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Aircraft Design, Performance, etc.

Aerodynamical Research and Test of Fairchild Amphibian. (A. A. Gassner, Aero Digest, Vol. 26, No. 5, May, 1935, pp. 30-33.) (5.10/30698 U.S.A.)

Sketches show the general arrangement and lines of models tested.

Six nacelle arrangements are shown in detail.

Aerodynamical characteristics are given graphically in six diagrams. A second article describes the full size aircraft.

The wing floats and land carriage are retractable.

Application of Statistical Methods to Structural Strength of Aeroplanes. (H. G. Kussner, L.F.F., Vol. 12, No. 2, 16/5/35, pp. 57-61.) (5.15/30699 Germany.)

The number of machines built in series to the same drawings is too small for statistical analysis.

The author takes the number of hours flown as the axis of abscissæ and the stresses at various times as ordinates.

On this basis the application of elementary statistical methods yields figures of the expectation of life of an aeroplane of a given type.

It is made clear that the expected life of a wing is much decreased with increased flying speed.

Correlations between independent causes of failure yield contours or iso-curves of which two illustrated examples are given.

Two references.

Study of Wing and Body Filleting by Smoke Filament. (J. Valensi, L'Aeron., No. 194, July, 1935, pp. 179-182.) (5.10/30700 France.)

Dimensions of the models are given. Six photographs show the improved flow obtained by filleting. Polar curves show corresponding improvements in the characteristics of the model.

The Efficiency of Wing Sections at Very High Air Speeds. (N. W. Akimoff, L'Aeron., No. 194, July, 1935, pp. 182-184.) (5.20/30701 France.)

This article is a short review of the following publications:—

Gasdynamik, by Busemann.

Raketenflugtechnik, by E. Sanger.

Flügelprofile bei Überschallgeschwindigkeit, by Busemann and Walchner (Göttingen).

R. & M. 1467, by G. I. Taylor.

N.A.C.A. Report 255, by Briggs and Dryden.

Lift/drag values for normal aerofoils diminish rapidly from 18/1 to 2/1 as the velocity of sound is approached and exceeded. The variation with incidence becomes less marked and the maximum L/D is shifted to larger angles of incidence. Thin sharp-nosed sections are better than conventional aerofoils and the latter give a better L/D value if reversed, *i.e.*, trailing edge facing the wind.

(See also "Aerodynamic Lift at Supersonic Velocities," A. Busemann, L.F.F., Vol. 12, No. 6, 3/10/35, pp. 210-220.)

Method of Determining Distribution of Lift Along the Span. (A. Lippisch, Luftfahrt Forschung, Vol. 12, No. 3, 17th June, 1935, pp. 89-106.) (5.20/30702 Germany.)

This paper is of importance to designers.

A brief summary is given, in qualitative terms, of the effect of wing shape, distribution of incidence, recesses (cut out portions), etc., on lift distribution and structural stresses.

The usual theory is applied and the lift distribution is expressed by an integral equation, which is reduced by expressing the lift distribution as a Fourier series. The coefficients in the expansions are obtained as integrals, and it is shown that the terms in the series beyond the third become small, and that neglecting these gives an approximation within 3 per cent. in many cases.

Further approximations are discussed and approximate expressions are obtained.

A numerical example is worked out, the lengthy computations are tabulated and graphical methods of obtaining approximate values are given.

Rolling and yawing coefficients for given moment of the central surface are computed by the same methods and comparison of Lotz's results with the author's first approximation show satisfactory agreement.

Four references.

Airscrews

The Motor Ship "Deutschland." (W.R.H., Vol. 16, No. 12, 15/6/35, pp. 194-199.) (5.65/30703 Germany.)

The vessel is interesting on account of its Voith-Schneider marine blade drive in which the feathering blades are of aerofoil section and project vertically downwards from the horizontal driving disc which is flush with the ship's bottom.

Three references.

Voith-Schneider Marine Screw. (Dr.-Ing. Völker, W.R.H., Vol. 16, No. 15, 1/8/35, pp. 251-253.) (5.65/30704 Germany.)

Two photographs show a full-scale vessel at speed in a seaway and the stern and screw on the slipway. Three further photographs show a model installation in the air for inspection, in the tank with self-driving equipment, and an underwater photograph shows the general flow over the screw in action.

Three diagrams of ships' lines are reproduced giving successive changes in performance.

The search for the best shape of overhung counter and best position of screw has led to substantial improvements in performance. (Possible application to airships is worth consideration.)

Calculation of the Three Lowest Bending Frequencies of Rotating Airscrews. (L.F.F., Vol. 12, No. 5, 31/8/35, pp. 155-160.) (5.65/30705 Germany.)

An empirical equation is given for the fundamental frequency in which the angular velocity appears as a parameter.

Ten references.

German Wooden Propeller with Cellulose Sheathing (Schwartz Patents). (R. Sancery, L'Aeronautique, May, 1935, No. 192, pp. 132-136.) (5.652/30706 France.)

The wooden propeller is closely covered with a special fabric and then impregnated with a plastic material derived from cellulose acetate. The material impregnates the wood, the fabric acting as additional anchoring. High surface finish can be obtained and the leading edge can be further strengthened by metal strips embedded in the compound. Propellers of this type do not splinter when pierced by bullets and stand atmospheric conditions better than normal wood propellers. The construction can also be adapted to variable pitch designs. The method of covering the surface treatment is stated to have been successfully employed on the plywood wings of the Heinkel 70 high-speed monoplane.

Propeller Brakes in Multi-Engined Aircraft. (Aero Digest, Vol. 27, No. 2, August, 1935, page 30.) (5.662/30707 U.S.A.)

Developments were initiated by R. B. Quick, Engineering Inspector for the Bureau of Air Commerce. Tests with a four-engined Sikorsky are described. Two photographs and a diagram are reproduced.

Propeller Stresses. (M. M. Munk, Aero Digest, Vol. 26, No. 5, May, 1935, pp. 22-26.) (5.66/30708 U.S.A.)

An elementary descriptive account is given of the stresses in an airscrew, particularly from vibration in resonance. Simple formulæ are given with a correction factor for blade vibration.

Instruments

Investigation of Current Meters. (S. L. Kerr, Trans. A.S.M.E., Vol. 57, No. 6, August, 1935, pp. 295-301.) (6.22/30709 U.S.A.)

Meter readings are compared with discharge, and with the results of exploration of velocity field with a pitot tube. Comparisons are given in numerical tables and curves.

Differential Analysis. (Engineer, Vol. 160, No. 4149, pp. 56-58-to be continued.) (6.10/30710 Great Britain.)

A description is given of an integrating machine installed in the physics department of Manchester University. (Refer Abstract No. 22649, Journal Franklin Inst., Oct., 1931.)

Water Gauging for Low Head Units. (J. M. Mousson, Trans. A.S.M.E., Vol. 57, No. 6, August, 1935, pp. 303-316.) (6.20/30711 U.S.A.)

Water meters which give satisfactory readings in long channels with reasonably steady mean flow give erratic results in short channels with oblique and pulsating flow.

Two meters, differently affected by irregularity of flow, may be used in combination to eliminate errors of this type.

Twelve references.

Flow of Water Measurement. (W. M. White and W. J. Rheingans, Trans. A.S.M.E., Vol. 57, No. 6, August, 1935, pp. 273-280.) (6.20/30712 U.S.A.)

A battery of pitot tubes is connected with manometers mounted on a board.

A photograph of the manometer board records the distribution of velocity indicated by the pitot tubes.

Irregularities in time and space distribution are eliminated.

Photographs and curves are reproduced.

Three references.

The Rotating Sphere Viscometer. (A. Guillet, Comptes Rendus., Vol. 200, No. 18, 29/4/35, pp. 1522-1524.) (6.225/30713 France.)

Discrepancies obtained with this instrument show that the Theory of Stokes is incomplete. (See also Comptes Rendus, p. 442, of 1935.)

The Logarithmic Diagram. (*Application to Phenomena in Engine Cylinders, Discussion.*) (A. T. Gregory, S.A.E., Jnl., Vol. 36, No. 5, May, 1935, pp. 191-199.) (6.252/30714 U.S.A.)

Four indicator diagrams are reproduced as a logarithmic scale which transforms parabolas of any order into straight lines. An elementary exposition of the thermodynamical relations is given from the diagrams.

In the discussion two possible sources of error in application of the method were given with numerical examples.

Four references.

Effect of Humidity on Hot Wire Measurements. (N. Paeschke, Phys. Zeit., Vol. 36, No. 16, 15/8/35, pp. 564-565.) (6.40/30715 Germany.)

Details of the hot wire apparatus are given and results of measurements at 82 and 32 per cent. humidity are tabulated graphically.

A systematic difference of the order of 10 per cent. is shown.

Two references.

Pitot Tube Practice. (E. S. Cule, Trans. A.S.M.E., Vol. 57, No. 6, August, 1935, pp. 281-294.) (6.40/30716 U.S.A.)

An account is given of the development of the pitot and venturi tubes and manometers. Calibrations are given for velocity angle and length of projecting tubes.

A special form of pitot head for a wide range of incidence is shown in dimensional sketches.

The pressure head characteristic is nearly constant for axial flow over a wide range of velocities. For a range of incidence, $\pm 5^\circ$, an approximation to the cosine curve is obtained.

Training and experience are necessary in taking measurements.

Fourteen references.

Exhaust Operated Venturi. (Flight, Vol. 28, No. 1397, 3/10/35, p. 367.) (6.52/30717 Great Britain.)

A sketch shows the venturi tube placed in an engine exhaust pipe. The pressure difference was used to drive a gyroscope controlling a turn indicator. The venturi tube was of heat resisting material and after a test no accumulation of soot was observed.

Instrument for Measuring Total Pressure, with Small Sensitivity to Obliqueness in the Stream. (G. Kiel, L.F.F., Vol. 12, No. 2, 16/5/35, pp. 75-79. D.V.L. Report 35/03.) (6.40/30718 Germany.)

The instrument is of the venturi type, the pressure head being placed axially. Sections of various tubes are shown with their points of greatest internal constriction at different axial positions.

Characteristic curves of variation of indicated pressure with inclination of the axis to the stream are shown graphically.

The final arrangement selected maintains the indication up to an inclination of 40° and shows drops of $\frac{1}{2}$ per cent. at 50° , 7 per cent. at 55° , and 40 per cent. at 60° .

Photographs and sketches show the observed streamline, the dimensions of the instrument, and methods of mounting on a wing and trailing behind an aeroplane. (Translated in N.A.C.A. Tech. Memo. No. 775.)

Three references.

Instrument Panel Layout. (Aero Digest, Vol. 27, No. 2, August, 1935, pp. 40-42.) (6.90/30719 U.S.A.)

Descriptions are given of seven instrument boards and illustrated by ten photographs.

Aircraft Flight

Contribution to Theory of Slotted Wings. (F. Weinig, L.F.F., Vol. 12, No. 5, 31/8/35, pp. 149-154. D.V.L. Report No. 35/10.) (7.72/30720 Germany.)

Below stalling incidence of the unslotted profile, the slotted profile at equal incidence shows a decrease in the lift coefficient. In this range the flow is substantially potential flow, and the reduction of the lift can be accounted for by hydrodynamical theory.

The usual Joukowski transformation is applied to the unslotted wing, the slots are then taken into account. The potential difference at the two ends of the slot as calculated for the unslotted wing sets up a flow which is estimated by drawing a network of streamlines and iso-potentials.

Each partial flow reduces the circulation round the part of the wing downstream from the slot.

Examples are worked out for the unslotted wing and for 15 combinations of slots, and numerical values are given in tables and graphically, showing comparative lift characteristics.

(Full translation in hand.)

Wing Brake Flaps. (W. Pleines, Aircraft Eng., Vol. 7, No. 79, Sept., 1935, pp. 213-219.) (7.72/30721 Great Britain.)

An abridged translation of article in Luftwissen, Nos. 3 and 5, 1935, pp. 58 and 63 and 121-131.

Seaplane Take-off Characteristics. (A. O. Mattocks, Flight, Vol. 28, No. 1396, 26/9/35. Suppt., The Aircraft Engineer, pp. 2021.) (7.3/30722 Great Britain.)

Experimental curves of thrust and resistance are integrated graphically and applied to a numerical example.

Mechanics of Longitudinal Oscillations of Aircraft. (A. Proell, Z.A.M.M., Vol. 15, No. 4, July, 1935, pp. 233-237.) (7.2/30723 Germany.)

Lanchester's simplified theory of long pitching motion is extended. The comparative results are shown graphically.

Six references.

Investigation of the Accelerated Longitudinal Motion of an Aeroplane. (R. Schwarn, L.F.F., Vol. 12, No. 2, 16/5/35, pp. 62-69.) (7.2/30724 Germany.)

Treatment is confined to motion in the plane of symmetry.

The equations of motion are formed as for discussion of stability, empirical functions are substituted for coefficient of lift and moment and their derivations and the aeroplane velocity is eliminated. This leaves two equations which connect incidence with time.

The variables are shown graphically as discrete experimental values with continuous curves representing the empirical expressions employed.

The motions of a Curtis JN₄H in a loop are calculated and compared graphically with a loop calculated by Banister and an American report. The author states that the comparison is satisfactory.

Eighteen references.

Engines, Thermodynamics

The Experimental Determination and Theoretical Calculation of Flame Temperature and Explosion Pressures. (W. T. David, Phil. Mag., Vol. 20, No. 131, July, 1935, pp. 65-68.) (8.13/30725 Great Britain.)

The sodium line reversal method of determining flame temperature is held to be in error, since it gives results which are neither in agreement with theory nor do they agree with other experimented methods.

Discussion on C. C. Minters' Paper on Flame and Pressure Development in Gasoline Engines. (A. Taub and others, S.A.E. Jnl., Vol. 36, No. 4, April, 1935, pp. 159-164.) (8.13/30726 U.S.A.)

On the assumption that the flame spreads from the plug in the form of a sphere, a relation is deduced between the rate of increase of flame volume and the rate of increase of flame travel. The necessary data for this are obtained from a plaster cast of the combustion chamber under consideration. A standard of reference is obtained by analysis of a combustion chamber known to be "smooth."

Extension of Nuclear Inflammation Theory to Injection Engines. (M. Serrings, Comptes Rendus., Vol. 200, No. 16, 15/4/35, pp. 1376-1378.) (8.13/30727 France.)

In the injection engine, the combustion may be initiated by detonation and there may be several subsequent detonations before combustion is complete. The process thus differs radically from that of the carburettor engine where detonation, if it occurs at all, is confined to the end of the combustion period. (See Comptes Rendus, Vol. 198, pp. 1385 and 1574.)

Black smoke in the exhaust is evidence of thermal decomposition of the fuel (insufficiently diluted with air) by the action of the detonating wave.

One reference.

Flame Temperatures Vary with Knock and Combustion Chamber Position. (G. M. Rassweiler and L. Withrow, S.A.E. Jnl., Vol. 36, No. 4, April, 1935, pp. 125-136 and 146.) (8.13/30728 U.S.A.)

The author used the sodium line reversal method for measuring the "average" gas temperature in an engine, for various parts of the stroke. By fitting three pairs of windows, the temperature of different zones in the cylinder can be compared. One of these zones contained the sparking plug, whilst the other two passed through the centre of the combustion space and near the end

wall, respectively. The optical path is normal to the general direction of flame travel in every case.

For the occurrence of "self reversal," it is concluded that the gas temperature in any one zone at a given instant may be far from uniform. Assuming, however, that the recorded temperatures represent a mean value, the experiments indicate considerable temperature difference between the various zones at the same crank angle. The temperature in the zone containing the spark plug may exceed that near the cylinder wall by over 300°C., the difference being specially marked when knocking takes place. During expansion, the "knocking" explosion is considerably cooler for all three zones, the difference being most marked for the central zone (drop of 160°C. at 80° A.T.D.C.).

The gas temperature curves under knocking and normal conditions cross generally at between 20° and 40° A.T.D.C.

In the comments following the paper, the validity of the method of estimating temperature by line reversal as well as the theory of excitation lag are discussed.

A bibliography of 50 references is attached.

Engines—Design and Performance

Anti-Torque Aircscrew Drive. (Sci. Amer., Vol. 153, No. 3, September, 1935, p. 146.) (8.20/30729 U.S.A.)

A photograph shows a rotary engine, turning in one direction and carrying a two-bladed aircscrew mounted on the housing. A second two-bladed aircscrew is driven by the crankshaft in the opposite direction.

(A return to the Siemens engine of 1917.)

No technical details are given.

The Wolseley "Scorpio." (Flight, Vol. 28, No. 1386, 18/7/35, pp. Supplement b-d.) (8.20/30730 Great Britain.)

A descriptive account is illustrated with photographs, sketches and a sectional drawing.

Report on Experiments Carried Out in the High Altitude Test Plant of Messrs. Isotta Fraschini on Engine "Asso 750" with the Object of Determining a New Formula for Reducing Power Output to Standard Air Conditions. (Communicated by the Italian Air Ministry, L'Aerotecnica, Vol. 15, No. 5, May, 1935, pp. 456-482.) (8.23/30731 Italy.)

The experiments were carried out at a series of absolute intake pressures ranging from 350 m/m. to 760 m/m. absolute. At each pressure the intake temperature was varied between -20°C. and -15°C. The effect of engine speed was also investigated over the range 1,500-1,900 r.p.m.

- r. If the exhaust pressure=intake pressure, the b.h.p. of the engine was related to the intake pressure and temperature according to the following equation:—

$$W_z/W_o = (p_z - 60) (617 - t_z) / (p_o - 60) (617 - t_o)$$

W_z = b.h.p. at absolute pressure p_z (m/m. of mercury).

t_z = temperature °C. at p_z .

W_o and t_o corresponding value under standard conditions (same r.p.m. as W_z).

(The above equation represents the mean relationship over the speed range.)

The formula differs appreciably from that given in N.A.C.A. No. 44, i.e.,

$$W_z/W_o = (p_z) (529 + t_o) / (p_o) (529 + t_z).$$

2. The effect of exhaust back pressure was investigated at a series of intake pressures. The results are given by the following equation:—

$$W_{zz}/W_{z0} = .802 (p_z - 94) / \{ [(p_z - p_0)/5.04] - 74 \}$$

where W_{zz} = b.h.p. at inlet pressure p_z and back pressure p_z .

W_{z0} = b.h.p. at inlet pressure p_z and back pressure p_0 .
 p_z and p_0 measured in m/m. of mercury.

3. The effect of the exhaust being at a less pressure than the inlet was next investigated. This corresponds to the case of supercharging at altitude by means of a gear driven blower. In these experiments the intake pressure was kept constant (749 m/m.). The gain in b.h.p. under these conditions was given by

$$\text{gain} = 0.210 \Delta p \text{ h.p.}$$

where Δp = depression on exhaust side in m/m. of Hg.

Similar experiments are in hand with Fiat plant using a different engine.

N.B.—New temperature factor is 2 per cent. less for $t_2 = 20^\circ\text{C}$. than those given by N.A.C.A. 44.

New pressure factor is 2 per cent. less for $p_2 = 400$ m/m. than those given by N.A.C.A. 44.

Winter Operation of Aero Engines. (A. Ferrier, S.A.E. Jnl., Vol. 36, No. 4, April, 1935, pp. 137-146.) (8.23/30732 U.S.A.)

Types of shelter for engine warming in use in Canada are described. Difficulties are reduced considerably by using an oil of low viscosity for lubrication. This seems to have no deleterious effect apart from an increased oil consumption. An oil with a Saybolt viscosity of 63 sec. (at 212°F .) will not require preheating for air temperature exceeding -20°F . Starting up then becomes mainly a question of fuel characteristics and these may entail heating of engine induction system.

Supercharger for Petrol Engines. (Engineering, Vol. 140, No. 3634, 6/9/35, pp. 247-248.) (8.235/30733 Great Britain.)

A photograph and two sectional sketches show the general arrangement of the (Roots type) blower. A photograph shows details of case and rotors.

Two characteristic curves of performance show pressure and volumetric ratio against rotor speed.

The blower may be reversed and used as a vacuum pump.

Diesel Engines in Canadian Commercial Vehicles. (L. Witteck, S.A.E. Jnl., Vol. 37, No. 3, Sept., 1935, pp. 13-20.) (8.25/30734 U.S.A.)

A descriptive account is given of various types of C.I. engines employed in Canada.

Weights and fuel consumptions are stated and photographs show engines and vehicles.

Some performance characteristics are given graphically.

Mercedes Benz 12-Cylinder 700 h.p. Injection Engine (Type O.F.2). (Flugsport, Vol. 27, No. 21, 16/10/35, pp. 475-478.) (8.25/30735 Germany.)

This 12-cylinder V engine employs two stages ignition and has the following leading characteristics:—

Bore,	165	m/m.			
Stroke,	210	m/m.			
Compression pressure	...	...	...	40	atmospheres.
Explosion pressure	...	...	...	60	"
Fuel injection pressure	...	...	...	95	"
M.E.P.	...	...	...	7.15	"

- (a) Cruising output 720 h.p. at 1,720 r.p.m.
- (b) Max. output (short period) ... 800 h.p. at 1,790 r.p.m.
- Consumption (a) 180 gm./b.h.p. hour ... Fuel.
- 9 gm./b.h.p. hour ... Oil (lubricating).
- (b) 185 gm./b.h.p. hour ... Fuel.
- 10 gm./b.h.p. hour ... Oil.

Weight of engine complete with reduction gear, air starter, air bottle, electric generator, battery and propeller hub, 1,033 kg.

Two-Stroke Ship's Diesel Engine, 5,500 h.p. (G. Eichelberg, Z.V.D.I., Vol. 79, No. 5, 2/2/35, pp. 130-132.) (8.252/30736 Germany.)

The fuel injection pipe line is made intentionally long so that sufficient lag is obtained to enable the use of an injection cam which is symmetrical with regard to T.D.C. The engine can therefore be reversed in four seconds without having to touch the injection timing. The scavenging air is supplied by a piston compressor fitted with copper piston rings.

High Speed C.I. Engine Performance. (E. A. Whitney, S.A.E. Jnl., Vol. 37, No. 3, Sept., 1935, pp. 328-341.) (8.26/30737 U.S.A.)

A photograph shows a single cylinder laboratory installation.

Three principal types of combustion chamber are described and illustrated by sketches indicating type of air flow.

Thirteen graphs show characteristic curves of explosion pressure, mean effective pressure and fuel consumption, as functions of clearances, valve passage diameter, quality of fuel, boost, scavenging, temperature of cooling medium, etc. The figures are also tabulated.

Supercharging Diesel Engines for Ship Propulsion. (W. Pflaum, W.R.H., Vol. 16, No. 12, 15/6/35, pp. 206-210.) (8.275/30738 Germany.)

Three methods of supercharging four-stroke Diesel engines are feasible:—

- (a) Gear driven rotary blower.
- (b) Exhaust driven centrifugal fan.
- (c) Utilisation of underside of power piston.

For large power units of the order of 4,000 h.p. run at low speeds (approx. 100 r.p.m.) method (c) is the simplest and has received considerable application of late. An increase of 60 per cent. in h.p. is possible for an increase of approximately 3 per cent. in the weight of the engine plant.

The exhaust driven supercharge is most easily applied to engines of large power output (over 1,000 h.p.), although a few smaller units are also illustrated.

The gear driven rotary blower practically covers the range below 2,000 h.p.

As regards fuel economy, it is difficult to get accurate data. Theoretically the exhaust driven job should be the most efficient since the waste heat is utilised. In practice, provided the mechanical blower is reasonably efficient, there appears to exist but little difference in the specific fuel consumption of engines supercharged according to the three methods described.

Six references.

Increased Performance of Four-Stroke Diesel Engines by Means of Scavenging and Supercharging. (A. Schütte, W.R.H., Vol. 16, Nos. 9 and 13, 1/5/35 and 1/7/35, p. 131 and pp. 221-224.) (8.275/30739 Germany.)

The weight of air in the cylinder at the beginning of compression is calculated on certain simplifying assumptions for various degrees of supercharge and scavenge. By taking into account the heat exchange of the air, the charge weight departs slightly from a linear relationship with degree of supercharge, the difference becoming specially marked at low degrees of supercharge.

According to the author, a supercharging pressure of 4,000 mm. of water produces an increase of indicated h.p. of approximately 45 per cent. together with a normal amount of scavenge.

When supercharging it is generally impossible to prevent some temperature rise of those portions of the engine mechanism which are exposed to the combustion. For small degrees of supercharge, this rise can be controlled by increase of scavenging and thus producing internal cooling. For higher degrees, however, this is not economic. Excessive outside cooling by means of a jacket is to be deprecated since it increases stress in the metal walls. The engine should be designed to run with as high a jacket temperature as possible and stresses are thus automatically reduced. By the exterior use of welded steel wall thicknesses and stresses can be further controlled. It is also advisable to place the cylinder head joint so low that it is overrun by the piston and thus protected from the peak temperatures.

In the case of marine engines using sea water cooling, it is generally impossible to have jacket temperatures exceeding 50°C., as otherwise the danger of deposits arises. In this connection oil cooling is receiving attention.

If all the above factors are borne in mind, it is now generally recognised that supercharging and scavenging provide an efficient means of increasing power output by about 50 per cent. over considerable periods of time without affecting weight and floor space of plant and the specific fuel consumption appreciably.

Five references.

Spark Ignition and Compression Ignition in Aircraft Engines. (K. A. Browne, S.A.E. Jnl., Vol. 37, No. 3, Sept., 1935, pp. 342-348.) (8.28/30740 U.S.A.)

The relative qualities of spark ignition and compression ignition engines are discussed in reference to aircraft requirements.

A specification for a C.I. engine is proposed.

A critical comment follows.

A New Axial Engine. (The Engineer, Vol. 159, No. 4141, 24/5/35, p. 545-547.) (8.292/30741 Great Britain.)

The nine-cylinder axial engine of 7-litre stroke volume is of the swash plate type, and uses spark ignition. In this design the swash plate is mounted on ball bearings on the oblique crank. Under the action of the piston thrust the plate undergoes an oscillation only, whilst the oblique crank rotates continuously. This necessitates ball and socket joints at both ends of the connecting rods (swash plate and piston).

The cylinders are arranged on one side of the swash plate and are provided with a common rotary valve gear.

The engine is intended for omnibus propulsion where its compact shape facilitates installation and increases seating capacity.

From the published performance it appears that a b.m.e.p. of the order of 100 lbs./sq. inch can be dealt with successfully at 2,000 r.p.m., using petrol.

Longer experience will be required to test the mechanical details fully, of which the rotary valve appears the most vulnerable.

Engines—Design and Strength of Components

Vibration Characteristics of Aircraft Engine Crankshafts. (Air Corps Tech. Report No. 3533. A.C.I.C., Vol. 7, No. 664, 23/2/32.) (8.36/30742 U.S.A.)

Torsiographs (using an instrument of the Geiger type developed by the Air Corps) were taken on a number of representative American engines (water-cooled in-line and air-cooled radials).

The engines were operated under a variety of conditions (r.p.m., gearing, coupling, spark setting, fuel). The torsional frequencies were also calculated using the formulæ developed by Timoshenko for constrained and unconstrained shafts. Excellent agreement was obtained with experimental results if the shafts were considered constrained in the case of the in-line engines and unconstrained for the radials. The very much simpler formula proposed by Carter gives slightly lower answers (maximum difference 10 per cent.).

The following general conclusions may be drawn from the report:—

- (1) Detonation does not affect amplitude of torsional vibrations.
- (2) Pre-ignition does.
- (3) Faulty distribution is very detrimental.
- (4) Reduction gearing introduces considerable flexibility with a corresponding reduction in resonance periods.
- (5) Flexible coupling without sufficient internal damping is detrimental.
- (6) Crankshafts of radial engines can generally be designed stiff enough to be free from torsional troubles.

The Bearing Problem in Aero Engine Construction from the Point of View of Materials. (H. Mann and H. Heyer, L.F.F., Vol. 12, No. 5, pp. 168-175.) (8.37/30743 Germany.)

Bearings have to be replaced because they wear or crack. Neither factor is amenable to mathematical treatment. Thus the well known PV factor only gives a measure of the heat generated in dry friction (brake) and the more recent V/P factor only registers minimum friction without indicating the safety factor. On the other hand it is difficult to reproduce working conditions in a testing machine. Recent improvement has been in the direction of materials and design. Bearing materials can be divided into three classes:—Soft, semi-soft and hard. The soft bearing materials (Tn and Pb) are satisfactory, provided no great shock loads have to be dealt with. The bearing metal is cast on to a medium hard bronze shell and recent work has shown that it is an advantage to keep the soft casting as thin as possible (0.3 mm.). Medium hard bearing metals are of the soft bronze type (Pb/Cu) or have a cadmium base. These are cast on steel shells and the bearing metal usually exceeds 1.5 mm. in thickness. Such bearings withstand shock, but require glass hard shafts, which adds considerably to the expense. Hard bearing metals may consist either of hard bronzes (tin base), light alloys or cast iron. Their use is generally restricted to special cases (pistons, valve guides, connecting rod bearings, auxiliary drives).

Thirty-one references.

Engines—Cooling

Directional Distribution of Heat Radiated from Surfaces. (E. Schmidt and E. Eckert, Forschung, Vol. 6, No. 4, July/Aug., 1935, pp. 175-183.) (8.40/30744 Germany.)

Measurements are carried out on metals and non-metals, and the numerical results are shown graphically.

With non-metals the radiation is concentrated near the normal direction. In metals with smooth surfaces, the radiation increases with departure from the normal direction to four times the value along the normal, and falls off abruptly near tangential directions.

There is marked departure from Lambert's cosine relation for smooth surfaces, but for roughened surfaces the agreement is better. Measurements along the normal direction alone are misleading.

Ten references.

Heat Conductivity Distributed Function. (W. S. Kimball, *Phil. Mag.*, Vol. 20, No. 131, July, 1935, pp. 97-128.) (8.40/30745 Great Britain.)

The molecular theory of viscosity and heat conduction is discussed in terms of Newtonian mechanics and a solution is obtained of Boltzmann's equation which meets the requirements of the kinetic theory and satisfies the conditions of conservation of energy, equality of action and reaction, equilibrium of torques, equipartition of energies and persistence of velocities.

The ratio of heat conductivity to viscosity is smaller than the value given by Chapman and Enskog, and an experimental error arising from leakage in heat conductivity measurements is suggested as the cause of the discrepancy.

Five references.

Dimensions of Radiators. (W. Worth, *Aviation*, Vol. 34, No. 8, August, 1935, pp. 19-21.) (8.44/30746 U.S.A.)

Experiments at Wright Field on airflow controlled by cowling led to the design of radiators with increased surface and reduced resistance.

Diagrammatic sketches show the relative areas of cowled and uncowed radiators.

Numerical values are given and characteristic curves show the reduction in power dissipated.

Heat Transmission during Evaporation of Fluids at Vertical and Horizontal Surfaces. (M. Jakob and W. Linke, *Phys. Zeit.*, Vol. 36, No. 8, 15/4/35, pp. 267-280.) (8.464/30747 Germany.)

The surface is electrically heated and immersed in a liquid bath, the container being surrounded by a second bath of the same liquid which is heated independently; cooling losses are thus reduced to a very small amount. The surface temperature distribution of the heater and that of the liquid are recorded by a series of thermo couples. It is thus possible to calculate the heat transfer coefficient α over a range of thermal loadings ($K \text{ cal/M}^2\text{H}$ transferred from heater to liquid). For ordinary convection α is of the order of $500 K \text{ cal/M}^2\text{H } ^\circ\text{C}$. for water and 150 for CCl_4 .

Engines—Lubricants

Experiments on the Spreading of Castor Oil and its Constituents on the Surface of Water. (C. Bouchet and P. Lamarche, *Pubs. Sci. et Tech.* No. 51, 1934.) (8.54/30748 France.)

The Oxidation of Mineral Oils at Moderate Temperatures. (M. G. Muller, *Comptes Rendus.*, No. 21, May, 1935, p. 1769.) (8.54/30749 France.)

The oxygen absorption was measured at 100°C ., for periods extending to 500 hours.

The amount absorbed varies considerably for different oils and is most marked for super-refined (so-called white) oils. It may amount to 8 litres per 100 c.c. of oil after 300 hours. The absorption of oxygen is accompanied by a liberation of volatile products, viz., water, CO_2 , CO, acids, etc. The author has established a satisfactory balance between weight of these products and oxygen absorbed. Only a small percentage of the oxygen enters into the formation of sludge.

Friction and Structure of Mono and Bi-Molecular Layers of Fatty Substances on Metallic Surfaces. (J. Trillat and H. Motz, *Comptes Rendus.*, Vol. 200, No. 15, 8/4/35, pp. 1299-1301.) (8.54/30750 France.)

The fatty substances are dissolved in ether and the solution deposited on a gold film. On evaporation of the solvent extremely thin layers of the solute are exposed to electron diffraction. In addition to the well known gold pattern, the

photographs show regular patterns which indicate that the molecules of the film are attached perpendicularly to the surface. Moreover, the similarity of the pattern structure for the various fatty substances, such as paraffin wax and beeswax, shows that the pattern is principally due to the arrangement of the carbon atoms in the chain and not due to the end radicles. (Diffraction patterns by X-rays, on the other hand, are affected by these radicles.)

It was noted that such films will form spontaneously on metal surfaces exposed to the atmosphere quite apart from the presence of any lubricant. The source of such contamination is not clear.

The Lubrication Requirements of Automotive Worm Gearing. (C. H. Schlesman, S.A.E. Jnl., Vol. 36, No. 4, April, 1935, pp. 147-158.) (8.54/30751 U.S.A.)

No single lubricant possesses all the characteristics desired in worm gear lubrication.

Extreme pressure lubricants are unsatisfactory for this class of work. Under certain conditions such lubricant will oxidise with great rapidity and become solid after a few hundred hours' service.

Engines, Fuels

The Use of Cracked Spirits in the Internal Combustion Engine. (B. Vellinger and G. Radulesco, Comptes Rendus., Vol. 200, No. 22, 27/5/35, pp. 1858-1860.) (8.602/30752 France.)

Cracked spirits are apt to form gum. If the tendency is reduced by refining, the anti-knock value of the fuel suffers. The authors recommend carrying out the cracking process in such a way that a fuel of suitable volatility is obtained without any subsequent refining. The gum formation is kept within suitable limits by the addition of inhibitors such as triphenol and/or products from the destructive distillation of wood.

Engine experiments have justified the authors' conclusions.

Removal of Smoke and Acid Constituents from Flue Gases. (J. L. Pearson, G. Nonhebel and P. H. N. Ulander, J. Inst. Elec. Eng., Vol. 77, No. 463, July, 1935, pp. 1-48.) (8.64/30753 Great Britain.)

Comprehensive data are collected on quantity and distribution in the atmosphere of impurities. The capital and operative costs of cleaning plant are estimated and are held to be small in relation to the abatement of atmospheric pollution.

Eight references.

Carbon Monoxide Danger in Motor Cars. (F. M. Van Deventer, S.A.E. Jnl., Vol. 37, No. 3, Sept., 1935, pp. 322-327.) (8.64/30754 U.S.A.)

Six photographs show examples of exhaust pipe failure leading to poisoning by carbon monoxide.

Recommendations are made for periodical inspection.

Volatility of Gasoline. (J. O. Eisinger and D. P. Barnard, S.A.E. Jnl., Vol. 37, No. 2, August, 1935, pp. 293-300.) (8.64/30755 U.S.A.)

The effect of the temperature volatility characteristics of fuels are discussed, and the advantage of varying these factors with the season of the year is discussed.

Comparison of Various C.F.R. Engines. (A. V. Philippovtch and F. Seeber, Luftfahrt-Forschung, Vol. 12, No. 5, 31/8/35, pp. 161-167.) (8.645/30756 Germany.)

Seven fuels (Nos. 2-8 in table) were tested in eight different engines. The same sub-standard (No. 1 in table) was supplied to all the stations and the octane

number of mixtures of this with benzole were obtained by direct comparison with octane/heptane. The benzol value of fuels 2-8 was next obtained and converted into octane number by using the calibration curve. The results are given in the accompanying table.

The scattering was found to be mainly due to the difference in the calibration curves—*i.e.*, the direct octane number determination of sub-standard mixtures is more difficult than the matching of the fuels against the sub-standard benzol mixture. For this reason the D.V.L. recommend the use of their calibration curve by *all* the stations. This reduces the mean deviation to 0.58 octane number for all the fuels and all the stations, with a maximum deviation of ± 2 octane number. This is slightly worse than the published results of the American comparison carried out in 1933 by 19 laboratories. The American results were, however, "selected" before publication whilst the German table gives results of all the stations.

D.V.L. recommend the following:—

- (1) The iso-octane and n. heptane should be washed with H_2SO_4 and re-distilled before use.
- (2) Great care has to be taken to get the benzol according to specification. If possible all the laboratories should be supplied from one common batch.
- (3) The same calibration curve should be used by all laboratories for converting benzol values into octane numbers. Direct octane/heptane determination should only be carried out by the station to keep a check on engine constancy.
- (4) The same sub-standard should be used by all laboratories. This should link up with the American sub-standard A_3 and C_7 .
- (5) The heater should be adjusted so that the sub-standard (benzol) mixture is at $300^\circ F.$, the fuel under test to take up its own temperature.

No.	Name.	% Aromatic unsat.	(Mg.) gum.	Octane No.	Scattering* in O.N.
1	Standard	11%	0.7	52	± 2.5
2	Grosny	9%	0.6	54	± 3.0
3	2 + 15% alcohol	—	0.8	68	± 1.5
4	2 + 30% benzol	—	2.2	71	± 2.2
5	Coal tar petrol	—	26	72	± 2.4
6	B.P. aero spirit	11%	0.6	72	± 1.8
7	Aral	44%	4.7	79	± 2
8	6-6 c.c./gall. Pb.	11%	0.6	86	± 2.5
9	Benzol	—	3.8	—	—

* Each station using its own calibration curve.

Petrol Systems in Aeroplanes of the Acrobatic Class. (L'Aerophile, No. 5, May, 1935, pp. 143-145.) (8.68/30757 France.)

The Stromberg and Zenith carburettors (specially designed for acrobatic flight) are described in detail. The former has a special float chamber fitted with two floats which compensate for change in level. The chamber is vented through an automatic ball valve which prevents loss of fuel when inverted. The fuel delivery holes are placed in such a manner that they are never uncovered and prolonged inverted flight (at full throttle only) is possible if a petrol pump is fitted.

The Zenith carburettor has no float chamber, but is fitted with an inlet valve under diaphragm control. This supplies petrol from the pump to the jets at a constant pressure of 10 gm./cm.², the size of the delivery jet being controlled by the throttle position. A hand controlled fine adjustment acts as altitude control.

A second valve, also diaphragm controlled, shuts off the fuel in case of a back fire. With this carburettor all types of acrobatic flight are possible at all throttle openings.

Engines—Injection Systems and Pumps

Automatic Power and Mixture Control for Aircraft Engines. (J. E. Beardsley, S.A.E. Jnl., Vol. 37, No. 2, August, 1935, pp. 301-306.) (8.701/30758 U.S.A.)

Details are given of a device for throttling the carburettor intake so as to maintain the density of air entering the choke at the equivalent of 7,000 feet. Characteristic pressure curves are given for the ordinary carburettor and for a controlled pressure carburettor, with the corresponding power/height characteristics.

Photographs and sketches illustrate the details and general assembly of the control device.

Development of Aircraft Fuel Pumps. (E. S. Evens, Aero Digest, Vol. 27, No. 2, August, 1935.) (8.74/30759 U.S.A.)

Pumps of different types are briefly described. A characteristic air compressor of variable pressure and central delivery pressure pump are shown graphically.

Armament

Pressure Developed by Explosives. (P. Bernard, Comptes Rendus., Vol. 200, No. 21, 20/5/35, pp. 1728-1730.) (9.01/30760 France.)

The crusher manometer has been calibrated by a piezo-electric indicator for a series of rapid explosions. The maximum difference was of the order of 17 per cent., the crusher reading low.

Four references.

Comparison between Calculated and Experimental Explosion Pressures of Certain Explosives. (H. Muraour and G. Annis, Comptes Rendus., Vol. 200, No. 23, 3/6/35, pp. 1929-1931.) (9.01/30761 France.)

The explosive consisted of a mixture of trinitrotoluene and ammonium nitrate and was fired by nitrocellulose and nitroglycerine. Maximum pressures were measured by means of a crusher manometer, calibrated piezo-electrically. Using thermodynamic data published by Nernst and Wohl the calculated pressure was in excellent agreement with experimental results (max. difference 3 per cent.).

Sudden Expansion of a Gas. (P. Noaillon, Comptes Rendus., Vol. 201, No. 4, 22/7/35, pp. 258-260.) (9.01/30762 France.)

The propagation of a sudden compression in a gas (shock wave) is well understood, thanks to the labours of Riemann, Hugoniot and others. The phenomenon, being always accompanied by an increase of entropy, is irreversible and thus the propagation of a sudden expansion requires a separate investigation. Reference is made to a two-dimensional solution of the problem by Neyer, reproduced in Geiger and Scheel's Handbook of Physics. The three-dimensional problem presents great difficulties, even if restricted to ideal gases. The author concludes that if the expansion is sufficiently rapid, the gas will occupy only a part of the space offered to it and there is a definite boundary beyond which the bombardment of the molecule does not proceed.

Four references.

Increased Revolver Power. (P. B. Sharpe, Army Ordnance, Vol. 16, No. 91, July/Aug., 1935, pp. 29-31.) (9.11/30763 U.S.A.)

A descriptive technical account is given of the development of the new Smith and Wesson revolver with gas pressures exceeding 20,000lbs. per sq. inch and muzzle velocities exceeding 1,500 feet per second. Test pressures of nearly 50,000lbs. per sq. inch were well stood by the barrel.

Bombardment of Railway Station and Lines. (Chief Naval Engineer Rougerson, Rev. de l'Armee de l'Air, No. 72, July, 1935, pp. 726-736.) (9.3/30764 France.)

A discussion is given of the relative damage inflicted by bombing attacks on stations, rolling stock and electric points in lines. A break in the line where there is no alternative route is much more effective than damage to a large network of a siding where traffic can be switched over to undamaged lines. Hence partial destruction of a great junction may yield negligible results in the holding up of traffic. The destruction of canal locks and especially of canal lines might interrupt traffic for months. Automobile routes are an invaluable complement to the railway systems and are being developed by Germany on the German-French frontier.

Air Power. The Mobile Attack Element. (A. Caldwell, Aero Digest, Vol. 26, No. 5, May, 1935, pp. 11-12.) (9.8/30765 U.S.A.)

Strategical relations of Navy, Army and Air Force in modern war are briefly stated.

Production Design of Ordnance. (J. D. Pedersen, Army Ordnance, Vol. 15, No. 90, May/June, 1935, pp. 347-351.) (9.80/30766 U.S.A.)

In view of the sudden manner in which war usually breaks out, production in peace should be laid out with a view to rapid expansion.

The paper discusses the selection of feasible limits in machine shop practice, the provision of fixtures and gauges, and the preparation and figuring of drawings. A list of proposed tolerances in shell manufacture is essential. Difficulties met with during the last war are described to illustrate the loss of time and material involved in faulty initial layout of the work.

Mechanised Forces. (J. K. Christmas, Capt., U.S.A., Army Ordnance, Vol. 15, No. 90, May/June, 1935, pp. 327-331, and No. 91, July/Aug., 1935.) (9.80/30767 U.S.A.)

A tabular comparison is given, of men, horses, vehicles, tons of supplies, road space, train space, ship tonnage, casualties and replacements on the one hand and mobility and fire power on the other hand.

The paper expands the tabulated material and quotes British, French and German views.

An analysis is given of the problem of supplying a mechanised cavalry brigade. The estimated daily requirements in action are, in round numbers:—Rations, 30 tons; fuel and oil, 190 tons; small arms ammunition, 300 tons; artillery ammunition, 120 tons.

Four photographs of armoured cars are reproduced.

Problems of the Pacific—Causes of War. (W. Prak, U.S. Naval Inst. Proc., Vol. 61, No. 389, July, 1935, pp. 917-927.) (9.80/30768 U.S.A.)

The writer takes a pessimistic view of the situation raised by the pressure of Japanese population.

The naval situation is discussed with reference to Japanese, U.S.A. and British bases for ships and aircraft.

The War Fleet as a Whole. (W.R.H., Vol. 16, No. 12, 15/6/35, pp. 199-203.) (9.80/30769 Germany.)

The relative advantages of speed, armament and protection are discussed in general terms.

The author favours six 13.5in. guns in double or triple turrets in ships of moderate displacement (12,000 tons) and speed (18 knots).

Biplane Tactics Against Fighters. (D. Mackiewicz, Rev. de l'Armee de l'Air, No. 72, July, 1935, pp. 737-762.) (9.80/30770 France.)

Diagrams illustrate tactics, in single and group combats, adapted to field of fire, and in sports, manœuvrability and formation.

Materials, Characteristics, Defects and Treatment

The Components of Steel. (Symposium by K. R. Van Horn and others, Metal Progress, Vol. 28, No. 2, Aug., 1935, pp. 22-27.) (10.10/30771 U.S.A.)

A concise summary is given of the transformation of carbon steels with successive formation of austenite, martensite and pearlite. The account is illustrated by diagrams of molecular lattices, micro-photographs and a phase diagram.

Nomenclature is discussed. A table gives approximate critical temperature of about one hundred carbon and alloy steels.

German Progress in Automobile Castings. (W. A. Geissler, Engineering, Vol. 140, No. 3633, 30/8/35, pp. 234-236.) (10.10/30772 Great Britain.)

The paper, read at the Institute of British Foundrymen, and reproduced in abridged form, gives much German experience in the selection of castings and in melting and casting of piston rings and liners.

Methods of testing are also discussed.

Pitting Due to Rolling Contact. (S. Way, Trans. A.S.M.E., Vol. 2, No. 2, June, 1935, pp. A.49-A.58.) (10.104/30773 U.S.A.)

Pitting is due to the lubricant working its way into small surface cracks and opening them up under hydraulic pressure. Rollers running completely dry do not pit, but oxidise. A high viscosity renders oil penetration difficult and reduces pitting.

Ten references.

Stresses in Overstrained Materials, Report of B.A. Committee. (Engineering, Vol. 140, No. 3635, 13/9/35, pp. 291-2.) (10.104/30774 Great Britain.)

A summary of this report is given and a list of relevant papers published by members of the committee.

Five references.

Electro Magnetic Tests for Work Hardening Steel Wires. (T. F. Wall, The Engineer, Vol. 160, No. 4157, 13/9/35, pp. 261-263.) (10.105/30775 Great Britain.)

Work hardening alters the ordinary magnetic induction characteristics of steel wires slightly and gives no criterion of overloading. Magnetisation characteristics under mechanical load, on the other hand, are modified substantially, linear characteristics become curves, and an easily observed criterion of overload is given. Numerical values are given in tables and curves.

Oscillograms of surges in earthing cables show peaks of load such as produce hardening.

Nine references.

Specifications of Magnetic Qualities. (L. G. A. Sims, Report of B.A. Paper, Engineering, Vol. 140, No. 3635, 13/9/35, pp. 290-291.) (10.105/30776 Great Britain.)

The application of sinusoidal magnetising e.m.f. to an iron circuit produces the well known distorted magnetising current characteristic with sharp peaks at maximum induction.

Instruments which average their values over a cycle give the same time and amplitude means as the ballistic method, but if a D.C. magnetising current is superposed, the mean values no longer agree.

It is considered that special methods should be used for specifying magnetic qualities for operation under the latter condition.

Three references.

Surface Cracking. (H. H. Ashdown, Metal Progress, Vol. 27, No. 5, May, 1935, pp. 29-33.) (10.12/30777 U.S.A.)

Photographs show flawless material cut from a shaft with numerous surface cracks.

The author attributes the cracks to the formation of a surface film by flow of metal and its subsequent rupture by abrupt changes of magnitude and direction of surface load. This may take place in metal initially in irreproachable condition.

New Method of Testing Resistance to Fissuring of Industrial Metals. (P. Brenner, L.F.F., Vol. 12, No. 3, 17/6/35, pp. 107-115. Report 35/05 of the D.V.L.) (10.125/30778 Germany.)

Examples are shown in ten photographs and micro-photographs of fissures which appeared in working materials under influence of stress and corrosion.

A simple apparatus is shown in a sketch, and photographs for subjecting sample strips of metal to a determinate (initial) bending stress under exposure to corroding influences. Examples of corroded lantal, dural and hydronalium strips are shown in photograph, three with characteristic fracture.

Five micro-photographs show the grain of the metal.

A summary of results is given, from which rules as to selection of non-cracking materials and conditions may be drawn.

Four references.

Comparative Tests of Resistance to Corrosion of Eleven Light Alloys Under Natural and Laboratory Conditions. (E. K. O. Schmidt and E. Böschel, L.F.F., Vol. 12, No. 3, 17/6/35, pp. 116-120, D.V.L. 3 Report 35/06.) (10.125/30779 Germany.)

Eleven aluminium alloys in test sheets 1 mm. thick were exposed to natural corrosion by sea water and to artificial corrosion in the laboratory.

The chemical composition and mechanical properties are specified, and the change in the mechanical properties after prolonged exposure (1-24 months) under natural conditions, and briefer exposure (6-180 days) under accelerated laboratory conditions, are tabulated.

Photographs show the external appearance of the specimens after exposure.

The K.S. (sea water) specimens are remarkably free from general corrosion, but show local attack over small areas. With about half the specimens the rate of corrosion, measured by change in mechanical properties, was accelerated as much as 18 times in certain cases. With the remaining specimen no such effect is evident.

Electric Seam Welding Machines. (Engineer, Vol. 160, No. 4154, 23/8/35, pp. 190-192.) (10.14/30780 Great Britain.)

Types of seams are shown in sketches. Five photographs show the external appearance of the welding plant for different types of operation. Consumption of power, and rate of welding are given.

Oscillograph records show the alternating current characteristics during operation.

Development of Welding in Steel Construction. (K. Kloppel, W.R.H., Vol. 15, No. 9, 1/5/35, pp. 137-139.) (10.14/30781 Germany.)

Photographs show fractures in the girders of a swing bridge. Sketches illustrate the method of welding repair adopted.

Welding in German Shipbuilding Yards, No. V. (Six photographs. W.R.H., Vol. 16, No. 9, May, 1935, pp. 140-141.) (10.14/30782 Germany.)

Springing of Automobiles. (N. S. James, H. E. Churchill and F. E. Ullery, S.A.E. Jnl., Vol. 37, No. 3, Sept., 1935, pp. 313-321.) (10.164/30783 U.S.A.)

The methods of analysis of spring suspension problems, given by Professor J. J. Guest at the Institution of Automobile Engineers (1926), are described and applied.

Moments of inertia are determined experimentally with a horizontal compound pendulum, and numerical values are tabulated.

Load displacement curves for front and rear wheels, and for tyres, show typical hysteresis loops.

Continuous Flow Corrosion Tests of Steel Pipes. (H. S. Rawdon and L. J. Waldron, Engineering, Vol. 140, No. 3632, 23/8/35, pp. 208-209.) (10.262/30784 Great Britain.)

Sections of pipe are subjected to continuous circulation of water with known salt or acid content.

Test results (as measured by loss of weight) are shown graphically for different positions in the circulative system. The maximum rate was at the inlet and decreased progressively along the pipe.

Numerical Records of Artificial Drying of Timber. (F. Kollman, Forschung, Vol. 6, No. 4, July/Aug., 1935, pp. 169-174.) (10.400/30785 Germany.)

Expressions are formed for the rate of decrease of moisture under known conditions of temperature and humidity of the surrounding air.

Temperature and humidity characteristics are shown graphically as functions of time of intermittent drying. The methods of predeterminating are approximate. Twenty references.

Magneto-Optical Properties of Liquids. (M. Schérer, Pubs. Sci. et Tech., No. 50, 1934, pp. 1-91.) (10.403/30786 France.)

Saturated and unsaturated paraffins up to C₁₆, benzenes with one or more side chains, cyclohexanes, etc., were examined optically in a magnetic field, parallel, normal and oblique to a ray of polarised light. The results were correlated with molecular structure.

Accepted theories were confirmed as approximate rules, but the numerical discrepancies are numerous.

In many cases properties of components are approximately additive to give properties of mixtures.

Molecular structure has a fundamental influence on the phenomena.

Electrical Properties of Rubber Compounds. (A. H. Scott, Bur. of Stan. J. Res., Vol. 15, No. 1, July, 1935, pp. 13-24.) (10.408/30787 U.S.A.)

Measurements of capacitance, conductance, dielectric constant and power factor under pressures up to 700 bars (690 atmospheres) are shown in twelve graphical charts.

Twenty-two references.

Fire Resistant Doped Fabric for Aircraft. (G. M. Kline, Bur. Stan. J. Res., Vol. 14, No. 5, May, 1935, pp. 575-587.) (10.60/30788 U.S.A.)

The fabric is first treated with a 3:7 boric acid-borax mixture and subsequently doped with cellulose acetate. This procedure yields a covering which is less inflammable than the normal nitrate.

Bibliography of 75 references.

Testing Apparatus and Methods of Testing

High Speed Wind Channels. (L. Crocco, L'Aerotecnica, Vol. 15, No. 3, March, 1935, pp. 237-275, and No. 7-8, July/Aug., 1935, pp. 735-778.) (11.10/30789 Italy.)

The adiabatic equations of motion of a compressible fluid are formed and the physical relations between velocity, pressure, density and temperature are developed at length.

Applications are made to five types of wind channel, two with closed circuits and three with open circuits. The difference lies in the arrangement of the diffusors and effusers and in the supply of additional air at the exit of the test chamber.

Numerical values calculated from the mathematical theory of the first paper are compared with measurements drawn from a wide variety of sources. The efficiency of diffusors with continuous and impulsive compression, the mass of air, pressure and velocity, power absorbed and Reynolds number attained are shown in functional relation.

Extensive comparisons are made of figures of merit of different types of wind channel. The direct wind channel appears to have the advantage over induced wind channel.

The object of the paper is to establish design data for minimum power consumption for the channel.

(Translation available No. 261.)

Eight references.

Boundary Influence of Wind Channels of Circular Section. (I. Tami and M. Taima, Aer. Res. Inst., Tokyo. Report No. 121, Vol. 10, No. 3, June, 1935.) (11.16/30790 Japan.)

Two notes are given. The first note deals with completely closed channels and completely open jets of circular section. The second note deals with partly open channels with free segments.

In the first note reference is made to a method due to Burgers which takes account of the so-called attached lines of vorticity and of the curvature of the streamline. Application is made of Watson's method of reducing the resulting series to computable form. Results are given graphically for elliptic, rectangular, and intermediate distribution of vorticity along the span.

The boundary influence of open and closed channels is approximately equal, but of opposite sign, and the problem of determining a partly open channel of zero interference has been considered by various writers to whom references are given.

Elementary approximation place the angle of the segment between 130° and 140°.

Systematic experiments are shown graphically and indicate that a closed segment of 138° nearly brings the experimental values into agreement with the values for a completely closed channel corrected for interference.

Numerical tables of experimental values are given at the end of the paper.
Eighteen references.

Wind Channel Interference. (E. Pistolesi, *L'Aerotecnica*, Vol. 15, No. 7-8, Aug., 1935 (see Absts. 27093, 28837) pages 697-734.) (11.16/30791 Italy.)

A comprehensive summary is given of the problem in its various forms.

One of Rosenhead's results is slightly lacking in generality, but is easily generalised. This has been done by Janotika.

Seventeen references.

The Oxford Impact Machine. (R. V. Southwell, J. H. Lavery and H. Hallam, *Engineering*, Vol. 140, No. 3627, 19/7/35, p. 54.) (11.40/30792 Great Britain.)

The apparatus is designed to eliminate the transmission of impact energy to the ground. Both striker and anvil are suspended and the blow is delivered horizontally along a line through the centre of gravity of both. Four point support and application of load produces pure bending. Izod figures are correlated with "Oxford" figures defined as the energy of fracture in foot lbs. per sq. in. of fractured area. As far as present tests indicate, the relationship is linear. Sketches and photographs show general assembly and details of the apparatus.

Two references.

X-Ray Examination of Aircraft Materials. (P. Brenner, *Luftwissen*, Vol. 2, No. 4, April, 1935, pp. 85-91.) (11.47/30793 Germany.)

A comprehensive report on X-ray examination of structural parts of aeroplanes was published in the D.V.L. Yearbook, 1932.

In the present report some new results are given and lines of further development of existing apparatus are indicated.

Tubes up to 100 kilo-volts suffice for light alloys, timber and thin rods of steel. For thicker steel parts, voltages of 200 kilo-volts and upwards are required. In extreme cases gamma rays must be employed.

A simple installation for testing timber is shown in a sketch and five X-ray photographs are reproduced. Descriptions are given of installations for examining metal parts of different sizes and shapes. Twenty-three photographs and X-ray photographs are reproduced.

Eight references.

Aerostats

New Zeppelin, L.Z. 129. (*Sci. Am.*, Vol. 152, No. 6, June, 1925, pp. 314-315. *Flight*, Vol. 28, No. 1397, 3/10/35, pp. 352-354.) (12.10/30794 U.S.A.)

Descriptive details of this new airship are supplied by the builders. Length, 815ft.; max. diameter, 134ft.; gas capacity, 6,700,000 cu. ft.; h.p., 4,800; speed, 84 m.p.h. Photographs show the hull under construction and covered. The hull is divided into seventeen gas compartments and the hydrogen cells are surrounded by helium filled spaces. The sections are regular 36-sided polygons throughout and the finished hull shows very clean lines. The four Diesel engines are carried in external gondolas.

Effect of Protective Coatings on the Absorption of Moisture by Gelatin-Latex Gas-Cell Fabrics. (D. F. Houston, *Bur. Stan. J. Res.*, Vol. 15, No. 2, Aug., 1935, pp. 163-172.) (12.42/30795 U.S.A.)

Samples of fabric were submitted by the Goodyear Zeppelin Company.

Paraffin wax coating decreased the rate of absorption of moisture, and coating on both sides was much more effective than coating on one side only.

Aluminium varnish coatings were much heavier and not as effective.

Nine references.

Wireless

Nature of Cosmic Radiation. (T. H. Johnson, J. Frank. Inst., Vol. 220, No. 1, July, 1935, pp. 41-67.) (13.10/30796 U.S.A.)

An observer with suitable nerve responses would be conscious of about 25 cosmic ray shots through some part of the body each second.

These cosmic rays consist of He and H nuclei projected into space by the action of electric fields surrounding the stars. It is concluded that the total energy in the universe in this form exceeds that of starlight and any theories of the universe which fail to incorporate cosmic radiation are necessarily incomplete.

Thirteen references.

A Method of Exciting the Aerial System of a Rotating Radio Beacon. (H. A. Thomas, J. Inst. of Elect. Engineers, Vol. 77, No. 464, Aug., 1935, pp. 285-290.) (13.2/30797 Great Britain.)

Author's Abstract.—This paper describes a novel method of feeding the spaced aerial system of a radio beacon transmitter, which has arisen from the consideration of the possibilities of the application of the Adcock aerial principle to such a beacon. A brief discussion is given of the limitations of the ordinary rotating coil goniometer arrangement for such a beacon when the transmitter power is high.

The alternative method described utilises two power amplifiers to feed the two pairs of spaced aerials. These two amplifiers are supplied with radio-frequency voltages by means of a mechanical controller which automatically provides the required time/voltage variations. A description is given of this controller, together with its application to the problem of exciting the two amplifiers. It is shown that such a controller can fulfil the requirements of the excitation apparatus, and it is concluded that the system described would be suitable for incorporation in a full-size rotating radio beacon for marine navigational purposes.

Monitoring Standard Frequency Emissions. (E. G. Lapham, Proc. Inst. Rad. Eng., Vol. 23, No. 7, July, 1935, pp. 719-732.) (13.30/30798 U.S.A.)

A description gives the method and equipment in use at the National Bureau of Standards.

Graphical records are given showing comparison with N.P.L. primary standards, confirming a frequency variation control of the order of a few units in ten million.

Three references.

Propagation at a Wave-Length of Seventy-Three Centimetres. (B. Trevor and R. W. George, Proc. Inst. Rad. Eng., Vol. 23, No. 5, May, 1935, pp. 461-469.) (13.31/30799 U.S.A.)

Satisfactory communication has been maintained both on the ground and in aircraft over distances up to 100 miles, provided sender and receiver are in the line of sight. With the receiver below the line of sight the field strength diminished very rapidly (approximately as the inverse 9th power of the distance from the sender).

Reception is generally much better at night.

Radio Propagation Over Spherical Earth. (C. R. Burrows, Bell Tele. Pubs. No. B. 869, 1935.) (13.31/30800 U.S.A.)

Abraham's, Watson's and Eckersley's solutions are discussed.

Refraction by lower atmosphere and imperfect conduction of the earth are taken into account.

Measurements of propagation over sea water agree with calculation for a perfectly conducting earth for wave-lengths exceeding 100 metres.

Fifteen references.

Single Sideband Short Wave System for Trans-Atlantic Telephony. (F. A. Polkinghorn and N. F. Schlaack, Proc. Inst. Rad. Eng., Vol. 23, No. 7, July, 1935, pp. 701-718.) (13.31/30801 U.S.A.)

Observations were made on a wave-length of about 30 m. (10,000 k.c.) with an audio frequency range of 250 to 2,800 cycles per sec.

Signal to noise ratio and articulation tests form the basis of a figure of merit.

Figures of merit are plotted against full strength in decibels for double and single side bands and show a substantial superiority of the latter, over the whole range of tests.

Four references.

Ultra-Short Wave Transmission Phenomena. (C. R. Englund, A. B. Crawford and W. W. Mumford, Bell Tele. Pubs. No. B. 870, 1935.) (13.31/30802 U.S.A.)

The main characteristics of short wave transmission are calculated on the principles of geometrical optics up to the range of the ray tangent to the earth's surface. Beyond this range, signals of variable intensity are received and the variations can be correlated with the variations of water vapour content of the atmosphere, and consequent variation in diffraction and refraction.

Records of reception on wave-lengths of 1.58 metres and 4.6 metres during fourteen aeroplane flights are shown graphically in comparison with value calculated on the above hypothesis.

The elementary theory is given in a mathematical appendix.

Diurnal and Seasonal Variations in the Ionosphere, 1933, 1934. (I. P. Schafer and W. M. Goodall, Bell Tele. Pubs. B. 866, 1935.) (13.32/30803 U.S.A.)

Extensive data are exhibited graphically. Correlation is established between magnetic disturbances and decrease in ionisation.

Daily and annual periodicities are established, but phase difference of six hours in the daily period, and six months in the annual period, are shown in different regions.

Detection of Frequency Modulated Waves. (J. G. Chaffee, Bell Tele. Pubs. No. B. 863, 1935.) (13.32/30804 U.S.A.)

The mathematical theory is summarised and approximate series are given for the terms of the expansion in Bessel functions.

Experimental and calculated values are compared graphically and show fundamental agreement in the general run of the characteristics, with numerical divergencies due to the approximate value of the assumptions.

Super-Regeneration of Ultra-Short Wave Receiver (Wave-Length 5 m.). (H. Ataka, Proc. Inst. Rad. Eng., Vol. 23, No. 8, Aug., 1935, pp. 841-884.) (13.32/30805 U.S.A.)

From Author's Abstract.—In Part I is developed an analysis of a quenching action, when the quenching electromotive force is assumed to operate by varying sinusoidally the amount of effective resistance of the oscillatory circuit.

In Part II are described the experiments on the quenching action. The stable and the unstable regions of the oscillation under the influence of quenching action are determined.

In Part III are studied the effects of an incoming signal on the receiver. The suppression of the characteristic noise is concluded to be ascribed to a synchronisation of the oscillation in the receiver with that of the incoming signal wave.

In Part IV is considered the amplification by super-regeneration. For too low quenching frequencies, the sensitivity is as low as for too high quenching frequencies. There is an optimum quenching frequency which gives the best sensitivity. There are three important factors which determine the amplification, the quenching frequency, the quenching voltage, and the time of advance by which the oscillation is initiated early in the presence of the signal. A theory of amplification by super-regeneration is developed and the effects of the various factors are considered theoretically.

Eight references.

Detection of Frequency Modulated Waves. (J. G. Chaffee, Proc. Inst. Rad. Eng., Vol. 23, No. 5, May, 1935, pp. 517-540.) (13.32/30806 U.S.A.)

In ultra high frequency modulations a larger number of side bands is introduced and individual measurement of components becomes impracticable.

A general mathematical analysis is given in terms of Bessel functions.

Calculated and measured results are shown graphically for six characteristic relations, and show that the theory is a guide to the general run of observed phenomena, and gives numerical results which are in substantial agreement, with the exception of limited ranges, in which the simplifying assumptions fail.

Theory of Electron Gun. (I. G. Maloff and D. W. Epstein, Proc. Inst. Rad. Eng., Vol. 22, No. 12, Dec., 1934, pp. 1386-1411.) (13.5/30807 U.S.A.)

The principle of the electron gun is to generate, control and concentrate an electron beam on to a required spot. The theory of electron lenses with detailed analysis of the actions of the various parts of the gun is given.

Five references.

Influence of Impurities in Core-Metal on Thermionic Emission from Oxide Coated Nickel. (M. Benjamin, Phil. Mag., Vol. 20, No. 131, July, 1935, pp. 1-24.) (13.5/30808 Great Britain.)

Nickel of high purity was prepared and small quantities of magnesium, manganese, iron and ferro-titanium, etc., were added.

A vacuum tube was designed to contain two coated cathodes mounted symmetrically to ensure identical conditions. It was found necessary to interpose a sheet nickel screen to prevent deposit of sublimated matter from one cathode on the other.

Extensive data are given in nine diagrams showing emission as a function of time of run and of anode volts.

The phenomena are involved, but it is inferred that emission from barium oxide coated filament depends on the amount of metallic barium present at the surface of the active filament and that this can be purposely affected by the impurities present in the core and diffused into the coating.

Suitable choice of impurities increases the emission substantially.

Thirteen references.

Analysis of the Operation of Vacuum Tubes as Class C Amplifiers. (I. F. Monromtseff and H. N. Kozanowski, Proc. Inst. Rad. Eng., Vol. 23, No. 7, July, 1935, pp. 752-778.) (13.50/30809 U.S.A.)

Constant current charts are prepared on the basis of which output efficiency grid driving power and other factors can be predetermined for three tubes. Oscillograms confirm the computation.

Four references.

Anode Bend Detection. (M. J. O. Strutt, Proc. Inst. Rad. Eng., Vol. 23, No. 8, Aug., 1935, pp. 945-957.) (13.50/30810 U.S.A.)

From Author's Abstract.—The anode direct current versus grid bias voltage characteristic of tubes is developed in the form of a series where two or three terms suffice to represent the curves of some modern commercial tubes quite accurately. By comparison with measured values, detection slope and distortion effects may be accurately calculated from the static tube characteristics. Some general conclusions are obtained regarding the detection of various input waves. Measured and calculated values of detection gain are compared and found to check fairly well.

Three references.

Vacuum Tubes for Generating Frequencies above 100 Megacycles. (C. E. Fay and A. L. Samuel, Bell Tele. Pub. No. B. 855, 1935.) (13.50/30811 U.S.A.)

Photographs show a Barkhausen oscillator which maintains a fair output and efficiency up to 580 megacycles.

Fifteen references.

Electrical Characteristics of a Rectifying Film of Lead Sulphide. (W. Schade, Phys. Zeit., Vol. 36, No. 14, 15/7/35, pp. 499-508.) (13.50/30812 Germany.)

A diagram of connections shows the arrangement of the apparatus for separating the rectified and alternating components of the current, as a function of the applied alternating voltage. Cinematograph records of these components are reproduced, and numerical values of the rectified current are plotted graphically over a range in which the current reaches a maximum after which it decreases and reverses.

Eight references.

Amplifying Circuit for Photocells. (E. Einsporn, Phys. Zeit., Vol. 36, No. 10, 15/5/35, pp. 347-356.) (13.70/30813 Germany.)

Amplifying valves for photocells have to respond to small changes in grid voltage. To ensure constancy of electron emission this requires a low filament temperature. Valves possessing desirable characteristics under such conditions are described. They maintain their calibration over long periods.

The Chemistry of the Atomic Nucleus. (S. Flugge and A. Krebs, Phys. Zeit., Vol. 36, No. 13, 1/7/35, pp. 466-480.) (13.70/30814 Germany.)

A résumé of the latest work on protons and neutrons. An extensive bibliography (211 items) covers the period 1921 to date.

Electrical Measurements at Ultra High Frequencies. (R. King, Proc. Inst. Rad. Eng., Vol. 23, No. 8, Aug., 1935, pp. 885-934.) (13.80/30815 U.S.A.)

Author's Abstract.—*Part I.*—A modified form of the long line equations for use at ultra high frequencies is given. A complete solution is obtained for a pair

of parallel wires bridged at each end by a general impedance. The solution is in the form of expressions giving the voltage across and the current through one of these impedances. Conditions are given under which the current or voltage becomes a maximum, as well as formulas for these maximum amplitudes. Special cases are discussed and expressions are derived for use in the measurement of reactance and resistance.

Part II.—A convenient form of parallel wire system for ultra-high frequency measurements is briefly described and its constants are listed. The use of a tandem bridge is explained. The general problem of measuring current and voltage at ultra-high frequencies is considered. A method is mathematically derived for obtaining the calibration characteristics of current and voltage indicators; the method is applied experimentally to determine such characteristics for a thermal milliammeter and for the symmetrical screen grid voltmeter. The scale factor is discussed.

Part III.—The mathematical theory of Part I is applied to obtain two methods for measuring respectively high and low reactances. These are used to measure the reactances of various wires, coils, condensers, thermal milliammeters, vacuum thermo-couples, etc., and to study series and parallel resonance circuits at ultra-high frequencies.

Part IV.—The general problem of resistance at ultra-high frequencies is discussed. The mathematical theory of Part I is applied to the measurement of resistance. Methods are described for measuring the resistances of wires and coils, and of high resistance leaks. A method is suggested for measuring the permeability of wires. Experimental results are given.

Part V.—A method is described for determining the component frequencies present in an ultra-high frequency source, and for measuring their relative amplitudes.

Seventeen references.

Errors Due to "Leads" in Radio Frequency Measurements. (R. M. Davies, *Phil. Mag.*, Vol. 20, No. 131, July, 1935, pp. 75-97.) (13.80/30816 Great Britain.)

Equivalent circuits are specified for a number of circuits occurring in practice, and the current voltage relations are discussed formally.

Numerical examples are worked out and indicate the importance of keeping down inductance in the leads and in making corrections for their effect.

Photography

Absolute Colour Sensitivity of Photographic Layer. (M. Blitz, *Phys. Zeit.*, Vol. 36, No. 16, 15/8/35, pp. 559-563.) (14.60/30817 Germany.)

Previous measurements were made of the density of precipitation at two wave-lengths. The measurements are here extended to the whole visible spectrum.

The apparatus is described and results are plotted for three different photographic films—over the range 400 to 700 mμ.

Fourteen references.

The Process of Development in Photography. (W. Neidinger, *Phys. Zeit.*, Vol. 36, No. 9, 14/5/35, pp. 312-320.) (14.60/30818 Germany.)

The process of development is followed under the microscope, using a special Ag. Br. gelatine emulsion. The characteristic of this emulsion lies in the fact that it is very insensitive although containing a high percentage of large grains (6-8μ). Over exposure renders the grain less responsive to the developer. The time for reduction, when action has once started, is however the same as for normal exposures.

A series of beautiful micro-photographs illustrate the article.

Ten-Lense Camera. (Aviation, Vol. 34, No. 8, August, 1935, p. 34.) (14.9/30819 U.S.A.)

A brief description is given, with a photograph showing the general appearance of the Fairchild ten-lense camera. Two hundred composite photographs, or two thousand separate photographs, can be taken in one flight.

Acoustics, Noise Reduction, etc.

Origin and Silencing of Aircraft Noise. (K. Krüger, Luftwissen, Vol. 2, No. 7, July, 1935, pp. 171-176.) (15.38/30820 Germany.)

Harmonic analysis gives the so-called tone spectrum of the composite exhaust noise.

A photographic record of a B.M.W. VI six-cylinder engine at 1,800 r.p.m. shows peaks at 85/sec., 190/sec., 255/sec., and so on, the intensity decreasing with frequency. Minor peaks at other frequencies indicate overtones lying between the simple harmonic ratios.

Intensity of propagation in different directions is shown graphically, the polar distribution of intensity being very different for the first five harmonics.

Airscrew noise is discussed on similar lines.

Multi-engined aircraft will give much more complicated intensity distribution.

Air Navigation

Surface Navigation with Bubble Octant. (Lieut.-Cmdr. J. M. Sheehan, U.S.N., U.S. Nav. Inst. Proc., Vol. 61, No. 391, Sept., 1935, pp. 1228-1232.) (15.50/30821 U.S.A.)

The instrument was lent by the Bureau of Aeronautics. On board ship rolling motion made it difficult to effect collimation. Pitching had much less effect. Example of fixes are given and show increasing accuracy with experience.

Simplified Altitude and Z. Azimuth Tables. (C. E. Dazler, U.S. Naval Inst. Proc., Vol. 61, No. 389, July, 1935, pp. 928-933.) (15.50/30822 U.S.A.)

Various tables are compared. Rust's azimuth diagram is preferred by some aviators.

Wind and Ground Speed. (H. H. Strickland, Aero Digest, Vol. 27, No. 2, August, 1935, p. 20.) (15.50/30823 U.S.A.)

Examples of variation of wind with height are shown graphically, and rules are given for pilots to select the most advantageous height on fixed courses.

Savings are estimated at $\frac{1}{4}$ dollar to 1 dollar per flying hour.

Mark VII Navigational Computer for Aircraft. (Lieut.-Col. P. V. H. Weems, U.S.N., Aero Digest, Vol. 26, No. 5, May, 1935, p. 28.) (15.50/30824 U.S.A.)

A graduated circle is mounted so as to rotate on a ruled rectangular sheet. A graduated circular slide rule is supplied. Given wind speed, variation and deviation, the apparent compass course is laid off quickly.

Accidents and Precautions

The Parachute. (H. F. King, Flight, Vol. 28, No. 1390, 15/8/35, p. b-179.) (16.20/30825 Great Britain.)

A descriptive account is given of types of parachutes in use in this country with details of attachments and quick release devices, illustrated by sketches.

Aircraft—Unorthodox

Roof-Top Gyroplists. (J. G. Ray, *Aviation*, Vol. 34, No. 8, August, 1935, pp. 11-14.) (17.05/30826 U.S.A.)

Experimental landings and stallings were made with two direct control autogyros on the roof of the new Philadelphia Post Office with a clear area of 288ft. by 365ft.

Air eddies produced by the wind or by local convection current present difficulties which are discussed.

Three photographs are reproduced.

Gyroplane Sail-Boat. (*Sci. American*, Vol. 153, No. 3, Sept., 1935, p. 147.) (17.05/30827 U.S.A.)

Two photographs show the complete boat, on the stocks, and sailing.

From the description the two-bladed rotor works on the autogyro principle. It is mounted on a mast and it is stated that the disc inclination is about 17° to the mast.

The mast can be rotated and locked at angular intervals of 6° .

Rocket Propulsion. (Willy Ley, *Aircraft Eng.*, Vol. 7, No. 79, Sept., 1935, pp. 227-231.) (17.2/30828 Great Britain.)

A useful summary is given of the elementary theory. Tables show the ratio of fuel weight to resident load for various final velocities and ranges, the calorific values of hydrogen and other fuels, requiring an external supply of oxygen, and the composition of compounds, such as potassium perchlorate, supplying part of their oxygen.

A description of practical rocket experiments is given, and illustrated by photographs of the apparatus and section sketches of rocket tubes.

Thirty-nine references.

Modern Conceptions about Animal Flight. (Researches by Dr. A. Magnan, reviewed by R. S. Lacape, *L'Aérotechnique*, No. 151, pp. 61-75, Supplement to *L'Aéron.*, No. 194, July, 1935.) (17.6/30829 France.)

The article deals with the researches of Dr. A. Magnan on the flight of birds and insects.

Flapping flight was studied by means of high speed cinematography, the bird or insect being held by the feet. Smoke pictures were taken of the air flow. There is a strong suction along the back between the wings, and this may account for the forward motion of the wing tips of many birds during the down stroke.

It appears that the wing surface of a bird is normally in excess of requirements and can be reduced by almost 50 per cent. without sensibly affecting performance. If, however, the leading edge is interfered with, flight becomes impossible.

The following table gives some average data:—

	Insect.	Bird.
Number of flaps per second	100	5
Flying speed cm./sec.	400	3,000
Air speed along body between wings (animal held by its feet) cm./sec.	300	1,200
H.P. per 100 kg. of animal weight	3.5	4

According to Dr. Magnan, the air in the vicinity of a flapping wing is in a peculiar turbulent state and ordinary resistance laws can only be applied with caution.

Flight by muscular power seems to be in the realms of possibility for man.

Aircraft Carriers

The Small Cruiser. Carrying Scouting Aircraft. (F. G. Percival, Lieut., late U.S.N., U.S. Nav. Inst. Proc., Vol. 61, No. 387, May, 1935, pp. 641-653.) (18.0/30830 U.S.A.)

The problem is discussed of designing a satisfactory light cruiser of a displacement of 5,000 tons, on the assumption that all naval forces carry scouting aircraft.

Meteorology and Physiology

Upper Air Soundings by Aerograph. (F. J. Nelson, U.S. Naval Inst. Proc., Vol. 61, No. 390, August, 1935, pp. 1140-1144.) (19.10/30831 U.S.A.)

An elementary account is given of the distribution of pressure, temperature and humidity in the troposphere in relation to the weather.

A descriptive account is given of methods of making aeroplane observations with photographs of a combined aerograph and its mounting on an aeroplane.

Weather Editorial. (Canadian Aviation, Vol. 8, No. 8, Aug., 1935, p. 3.) (19.10/30832 Canada.)

Canadian aeronautical weather services are not developed as far as the extensive U.S.A. organisation.

Constructive suggestions are made.

Nature of Nucleus of Hygroscopic Droplets. (J. H. Coste and H. L. Wright, Phil. Mag., Vol. 19, No. 132, Aug., 1935, pp. 209-233.) (19.10/30833 Great Britain.)

The condensation nuclei are predominantly solution of nitrous acid in droplet form. These are produced from the constituents of the air under suitable conditions. Visible flames are not necessary, but contact with a solid surface at temperature of the order of 600°C. will generally suffice.

Nineteen references.

Lightning Currents and Their Variations. (H. Norinder, J. Frank. Inst., Vol. 220, No. 1, July, 1935, pp. 69-92.) (19.10/30834 U.S.A.)

Lightning current is investigated by recording variation in magnetic field in proximity to discharge. The lightning current is pulsating. The maximum current in a pulse is usually of the order of 30,000 amps., the pulse lasting 20 micro-seconds. The total charge transported by the flash seldom exceeds two coulombs.

Six references.

Formation of Ice on Tree-Trunks. (A. Naamann, Phys. Zeit., Vol. 36, No. 12, 15/6/35, pp. 445-447.) (19.15/30835 Germany.)

Sketches of observed ice formations show resemblance to growth of ice on struts and wings. An aerodynamical explanation is suggested.

Mechanical De-Icer Equipment. (Aero Digest, Vol. 27, No. 2, Aug., 1935, pp. 34-35.) (19.15/30836 U.S.A.)

The wing tip is furnished with expansible covering, periodically inflatable as shown in three sketches.

Details of the air driven pump and distributing valve are described.

A Remedy for Air-Sickness. (Sci. Amer., Vol. 153, No. 2, Aug., 1935, p. 91.) (19.29/30837 U.S.A.)

Air sickness can often be cured by making the patient breathe air containing CO₂. A simple way of ensuring this is to breathe in and out of a paper bag. Holding the breath for periods of the order of 15 seconds is also useful.

Ascents into the Stratosphere. (A. Prokfiév, Air. Eng., Vol. 7, No. 79, Sept., 1935, p. 232.) (19.30/30838 Great Britain.)

A brief statement is made of the scientific and technical data which may be sought in stratosphere ascents.

The Problems of Stratosphere Flight. Engine Cooling. (Capt. Rougeron, L'Aeron., No. 194, July, 1935, pp. 187-194.) (19.30/30839 France.)

Stratosphere flight is only of interest if full advantage is taken of the high flying speeds thereby rendered possible. The cooling of engines of the large power output required presents considerable difficulties under these conditions. Normal radiators offer too much resistance and wing radiators are too vulnerable. Direct air cooling is only successful for relatively small power outputs.

(To be continued.)

Equipment

Wind Channel Tests of Model Aerodrome. (Flight, Vol. 28, No. 1396, 26/9/35, p. 343.) (20.20/30840 Great Britain.)

A model was made of Rongotai Aerodrome, N.Z. Wind velocities were measured, and local wind direction observed by steamers attached to wires or posts. The general nature of the air flow agreed with full-scale observation. Eddies from a neighbouring ridge were erratic, and an adjacent valley created a dead spot.

Wind channel experiments indicate that the worst eddies would be mitigated by removing the summit of the ridge and filling up the valley.

Blind Landing. (E. A. Cutrell, Aviation, Vol. 34, No. 8, August, 1935, pp. 22-24.) (20.20/30841 U.S.A.)

Landings by radio beam and by radio compass were carried out at Newark Airport where 99 approaches and 171 completed blind landings were made in six months.

A descriptive account is given with sketches of landing ground layout, and photographs of instrument board and visual indicator.

Light

The Best Illumination for the Examination of Black and White and Colour Prints. (G. Colange, Comptes Rendus., Vol. 201, No. 3, 16/7/35, pp. 204-206.) (21.22/30842 France.)

Generally speaking, oblique illumination increases contrast and will bring out details which are lost under normal incidence. This applies to both colour and black and white prints and is being adopted by museums.

The incidence required is of the order of 20° from the horizontal.

Additive Property of Binocular Vision when Observing Targets and the Advantage of Yellow Beam Searchlight. (A. Blondel, Z. Instrum., No. 6, June, 1935, p. 271. Abstract from Revue d'Optique, Vol. 13, pp. 247-250, 1934.) (21.22/30843 Germany.)

Simultaneous impulses received by both eyes superimpose in the brain according to the same laws (both quantitative and qualitative) as simultaneous

impulses received by a single eye. Binocular vision is therefore superior, provided the observer's eyes taken individually react in a similar manner. In some cases this is not so. The author mentions a case where an observer required an illumination of 600 lux for the left and 800 lux for the right eye, in order to distinguish details which he could observe at 200 lux using both eyes.

Yellow light as an illuminant is a distinct advantage and the author recommends using gilded mirrors for searchlights.

Aerodynamics and Hydrodynamics

Flow in Soil Seepage. (M. G. Ionides, Engineering, Vol. 140, No. 3633, 30/8/35, pp. 211-212.) (22.10/30844 Great Britain.)

In soil which is not too coarse the flow satisfies approximately the (vector) differential equation $\nabla^2 V = 0$.

Photographs of a two-dimensional installation show observed lines of flow corresponding fairly well with the two-dimensional flow of the equation.

On a Method of Measuring Rate of Descent of Solid Spheres in a Viscous Liquid. (M. M. Mahmoud Ghali, Comptes Rendus, Vol. 200, No. 26, 24/6/35, p. 2155.) (22.10/30845 France.)

The descending sphere obstructs a beam of light impinging on a photo cell. The height of drop is 17.4 cm. and times are measured to 1/1,000 sec. Interesting interference results are obtained by dropping spheres in succession or in different groupings.

Analytical Synthesis of Ship Forms. (G. Weinblum, Z.A.M.M., Vol. 15, No. 4, July, 1935, pp. 205-219.) (22.10/30846.)

Following Havelock and Wigley, approximate formulæ of polynomial type and the required integrals thereof are developed in detail.

Numerical examples are shown graphically for a range of selected arbitrary coefficients corresponding to actual ship forms.

The results of the complete integration of resistance are shown graphically and compared with model experiments over a range of speeds from 1 to 5 m./sec.

The general run of the resistance characteristics agrees well, but the peaks in the calculated curve are much more pronounced.

Twelve references.

Theory of Fluid Friction between Shaft and Bearings. (E. Heidebroek, Forschung, Vol. 6, No. 4, July/Aug., 1935, pp. 161-168.) (22.10/30847 Germany.)

Expressions in the form of integrals are obtained for pressure, load and friction, in terms of angular position.

The integrations are carried out and numerical examples are shown graphically. The effects of elastic deformations under high loads introduce difficulties which have not yet been resolved.

Hydrodynamic Analogy of Torsion. (J. P. der Hartog and J. G. McGivern, J. App. Mech., Vol. 2, No. 2, June, 1935, pp. A. 46-A. 48.) (22.10/30848 U.S.A.)

In the well-known Kelvin hydrodynamic analogy, an ideal fluid takes the place of the twisted shaft. The author photographed the potential motion of a practical fluid started from rest before the break up of the boundary layer causes the development of eddies.

Typical photographs obtained by sprinkling Al. powder on the surface of water under these conditions are given.

Five references.

New Bernoulli Theorem. (M. M. Munk, *Aero Digest*, Vol. 27, No. 2, August, 1935, pp. 28-29.) (22.10/30849 U.S.A.)

A transformation of Bernoulli's theorem is given, in which the velocity enters linearly.

(Continued.)

On the Motion of a Fluid Behind a Sphere. (A. Foch and C. Chartier, *Comptes Rendus*, Vol. 200, No. 14, 1/4/35, pp. 1178-1181.) (22.10/30850 France.)

The experiments were carried out on a sphere 15 cm. diameter placed in a water channel 50 by 50 cm. Water speeds of between 30 and 200 cm./sec. could be maintained accurately and the flow was studied by means of a special stereoscopic chronographic camera described in *C.R.*, Vol. 197, p. 1642 (1933). Sketches show the variation in flow picture obtained. The author claims that ordinary photographs yield misleading pictures and that the stationary eddy formed can only be studied by stereoscopic means.

Friction of Disc Rotating in Housing. (F. Schultz-Grunow, *Z.A.M.M.*, Vol. 15, No. 4, July, 1935, pp. 191-204.) (22.10/30851.)

Sketches show detail of experimental mounting. The angular speed varied from 50 r.p.m. to 10,000 r.p.m. and the corresponding Reynolds number from 10^4 to 2×10^6 .

For lamina flow the equations are soluble by successive approximations. For turbulent flow empirical expressions are introduced and transformed.

Comparison between experiment and calculation is not altogether satisfactory.

Systematic Reduction of Measurement on Ship Steaming and Towing Performances. (G. Kempf, *W.R.H.*, Vol. 16, No. 12, 15/6/35, pp. 189-194.) (22.35/30852 Germany.)

A description is given of instruments for measuring wind velocity and direction, dynamic pressure of relative water velocity with variations due to wave motion. The velocity in the boundary layer is explained and the resistance is analysed. Measurement on rope tension gives the total resistance in the relative stream.

Vorticity Transport in Turbulent Motion. (S. Goldstein, *Proc. Camb. Phil. Soc.*, Vol. 31, No. 3, July, 1935, pp. 351-359.) (22.4/30853 Great Britain.)

The equation of motion of a non-viscous fluid is written down in vector form. The equation obtained by forming the curl of the equation of motion is expanded in cartesian co-ordinates and gives three equations which exhibit the convections of vorticity.

Various general transformations are carried out to the first order of small displacements and formal results are obtained in different ways.

Materials—Elasticity and Plasticity

A Note on the Surface Temperature of Sliding Metals. (F. P. Bowden and K. E. W. Ridler, *Proc. Camb. Phil. Soc.*, Vol. 31, Part 3 (1935), pp. 431-432.) (23.0/30854 Great Britain.)

Surface temperatures are measured directly by using the rubbing contacts of two different metals as a thermo-couple and determining the e.m.f. generated on sliding.

With quite moderate sliding speeds, the e.m.f. generated suggests a temperature rise of several hundred degrees Centigrade.

When using readily fusible metals, the melting temperature is not exceeded, whatever the load and speed of sliding and this is considered proof that true surface temperatures are recorded.

Use of Hele-Shaw Apparatus in Investigation of Flow of Metals. (H. M. Herbert and F. C. Thompson, *Engineering*, Vol. 140, No. 3637, 27/9/35, pp. 347-349. Paper read to Iron and Steel Institute, 1st September, 1935.) (23.0/30855 Great Britain.)

Photographs of macro structure after drop stamping and drawing, and corresponding photographs of flow in the Hele-Shaw apparatus show marked similarities.

The analogy appears to be qualitative.

Stresses in Radially Loaded Discs. (R. G. Minorili, J. Frank. Inst., Vol. 219, No. 5, May, 1935, pp. 583-596.) (23.0/30856 U.S.A.)

The appropriate form of the elastic equations is solved in trigonometric series. Isoclinics and isochromatics are computed and plotted for a bakelite disc, and comparison with a photoelastic photograph shows substantial agreement.

One reference.

Fields of Tensile Stress in Thin Plates, Initially Curved, Under Shear Load. (H. Wagner and W. Ballerstedt, L.F.F., Vol. 12, No. 2, 16/5/35, pp. 70-74.) (23.3/30857 Germany.)

The elementary equations of elastic equilibrium are applied. A photograph shows an initially circular cylindrical sheet buckling along spirals making about 25° with the axis. Appropriate forms of solution are suggested by experimental work, and take comparatively simple form.

Two cases are discussed analytically, one with closely spaced stiffeners along the generator, the other with closely spaced circular stiffeners perpendicular to the axis.

The numerical result for both cases are shown graphically.

Centre of Shear in a Beam Under a Single Load. (E. Trefftz, Z.A.M.M., Vol. 15, No. 4, July, 1935, pp. 220-225.) (23.3/30858 Germany.)

The equations of elastic equilibrium are formed for simple bending and simple torsion. The corresponding expressions for energy of bending and energy of torsion are formed and superposed to give total strain energy.

The centre of shear is defined and a formal expression is obtained for it, which is independent of Poisson's ratio. The treatment is formal.

Miscellaneous

Pan-American Figures. (*Flight*, Vol. 28, No. 1390, 15/8/35, pp. 175-177.) (O.G./30859 Great Britain.)

An analysis is given of the amount and application of indirect subsidies to civil aviation in the U.S.A.

Science in the Control of Road Traffic. B.A. Papers and Discussion. (*Engineering*, Vol. 140, No. 3637, 27/9/35, pp. 332-333.) (O.G./30860 Great Britain.)

The psychological aspect of road accidents is relevant to the corresponding problems in air navigation.

Absorption. (Leading article, *Engineering*, Vol. 140, No. 3637, 27/9/35, pp. 339-340.) (O.G./30861 Great Britain.)

A brief account is given of typical phenomena, and reference is made to the somewhat conflicting molecular theories put forward.

Application to gas masks, separation of mixtures of rare gases, of oxygen and nitrogen from hydrogen and helium, etc., are mentioned. A satisfactory

general theory has not yet been evolved from the accumulated mass of experimental knowledge.

Smokeless Zone Round a Heated Platinum Ribbon. (S. Miyake, Aer. Res. Inst., Tokyo; Report No. 123, Vol. 10, No. 5, June, 1935.) (O.G./30862 Japan.)

A sketch shows the mounting of the apparatus which consists of a closed vessel of brass (with windows) at the axis of which a platinum strip was mounted. On heating the strip convection currents were set up.

Using smoke of various kinds as indicators, a clear space was observed near the platinum strip and photographed through the window.

Numerous experimental data, tabulated and shown graphically, connect the trend of the smokeless zone with the temperature.

Various physical explanations are discussed and an empirical formula is quoted which gives an approximate fit with the experiment.

Aircraft in the Antarctic. (Lieut.-Cdr. G. O. Neville, Aero Digest, Vol. 26, No. 5, May, 1935, pp. 14-15 and 70.) (O.G./30863 U.S.A.)

A map shows Byrd's base on the Antarctic continent, indicating five extended flights, including one round the South Pole.

Actually 142 flights were made with a total mileage of 13,000 miles. Descriptive details are given.

Theory of Electrostatic Machine. (H. Strauch, Phys. Zeit., No. 17, 1/9/35, pp. 575-584.) (O.G./30864 Germany.)

The separately excited machine is preferred. The main losses are due to corona effects. Attempts to use compressed air or oil as dielectric have not been successful.

Air Resistance of Motor Cars. ("Farewell to the Horseless Carriage.") *A Discussion.* (E. G. Reid, S.A.E. Jnl., Vol. 36, No. 5, May, 1935, pp. 180-190.) (O.G./30865 U.S.A.)

Curves of comparative resistance of aeroplanes and motor cars show the importance of air resistance at high wind speeds. Diagrams of power required exhibit the fact that avoidable air resistance absorbs as much as 15 per cent. of the total power required to propel a motor car at 50 m.p.h.

Six references.