, October, 1934, pp. 198-199.) (11.16/29864 U.S.A.)

The introduction of a fixed plate to represent the ground below a model in the wind channel sets up disturbances not present in aeroplane flight over the ground in still air. A method of sucking away the boundary layer and feeding in new air to replace it introduces further complications. These difficulties are removed by the use of a travelling belt running on rollers, the upper side moving with the air flow. Trial runs have given satisfactory results.

*Experimental Verification of Theodorsen's Theoretical Jet-Boundary Correction Factors.* (G. Van Schliestett, *N.A.C.A. Tech. Note No. 506*, October, 1934.) (11.16/29865 U.S.A.)

From Author's Abstract.—This report presents the results of wind tunnel tests conducted at the Georgia School of Technology for the purpose of verifying the five cases analysed by Theodorsen.

The tests were conducted in a square tunnel and the results constitute a satisfactory verification of his general method of analysis. During the preparation of the data two minor errors were discovered in the theory and these have been rectified.

Thirteen references.

*Installation at the Aero and Hydrodynamic Laboratory at Lille.* (A. Martinot-Lagarde, *L'Aéron.*, No. 185, October, 1934, pp. 236-240.) (11.20/29866 France.)

The water channel, 22 metres long, 1.5 metres wide and 1.55 metres deep, is extensively fitted with glass panels for visual observation. A carriage speed of 4 metres per second can be maintained for 8 metres. The maximum speed is 15 metres per second, acceleration and deceleration about  $g$  and  $2g$  respectively.

The wind channel of the Eiffel type has an open jet of 2.2 metres diameter and maximum air speed of 60 metres per second. The power absorbed is 200 h.p. No guide vanes are required in the return channel, the exit diffuser (carrying the fan) being close to the end wall.

*Complete Tank Tests of Two Flying Boat Hulls with Pointed Steps—Models 22-A and 35.* (J. M. Shoemaker and J. W. Bell, *N.A.C.A. Tech. Note No. 504*, September, 1934.) (11.22/29867 U.S.A.)

From Authors' Abstract.—Take-off examples are worked out using data from these tests and a previous test of a conventional model applied to an arbitrary set of design specifications for a 15,000 pound flying boat. The comparison of these examples shows both pointed-step models to be superior to the conventional form and Model 35 to be the better of the two.

Model 35 is applied to a hypothetical 100,000 pound flying boat of the twin-hull type and performance calculations are made both for take-off and range. The results indicate that the high performance of this type of hull will enable the designer to use higher wing and power loading than are found in current practice, with a resulting increase in range and pay load.

Seven references.

*Tank Tests of Flat and V-bottom Planing Surfaces.* (J. M. Shoemaker, *N.A.C.A. Tech. Note No. 509*, November, 1934.) (11.22/29868 U.S.A.)

From Author's Abstract.—Four planing surfaces were tested. The results cover a wide range of speeds, loads and trim angles. The data are analysed to determine the characteristics of each surface at the trim angle giving minimum resistance for all the speeds and loads tested. A planing coefficient intended to



facilitate the application of the results to design work is developed and curves of resistance, wetted length and centre of pressure are plotted against this coefficient.

Several examples, showing the application of the test data to specific design problems, are included.

Ten references.

*The Influence of Shape on Performance of Sea-going Vessels.* (Z.V.D.I., Vol. 78, No. 50, 15/12/34, pp. 1449-1452.) (11.22/29869 Germany.)

The article is a resumé of papers read before the Hamburg Shipbuilding experimental station, including the action of waves on self-driven models and tests of manoeuvrability of a large model.

It is hoped to reduce the number of designs by the exchange of practical experience.

Twenty references.

*Hull Design.* (S. Truscott, Aviation, Vol. 33, No. 8, August, 1934, pp. 250-252.) (11.22/29870 U.S.A.)

A brief review is given of the problem of hull design and the rôle of the test tank in solving hydrodynamical problems.

*Spectroscopic Methods of Chemical Analysis.* (H. Moritz, Z.V.D.I., Vol. 78, No. 50, 15/12/34, pp. 1453-1456.) (11.40/29871 Germany.)

A description is given of spectroscopic apparatus for testing engineering materials. An example is given of Cr determination in a steel by the spectral photometer and reference spectra.

Seven references.

*Sensitivity of X-Ray inspection of Metal Defects.* (L. E. Abbott, Bell Tele. Tech. Pubcn. B-803, 1934.) (11.47/29872 U.S.A.)

An account is given of quantitative measurement of dimensions, cracks, inclusions, etc. Two X-ray photographs taken at right angles determine the length and orientation of the crack. Photographs taken along the greatest length of the crack may succeed where those at other orientations fail to give a photographic record.

In general the limit of X-ray inspection with a 200,000 volt tube is about two or three inches of steel, after which gamma ray inspection extends the range. There is a difference of opinion on the exact thickness at which the latter should supersede the former.

Photographs are reproduced and a calibration curve is given.

*Testing of Metals by Mesothorium Radiation.* (M. Widemann, Z. Metallk., Vol. 26, No. 9, September, 1934, pp. 204-206.) (11.47/29873 Germany.)

The mesothorium preparation produces a point source of gamma radiation suitable for the inspection of thick metal objects for which X-ray investigation becomes very expensive. Typical photographs are reproduced.

Six references.

### ***Airships, Balloons, etc.***

*Ascension to Stratosphere by U.S.A. Balloon "Explorer."* (P. L'église, L'Aéron., No. 185, October, 1934, pp. 241-247, and No. 186, November, 1934, pp. 273-276.) (12.19/29874 France.)

Details are given of the construction of the balloon and the ascent. The envelope tore near the estimated ceiling (60,000 feet). After a gradually

accelerated descent to 6,000 feet the three passengers escaped by parachutes. The gondola and most of the apparatus were wrecked. A remarkable film of the last stage of the descent was taken by an aeroplane.

Illustrations are reproduced.

*The Stalling of Airships.* (W. B. Klemperer, *J. Aer. Sci.*, Vol. 1, No. 3, July, 1934, pp. 113-122.) (12.30/29875 U.S.A.)

Stalling is an aerodynamic phenomenon affecting the dynamic lift and drag. Airships with considerable dynamic lift exhibit the phenomenon of stalling. If the buoyancy is equal to the weight, stalling can only be produced by the sudden application of large elevator moments. The manœuvres for recovering from a stall depend on the causes of the disturbing moments, whether extraneous or internal and the corresponding movements of the control may be direct or reversed.

Instruments are required to show the cause of the disturbance so that the pilot can act quickly. At present too much depends on the experience of the commander.

### Wireless

*Limits to Amplification.* (J. B. Johnson and F. B. Llewellyn, *Bell Tele. Pubcn.* B-838.) (13.2/29876 U.S.A.)

The sources of noise in amplifiers are stated and discussed briefly. A short account is given of sources of noise other than the amplifier.

Forty-three references.

*Electro-Magnetic Radiations.* (Lord Rutherford of Nelson, *Engineering*, Vol. 139, No. 3611, 29/3/35, pp. 341-2.) (13.30/29877 Great Britain.)

Energy distributions of black body radiation for wave lengths up to 300  $\mu$  are shown graphically. Long wave radiations can be reflected from and refracted by quartz screen and lenses. Waves longer than one  $\mu$  are almost completely cut off by a layer of water.

*North Atlantic Ship-Shore Radiotelephone Transmission during 1932/33.* (C. N. Anderson, *Proc. Inst. Rad. Eng.*, Vol. 22, No. 10, October, 1934, pp. 1215-1224.) (13.31/29878 U.S.A.)

Author's Abstract.—This paper extends the analysis of ship-shore radio transmission data for an additional two-year period beyond that reported on in a previous paper (see Abstract 26587).

Contour diagrams show the variation of signal field with time of day and distance for the winter, summer, spring, and fall seasons and for the approximate frequencies 4, 18 and 13 megacycles.

A comparison is made with the data obtained during 1930 and 1931. In general transmission during 1932/33 tends to be somewhat better on frequencies below about 9 megacycles and somewhat poorer on frequencies above 9 megacycles. At 4 megacycles the increase is of the order of 10 decibels, and for 13 and 17 megacycles, the decreases are about 6 and 10 decibels respectively.

*Improved Aircraft Radio Beacon.* (*Aero Digest*, Vol. 25, No. 6, December, 1934, p. 48.) (13.4/29879 U.S.A.)

Skyward radiation is reduced by the use of four vertical antennæ at each station. Interference between the original beacon wave travelling along the ground and reflected sky waves is reduced and reception is improved.

*Emission of Electrons from Cold Metals.* (C. C. Chambers, J. Frank. Inst., Vol. 218, No. 4, October, 1934.) (13.5/29880 U.S.A.)

Previous experimental work is reviewed critically and anomalies are referred to welded supports and to changes in the surface conditions of the wire specimens.

*Helium Glow Lamp Current Indicator.* (Z.V.D.I., Vol. 78, No. 35, 1/9/34, p. 1042.) (13.5/29881 Germany.)

The glow lamp is fitted with a straight wire cathode surrounded at its lower end by a ring-shaped anode. The glow along the cathode increases with the lamp current. There is no lag in the indications, which makes the lamp suitable for oscillography. It has received application as a tuning indicator in wireless sets.

One reference.

*The Construction of High Vacuum Cathode Ray Tubes for Television and Measuring Purposes.* (M. Ardenne, H.F. Technik, Vol. 44, No. 5, November, 1934, pp. 166-173.) (13.5/29882 Germany.)

The influence of anode current and anode potential on spots of various size is examined and an electrostatic accelerating circuit is described. An illustration shows a modern valve, 60 cm. long. The diameter of the spot of  $\frac{3}{4}$  mm., the normal picture size 13 by 18 cm. and the sensitivity 3 mm. deflection per volt.

Fifteen references.

*Vacuum Tubes as High Frequency Oscillators.* (M. J. Kelly and A. L. Samuel, Bell Tele. Pubcn. B-839.) (13.5/29883 U.S.A.)

The negative grid, the protective grid of Barkhausen, and the so-called magnetron oscillators are considered in reference to frequencies above 100 megacycles.

The electro-magnetic coupling becomes increasingly complex with increasing frequency and empirical knowledge is in advance of mathematical physical theory.

The construction of various types of tube is shown in twelve photographs. Diagrams of circuits and experimental characteristics are given graphically.

The accepted elementary physical relations are stated and the ground is prepared for further development of theory.

Twenty-seven references.

*Gas Filled Cathode Ray Tubes for Television.* (F. Michelssen, H.F. Technik., Vol. 44, No. 3, September, 1934, pp. 95-100.) (13.5/29884 Germany.)

In its applications to television the cathode ray beam is subjected to periodic variations both of intensity and direction.

The author describes various patented circuits. Difficulties of technique in the formation and adhesion of fluorescent films are discussed.

Twenty-five references.

*Experimental Investigation of the Disturbing Night Effect on Wireless Direction Finding.* (Pt. I, G. Barkowitz, H.F. Technik., Vol. 44, No. 5, November, 1934, pp. 174-178, and Pt. II, A. Hagen, No. 6, December, 1934, pp. 181-185.) (13.6/29885 Germany.)

PART I.—Apparatus is described for continuous registration of D/F response. It was found that waves of 260-680 m. were subject to greater and more frequent disturbances than waves of 1,400-2,000 m., but there were generally intermediate periods when correct direction was given.

Fifteen references.

PART II.—Modifications are described which improve the accuracy of the receiving antenna circuit. An inclination of the plane of the frame aerial to the horizon is generally beneficial.

The superiority of the Adcock antenna is demonstrated.  
Four references.

*Interference in Reception of Short Waves by the Ignition System of Combustion Engines.* (A. Neubauer, H.F. Technik., Vol. 44, No. 4, October, 1934, pp. 109-118.) (13.6/29886 Germany.)

The range of interference depends on size of engine and may extend to several thousand feet. A resistance of the order of 15,000 ohm placed at the spark plug terminal is most effective in reducing the effect.

Reference is made to an article, L. F. Curtiss on "Electrical interference in motor car receivers" (Proc. I.R.E., Vol. 20, No. 4, April, 1932), which deals with similar problems for longer wave lengths.

Twenty-five references.

*Production and Application of Ultra Short Undamped Electric Waves.* (H. E. Hollmann, H.F. Technik., Vol. 44, No. 2, August, 1934, pp. 37-60.) (13.6/29887 Germany.)

By decreasing the dimensions of standard valves, shorter waves can be produced, down to 50 cm. wave length. For shorter waves special circuits have to be devised in which vibrating electrons become the source of the radiation. The additional range of frequency is available for signalling, television, cross channel navigation, etc.

The short waves are refracted by the water vapour in the air. They have been extensively employed in the study of molecular structure by anomalous dispersion.

Forty figures and 84 references.

*Television by Electron Image Scanning.* (P. T. Farnsworth, J. Frank. Inst., Vol. 218, No. 4, October, 1934, pp. 411-444.) (13.7/29888 U.S.A.)

An optical image is focussed on a uniform photo-electric surface (caesium-silver oxide) with a sensitivity of 50-65 micro-amperes per lumen. The surface is scanned by a focussed beam of electrons and the released electron stream is multiplied by additional caesium-silver oxide surfaces. The problem of synchronising transmitter and receiver is discussed briefly.

The received signals operate a cathode tube emitting an electron beam focussed by an air-core coil on a fluorescent screen. Electrostatic deflection is feasible. The anode and cathode operate at 4,200 volts. Photo-electric current and illumination characteristic are given graphically. Two reception images are reproduced.

*Photocells Used in Light Controlled Machines and Apparatus.* (W. Kluge and H. Briebrecher, Z.V.D.I., Vol. 78, No. 31, 4/8/34, pp. 935-938.) (13.7/29889 Germany.)

Descriptions are given of the alkali cell, the selenium resistance cell and the transition layer cell. Resistance to external E.M.F. diminishes with increase in light intensity, linearly in the alkali cell, and non-linearly in the selenium cell.

The transition layer cell generates E.M.F. internally under the influence of light in analogy with the thermo-couple under the influence of heat.

The selenium cell exhibits the greatest sensitivity to small light intensity, but reaches saturation at comparatively low intensity, beyond which its performance is inferior to that of the transition layer type.

The alkali cell has a linear characteristic, but its output is considerably below that of the other two. Its advantages are constancy of calibration, quickness of response, robustness and sensitivity to infra-red rays.

Diagrams of typical circuits are given for the three types of cells.  
Seven references.

*Modern Aircraft Radio Equipment.* (Flight, Vol. 27, No. 1368, 14/3/35, pp. 274-279.) (13.97/29890 Great Britain.)

In a summary of radio equipment as installed in military and commercial aircraft brief specifications are given, with photographs, sketches and a diagram of connections.

### *Acoustics, Noise Reduction, etc.*

*Balloon Theodolite for Observations from Land and Ships.* (W. Schnittger and H. Linke, Z. Instrum., No. 9, September, 1934, pp. 311-317.) (15.10/29891 Germany.)

These instruments are intended for medium altitudes and are characterised by ease of manipulation, since the reading points for azimuth and altitude are immediately below one another. The accuracy is  $1/10^\circ$ . For observation from a ship a reflection of the horizon is provided. Alarm clocks give time signals for taking readings, preceded by a "ready" signal.

*Sound Absorption in Acoustic Filters.* (E. Grossmann, Ann. d. Phys., Vol. 21, No. 4, December, 1934, pp. 433-442.) (15.20/29892 Germany.)

The physical theory is given in Waetzmann's form. Numerous measurements are plotted in comparison with calculated values and show substantial agreement.

Five references.

*Dependence of Sound Absorption upon Area and Distribution of Absorbent Material.* (V. L. Chrisler, Bur. Stan. J. Res., Vol. 13, No. 2, August, 1934, pp. 169-187.) (15.20/29893 U.S.A.)

When part of the surface of a chamber is highly absorbent relatively to the rest of the surface the distribution of wave energy appears to become heterogeneous and the decay ceases to be logarithmic. Examples are given graphically.

The Sabine formula may succeed for more or less acoustically similar spaces, although it does not describe the physical realities. Where the acoustical dissimilarity is great the differences may not average out and predictions based on the Sabine formula may fail seriously.

Three references.

*Air Soundings.* (L. Laboureur, Rev. de l'Armée de l'Air, No. 61, August, 1934, pp. 867-882.) (15.20/29894 France.)

A descriptive technical account is given of the Laboureur-Dubois sounding apparatus, illustrated by seven photographs, two diagrams of connections and a sketch showing the installation on an aeroplane.

A siren emits notes of frequency 1,500 duration  $1/100$ th second. The ground echo is received by a microphone. The signal illuminates a neon lamp and the echo extinguishes it. The duration of illumination, which may be from  $1/100$ th seconds to two seconds, is indicated on a dial calibrated to corresponding heights.

Two series of readings are given, one showing a rise from ground level to 250 metres and return, the other showing the variations during horizontal flight over rising ground. The smallest height measurable is about 5 metres, with the selected signal duration.

*Characteristics of Microphones. Part I.* (K. Sato, H. Kawai and R. Tate, Aer. Res. Institute, Tokyo, Report No. 110 (Vol. 9, No. 2), August, 1934.) (15.26/29895 Japan.)

From English Abstract.—A sketch shows the test installation with position of microphone and Rayleigh disc in a sound-proof chamber.

Diagrams of connections are given for different types of microphones and characteristics are plotted graphically.

*The Importance of Sound Transmission through Solids in the Acoustic Properties of Rooms and Buildings.* (E. Meyer, Z.V.D.I., Vol. 78, No. 32, 11/8/34, pp. 957-963.) (15.38/29896 Germany.)

In a concert hall the air transmits the greater part of the sound energy received by the audience and the wall material has a relatively small effect. The transmission of sound from one room to another through the structure of the building, depends largely on the materials.

Sound insulation is obtained by using materials of low sound conductivity or by the provision of reflectors or sound absorbing material at certain points only. An installation is described which determines the damping of the insulating material numerically.

Thirteen references.

### **Air Navigation**

*Recent Developments in Astronomical Observations during Flight.* (A. Bastide, L'Aéron., No. 185 (Bulletin), October, 1934, pp. 89-97.) (15.5/29897 France.)

Various proposals are briefly reviewed in respect of small weight and size of the apparatus and simplicity, rapidity and accuracy of operation. No single method combines all these requirements. Preference is given to Kahn's method by observation of altitude only of sun or star, with the disadvantage of special and extensive maps, which require redrawing every two years for the sun and every five years for the stars.

Reference is made to the Guyot mechanism (see Abstract 29898), which is considered too cumbersome.

*A New Apparatus for Rapid Position Finding from Astronomical Observations taken on Aircraft.* (Capt. Guyot, L'Aéron., No. 184 (Bulletin), September, 1934, pp. 73-81.) (15.5/29898 France.)

The procedure of position finding involves the following operation, as well as the use of special charts:—

- (1) Identification of a particular star.
- (2) Determining its altitude at a known time (M).
- (3) Correcting the altitude.
- (4) Determining the terrestrial co-ordinates of the projected star position at time M.
- (5) Determining altitude and azimuth corresponding to centre of special chart.
- (6) Tracing relative altitude circle on special chart.

The apparatus carries out operations (3) to (6) mechanically.

### **Accidents and Precautions**

*Protection of Large Oil Store against Air Attack.* (R. v. Feld, Z.V.D.I., Vol. 78, No. 39, 29/9/34, p. 1146.) (16.00/29900 Germany.)

Underground tanks 10 feet below the earth surface and with one or two layers of concrete or wire netting interposed are adequately protected against bomb



attack. Alternatively tanks on ground level may be protected by earthworks. Distilling towers and other prominent plant equipment should be scattered to isolate the damage.

Two references.

*Fire Danger in Passenger Ships.* (Z.V.D.I., Vol. 78, No. 47, 24/11/35, p. 1367.) (16.00/29901 Germany.)

It is proposed that the furnishings of selected blocks of cabins on each deck be effectively fireproofed as checks to the spread of fire without the expense of fireproofing the whole ship.

Two references.

*Mobile Supply Column "Bayern."* (Z.V.D.I., Vol. 78, No. 47, 24/11/34, p. 1388.) (16.00/29899 Germany.)

As a precaution against large scale explosion or fires a supply column has been organised and equipped with high speed lorries carrying field kitchens and field medical equipment with supplies. Three thousand rations and 5,000 gallons of tea or coffee can be supplied daily.

### **Aircraft, Unorthodox**

*Historical Notes.* (L'Aerotecnica, Vol. 14, No. 8/9, August/September, 1934, pp. 1047-1065.) (17.00/29902 Italy.)

Twenty-six photographs show details of models of flying machines constructed in the 15th and 16th centuries by Leonardo da Vinci and others.

*Landing Characteristics of an Autogiro.* (W. C. Peck, N.A.C.A. Tech. Note No. 508, November, 1934.) (17.05/29903 U.S.A.)

Author's Abstract.—An investigation to determine the rate of descent, the horizontal velocity, and the attitude of contact of an autogiro in landings was made by the N.A.C.A. The investigation covered various types of landings.

The results of the investigation disclosed that the minimum rate of descent at contact with the ground (10.6ft. per sec.) was less than the minimum rate of descent attainable in a steady glide (15.8ft. per sec.); that the rates of descent at contact were of the same order of magnitude as those experienced by conventional aeroplanes in landings; that flared landings resulted in very low horizontal velocities at contact, and that unexpectedly high lift and drag force coefficients were developed in the latter stages of the flared landings.

Three references.

(Flaring=flattening out of flight path.)

(Flared landing=landing with abrupt flattening out.)

*Direct Start Autogiro.* (J. de la Cierva, Flight, Vol. 27, No. 1369, 21/3/35, pp. 308-310, and Aeroplane, No. 1243, 20/3/35, pp. 330-332.) (17.05/29904 Great Britain.)

Lengthy extracts are given from a paper read before the Royal Aeronautical Society.

A description is given of the comparatively simple mechanism, whereby the incidence of the blades is kept at zero during run up by direct drive and increased to effective flying incidence on de-clutching.

A jump to 20 feet is mentioned as sufficient for starting purposes. The autogiro then climbs at its normal path angle.

A sketch shows the flexible mounting of the blades.

Two photographs show an autogiro rising from and alighting on the Italian cruiser "Fiume."



*An Aerodynamic Analysis of the Autogiro Rotor with a Comparison between Calculated and Experimental Results.* (J. B. Wheatley, N.A.C.A. Report No. 487, 1934.) (17.05/29905 U.S.A.)

From Author's Abstract.—An extension of the autogiro theory of Glauert and Lock is presented in which the influence of a pitch varying with the blade radius is evaluated and methods of approximating the effect of blade tip losses and the influence of reversed velocities on the retreating blades are developed. An approximate evaluation of the effect of parasite drag on the rotor blades established the importance of including this factor in the analysis.

Five references.

*The Rotary Wing.* (E. Everling, Luftwissen, Vol. 1, No. 8, 15/8/34, pp. 221-224.) (17.10/29906 Germany.)

The Rohrbach wings are of the paddle wheel type. A double cam drive controls the feathering of the blades. In case of engine failure, the wing system autorotates. Aerodynamically the design is promising. (N.A.C.A. Technical Note No. 467.) The mechanical details of the drive may present difficulties.

Eight references.

*Influence of Aerodynamical Refinements on Glider Performance.* (A. Lippisch, L.F.F., Vol. 11, No. 5, 25/10/34, pp. 122-127.) (17.40/29907 Germany.)

Formulæ for horizontal and vertical components of glide velocity are given in normal and in simplified form. Relations between gliding angle, wing loading, vertical velocity component and profile resistance are shown graphically. Optimum conditions are obtained by integration of the vertical component over its mean range.

The elementary, but rather complicated expressions, are exhibited graphically for ranges of values of the vertical component and mean profile resistance, so that the best compromise can be chosen. Two gliders are compared and show a notable advance in performance obtained, particularly by careful filleting of wings and body.

Seven photographs show structural details, finish and appearance in flight.

*Convection Current Gliding.* (W. Georgii, L.F.F., Vol. 11, No. 5, 25/10/34, pp. 117-121.) (17.40/29908 Germany.)

An elementary account is given of the origin and nature of convection currents in the atmosphere. Diagrams show lapse rates up to 500 m. under varying conditions of radiation, absorption, evaporation and condensation over land and sea. A map of the Rhön gliding competition shows four glides of over 300 km. in a west wind of 45 to 50 km. per hr. at 1,000 to 2,000 m. height.

Warm moist air from the South Atlantic transported thermal energy which was released over the Rhön district by condensation with concomitant cloud formations and rising convection currents which were utilised by the gliders.

Barograms of the four glides are reproduced.

*Influence of Weight and Resistance on Vertical Component and Gliding Ratio of Gliders.* (R. Kosin, L.F.F., Vol. 11, No. 5, 25/10/34, pp. 128-130.) (17.40/29909 Germany.)

In supplement to the previous paper by Lippisch, more general standard formulæ are written down and typical numerical examples are shown graphically.

Rules are given for proceeding to optimum values of the glider characteristics.

### **Aircraft Carriers**

*Mothership "Schwabensland."* (Luftwissen, Vol. 1, No. 8, 15/8/34, pp. 225-227.) (18.04/29910 Germany.)

The motor ship "Schwabensland" of 8,000 tons displacement has been designed as a tender ship on the Gambia-South America route of the Lufthansa. The installation is similar to that of the "Westfalen" and it is intended to use one ship at either end of the long sea passage for catapult starting.

*Lufthansa Aircraft Carrier for the South Atlantic Air Service.* (E. Foerster, W.R.H., Vol. 15, No. 22, 15/11/34, pp. 330-334.) (18.04/29911 Germany.)

Photographs and drawings show the aircraft mothership "Schwabensland" and the aircraft hoisting equipment. The hoisting-in of a seaplane, by the stern crane, is shown in a calm sea, the "trailing sheet" not being in use.

### **Meteorology and Physiology**

*Meteorological Transatlantic Service.* (J. H. Kimball, Aviation, Vol. 33, No. 8, August, 1934, pp. 244-245.) (19.10/29912 U.S.A.)

A map of the North Atlantic shows land stations and a typical distribution of reporting ships. The steamer route is well reported, but the flying route over Labrador, Greenland, Iceland and the North of Scotland is sparsely covered.

An account is given of the international machinery for collection and broadcasting.

*A New Hygrometer Using a Cellophane Membrane.* (H. Bongards, Z. Instrum., No. 9, September, 1934, pp. 322-323.) (19.10/29913 Germany.)

Cellulose membranes known as "cellophane" are permeable to water vapour, but impermeable to air, and withstand pressure differences of the order of one atmosphere. A U-tube, partly filled with mercury, has one limb closed by a cellophane membrane, and a difference of level is established and measures the vapour pressure of the air directly.

*The Goodrich De-icing System for Aircraft.* (Tech. Aéron., No. 134, 1934, p. 211.) (19.15/29914 France.)

Rubber bags are fitted to conform to the general wing contour. A periodic inflation, about twice a minute, cracks off the ice.

The airscrew is protected by rubber pads soaked in a mixture of castor oil, resin and di-ethyl phtalate, the hub being shielded by a spinner. The outer blade section needs no protection, the high centrifugal force preventing ice formation.

*De-icing Wings.* (Aeroplane, Vol. 48, No. 1241, 6/3/35, p. 276.) (19.15/29915 Great Britain.)

A brief description is given of the Goodrich de-icing equipment fitted to the leading edge of the wing and the method of operation is illustrated by four sketches.

*Physical Effects and Diseases of Flying Personnel Due to Exceptional Fatigue Under Service Conditions.* (Dr. Flamme, Rev. de l'Armée de l'Air, No. 62, September, 1934, pp. 987-1019.) (19.29/29916 France.)

The physiological strain of flying is great. Cold, vibration, noise, smell, etc., contribute to weaken the constitution and the pilot must occupy his spare time in a healthy manner to maintain his fitness.

If the medical entrance is to be made easier, in order to pass the necessary number of candidates, subsequent medical control is essential.

*Acceleration Effects on the Labyrinth of the Ear in a Spin.* (H. v. Diringshofen, L.F.F., Vol. 11, No. 5, 25/10/34, pp. 150-151.) (19.29/29917 Germany.)

Reference is made to physiological sensations recorded by G. Schubert in a medical journal. By shaking his head violently he produced so-called "blackening out" or loss of vision due to failure of blood supply to the retina.

The author repeated the experiment without obtaining results. Strips of cinema film are reproduced showing the amplitude of the motion, the period being given by the rate of exposure, 15 per second.

The accelerations and physiological effects of spins are recorded and discussed. Three references.

### **Lighting**

*Electric Installations in Commercial Aircraft.* (H. Beckert, Luftwissen, Vol. 1, No. 12, 15/12/34, pp. 345-347.) (21.0/29918 Germany.)

The weight of the electrical installation is between 2 and 5 per cent. of the net weight of the Junkers commercial aircraft. It includes ignition, wireless and navigation lights, engine starting, changing of airscrew pitch and operation of landing gear.

All instruments operated electrically must be added to the list.

*Photometric Standards of Tungsten Lamps.* (H. T. Wensel and others, Bur. Stan. J. Res., Vol. 13, No. 2, August, 1934, pp. 161-168.) (21.07/29919 U.S.A.)

Disagreements in international comparisons are due to the photometric calibration of tungsten lamps from carbon filament lamps, without due regard for variability of chromatic intensity perception in different subjects. The relative intensity of red and green colour sensation in two subjects, both with normal vision, varied by as much as 5:1. By taking average values of sensation intensity from a large number of observers it is considered that sufficient accuracy is obtainable to bring stepped-up standards into agreement within 1 per cent.

A physical method is based on photometric comparison of carbon lamps with a black body immersed in freezing platinum (2,047°K.) and of gas-filled tungsten lamps with a black body immersed in freezing iridium (2,722°K.). An empirical formula is given for the brightness of a black body from 1,530 to 2,727K.

Fourteen references.

### **Aerodynamics and Hydrodynamics**

*Hydrodynamics—Principle of Minimum Dissipation in a Viscous Fluid, with Application to the Sun's Angular Velocity.* (G. Dedeant, Ph. Schereschewsky and Ph. Wehrle, Comptes Rendus, Vol. 199, No. 23, 3/12/34, pp. 1287-1289.) (22.0/29920 France.)

Assuming a constant coefficient of turbulent velocity the author writes down an expression for the dissipation, applies the conditions of invariance and deduces a differential equation for the vorticity of an element in terms of its radius of rotation.

A formal solution is written down and values computed therefrom agree with observed rotation at the surface more closely than previous expressions.

*Path and Stability of a Vortex Moving Round a Corner.* (A. Miyadzu, Phil. Mag., Vol. 19, No. 127, March, 1935, pp. 644-660.) (22.0/29922 Great Britain.)

In supplement to the previous papers (see Abstracts Nos. 27153 and 29921) eight examples are given of plane boundaries with angular discontinuities. The

velocities are expressed in bipolar co-ordinates in terms of elementary functions only.

The methods of conformal transformation are used throughout.

*Path and Stability of a Vortex Moving Round a Corner.* (A. Miyadzu, Phil. Mag., Vol. 17, No. 115, May, 1934, pp. 1010-1023.) (22.0/29921 Great Britain.)

In extension of a previous paper (Abstract 27153) expressions are formed for the velocities in complex co-ordinates.

Twelve examples are given of plane boundaries, three at obtuse angles, four at right angles and three at  $270^\circ$ .

*An Experimental Method of Determining an Irrotational Velocity Field.* (W. Barth, Z.A.M.M., Vol. 14, No. 6, December, 1934, pp. 347-348.) (22.0/29923 Germany.)

The boundaries are those of a vessel. The vessel is filled with fine quartz sand with grains of uniform average size and shape taken over sensible elementary volumes. A nozzle with numerous small perforations represents a surface of sources, the sink being the outlet of the vessel.

The passages between the grains are so narrow that laminar flow takes place and the mean resistance coefficient is approximately a linear function of the mean velocity and constant through the volume of the sand. The open end of a thin pipe connected with a gauge is used to explore the pressures. A calibration curve of pressure gradient as a function of mean velocity is given and two isobar diagrams are reproduced.

One reference.

*Motion of Stretched String in a Turbulent Flow of Air.* (D. Nukiyama, Aer. Res. Inst., Tokyo, Report No. 112 (Vol. 9, No. 4), September, 1934.) (22.0/29924 Japan.)

The author refers to the influence of turbulence, heating by the sun, and wetting by rain, but in forming the differential equations of motion falls back on simplifying assumptions giving the usual linear differential equation with constant coefficients. Formal solutions are developed at some length.

A brief reference is made to physiological scales of intensity. The determination of meap coefficients is not attempted on account of the experimental difficulties.

*Sphere Drag Determined by Coasting Through Still Air.* (R. T. Sauerwein, J. Aer. Sci., Vol. 1, No. 3, July, 1934, pp. 147-150.) (22.0/29925 U.S.A.)

The apparatus used has been described in a previous abstract (see Abstract 28835). The present paper deals with tests on a 24in. sphere (inflated rubber balloon). Appreciable discrepancies with wind channel results may be due to differences in the turbulence of the air or to the mounting of the sphere. Further investigations are being made.

Four references.

*Effect of Bridge Piers on the Resistance of Vessels.* (G. Kempff, W.R.H., Vol. 15, No. 19, 1/10/34, pp. 265-268.) (22.0/29926 Germany.)

The effect of increased flow velocity and of standing waves is analysed and the calculated results are in sufficient agreement with measurements to exclude any serious unknown reactions due to eddy formation or otherwise.

*Laminar Entry Flow.* (H. Schlichting, Z.A.M.M., Vol. 14, No. 6, December, 1934, pp. 368-373.) (22.10/29927 Germany.)

The Blasius differential equation for flow past a semi-infinite plane is extended to flow between two parallel semi-infinite planes by bringing in additional terms.

There is a brief outline only of the analysis and the results are given in numerical tables and graphically for 18 stations intermediate between uniform entry flow and the final parabolic distribution of velocity.

Seven references.

*Criteria of Instability of Laminar Flow.* (W. Tollmien, Z.A.M.M., Vol. 14, No. 6, December, 1934, pp. 375-376.) (22.15/29928 Germany.)

A brief reference is given to the recent work of H. B. Squire. The resulting differential equation is non-linear. For large Reynolds numbers the problem approaches Rayleigh's treatment and yields his result that there must be no point of inflexion in the curve of velocity distribution.

*Oscillations with Quadratic Damping.* (W. Müller, Ing. Arch., Vol. 5, No. 4, August, 1934, pp. 306-315.) (22.15/29929 Germany.)

The resistance to the flow of water in a conduit supplied by a reservoir is proportional to the square of the mean velocity under practical conditions. The equation of motion becomes non-linear and the solution is formed by successive approximations up to the third. The numerical results are given in tables and graphs.

Seven references.

*The Turbulent "Mixing Length."* (H. Gebelein, Z.A.M.M., Vol. 14, No. 6, December, 1934, pp. 357-360.) (22.15/29930 Germany.)

A note on the statistical analogy between molar (turbulent) and molecular exchanges is too brief to touch on the numerous physical difficulties. (Reference is made to a book by the author in the Press, entitled "Turbulence," in which the difficulties no doubt receive fuller discussion.)

It is stated, without proof, that the mean mixing velocity is proportional to the fourth root of the mean vorticity.

Expressions are derived for the "exchange vector" with four simple boundary conditions:—Infinite plane, semi-infinite plane, parallel infinite plane and circular pipe, and are given in tensor notation. The last result is shown graphically.

*Oscillations of Ships in a Rough Sea.* (G. Weinblum, Z.V.D.I., Vol. 78, No. 47, 24/11/34, pp. 1373-1379.) (22.15/29931 Germany.)

In any given attitude with respect to the wave a ship may undergo linear and angular oscillations which may be related to a system of three axes. The problem may be simplified by considering oscillation with the longitudinal axis parallel or perpendicular to the wave.

The damping of the oscillations has so far been studied mainly for rolling. Attempts have been made to reduce heaving by fitting fins. Irregularities in the waves introduce serious complications and experiments in tanks with artificial waves are required before a general conclusion can be drawn.

The equations of motion can be estimated if the lengths and inclination to the ship of the surface waves is known. Load distribution and moments of inertia are important factors.

Nineteen references.

*Equalising Effect of Nozzles on Velocity Distribution.* (B. Eck, Ing. Arch., Vol. 5, No. 4, August, 1934, pp. 315-324.) (22.2/29932 Germany.)

The change of velocity distribution by rapid contraction of the nozzle diameter is discussed, with neglect of viscosity, and approximate expressions are obtained.

The experimental values are shown graphically and lie closely on the calculated velocity profile. The experimental apparatus is described and illustrated by a sketch and a photograph.

*Flow in Curved Pipes.* (M. Adler, Z.A.M.M., Vol. 14, No. 5, October, 1934, pp. 257-275.) (22.2/29933 Germany.)

An approximate solution is constructed for steady laminar flow when the radius of a portion of the pipe is large in relation to the radius of the (circular) cross section.

The velocity distribution in steady laminar flow departs slightly from the parabolic profile with which first and second approximations are compared graphically. At large Reynolds numbers the mathematically intractable problem of turbulent flow is discussed and empirical expressions are constructed. The form of these expressions is, of course, restricted by general principles of dynamical similitude. The expressions in the empirical analysis became very heavy and as there is no unifying physical basis for the methods selected, they are not susceptible of concise abstraction.

The experimental installation is fully described and measured results are plotted and, in some cases, compared with empirical formulæ. Diagrams showing the velocity distribution and the transverse flow are reproduced.

Seventeen references.

*Diversion of a Free Jet by a Plane Barrier.* (W. Schach, Ing. Arch., Vol. 5, No. 4, August, 1934, pp. 245-259.) (22.35/29934 Germany.)

A summary of two-dimensional theory is given and the free surfaces are shown for six different angles of incidence. Potential and stream functions are shown in accordance with Prandtl's hodographic method.

Experimental results were obtained for jets of rectangular and circular section impinging on a flat plate. The streamlines at the surface of the plate were recorded by lines of flow formed in a thin layer of white paint on the surface of the plate. The pressure of the rectangular jet distribution on the plate was measured directly and was within a few per cent. of the theoretical values.

Twelve references.

*Determination of Configuration of Flow in Three Dimensions by the Paint Streak Method.* (G. Vogelspohl, Z.V.D.I., Vol. 78, No. 45, 10/11/34, pp. 1332-1333.) (22.36/29935 Germany.)

A boundary surface is covered with a first coat of black lacquer and a second coat of thin white oil paint. The flow of water in the channel etches furrows in the white paint which may be interpreted as mean streamlines in the neighbourhood.

The method is limited to the exhibition of flow near a solid boundary. Examples of flow between the parallel walls of a channel are reproduced. High water speeds are essential and the furrows require 30 seconds or more to form.

Four references.

*Method of Calculating Induced Velocity.* (I. Tani, Aer. Res. Institute, Tokyo, Report No. 111 (Vol. 9, No. 3), August, 1934.) (22.4/29936 Japan.)

The relation between lift and circulation is expressed by equating total lift to the velocity, multiplied by the integral of the circulation along the span. Various methods of solving the integral equation have been devised.



In the present paper the span is divided into four or five sections, approximate values are assumed and successive approximations converge quickly, and the third approximation is sufficient for all practical purposes. The method of forming the terms is based on Gauss's method of approximate integration.

Four references.

*Air Forces on an Elliptic Cylinder in an Ideal Fluid.* (A. Ratib, Z.A.M.M., Vol. 14, No. 6, December, 1934, pp. 340-342.) (22.4/29937 Germany.)

The usual expressions for velocity and pressure distribution, resultant force, centre of pressure and moment, are developed, with a view to applications to rudder and aileron control.

*Flow Round a Thin Slightly Curved Wing Profile.* (F. Weinig, Z.A.M.M., Vol. 14, No. 5, October, 1934, pp. 279-284.) (22.4/29938 Germany.)

In the development in series of the complex expression for streamlines and iso-potentials, the first term gives the simple Joukowski transformation, approximately to a circle. Higher terms in the series represent flow sources of higher order.

The coefficients of the expansion are obtained from the profile by arithmetical methods.

*Irrotational Flow Past a Biplane.* (G. Schmitz, Ann. d. Phys., Vol. 21, No. 1, October, 1934, pp. 37-66.) (22.4/29939 Germany.)

Following the original methods of Kutta and applying Joukowski's criterion of smooth flow at the trailing edges a considerable extension of the analysis is obtained. Lagally obtained the conformal representation of two circles expressed in bi-polar co-ordinates on the inside boundary of a rectangle, the point at infinity becoming the origin in terms of Weierstrasse's elliptic functions. The further step required is the representation of the biplane on the same rectangle.

Expressions are developed for two plane segments, in tandem and superposed, of equal and unequal length by an inverse method. Expansions of the elliptic functions in series give by reversion the required expression.

The resultant lift and moment depend on individual coefficients occurring early in the series and in form resemble closely the expressions for single wing contours obtained by Kutta and Blasius. The pressure distribution over the surfaces is obtained by determining the coefficients of the expansion to higher power.

Approximate numerical values are obtained for a staggered biplane of unequal segments and the pressure distribution is exhibited graphically.

Five references.

*Air Flow Past a Heated Sphere.* (I. Hartmann, J. Frank. Inst., Vol. 218, No. 5, November, 1934, pp. 593-612.) (22.4/29940 U.S.A.)

A hollow brass sphere of 12.7 cm. diameter was heated electrically to temperatures between 25°C. and 108°. The air resistance was measured in a Venturi type wind channel of 8.4 m.<sup>2</sup> sectional area, at air speeds from 27 to 160 m. per sec., giving Reynolds numbers from 70,000-210,000.

Measurements were made with and without a wire gauze screen in front of the sphere.

Tables of experimental data are given and results are also shown graphically.

Five references.



*Reaction Diffusor.* (J. Chalom, Comptes Rendus, Vol. 199, No. 23, 3/12/34, pp. 1289-1291.) (22.5/29941 France.)

The general arrangement of jet and diffusor is shown in a sketch and dimensions are given from experimental investigations.

Expressions are written down for the reactions at a fixed point and in uniform motion through the air.

*Computation of Two-Dimensional Flow in a Laminar Boundary Layer.* (H. L. Dryden, N.A.C.A. Report No. 497, 1934.) (22.6/29942 U.S.A.)

From Author's Abstract.—A comparison is made of the boundary layer flow computed by the approximate method developed by K. Pohlhausen with the exact solutions which have been published for several special cases. A modification of Pohlhausen's method has been developed, which extends the range of application at the expense of some decrease in the accuracy of the approximation.

Seven references.

### **Materials, Elasticity and Plasticity**

*A General Property of Two-Dimensional Thermal Stress Distribution.* (M. A. Biot, Phil. Mag., Vol. 19, No. 127, March, 1935, pp. 540-549.) (23.10/29943 Great Britain.)

The thermo elastic equations are written down and two conditions for zero stress with steady temperature distribution are deduced in terms of elastic constants and strains only.

The cubic thermal expansion, and hence the (steady) temperature field, satisfies Laplace's equation. The remaining condition is a relation between Young's modulus, the cubical thermal expansion and the axial stress only. It follows that a uniformly heated cylinder expands freely in the plane of each right section.

For a hollow cylinder the total flows over each (inner and outer) surface must be zero and two contour integrals round each boundary must be zero. In an example an analogy with the theory of elastic dislocations is shown, which suggests a method of applying stress optical observations to thermal problems.

One reference.

*Magnetic Fault Detection.* (Flight, Vol. 27, No. 1367, 7/3/35, p. 248.) (23.10/29944 Great Britain.)

In "Bristol" works inspection, a magnetic flux is passed through the test article and a liquid with suspended iron particles is applied to the surface. A concealed fault produces variation in the flux density which is indicated by local concentrations of the iron particles.

*Rivet in Plate of Finite Breadth.* (R. C. Knight, Phil. Mag., Vol. 19, No. 127, March, 1935, pp. 517-540.) (23.10/29945 Great Britain.)

The elastic equations are written down in polar co-ordinates for Filon's conditions of generalised plane stress. The stress function is built up by superposing partial stress function, satisfying successive conditions.

Selection is made of suitable expansions for these functions in series and the coefficients are determined to satisfy the boundary conditions of the various problems. The stresses due to the stress function are then computed and tabulated. The effects of changes in the generalised Poisson's ratio are discussed.

The paper is an extension of previous work by other authors, to whom full references are given.

Eight references.

*A New Form of Solution of Problems in Elasticity.* (H. Neuber, Z.A.M.M., Vol. 14, No. 4, August, 1934, pp. 203-212.) (23.10/29946 Germany.)

The elastic stress-strain equations are transformed by the introduction of three harmonic functions to a form which expresses the displacements by differentiation of the stress function.

The appropriate functions are given for torsion of a prismatic rod in cartesian co-ordinates and for a circular cylinder in polar co-ordinates.

Rules for transformation to curvilinear co-ordinates are given and the method is applied to a hollow cone.

Eleven references.

*Photo-Elastic Measurements in Aircraft Construction.* (M. V. Tesar, Tech. Aeron., No. 134, pp. 213-225, and No. 135, 1934, pp. 159-176.) (23.15/29947 France.)

The usual types of photo-elastic patterns are reproduced. Celluloid test pieces are attached to engine parts and follow their deflections. The strains in the attached test pieces are recorded through a cycle by a high speed cinematograph.

Reference is made to the work of Tuzi and others (Sci. Papers of Inst. of Phys. and Chem. Research, Tokyo, 1928).

Four references.

*Coefficient of Photo-Elastic Extinction.* (J. Kuno, Phil. Mag., Vol. 19, No. 126, February, 1935 (Suppmt.), pp. 457-466.) (23.15/29948 Great Britain.)

Certain precautions are required in calibrating specimens of phenolite for photo-elastic experiments.

A rapid method of calibration is described which eliminates the effect of initial stresses and of creep.

Three references.

*Tests on Aluminium Alloy Sheet.* (C. G. Brown and S. R. Carpenter, Air Corps Inf. Circ., Vol. 7, No. 691, 10/7/34.) (23.20/29949 U.S.A.)

Thirteen tables of data are given for permissible bearing values of rivet pins in heat treated aluminium alloy sheet of standard U.S.A. specifications.

The allowable bearing stress with 4 per cent. elongation of transverse diameter of pin was found to be constant, irrespective of diameter in the range  $3/32$  inch to  $3/16$  inch and of sheet thickness in the range 0.015 inches to 0.05 inches.

The average permissible bearing stress varies from 75,000lb. per sq. inch to 90,000lb. per sq. inch, according to the specification of the alloy sheet.

*Strains and Stresses in Thin Circular Rings and Pipes.* (M. J. Gercke, Z.A.M.M., Vol. 14, No. 5, October, 1934, pp. 313-315.) (23.30/29950 Germany.)

The approximate differential equation of elastic stability for the assumed boundary conditions is linear of the fourth order and has constant coefficients.

The solution is obtained in the usual way in terms of elementary functions and this in turn is transformed to a convergent series, three terms of which give a sufficient approximation.

*Buckling of Vertical Rods Under Their Own Weight.* (A. Leon and E. Erlinger, Ann. d. Phys., Vol. 20, No. 6, September, 1934, pp. 635-645.) (23.30/29951 Germany.)

Greenhill's formula is applied numerically to the buckling area of circular sections of iron, steel, copper, aluminium and lead. Static and dynamic methods

of experimental determination give continuous series of equilibrium positions with continuously increasing lengths beyond the critical value.

Greenhill's results correspond to particular cases in these series, but give a fair mean value with  $-4$  per cent. and  $+7\frac{1}{2}$  per cent. of the extreme experimental cases. Time creep in aluminium wire shows a series of instantaneous equilibrium positions.

Nine references.

*The Strength of Metal Pipes Under Internal Pressure.* (E. Siebel and E. Kopf, Z. Metallk., Vol. 26, No. 8, August, 1934, p. 169.) (23.30/29952 Germany.)

The flow of metal from yield point up to final rupture was observed in tubes of carbon steel, lantal, copper, brass and lead, under tension and under internal pressure.

The non-ferrous metals were inferior to steel under internal pressure; the inferiority was less marked under tension.

Two references.

*Breaking Tests of Flat Struts of Variable Widths.* (H. Fromm, Z.A.M.M., Vol. 14, No. 6, December, 1934, pp. 353-357.) (23.30/29953 Germany.)

Elementary generalities are given on stress distribution in round and flat struts.

Breaking tests on flat struts with constraint preventing lateral bending show failure in shear or in tension—according to the material. In some cases a tensile failure at the centre passes into a shear failure in the outer layers.

The numerical values from experiment are difficult to reconcile with the approximate theory.

Eleven references.

*Transverse Oscillations of Beams Under Moving Variable Loads.* (A. N. Lowman, Phil. Mag., Vol. 19, No. 127, March, 1935, pp. 708-715.) (23.30/29954 Great Britain.)

Reference is made to existing solutions for uniform velocities, and to a method of successive approximations for variable velocities.

A rigorous formal solution is obtained for the general problem of variable loads and velocities. No numerical results are worked out.

Five references.

*Strength of Structure.* (C. Minelli, L'Aerotecnica, Vol. 14, Nos. 8/9, August/September, 1934, pp. 991-1029.) (23.40/29955 Italy.)

Elementary examples are given, with sketches, of deformation of structure and failure by local buckling of struts and flanges. Experimental work on buckling of thin flanges is shown in over twenty photographs.

Comparison is made with Southwell's theory of buckling. The discussion is non-mathematical.

Forty-eight references.

*Stressed Skin Construction.* (E. E. Blount, J. Aer. Sci., Vol. 1, No. 4, October, 1934, pp. 186-194.) (23.41/29956 U.S.A.)

A descriptive account is given of the numerous problems of detail entering into the design of structures in which the covering carries some part of various stresses.

Illustrative numerical values are given throughout and rules for design are stated. Types of metal spare ribs and covering are shown in seven sketches.

Two references.

*Matrices Applied to Motion of Damped Elastic Systems.* (W. J. Duncan and A. R. Collar, *Phil. Mag.*, Vol. 19, No. 125, February, 1935, pp. 197-219.) (23.46/29957 Great Britain.)

A previous paper dealt with undamped systems.

In the present paper damping forces are introduced. The differential equations are in both cases linear, with constant coefficients. A matrix notation is defined and several relevant properties are established. The method is a purely numerical one and depends on successive substitution. Numerical examples are fully worked out in both papers.

Three references.

*Natural Modes of an Equilateral Triangular Membrane.* (L. Collatz, *Z.A.M.M.*, Vol. 14, No. 5, October, 1934, pp. 315-317.) (23.46/29958 Germany.)

The methods of finite differences are applied. The triangle is sub-divided by a network of regular hexagons, the nature of the potential function at a vertex being one-third of the sum of the values at the three neighbouring vertices.

A numerical example is worked out and the nodal lines of the first ten periods are shown graphically.

Two references.

*Oscillation of Systems with Two Degrees of Freedom.* (W. Quade, *Z.A.M.M.*, Vol. 14, No. 6, December, 1934, pp. 365-366.) (23.46/29959 Germany.)

The roots of the usual quartic for the period are classified and fourteen possible combinations are obtained from changes of sign and from the presence of complex conjugate roots and of multiple roots.

*The Vibration of Steam Turbine Blades.* (K. Karas, *Ing. Arch.*, Vol. 5, No. 5, October, 1934, pp. 325-352.) (23.46/29960 Germany.)

The general differential equation is formed for blade vibration in the plane of rotation, taking into account centrifugal action.

An example is worked out numerically, the result being in fair agreement with experimental values.

Forty references.

### Miscellaneous

*Locomotives with Condensers.* (*Z.V.D.I.*, Vol. 78, No. 40, 6/10/34, pp. 1171-1172.) (29961 Germany.)

Messrs. Henschel and Son have developed a surface condenser incorporated in a special tender which can be attached to existing locomotives, after minor modifications. The water consumption is very considerably reduced, 10 tons sufficing now for a run of over 500 miles. Installations are working successfully in Russia and the Argentine.

*Burlington Zephyr.* (E. C. Anderson, *Trans. A.S.M.E.*, Vol. 56, No. 9, September, 1934, pp. 659-666.) (29962 U.S.A.)

Author's Abstract.—The Chicago, Burlington and Quincy Railroad Company's "Zephyr" comprises three cars supported on four roller-bearing trucks, with articulated joints between adjacent cars. Its load-carrying truss members are of 18-8 stainless steel, as is also its unpainted outside surface. Its roof and belly sheets, and also its steel floor, share in the work of carrying load. All truss members and other stainless steel parts are tied together by the "shot-weld" system, in which a specialised and improved form of spot welding is used under such exact control of pressure, current, and time that the welds do not adversely affect the non-corrosion qualities of metal or joints.

The motive power is furnished by a 660 h.p. two-cycle Diesel engine driving a generator which produces current for the two traction motors which are mounted on the axles of the front truck. The train is streamlined and smoothed throughout its entire length to reduce air resistance, has automatically controlled steam heat, air conditioning and cooling, and electric buffet service and lighting.

The "Zephyr" has broken all records for long-distance runs, both as to mileage and speed, having made a non-stop run from Denver to Chicago, 1,015 miles, in 13 hrs. and 5 min. Much of this run was at speeds in excess of 100 m.p.h.

*Different Types of Coupling in the Frahm Anti-Rolling Tank.* (O. Föppl, W.R.H., Vol. 15, No. 24, 15/12/34, pp. 357-358.) (29963 Germany.)

A descriptive account is given of the physical factors entering into the problem and a partial differential equation is quoted from a previous paper, the terms and coefficients of which illustrate the descriptive remarks.

Three references.

*The Mechanics of Caterpillar Tractors.* (E. Heidebrock, Z.V.D.I., Vol. 78, No. 43, 27/10/34, pp. 1276-1280.) (29964 Germany.)

Elementary principles are discussed. Turning is best effected by having separate electric drives on each band. Differential gears are described as an alternative.

*The Motor Car in the Service of the Army.* (W. Xylander, Z.V.D.I., Vol. 78, No. 43, 27/10/34, pp. 1249-1252.) (29965 Germany.)

In previous wars operations were largely conditioned by facilities for railway transport of men and materials. The motor car renders operations less dependent on the railway system and increased mobility may make up for inferior numbers.

The armoured car or "tank" as a weapon of attack should not be over-rated in view of improvements in anti-tank weapons.

Nine photographs of French and British tanks and caterpillar tractors are given.

Two references.

*Fire Tactics of Fighter Formations and Light Bombing Formations. Translated from the Russian.* (Riv. Aeron., Vol. 10, No. 10, October, 1934, pp. 97-136.) (29966 Italy.)

Thirty diagrams illustrate problems of fire control arising out of attacks by fighter formations on light bombing formations.

*Visit of Soviet Military Mission to France.* (L'Aéron., No. 186, November, 1934, p. 280.) (29967 France.)

A visit to Paris has been made by three Russian low wing four-engined bombers. The water-cooled wing engines rated at 600 h.p. each are of Russian manufacture. Ten photographs show details of the machines.

According to the author the general design follows closely that of Junkers and is about four years behind modern practice.