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PART I.—PHYSICS AND ENGINEERING SCIENCE

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LIST OF ABBREVIATIONS OF TITLES OF JOURNALS.

Aer. Res. Inst. Tokio	Aeronautical Research Institute of Tokio.
Aeron. Eng.	Aeronautical Engineering.
A.C.I.C.	Air Corps Information Circular.
Airc. Eng.	Aircraft Engineering.
Ann. d. Phys.	Annalen der Physik.
Army Ord.	Army Ordinance.
Autom. Absts.	Automotive Abstracts.
Autom. Tech. Zeit.	Automobiltechnische Zeitschrift.
Autom. Eng.	Automobile Engineer.
Autom. Ind.	Automotive Industries.
Bell Tele. Pubs.	Bell Telephone Publications.
Bur. Stan. J. Res.	Bureau of Standards (U.S.A.) Journal of Research.
Comp. Rend.	Comptes Rendus de l'Academie des Sciences.
Chem. Absts.	Chemical Abstracts.
Chem. and Ind.	Chemistry and Industry.
D.M.Z.	Deutsche Motor-Zeitschrift
Eng. Absts.	Engineering Abstracts.
Forschung	Forschung auf dem Gebiete des Ingenieurwesins.
Fuel.	Fuel in Science and Practice.
H.F. Technik.	Hochfrequenztechnik und Electroa Kustik.
Ind. and Eng. Chem.	Industrial and Engineering Chemistry.
Inst. Autom. Eng.	Institution of Automobile Engineers. Research and Standardisation Committee.
J. Aer. Sci.	Journal of the Aeronautical Sciences.
J. App. Mech.	Journal of Applied Mechanics.
J.R. Aer. Soc.	Journal of Royal Aeronautical Society.
J. Frank. Inst.	Journal of Franklin Institute.
J. Sci. Inst.	Journal of Scientific Instruments.
J. Am. Soc. Nav. Eng.	Journal of American Society of Naval Engineers.
J. Inst. Elec. Eng.	Journal of Institute of Electrical Engineers.
J. Inst. Civ. Eng.	Journal of the Institution of Civil Engineers.
J. Met. Soc.	Journal of the Meteorological Society.

J.S.A.E.	Journal of Society of Automotive Engineers.
L'Aéron.	L'Aéronautique.
L.F.F.	Luftfahrtforschung.
Met. Mag.	Meteorological Magazine.
Met. Prog.	Metal Progress.
N.A.C.A.	National Advisory Committee for Aeronautics (U.S.A.)
Proc. Camb. Phil. Soc.	Proceedings of Cambridge Philosophical Society.
Phil. Mag.	Philosophical Magazine.
Phys. Berichte	Physikalische Berichte.
Phys. Zeit.	Physikalische Zeitschrift.
Proc. Inst. Rad. Eng.	Proceedings of the Institute of Radio Engineers.
Phil. Trans. Roy. Soc.	Philosophical Transactions of the Royal Society.
Proc. Roy. Soc.	Proceedings of Royal Society.
Pub. Sc. et Tech.	Publications Scientifiques et Techniques du Ministère de l'Air.
R. & M.	Reports and Memoranda of the Aeronautical Research Committee.
Riv. Aeron.	Rivista Aeronautica.
Rev. de l'Arm. de l'Air	Revue de l'Armée de l'Air.
Sci. Am.	Scientific American.
Sci. Absts. (A or B)	Science Abstracts (A or B).
Tech. Aéron.	La Technique Aéronautique.
Trans. A.S.M.E.	Transactions of the American Society of Mechanical Engineers.
W.R.H.	Werft-Reederei-Hafen.
Z.A.M.M.	Zeitschrift für Angewandte Mathematik und Mechanik
Z.F.M.	Zeitschrift für Flugtechnik und Motorluftschiffahrt.
Z.G.S.S.	Zeitschrift für Das Gesamte Schiess und Sprenstoffwesen.
Z. Instrum.	Zeitschrift für Instrumentenkunde.
Z. Metallk.	Zeitschrift für Metallkunde.
Z.V.D.I.	Zeitschrift für Vereines Deutscher Ingenieure.
Z. Mech.	Zentralblatt für Mechanik.

PART I.

PHYSICS AND ENGINEERING SCIENCE.

Acoustics

On the Propagation of Supersonic Sound Waves in Liquids. (R. Lucas, Comptes Rendus, Vol. 201, No. 24, 9/12/35, pp. 1172-1174.) (544 France.)

Experiments have shown that the reduction in intensity of supersonic sounds is greater than can be accounted for by transformation of sound energy into heat absorption coefficients given by Stoke and Kirchhoff.

The author suggests that the waves are scattered by molecular aggregate. The effect may be increased if there are variations in density throughout the liquid.

Investigations on the Origin of the Sound Emitted by Revolving Airscrews. (J. Obata and others, Aer. Res. Inst. Tokio, No. 132, Dec., 1935.) (753 Japan.)

The sound of a rotating airscrew consists of three parts :—

(1) Sound due to pressure differences on the two sides of the blade.
(2) Sound due to vortices.
(3) Sound due to elastic vibration of the blade.

The present paper deals with (1).

The model airscrew (metal, approx. 1 m. diameter) was rotated in the open at 2,500 r.p.m. and the pressure variations in the air at different distances from the blade was investigated by means of a condenser microphone. It appears that the velocity of propagation of the suction impulse in front of the blade exceeds the velocity of sound.

In a future paper the authors propose to deal with the directional properties of the sound emitted.

The Production and Measurement of Slow Pressure Vibrations of Sine Form in Air. (G. Bekesy, Annalen der Physik, Vol. 25, No. 5, pp. 413-432.) (764 Germany.)

It appears probable that the perception and analysis of low frequency sounds is no longer governed by the dimension of the cochlea, but take place directly in the auditory nerve. The author describes several methods of producing pure sine pressure variations, some mechanical and others electrical, producing sound pressure of the order of 20 gm./cm.^{2} in the auditory canal.

A subsequent article will deal with physiological effects.

The Frequency Spectrum and the Perception of a Note. (W. Burk, P. Kobowski and H. Lichte, Annalen der Physik, Vol. 25, No. 5, pp. 433-499.) (765 Germany.)

In order to perceive a definite note when the background is a continuous sound spectrum, it is necessary that 70 per cent. of the total radiated energy should be concentrated in a frequency belt of ± 5 per cent.

Vibrations of Air and CO_2 in Closed Spherical Resonators. (K. Voekler, Annalen der Physik, Vol. 24, Part 4, Oct., 1935, pp. 361-376.) (206 Germany.)

Vibrations were initiated by an electrically operated telephone membrane forming part of the surface of the sphere. The air vibrations were recorded optically by the motion of a thin (1/200 m/m. thickness) diaphragm of mica or tin foil.

Metal resonators introduced complications by their own vibrations. This difficulty was overcome by using spheres of plaster of paris.

Frequency measurement were in good agreement with theory (Rayleigh and Thiessen) as regards frequency, but only qualitative for damping of vibrations.

The damping depends very much on the order of the vibration and is also affected by moisture. CO_2 gives less damping than air.

Aerodynamics and Hydrodynamics

Turbulent Friction Layers in Curved Flow. (E. Gruschwitz, Ing. Archiv., Vol. 6, Part 5 (Oct.), 1935, pp. 355-365.) (203 Germany.)

Following a suggestion of Prof. Prandtl, the author introduces the term " friction layer " for what has so far been termed " boundary layer."

This latter term is retained for the laminar part of the friction layer.

Measurements are described of the flow along a flat wall, the potential flow line being curved in plane parallel to the wall.

The usual equations for the turbulent layer in plane flow as observed by the impulse method (Kármán) are extended to this case of three dimensioned flow and the shear stresses along the wall are calculated.

Comparison of this shear stress with that of plane flow shows no systematic difference.

NOTE.—See also " Turbulent layer of friction in two-dimensional flow with pressure drop and increase," by E. Gruschwitz (Translation No. 67A, List No. 1).

The Interdependence of Profile Drag and Lift with Joukowski Type and Related Airfoils. (H. Muttray, N.A.C.A. Tech. Memo., No. 768, 1935.) (267 U.S.A.)

Up to camber parameters $f/l=0.25$ and thickness parameters $d/l=0.4$, the profile drag coefficient is represented by a cubical parabola whose apex for cambered profile lies above the axis of resistance coefficients.

A Method of Showing up Small Differences in Density in Fluids, and its Application, to Study the Movement of Fluid in the Neighbourhood of a Swimming Fish. (A. and C. Magnan, Comptes Rendus, Vol. 201, No. 21, 18/11/35, pp. 937-938.) (479 France.)

The liquid is placed in front of a concave mirror of large aperture and illuminated by means of a point source. The reflected image is photographed in a high-speed cine camera.

Differences in density in the liquid are produced by immersing a hot wire. The fish employed was of a small tropical species and the photographs show the displacement of the warm liquid current by the fins. Whilst the vertical fins project the water mainly downward, the tail fin produces a powerful displacement to the rear.

Turbulent Flow in a Circular Pipe. (A. Fage, Phil. Mag., Vol. 21, No. 138, Jan., 1936, pp. 80-105.) (497 Great Britain.)

Distribution of the mean velocity (U), the maximum longitudinal velocity fluctuation (u_1) and of the maximum angular deviations from the axial direction of the path of particles moving in axial and tangential planes were measured with the aid of the ultramicroscope.

Maximum values of the radial and tangential components (v_1 and w_1) were deduced.

The distribution of turbulent components bear a general resemblance to those obtained previously with a round pipe, the ratios u_1/v_1 and v_1/w_1 are however greater.

Contribution to the Study of the Propulsion of Fishes. (A. Magnan and C. Magnan, Comptes Rendus, Vol. 201, No. 26, 23/12/35, pp. 1429-1430.) (548 France.)

For short distances the small tropical " Platis " fish previously experimented on (see Abstract No. 8) attained a forward speed of 56 cm./sec. by the reaction of 2.8 gm./sec. of water propelled at 24 cm./sec. This corresponds to approximately 1/100 h.p. per 100 kg. of animal weight.

In their experiments with insects and birds (see Abstract No. 30,829) the authors obtained values of the order of 3.5 h.p. and 4 h.p. per 100 kg. of animal weight respectively.

An Application of the Von Kármán-Milikan Laminar Boundary Layer Theory and Comparison with Experiment. (A. E. Von Doenhoff, N.A.C.A. Tech. Note No. 544, Oct., 1935.) (631 U.S.A.)

The computed and experimental characteristics of the laminar boundary layer about the elliptic cylinder are in good agreement. This agreement indicates that the method may be generally applied to the laminary boundary layer about any type of body provided that an experimentally determined pressure distribution is available. It appears that for all Reynolds numbers above 24,000 the separation point for the elliptic cylinder should occur at a constant distance behind the point of minimum pressure, provided that the boundary layer does not become turbulent.

The Compressibility Burble. (J. Stack, N.A.C.A. Tech. Note No. 543, Oct., 1935.) (632 U.S.A.)

Model experiments on an aeroplane wing show a rapid increase in minimum profile drag (from 0.015 to 0.10) as the velocity of the air (at some distance from the wing) increases from 0.7 to 0.85 that of the velocity of sound. Schlieren photographs demonstrate that the rapid increase is due to compression shock, the air speed reaching supersonic velocities in the neighbourhood of the upper surface of the wing.

The Theory of the Laminary Boundary Layer in Compressible Gases. (F. Frankl, Report of Central Aero-Hydrodynamical Inst., Moscow, No. 176, 1934, pp. 3-18.) (658 Russia.)

The present work contains a generalised theory of the boundary layer of compressible gases undergoing laminar flow.

The method used is an extension of that of Kármán-Pohlhausen, and the conclusion is reached that for a flat plate the effect of compressibility is to reduce the resistance coefficient as the speed increases. The conditions necessary for stable laminar motion have also been investigated and are in agreement with experiment.

The Growth of Prandtl's Boundary Layer in Rectangular Tubes for a Laminar Flow Condition. (Frankl and Balanov, Report of Central Aero-Hydrodynamical Inst., Moscow, No. 176, 1934, pp. 19-32.) (659 Russia.)

The following assumptions are made:—

(*a*) That the core of the flow is a rectangle of similar shape to the tube, the boundary layer filling the outside frame.

(*b*) That at the end of the so-called " starting distance " the velocity distribution in the outer frame follows Poiseuille's Law.

Length of starting distance pressure drop and growth of boundary layer are investigated for rectangular side ratios of 1/1 and 1/2.

On the Heat Generated in a Body Placed in a High-Speed Air Current. (E. Brun and R. Lecardonnel, Comptes Rendus, Vol. 202, No. 7, 17/2/36, pp. 555-556.) (806 France.)

Experiments were carried out in an air stream approximately 30 cm. in diameter. The net rise in temperature $d\theta$°C. of a thermocouple due to air friction was given by the relation $d\theta = 4.2 \times 10^{-4} v^2$ for speeds up to 200 m./sec.

Application of Bessel Functions to the Solution of Problem of Motion of a Circular Disc in Viscous Liquid. (M. Ray, Phil. Mag., Vol. 21, No. 141, March, 1936, pp. 546-564.) (863 Great Britain.)

Previous solutions of the problem were based on the gravitational potential function of the ellipsoid, the fluid moving in circles perpendicular to the axis.

The problem of the rotating disc is deduced as a limiting case.

The author presents a direct solution of the disc problem in terms of Bessel functions.

Note on the Development of the Circulation Around a Thin Elliptic Cylinder. (L. Howarth, Proc. Camb. Phil. Soc., Vol. 31, Part 4, 1935, pp. 582-584.) (905 Great Britain.)

In a previous paper (see Abstract No. 30,668), the present writer gave a solution of the problem of determining the circulation around a thin elliptic cylinder in a steady stream of slightly viscous fluid when the major axis of the cylinder is inclined at a small angle to the direction of the flow at infinity. The present

note gives a largely qualitative analysis of the manner in which this circulation is built up when the motion of the fluid or cylinder is started instantaneously from rest with a given velocity.

Note on the Flow Past a Circular Cylinder. (L. Howarth, Proc. Camb. Phil. Soc., Vol. 31, Part 4, 1935, pp. 585-588.) (906 Great Britain.)

Buri's method of solution of the equation of turbulent motion in a boundary layer has been used in a previous paper (see Abstract No. 30,668).

The method has now been applied to the case of a circular cylinder for which experimental data are available for comparison.

The comparisons do not fully substantiate the method, but the predictions are sufficiently near not to condemn the method.

The method should be checked by further experiments.

The Gliding of a Plate on a Stream of Finite Depth. (A. E. Green, Proc. Camb. Phil. Soc., Vol. 31, Part 4, 1935, pp. 589-603.) (907 Great Britain.)

The two-dimensional problem of an inclined plane, infinite in one direction, gliding on the surface of water of infinite depth, has been solved by Wagner and applied to the discussion of the dynamics of seaplanes (see Translation No. 247, List No. 1). In Wagner's work the trailing edge of the plane was necessarily at an infinite height above the undisturbed surface of the water, and so does not represent the conditions obtained in practice. Thus it is interesting to examine the case of gliding on a stream of finite depth.

The case considered is that of the two-dimensional gliding of a semi-infinite plate and expressions are obtained for the lift L in terms of the ratio D/H when H is the depth at infinity up stream and D is the height of the trailing edge of the plate above the surface of the stream.

It is concluded that the trailing edge cannot be at more than a height of 0.07 H above the upstream fluid surface.

For list of references see H. Wagner, Proc. 4th Inter. Congress for Applied Mechanics, Cambridge (1934), p. 146 (Translation No. 247, List No. 1).

Resistance of a Sphere Rotating about an Axis Parallel to the Wind. (S. Luthander and A. Rydberg, Phys. Zeit., Vol. 36, No. 16, 15/8/35, pp. 552-558.) (908 Germany.)

The experiments were carried out at the Royal Technical High School, Stockholm. A hollow copper sphere of 20 cm. diameter was polished, mounted as an axle running in ball bearings and balanced.

The axle bearings were suspended by wires downstream from the sphere so as to avoid disturbance. Wind velocities up to 24 metres per second and rotations up to 3,800 per minute were imposed.

The resistance of the sphere at rest is compared graphically with the Göttingen figures and shows systematically smaller values for the whole range of Reynolds number.

The resistance of the sphere in rotation is shown graphically for 12 different angular velocities as a function of Reynolds number. The curves show the well-known discontinuity for low angular velocities, but at high angular velocities the curves run smoothly within the range of Reynolds numbers shown.

The results are also plotted for different ratios of angular to axial velocity.

Six smoke photographs show the general appearance of the wake and the apparent potential flow outside the wake. At high axial velocity the wake shows a Vena Contracta and resembles the wake of an airscrew in outline.

The position of the point of diversion of the surface streamline was observed for a large variety of conditions, and the results are exhibited graphically.

It was found possible to account for the experimental results in a qualitative manner, using the known critical Reynolds number for a flat plate.

(Translation No. 124, List No. 1.)

Aircraft—Design and Performance

The First International Italian Aero Exhibition. (L'Aerophile, Vol. 43, No. 11, Nov., 1935, pp. 323-324.) (332 France.)

The exhibits enable the following conclusions to be drawn :—

1. Extensive use of steel and light alloys both for frame and wing covering.
2. General employment of flaps.
3. Improved comfort for passengers (ventilating, heating, cooling, noise).
4. Cantilever construction and retractable undercarriage becoming more general.

Summaries of Papers on the Problem of High-Speed Flying Presented at the Volta Conference, Rome, October, 1935. (L'Aerotecnica, Vol. 15, No. 9-10, Sept.-Oct., 1935, pp. 861-914.) (333 Italy.)

1. Technical development work in England in connection with the Schneider Competition, 1931. (H. E. Wimperis.)
2. Italian high-speed machines. (M. Castoldi.)
3. Italian engine for high-speed aeroplane. (C. F. Bona.)
4. High-speed flying and breathing of pilots (British experiments). (C. F. Stainforth.)
5. High-speed flying and breathing of pilot (Italian experiments). (M. Bernasconi.)
6. General consideration about the flow of a compressible fluid. (L. Prandtl.)
7. Stability of flow at high speeds. (G. I. Taylor.)
8. The effect of compressibility on fluid resistance. (T. de Karman.)
9. Lift at high speeds (below that of sound). (E. Pistolesi.)
10. Aerodynamic lift at supersonic speeds (in course of translation). (A. Buseman.)
11. Experimental technique at high speeds. (M. Panetti.)
12. American experimental researches on high-speed aerodynamic phenomena. (E. N. Jacobs.)
13. Experiments with model propellers. (G. P. Douglas.)
14. High-speed wind tunnels. (J. Ackeret.)
15. Thermodynamics of high altitude engines. (H. R. Ricardo.)
16. High altitude engines. Mechanism and cooling. (A. Anastasi.)
17. Stratosphere flight (translation No. Y.53). (G. Costanzi.)
18. Jet propulsion (in course of translation). (M. Roy.)
19. Rocket propulsion. (N. A. Rinin.)

Flexional Valuation of Cantilever Wings. A Case of Integrability. (C. Vairano, L'Aerotecnica, Vol. 15, No. 9-10, Sept.-Oct., 1935, pp. 938-943.) (335 Italy.)

The equation of transverse vibrations of a wing (considered as a clamped beam) is developed, taking into account internal damping and air resistance. A separation of variables is rendered possible on the supposition that the ratio of mass loading to the resistance coefficient is constant along the wing.

If mass and moment of inertia vary along the wing exponentially an elementary solution is possible.

The Drag of Airplane Wheels, Wheel Fairings, and Landing Gears—III. (W. H. Herrnstein and D. Biermann, N.A.C.A. Report No. 522, 1935.) (343 U.S.A.)

The drag of a conventional tripod landing gear with streamline wheels can be reduced about 39 per cent. by careful fairing of all strut intersections.

The drags of tail-wheel units and tail-skids are, even in the worst case, almost negligible.

Investigation of Full-Scale Split Trailing-Edge Wing Flaps with Various Chords and Hinge Locations. (R. Wallace, N.A.C.A. Report No. 539, 1935.) (344 U.S.A.)

Split trailing edge flaps materially affected the magnitude and distribution of pressures over the entire wing profile. At low angles of attack the predominant effect of the flaps was to increase positively the lower surface pressures; at high angles of attack to increase negatively the upper surface pressures. Down wash surveys indicated that horizontal tail planes located above the wing chord line would be more effective than those below the chord in counteracting the increased diving moment of the airplane with flaps deflected.

A Flight Investigation of the Spinning of the F4B-2 Biplane with Various Loads and Tail Surfaces. (N. F. Scudder and O. Seidman, N.A.C.A. Report No. 529, 1935.) (415 U.S.A.)

A flight investigation of the spinning of the F4B-2 single-seater fighter airplane was made for the purpose of finding modifications that would eliminate dangerous spin tendencies exhibited by this type of airplane in service.

Raising the horizontal surfaces gave the most pronounced beneficial effect on recovery, making possible recoveries in less than one turn. The alterations made to the horizontal and vertical surfaces for the tests did not introduce undesirable flying characteristics. Flight tests and model tests were in general agreement, but there were apparent discrepancies in certain details, particularly in regard to the comparative merits of several ways of manipulating the controls for recovery.

Study of Air Flow Round a Wing—Effect of Wing Tips. (J. Valensi, Comptes Rendus, Vol. 201, No. 21, 18/11/35, pp. 940-942.) (480 France.)

The author has developed a method of taking smoke pictures on a cine camera, the model wing being in a wind channel. The top vortices are clearly shown, the vortex core being well above the wake of the wing and visible for a considerable distance.

Stalling of Tapered Wings. (G. V. Lachmann, Flight, Vol. 29, No. 1410, 2/1/36, pp. 10-13.) (507 Great Britain.)

A rectangular wing stalls first at the centre portion, whilst tapered wings will stall near the wing tips.

Tip stalling can be controlled by twisting the wing so that the tips are at a smaller (geometrical) angle of incidence. This procedure, however, increases the drag considerably.

The writer recommends the fitting of a slotted flap to the central portion of the tapered wing and a tip slot to the outer portion. It is claimed that the tip slots contribute very materially to the maximum lift obtainable, even at the stalling angle of the ordinary section, whereas on a rectangular wing the contribution to total lift at normal stalling angles is negligible.

The Determination of Air Pressure on the Wings of a Pigeon in Flight. (A. Magnan and H. Girerd, Comptes Rendus, Vol. 201, No. 24, 9/12/35, pp. 1221-1223.) (546 France.)

The experimental apparatus has been described in Comptes Rendus, Vol. 201, 1935, p. 1145. Pressure curves on a time basis are reproduced, showing variation of air pressure at a point on the upper and another point on the lower wing surface whilst the bird

(*a*) Ran along the ground prior to take off;
(*b*) Was in horizontal flight;
(*c*) Hovering;
(*d*) Landing.

In horizontal flight, the suction on the top of the wing, although variable persists during the whole motion of the wing. The suction on the bottom surface of the wing is negligible.

So far pressure plotting has only been carried out over a few points of the wing surface, but the experiments, as far as they go, render it difficult to believe that the values obtainable will be sufficient to account for the observed lift.

Vibration Characteristics of Twenty Air Corps Airplanes. (A.C.I.C., Vol. 8, No. 702, 1/9/35, p. 3.) (572 U.S.A.)

The airplane structure is always susceptible to resonant vibration from the exciting forces generated by the rotating engine parts and cylinder explosion impulses.

The prevention or elimination of the buffeting type of surface vibration requires the use of properly shaped wing fuselage fillets.

The prevention of flutter requires the use of dynamically balanced surfaces. The degree of dynamic balance depends upon the relative value of the interacting natural frequencies. As yet there are not sufficient data available to determine the exact amount of dynamic balance for various combinations of the flutter matching frequencies.

The prevention of resonant structural vibration produced by the exciting forces generated in the engine requires a properly designed vibration isolating engine mount. Six references.

Airscrew Engine Combinations and their Effect on the Take-off. (G. V. Lachmann, Aircraft Engineer (Supplement to Flight), Nos. 1392 and 1396, August 29th, 1935, pp. 7-9, and Sept. 26th, 1935, pp. 15-19.) (585 Great Britain.)

Two kinds of aircraft are considered, the conventional service type (termed " slow ") and a type of the future (" fast "). The various means for improving " take-off " are discussed. Briefly, these are:—

(*a*) High ground boost, 8lbs./sq. in.
(*b*) Low ground boost, 2lbs./sq. in.
(*c*) Two speed blower.
(*d*) Variable pitch airscrew.

The combinations recommended are as follows:—

Slow Aircraft.—High boost and fixed pitch airscrew.

Fast Aircraft.—High boost and variable pitch airscrew.

This presupposes engine design capable of withstanding high boost over moderate periods.

Static Propeller Thrust and Model Experiments. (C. N. H. Lock and H. Bateman, Aircraft Engineer (Supplement to Flight), No. 1401, 3/10/35, p. 2F.) (586 Great Britain.)

A comparison between N.P.L. model experiments (R. & M. 829) and American full-scale experiments (F. W. Caldwell, S.A.E. Journal, August and September, 1934), reveals discrepancies which were considered by Lachmann (see Abstract No. 585) to be due to wall interference.

The authors point out that the difference is mainly due to differences in blade section of the model and full-scale, which difference becomes especially important when operating in the region of the stall.

Stalling of Tapered Wings. (W. R. Andrews, Flight, Vol. 29, No. 1413, 23/1/36, pp. 1-3 of Suppt., The Aircraft Engineer.) (655 Great Britain.)

The general applicability of the conclusions of Lachmann (see Abstract No. 507) as to the stalling of tapered wings are questioned, since they apply only to wings of constant thickness ratio along the span or to a wing having a reflexed trailing edge. For a more usual wing arrangement where the tip chord is about half the roof chord, and when body and engine interferences have to be taken into account, it is not anticipated that initial stall will take place at or near the tips, but rather in the centre as in a straight wing.

There is thus no need for a wing tip slot.

Limitations of the Pilot in Applying Forces to Airplane Controls. (M. N. Gough and A. P. Beard, N.A.C.A. Tech. Note No. 550, Jan., 1936.) (750 U.S.A.)

A cockpit model was constructed in which the position of the controls could be adjusted. The force exerted by the pilot was measured by means of strain gauges.

Positions of comfort for the pilot are not necessarily ones in which he can apply the most force to the controls.

Notes on the Technique of Landing Airplanes Equipped with Wing Flaps. (M. N. Gough, N.A.C.A. Tech. Note No. 553, Jan., 1936.) (752 U.S.A.)

In connection with the use of flaps the following points are of chief importance :—

(1) Willingness by the pilot to accept steep nose down attitude of machine.
(2) Maintenance of sufficient margin of speed above stall.
(3) A decisive use of control at the proper time.

The Problem of High-Speed Aviation. (R. Leduc and J. Villey, Comptes Rendus, Vol. 202, No. 6, 10/2/36, pp. 461-463.) (808 France.)

Supersonic speeds require impracticable wing shapes (razor blades) quite apart from the serious difficulty of temperature rise due to air friction. With orthodox wing shapes and present-day engine weights it can be shown that consideration of useful load puts an upper limit to flying speeds at about 500 miles/hour. The authors consider jet propulsion as the only feasible solution, the nozzle forming part of the wing surface.

The Security of an Aeroplane when Meeting a Vertical Gust. (G. A. Crocco, Z. Mech., Vol. 4, No. 2, 22/2/36, p. 85.) (872 Germany.)

Sudden gusts are usually rendered visible by the accompanying cloud formation. An elastic wing suspension to allow the incidence to vary under excessive lifts is recommended.

Effect of Tip Shape and Dihedral on Lateral Stability Characteristics. (J. A. Shortal, N.A.C.A. Report No. 548, 1935.) (893 U.S.A.)

Tests were conducted in the N.A.C.A. 7 by 10-foot wind tunnel to determine the effect of wing-tip shape and dihedral on some of the aerodynamic characteristics of Clark R wings that affect the performance of and lateral stability of airplanes.

The tests showed that the plan form of a wing tip as well as the elevation shape had considerable effect on the rate of change of rolling and yawing moment coefficients with angle of yaw.

Armaments

Employment of Conical Bore Gun and Rifle Barrels. (K. Justrow, Z.V.D.I., Vol. 79, No. 47, 23/11/35, pp. 1417-1419.) (357 Germany.)

Although conical bores possess certain theoretical advantages, which have to some extent been verified by experiment, the author is of the opinion that constructional difficulties far outweigh these.

It would be better to concentrate on perfecting the cylindrical bore weapon.

Reference is made to the so-called electromagnetic gun (an American proposal), in which the projectile is accelerated by a series of magnetic fields. The large electric energy required obviously rules out mobility of the gun in this scheme. The absence of noise and flash would render such a gun very difficult to spot

(In course of translation.)

Methods of Attack Against Bombers. (G. Sisti, Riv. Aeron., Vol. 11, No. 11, Nov., 1935, pp. 214-222.) (409A Italy.)

Reference is made to Capt. Vanin's article (translation No. 266). Attack by single-seater aircraft is first considered. High explosive bombs of 5, 10, 15 or 20 kg. are recommended, as well as splinter bombs of 0.5, 1 and 2 kg. " Chained projectiles " are also mentioned. Sighting is by means of a camera obscura placed in the bottom of the cockpit of the leader. Release is co-ordinated by wireless.

To get best results, a passenger should be carried and the attack carried out by means of specially designed aircraft, fitted with armour plating on its under surface. This aircraft, whilst only slightly inferior to the single-seater fighter in speed and climb, can carry a greater weight of bombs and can approach much closer to the bombing formation. As the sighting is now done by the observer a telescopic sight can be employed instead of the rather troublesome camera obscura.

Modern Warship Design—Arrangement of Armour Plating. (W.R.H., Vol. 16, No. 22, 15/11/35, pp. 355-356; *with Special Reference to Bombing Attack,* No. 23, 1/12/35, pp. 369-370; and No. 24, 15/12/35, pp. 378-379, *with Special Reference to Under Water Explosions.*) (417 Germany.)

As the total weight of armour is usually fixed, it is a question of so distributing it as to give maximum protection against various forms of attack.

Till recently first consideration was given to more or less horizontal shell fire above the water line and to torpedo attack.

With increasing range, some form of deck protection against oblique shell fire became necessary.

To this now has become added the need of protection against heavy bomb attack.

It is best to split up the armour protection over at least two decks, the top deck being the thicker plating (60 m./m.) the lower acting as a splinter protection (20 m./m.). This will suffice against bombs up to 1,000 kg. weight.

The writer is of the opinion that bombs of 2,000 kg. will soon become available in which case no existing ship will resist a direct hit.

It is reckoned that such a bomb dropped from 4,000 m. will hit the deck at 200 m./s. and possess a kinetic energy of over 4×10^6 kg. m., sufficient to perforate 100 m./m. of armour plating.

Bombs for this kind of duty will have to be specially designed and the casing stiffened.

Defence against bombs and projectiles, apart from thickness of plating, depends also on angle of impact.

Oblique angle causes a distribution of stress over very much greater areas, and this reduces risk of perforation.

Even if perforation ensues, the path of the projectile becomes refracted and can thus be guided away from vital parts.

As for under water bomb attacks, the method of defence is becoming standardised and the danger is no longer great.

It is usual to fit an outer skin which acts as receiver, followed by an expansion chamber which will take up the force of the explosion.

Of great importance is also the design of the ship's structure in helping absorption.

Modern American design is considered to be exemplary in this.

A fact of great importance is the possible resistance of the ship to repeated under water attack after the outer skin has been damaged.

Protection Against Air Attacks by Town Planning. (Z.V.D.I., Vol. 79, No. 50, 14/12/35, p. 1492.) (471 Germany.)

Main streets should be in the direction of prevailing winds and at least as wide as the sum of the building heights. All buildings likely to be attacked should be isolated. Ornamental lakes and fountains should be provided to assist fire-fighting. Chemical appliances should be available. Alternative sanitary appliances should be available in case of shortage of water supply. Important government offices should be duplicated so that skeleton staff can carry on. Provision should be made along the railway line so that trains can be side-tracked and unloaded irrespective of stations and traffic.

On a Rapid Method of Detecting Presence of Poison Gas (Chemical Warfare). (A. Kling and M. Rouilly, Comptes Rendus, Vol. 201, No. 26, 23/12/35, pp. 1373-1375.) (547 France.)

The suspected air is bubbled through distilled water containing bromothymol blue as indicator. If no discolouration takes place after the passage of 10 litres, the air is considered safe. A violet discolouration indicates danger.

Protection of Daylight Bombing Planes. (Commandant Moineville, Rev. de l'Arm. de l'Air, No. 77, Dec., 1935, p. 1332.) (587 France.)

The author suggests that the squadron operates at a low altitude (50 m.) and is guided by " flotilla leaders " operating above them (1,500 m.).

Official Doctrines of French Military Aviation. (P. Etienne, Rev. de l'Arm. de l'Air, No. 79, February, 1936, pp. 123-129.) (894 France.)

The main consideration is speed. Pride of place is therefore given to single-seater fighter and two-seater light bomber. The number of different types should be restricted to the utmost.

The Bombardment of Ships. (Lt. Aussenac, Rev. de l'Arm. de l'Air, No. 79, February, 1936, pp. 130-136.) (895 France.)

The sighting problems of attack (bombing) and defence (anti-aircraft gunnery) are similar, with the important difference that generally the gunnery officer gets his observation quicker and disposes of practically unlimited ammunition. Low altitude bombing is thus extremely dangerous for the aircraft. This has led to the development of special sights which enable the pilot to take readings at altitude whilst still changing course and only settling down to steady conditions a few seconds before release of the bomb. (See L'Aeronautique, No. 179, p. 77.) This method will, however, only pay against large ships which cannot change course quickly. Small surface craft are practically invulnerable.

Fixing the Position of Aircraft at a Given Instant. Measurement of Speed and Application to Bombing Practice. (Capt. Vauzou, Rev. de l'Arm. de l'Air, No. 79, February, 1936, pp. 137-166.) (896 France.)

The S.O.M. photo-theodolite is described in detail. The aircraft is photographed from the ground, the photographic plates being horizontal and the optical axis of the camera, vertical. Two or three views are taken simultaneously, the relative positions of the photographic plates on the ground being accurately co-ordinated. The plate is measured up by means of a micrometer and finally superposed stereoscopically. Wind speed is measured from the readings by means of $TiCl_4$ smoke clouds. Tables show the consistency of the measurements. The corrected barograph height differs from the true (stereoscopic) height by as much as 100 m. in 3,000 m. By using the known span of the aircraft, the calculation is simplified and the height estimated to within 40 m. at 3,000 m.

(To be continued.)

The Effect of Under Water Explosions. (A. Haid and A. Schmidt, Zeitschrift f.d. gesamte Schiess and Sprengstoffwesen, Vol. 30, No. 8, August, 1935, pp. 229/233.) (917 Germany.)

There are two principal effects—impact of pressure wave followed by impact of water masses disturbed by expansion of gas sphere.

The pressure wave effect depends primarily on the distance between obstacle and explosive.

The strength of the water impact, however, depends not only on the distance from the explosive, but also on the distance of the free water surface which acts as a "vent."

The greater the exploded charge, the deeper therefore it has to be fired in order to obtain max. destructive effect.

The following examples are given:—

Weight of charge (kg.)	13	66	180	375
Depth in metres ...	5	10	15	20

Fuels and Lubricants

Variation of Detonation Spectra with the Nature of the Surrounding Gas. (A. Michel-Levy and H. Muraour, Comptes Rendus, Vol. 201, No. 19, 4/11/35, pp. 828-830.) (170 France.)

A mixture of tetranitro methane and toluene was detonated in the presence of various gases (air, N_2, O_2, Cl_2, H_2, Ar, Kr, etc.).

The detonation wave activates the surrounding gas and the explosion yields a spectrum which varies from case to case. The nature and extent of the spectrum indicates that the source of the radiation is mainly thermal (sudden compression of gas by shock wave).

Relation of Power to Anti-Knock Fuel Requirements for Multi-Cylinder Engines. (S. D. Rubenz, J. Frank. Inst., Vol. 220, Nos. 5 and 6, 1935, pp. 615-656, 755-788.) (221 U.S.A.)

Assuring adequate mechanical strength, the power output of an engine is limited by two factors: Preignition and detonation.

In this article, the author only considers the second of these factors and concludes that the suitability of a given fuel for a given multi-cylinder engine can only be determined by tests in that engine.

It is generally recognised that the onset of detonation is largely governed by the thermal state of the mechanism exposed to the combustion and the author's conclusions amount to saying that single cylinder tests cannot be controlled in such a way as to ensure correspondence with the full-scale engine under service conditions.

As an example, the case of the supercharged engines is taken where the conditions of induction on the single cylinder are generally quite different to those existing in the complete engine.

Difficulties are especially marked in the case of the air-cooled engine, the thermal state of which is very sensitive.

The lack of suitable instruments to record the onset of detonation directly is seriously felt. It is usual to rely on temperature measurements, but these cannot be applied to such vital parts as the valves and piston.

Taking cylinder head temperature as a criterion, the author concludes that in any given engine operated at constant speed and full throttle the rate at which this temperature increases with decrease in mixture strength between the limit of slightly over-rich and best economy is the same for all fuels which do not detonate.

As soon as detonation sets in, the rate increases and varies with the severity of the detonation.

The type of spark play does not apparently affect these conclusions materially.

Lubricants with Corrosion-Inhibiting Properties. (C. M. and S. O. H. Clementson, Chem. and Ind., Vol. 54, No. 47, 22/11/35, p. 1034.) (229 Great Britain.)

Corrosion in engine cylinders is prevented by mixing with the lubricating oil a solution of an alkali peroxide in an alcohol, *e.g.*, Na_2O_2 in McOH, together with a stabilising agent such as cresol.

Combustion of Gas Mixtures on the Surface of Heated Metals. (Z.V.D.I., Vol. 79, No. 46, 16/11/35, pp. 1399-1400.) (257 Germany.)

A critical review of the work of Davis and Langmuir (England).

In the immediate neighbourhood of the heated wire, the strength of weak gas mixtures is further reduced by surface combustion. The combustion does not spread until the gas at some distance from the wire has been raised to the ignition temperature. This may require a considerable excess in wire temperature over the normal ignition temperature of the gas mixture.

Joint Meeting of the American Petroleum Institute and Society of Automotive Engineers (Nov., 1935). (Autom. Indust., Vol. 73, No. 22, 30/11/35, pp. 720-734.) (298 U.S.A.)

The following general conclusions may be drawn from the papers discussed:—

1. *Oil Testing.*—" Almost anything can be proved about almost any compounded product by selection of method of test and it is likely to be many years before the subject is clarified to a point where we can be really sure of our conclusions."

2. *Liquefied Gas Fuels.*—Extensive use is made of liquid butane and butane/propane mixture for truck propulsion in California and other parts of the coast. Such fuels are cheap and tar free and have shown desirable characteristics apart from cost. The distribution of the dry gas is very good and lean mixtures can be employed.
3. *Diesel Engined Trucks.*—First cost, heavy oil consumption and much higher repair costs hinder development.
4. *Petrol Car Operation.*—High volatility fuel is an advantage, provided vapour lock is guarded against. Low viscosity oils reduce ring sticking.
5. *Knock Rating Procedure.*—A modified bouncing pin is centred both on the diaphragm and on the contact blade. This renders the bouncing more free and improves consistency of method.

A Comparison of Fuel Sprays from Several Types of Injection Nozzles. (D. W. Lee, N.A.C.A. Report No. 520, 1935.) (342 U.S.A.)

Tests were made on 14 nozzles of nine commercial types, the spray being injected into still air at room temperature and various pressures. The sprays were photographed at the rate of 2,000 sec. and impressions on plasticine targets were also taken.

The following general conclusions can be drawn:—

1. *Plain Jet*—drop size variable—require high air speeds for break up—most used in two-stage ignition engines.
2. *Impinging Jets*—small drops—low penetration—useful for spark ignition engines (injection during induction or early compression stroke).
3. *Pintle Jets.*—These jets give a uniform spray with a greater proportion of solid care than the plain hole jets. The shape can be controlled over certain limits by the amount of needle lift and thus accommodated to requirements. This type of jet is in general use for high-speed engines.
4. *Slit Jets*—of limited penetration but great directive power. The slits are sensitive to corrosion, erosion and carbon deposits.
5. *Centrifugal Jets.*—The jet passage is grooved—not worth the extra complication.
6. *Effect of Air Pressure.*—Increase of air pressure from 1 to 14 atmospheres approximately halves the penetration in the early stages. (In the case of the pintle nozzle the effect of pressure is considerably less.)

There are 35 references to other work, from which the following additional conclusions are drawn:—

7. *Effect of Air Speed.*—Air moving at 50 feet/sec. will blow the envelope away from the core during the injection period and will help to distribute all the fuel throughout the combustion chamber after injection cut off. Air speeds of the order of 300 feet/sec. are required to break up the core during the injection period.
8. Spray tip penetration is considerably reduced by heating the fuel, and to a less extent by heating the air.
9. The average drop diameter increases with increase in fuel viscosity and surface tension.

Discussion on Fuel at Pacific Coast Meeting of S.A.E. (J.S.A.E., Vol. 37, No. 6, Dec., 1935, pp. 32-38.) (355 U.S.A.)

1. In the laboratory engines can be run with specific fuel consumption of 0.40. Pan American Air Line has been able to cruise at 0.48. An engine, fuel or carburettor that would reduce the practical consumption to the order of 0.42 would profoundly affect the financial position of any air line.

2. Ring sticking on high output engine of the type used on the " China Clipper " is somewhat of a problem.
3. From experience in maintaining privately owned aeroplanes, much lighter lubricating oils than those normally used are recommended. By reducing oil viscosity, time between overhauls could be extended. Instead of giving top overhauls every 200 hours, a major overhaul every 500 hours is much cheaper.

Effect of Various Additions on the Combustion of Gas Oil in an Injection Engine. (M. Aubert, P. Clerget and R. Duchene, Comptes Rendus, Vol. 201, No. 20, 12th Nov., 1935, pp. 879-881.) (478 France.)

The beneficial effect of additions of alcohol and benzoic aldehyde have already been noted (Comptes Rendus, Vol. 199 (1934), p. 1577). The present paper deals with additions of 25 and 50 per cent. of ethylnitrate to gas oil.

The combustion delay was reduced from 3 to 1 millisecond and the knock was suppressed.

The Dissociation of Carbon Monoxide. (P. Goldfinger and others, Comptes Rendus, Vol. 201, No. 21, 18/11/35, pp. 958-960.) (481 France.)

The energy of dissociation into normal atoms is estimated from spectroscopic data.

Influence of Absorbed Gas on the Boundary on the Chemical Reaction of Oxygen/Hydrogen Mixtures. (M. Prettre, Comptes Rendus, Vol. 201, No. 21, 18/11/35, pp. 962-964.) (482 France.)

Adsorption of water vapour accelerates whilst adsorption of H_2 reduces the rate of reaction of electrolytic gas at 550°C. in glass vessels.

Investigation of Factors Controlling Lubricating Oil Consumptions. (Inst. Autom. Eng., No. 8575B, Class 189, 14/11/35.) (488 Great Britain.)

To obtain consistent results rings must be pegged. For ring gaps pegged either in line on the thrust side or on opposite sides of the piston, oil consumption approximately doubles with a fourfold increase in gap. The pegging on opposite sides gives approximately half the absolute consumption.

The consumption increases proportionally with ring width.

Chemical Constitution and Grading of Engine Fuels. (M. Brutzcus, Comptes Rendus, Vol. 201, No. 7, 12/8/35, pp. 423-425.) (493 France.)

The author proposes to grade fuels according to the increase in the number of molecules brought about by combustion, a large variation being beneficial both from the point of view of specific fuel consumption and freedom from detonation.

Deflagration of Explosive Substance by Supersonic Sound Waves. (M. Marinesco, Comptes Rendus, Vol. 201, No. 24, 9/12/35, pp. 1187-1189.) (545 France.)

The temperature T reached in a supersonic sound wave is given by the expression :—

$$T = A\,(aF)\,(\gamma - 1)/\gamma$$

where A = constant, depending amongst other things on initial temperature and pressure of medium.

a = amplitude of wave.

F = frequency.

By means of powerful quartz oscillators, the author has succeeded in exploding a number of unstable substances such as fulminates, iodides of nitrogen,

peroxides, etc. The substances were immersed in a liquid which did not wet them and the explosion was due to the heating up of the small air bubbles attached. If such bubbles are removed (either by melting or using a liquid which wets the compound), explosions are not obtained.

In certain cases of excessive sensitivity, it was found possible to cause deflagration in the open, without immersion in a liquid.

The effect is rendered more obvious if the supersonic sounds are arranged to cause deflagration in the open, without immersion in a liquid.

Specific Heat, Entropy and Dissociation of Gases and Vapours. (E. Justi and H. Lüder, Forschung, Vol. 6, No. 5, Sept./Oct., 1935, pp. 209-216.) (748 Germany.)

The fundamental thermodynamical relations are written down in terms of the Plank-Boltzmann theory.

The molecular constants are determinable with accuracy from spectroscopic data.

The various characteristics are tabulated for hydrogen, nitrogen, oxygen and oxygen compounds, including carbon and sulphur dioxides.

Twenty-five references.

Detonation Road Tests. 1934 *Report of Co-operative Fuel Research Committee.* (J.S.A.E., Vol. 36, No. 5, May, 1935, pp. 165-179.) (749 U.S.A.)

The road tests are carried out under full throttle conditions and top gear, the car accelerating slowly (going up an incline or towing another vehicle, etc.). The knock intensity produced by various mixtures of the reference fuels at speeds in the range 15 to 50 m.p.h. are determined by ear and compared with the knock intensity produced by the fuel under test at the same intervals of road speed. A reference fuel mixture is formed which develops a maximum knock intensity identical with the maximum knock intensity of the test fuel, irrespective of the speed at which such knock intensities are developed.

By taking a large number of observations on different cars, a fair correspondence between the rating so obtained and that given by the C.F.R. motor method was shown. Individual observations were, however, found to vary erratically up to ± 8 octane number and the above mentioned correspondence can only be obtained by rejecting a certain percentage of the experiments.

It should be pointed out that the tests were carried out on standard cars under normal practical conditions. Neither mixture strength nor mixture temperature is controlled, the adjustment being that specified by the makers. The spark setting employed is generally that giving maximum power and may vary appreciably for different cars.

Under these circumstances the necessity of averaging a large number of determinations is scarcely to be wondered at.

An interesting factor brought out by the tests is the pronounced effect of atmospheric humidity on knocking and this may account for the general improvement of car performance in the evening.

The Detonating Speeds of Various Gas Mixtures. (J. Breton and P. Laffitte, Comptes Rendus, Vol. 202, No. 4, 27/1/36, pp. 316-318.) (811 France.)

Experiments were carried out on propane iso-butane, acetylene, ammonia and other mixtures. Both mixture limits capable of sustaining a detonation wave as well as maximum detonation speed were measured. Additions of small quantities of tetra-ethyl lead had no effect.

*Study of the Extinction of Flame by CC*14. (C. Dufraisse and J. Le Bras, Comptes Rendus, Vol. 202, No. 3, 20/1/36, pp. 227-230.) (813 France.)

The action of carbon tetrachloride is complex and ranges from simple dilution of oxygen content to certain specific chemical activities. The mechanism of extinguishing a flame after it has been formed is different from the prevention of flame formation and this explains non-correlation of the authors' results with those obtained by bomb explosions.

The Catalytic Combustion of Methane. Part I. (W. Davies, Phil. Mag., Vol. 21, No. 141, March, 1936, pp. 513-531.) (862 Great Britain.)

The results in general lead to the conclusion that the heterogeneous combustion of methane on platinum involves the adsorption of both reactants.

The Use of Alcohol Fuel (Djavol) as a Method of Cooling Aviation Engines. (J. Tourkia, L'Aerophile, Vol. 43, No. 12, pp. 368-371; also Luftwissen, Vol. 3, No. 2, Feb., 1936, p. 51.) (884 France.)

Two kinds of alcohol fuels have been in use for some time in France, the so-called national spirit (50 per cent. alcohol, 50 per cent. petrol) and heavy spirit (25 per cent. alcohol, 75 per cent. high density petrol).

The fuels suffer from a number of defects. The alcohol has to be dehydrated before mixing and the carburation is generally bad. Considerable deposition of liquid fuel takes place on the cylinder walls and this affects the lubrication of the engine deleteriously.

It is claimed by E. Desparmet that an upper cylinder lubricant introduced by him under the name of "anthene" overcomes lubrication difficulties with alcohol fuels and at the same time assists the atomisation of the fuel in the carburettor. It is also suggested that the presence of anthene renders the use of anhydrous alcohol unnecessary.

Mixture of benzol and alcohol containing anthene (0.25 per cent.) are supplied under the trade name "Djavol."

The octane number of such mixture is of the order of 97. Mixed with various proportions of petrol they are said to be stable against water crystallisation down to $-48°C$.

On account of the high latent heat of alcohol mixtures, the cylinder temperatures are lower in spite of increased power output (*i.e.*, increased volumetric efficiency).

Russian Experience with Cracked Spirits. (Abstract: M. Precoul, L'Aerophile, Vol. 43, No. 12, Dec., 1935, pp. 372-373; Luftwissen, Vol. 3, No. 2, Feb., 1936, p. 51.) (885 Germany.)

Considerable quantities of cracked fuel are employed in Russia. They contain a large amount of gum and therefore require stabilisation with phenol. The gum separates out mostly in the induction pipe and round the inlet valve. The fuel has 80 octane number and poor lead response.

Nitration of Gaseous Paraffins. (H. B. Hass, E. B. Hodge and B. M. Vanderbilt, Ind. and Eng. Chem., Vol. 28, No. 3, March, 1936, pp. 339-344.) (902 U.S.A.)

Nitro-methane, nitro-ethane, both nitro-propanes and all four nitro-butanes are readily obtainable. Their low ignition temperature renders them suitable as an addition to Diesel engine fuels.

Engines

Propagation of Combustion in the Diesel Engine. (L. Breves, Forschung, Vol. 6, No. 4, July/Aug., 1935, pp. 183-191.) (152 Germany.)

The experiments were carried out in one of the cylinders of a three-cylinder Krupp two-stroke engine, developing 75 b.h.p. at 500 r.p.m.

The travel of the flame was recorded by a series of ionisation gaps connected to a cathode ray oscillograph.

Combustion starts usually inside the cone of the injected fuel. The ignition lag (*i.e.*, time interval between beginning of injection and first appearance of a flame) depends on type of fuel, load and size of orifice. Injection pressure has only little effect. With diminution of size of orifice of fuel injector, the zone of initial combustion approaches the orifice. The spread of combustion is very uneven and may be extremely rapid in the case of brown coal tar oils. The flame persists longest in the centre of the combustion space and dies out first within the injected fuel cone.

The Measurement of Varying Temperatures in the Cylinder Wall of Piston Engines. (H. Pfriehm, Forschung, Vol. 6, No. 4, 1935, pp. 195-201.) (154 Germany.)

It is pointed out that the presence of insulators round the wires embedded in the cylinder wall may cause considerable errors by distortion of the temperature field (reflection of temperature waves). Such errors depend on the depth of the insulator below the surface and the wave length of the temperature wave. Errors of 20 per cent. are quite common.

A further source of trouble is the Peltier effect exhibited by couples as usually employed.

By restricting the amount of insulator and using two wires arranged concentrically, the author shows how both errors can be kept within small limits.

Evaluation of Variables Influencing Air Cooling of Engines. (K. Campbell, J.S.A.E., Vol. 37, No. 5, Nov., 1935, pp. 401-410.) (219 U.S.A.)

The object of these experiments is to convert cooling results obtained under one set of conditions to equivalent values under other conditions.

The tests were carried out mainly on a single cylinder Wright Whirlwind of modern design CR 7/1, bore 5in., stroke 5½in. fitted with baffles.

Some flight tests using a Cyclone engine were also carried out. Detonation was avoided throughout.

To investigate the thermal state of the cylinder the outside was provided with 36 thermocouples distributed over the head and walls.

The highest temperature recorded was at a place in the cylinder head between the rear plug and the exhaust valve seat. Under normal operative condition, this temperature was app. 480°F. (250°C.), other representative temperatures under similar conditions were as follows:—

Rear spark plug gasket	221°C.
Exhaust valve guide boss	215°C.
Exhaust valve spring seat	176°C.
Mid barrel	165°C.
Exhaust rocker pin	115°C.
Flange (front)	105°C.
Flange (rear)	132°C.

The front spark plug gasket temperature was found to be erratic, but the rear gasket temperature varied in a satisfactory manner with most of the other temperatures and could therefore be used as a standard reference for this cylinder and baffles.

A large number of experiments were carried out to investigate change of cylinder temperature with :—

1. Air speed;
2. Cooling air temperature;
3. Mixture strength;
4. Air intake temperature.

The flow of air through the baffle was also investigated and a flow indicator devised.

It was concluded that :—

1. The difference between air and cylinder temperature varies inversely as the square root of the mass flow of the air, for constant b.h.p. and cooling air temperature.
2. Variation of wall temperature with cooling air temperature is app. linear, but depends markedly on the position of thermocouple.
3. The effect of mixture strength is very pronounced, the temperature of the hottest spot on the head rising from 410°F. to 510°F. as the mixture is progressively weakened from 9/1 to 14/1. (Max. power corresponds to a *MS* 12/1 and temp. 480°F.).
4. An increase in air intake temperature from 60°F. to 212°F. is accompanied by a diminution of 10 per cent. in b.h.p. and a drop of app. 15°F. of cylinder wall temperature.

The effect of change in air speed temperature was also tested in an aeroplane fitted with a cyclone engine. Flights were carried out at five altitudes between 2,000 and 17,500 feet.

The result obtained in this manner departs in some instances considerably from those obtained on the ground, and the temperature difference between wall and cooling air appears to vary inversely as the mass flow rather than as the inverse square root.

It is suggested that the disturbed condition of the cooling air (propeller slipstream) is responsible.

The data published are not sufficient to enable the object of the research, as set out at the beginning of this review, to be realised.

Useful ground work has, however, been covered.

An Analysis of Critical Stresses in Aircraft—Engine Parts. (C. F. Taylor, J.S.A.E., Vol. 37, No. 5, Nov., 1935, pp. 412-418.) (220 U.S.A.)

Critical stresses are generally of a local character and cause failure under fatigue. Our knowedge of the endurance property of various materials is limited to tests on simple forms over limited ranges of local variation with simple types of stresses. In the engine the stresses are complicated, and at the present moment designers have to rely largely on accumulated experience obtained from successful engines and extrapolation has to be done with extreme caution. As a help, the behaviour of certain engine parts in special test plants under conditions simulating practice is of great interest. As the fitting of strain gauges is often difficult on account of the restricted space available, coating the part under test with a brittle enamel has given valuable information as to stress distribution. Fracturing models made of brittle material (plaster of paris) under steady load also simulate fatigue failures of the actual working substance. Similarly, strain distribution in a crankshaft has been studied by means of a rubber model. Such problems are difficult to explore by photo-elastic methods, which are restricted to two-dimensional cases. As a simple example of the utility of such experiments as applied to " scaling-up " of similar parts, fillet radii should be proportional to the other dimensions.

Fourteen references.

Iron and Copper Bonded in Composite Cylinder Heads. (I. E. Aske, Autom. Indust., Vol. 73, No. 22, 30/11/35, pp. 724-733.) (299 U.S.A.)

In a turbulent " L " head the combustion chamber opposite the piston is provided with a cast in copper plug, which projects into the water space.

It is claimed that this cools the charge and delays detonations.

Details of the required casting technique are given.

N.A.C.A. Study of Radial Air-Cooled Engine Cowling and Cooling. (D. H. Wood and C. Kemper, J.S.A.E., Vol. 37, No. 6, Dec., 1935, pp. 441-448.) (353 U.S.A.)

An investigation has been undertaken to determine a rational basis for the design of the N.A.C.A. cowling. The effect of front and of rear opening and shape of cowling on the quantity of air flowing through the cowling, the pressure drop and the drag have been determined from tests in a wind tunnel. The quantity of air and the pressure drop required for satisfactory cooling of a given design of air-cooled cylinder have been determined from tests on a single cylinder. The results obtained from the tests are being checked by large wind tunnel tests on a 550 h.p. engine fitted with propeller. The working of the latter exercises a considerable influence on the quantity of air passing through the cowling, and, when allowance is made for this, the results so far obtained are stated to be in satisfactory agreement with predictions based on model tests.

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

1. The quantity of heat to be dissipated to the cooling air from a given design of engine cylinder depends mainly on the indicated power output, and is thus the same whether the output is obtained at low engine speeds and high m.e.p. (boost) or high engine speeds and normal m.e.p.
2. The temperature difference between cylinder and air for constant air temperature is inversely proportional to $(P.V.)$ 0.4 to 0.5
   where P = air density
   V = air speed.
3. For constant conditions of engine power, mixture strength, induction temperature and (PV) for a change in 40°C. of cooling air temperature, the following changes in engine temperature can be reckoned with:—

Cylinder head	27°C.
Barrel	25°C.
Flange	15°C.

4. The change in cylinder temperature is usually of the order of 10 per cent. of the change in induction temperature. There are, however, many inconsistencies.
5. The power required for cooling a single cylinder (45 h.p.) by means of a separate blower and jacket amounts to 7 per cent. of the engine output (blower efficiency 50 per cent.).
6. Although the test results for some of the cowlings used are plotted in terms of non-dimensional coefficients, the graphs are marked: " For illustration only—do not use for design."

Evidently considerably more correlation work is required before the design of such cowlings can be put on a " rational basis."

The Electrolytic Cleaning of Exhaust Valves. (S. D. Heron and other, J.S.A.E., Vol. 37, No. 6, Dec., 1935, pp. 19-21.) (354 U.S.A.)

The valve, after a preliminary wash to remove oil, is made the cathode in a bath of fused sodium hydroxide—sodium carbonate. After about five minutes

with a current of 6 amps., all deposits (including those due to leaded fuels) are removed, without attacking any of the underlying metal.

Damping Influences in Torsional Oscillation. (J. F. Shannon, PL. D., Engineering, Vol. 140, No. 3649, 20/12/35, pp. 675-678, and No. 3650, 27/12/35, pp. 702-704.) (394 Great Britain.)

A four-cylinder engine with a two-bearing crankshaft was connected through a length of shafting to an electric motor and rotated at a series of speeds, the cylinder heads being removed.

The oscillation period of the system could be altered by the fixing of additional flywheels.

Vibration diagrams were taken at both ends of the crankshaft by means of a Geigor recorder.

The magnitude of the critical vibration varied in the ratio of 2 : 1, depending on the amount of oil fed to the bearings. A corresponding diminution in the electrical power required to motor the engine at critical speeds was noted.

Friction and Vibration. (H. Bock, Z. Instrum., Vol. 56, No. 2, Feb., 1936, pp. 71-74.) (769 Germany.)

The effect of solid and fluid frictions on the frequency of a mass under spring control undergoing continuous translation is investigated. Interesting examples in practice show the heavy damping brought about by fluid friction.

The Damping Influence of the Propeller during Torsional Oscillations. (H. Guntz Berger, Z. Mech., Vol. 4, No. 2, 22/2/36, p. 67.) (870 Germany.)

The effect of the water flow increases the inertia of the propeller by as much as 60 per cent. instead of the 25 per cent. usually assumed.

The damping moment depends on the angular velocity of the propeller and the speed of the boat, but not on the angular acceleration.

A New Method of Regulating the Output of Centrifugal Blowers. (G. Serragli, L'Aerotecnica, Vol. 15, No. 11-12, 1935, pp. 1068-1079.) (918 Italy.)

The blades are pivoted and fitted with balance weights so that the couple due to centrifugal force tending to open the blades is largely balanced by the couple due to air reaction.

The force required to move the blades is thus limited to overcoming the friction at the pivot.

The scheme in its present form is only applicable to relatively low speed fans fitted with few blades. Its application to aircraft supercharges will present great difficulties on account of the high speed of operation.

If frictional difficulty could be overcome, the variation of density with altitude might be used to govern blade position automatically.

Instruments

The Effect of Air or Instrument Vibration on the Reading of Dynamic Head. (G. Rich, Z.A.M.M., Vol. 15, No. 5, Oct., 1935, pp. 290-299.) (196 Germany.)

On the supposition that the instrument reads the true average of Pv^2 where v is the effective velocity at any instant, expressions for the effect of a vibration in the direction of flow (*i.e.*, along the instrument axis) are easily calculated. The effect of vibrations at right angles to this is complicated by the response varying with the obliquity of the resultant current. This causes the difference in reading between the steady and the vibrating instrument to pass through a maximum value and then decrease, for a gradually increasing amplitude of vibration. For an instrument of the Prandtl design, the maximum difference

in this case amounts to 8 per cent. and occurs at a frequency f given by the relation

$$af/vo = 0.092$$

where a = amplitude of vibration (assumed sinusoidal).

Vo = steady air velocity (if instrument is vibrating).

or = mean value of air velocity (if instrument is stationary and air current is vibrating).

Direct experiment with a vibrating instrument in a wind channel shows a difference of the estimated amount for frequencies up to 25 sec. For higher freqūencies experimental values are about double the calculated. The Author attributes this to the following factors which have been neglected in his computation:—

1. Capacity and throttling of pipe line.
2. Instrument does not read true time average ρv^2.

Ultra High Speed Motion Picture Photography. (Ind. and Eng. Chem., Vol. 14, No. 3, 10/2/36, pp. 61-62.) (760 U.S.A.)

Successive pictures are obtained by flashing the source of illumination (5,000 watt mercury vapour lamp) at rates up to 2,000 sec. by means of Thyratron control.

Photographic Registration of Angular Measurements. (K. Ludemann, Z. für Instrumentenkunde, Vol. 56, No. 2, pp. 63-71.) (767 Germany.)

The principles underlying photographic registration are briefly dealt with (balloon theodolites, cine-theodolites, etc.).

A valuable bibliography of 48 references is attached.

The Measurement of Absolute Viscosity. (L. R. Bacon, Journal of Franklin Institute, Vol. 221, No. 2, Feb., 1936, pp. 251-273.) (768 U.S.A.)

The falling sphere viscometer is investigated mathematically and experimentally over the range 7.5 to 3,600 poises.

After applying simple corrections, viscosity to within 1 per cent. of the absolute value obtained by capillary tube method can be realised.

Sixteen references.

New High-Speed Cine Camera. (L. Bull and P. Girard, Comptes Rendus, Vol. 202, No. 7, 17/2/36, pp. 554-555.) (805 France.)

The film is mounted on the inside of a drum which forms part of a pivotless air turbine. Special precautions are taken to ensure stability of operation. Intermittent spark illumination of the object is used, and the image is transferred to the inside of the drum carrying the film by means of a right-angled prism. 50,000 pictures a second each 5 cm.^{2} in area are possible, the film length required being only 22 cm.

Special Conditions Affecting the Use of Electrical Instruments in the Aeroplane. (W. Hofmann and K. Hellwig, Luftwissen, Vol. 3, No. 2, Feb., 1936, pp. 31-39.) (877 Germany.)

Vibration, acceleration and inclination put additional strains on the working of aircraft instruments, and require special design measures. Subsidiary factors are the effects of temperature and stray magnetic fields. Of special importance is the provision of an open scale, since conditions of observation are generally not good. Recent advances in magnetic Al. Ni. alloys have helped here, and the use of alternating current instruments wherever possible is also recommended (revolution counters). In their present form these instruments are difficult to compensate for temperature effects.

American Opinion Concerning Electric and Wireless Installation in Aircraft. (Luftwissen, Vol. 3, No. 2, Feb., 1936, p. 43.) (879 Germany.)

All engine accessories should be driven by the main engine direct. Other accessories should be supplied with independent power supply (auxiliary engine of suitable size).

As regards directional apparatus, the ground-operated beacon is preferred to the direction finder installed in the machine. The latter requires very careful installation to ensure absence of disturbances by other electrical circuits on the machine. Static charges produced on the outside antenna (especially in winter during gales) present a serious problem.

Echo Sounding—the C.E.M.A. Apparatus. (J. Routhier, Luftwissen, Vol. 3, No. 2, Feb., 1936, p. 49.) (880 Germany.)

The instrument has passed French Air Ministry acceptance tests. Time measurement is correct to 0.006 sec., and the instrument deals either with the range 5/40 m. or 30/250 m. The dimensions of both sender and receiver are approximately 60 × 30 × 30 cm.

Non-Magnetic Headphones. (Abstract from Aviation, Vol. 35, No. 1, Jan., 1936, p. 44; Luftwissen, Vol. 3, No. 2, Feb., 1936, p. 49.) (881 Germany.)

The headphones made by the American Brush Development Co. work on the pilzoelectric principle. There is thus no magnetic interference with other sensitive recording instruments.

Vibration Recorders and Accelerometers. (H. W. Kock, Luftwissen, Vol. 3, No. 2, Feb., 1936, pp. 55-56.) (886 Germany.)

The vibration recorders are intended for the study of the motion of structures as a whole.

Accelerometers are more often used to study the motion of isolated parts. In the latter case it is essential that the fixing of the apparatus does not seriously affect the motion.

A type of accelerometer is described in which the relative motion of the inertia mass affects the delivery of an air jet and can thus be recorded on a pressure gauge. Other types depend on the principle of the carbon microphone.

Materials and Elasticity

The Fracture of Rotating Discs of Brittle Material. (H. Schlechtweg, Ing. Arch., Vol. 6, Part 5 (Oct.), 1935, pp. 365-372.) (204 Germany.)

Every change in shape of a working substance can be considered as made up of two parts—a change in volume and a shear. In the case of brittle materials under practical conditions, it can be assumed that the change in volume is related to the hydrostatic pressure or tension in the same way as for bodies obeying a linear elastic law. The resulting shear strains in brittle bodies are, however, no longer related to the shear stresses by a constant shear coefficient, but the relationship depends on the existing tensile force distribution.

The author derives a number of new elastic constants which he defines as the "sensitivity" of the brittle working substance as regards tension, shear and pressure.

He then obtained an expression for the limiting safe speed as a linear function of these constants and the dimensional characteristics of the disc. It is of interest to note that a rotating wheel is loaded much more uniformly in the case of a brittle substance than if Hooke's law is obeyed. American experiments on emery wheels fit the calculated curve.

An Investigation of the Compressive Strength Properties of Stainless Steel Sheet-Stringer Combinations. (A.C.I.C., Vol. 7, No. 697, 30/11/34.) (390 U.S.A.)

For such data as were available the linear relationship between load carried and stiffener units, and independence from stiffener pitch applies as well to aluminium alloy plate stringer combinations.

The present specification for the strength of spot welds is not adequate to prevent failures of the type experienced during these tests. It is felt that it should be amended by a requirement to the effect that the weld strength of built-up sections be demonstrated by test to be sufficient to allow complete collapse, or crushing, of the section without weld failures.

Study of Intercrystalline Corrosion by Diffused Reflection of Light. (M. F. Carrac, Comptes Rendus, Vol. 201, No. 5, 29/7/35, p. 330.) (490 France.)

The amount of reflected light depends on the angle of incidence and the dimensions of the surface groove caused by pitting. In the case of dural the curve connecting intensity and time goes through a maximum and then approaches a constant (low) valve. The maximum is reached at the same time for all angles of incidence of illumination, the absolute values of the reflected light diminish, however, with increasing obliquity of the incident light.

The final constant value reached is connected in a simple manner with the dimensions of the surface groove.

Modulus of Elasticity of Materials for Small Stresses. (R. H. Evans and R. H. Wood, Phil. Mag., Vol. 21, No. 138, Jan., 1936, pp. 65-80.) (496 Great Britain.)

The materials tested consisted of steel, cast iron, glass, slate, marble, granite, sandstone and concrete.

The test piece was in the form of a column, 3oin. long and 2 sq. in. cross-section.

Strains of the order of 10^{-6} inches could be measured by means of special mirror extensometers.

All the curves showed a sharp rise of the value of E as the range of applied stresses is increased from zero. Explanations on the basis of combined elastic and viscous force having failed, the authors suggest the presence of initial stresses (both tensile and compressive) as a possible cause.

Stability of Bars with Lateral and Axial Loading. (W. Way, J. Aer. Sci., Vol. 3, No. 2, Nov., 1935, pp. 46-51.) (522 U.S.A.)

In this paper a method of calculating critical loads is used which involves applying an auxiliary moment M at one point of the structure, calculating the resulting rotation θ, and equating to zero the derivative $dM/d\theta$. This method makes it possible to easily investigate certain modes of buckling that would otherwise be apt to escape attention, as the unsymmetrical buckling of a uniformly loaded bar of two equal spans with axial load.

The critical end load for a one or two-span strut with lateral load is found to be independent of the lateral load. For a two-span strut, the critical load is found to lie between the Euler loads for the long and short span separately.

Two new problems are taken up. One is that of a two-bay strut with rotationally elastic middle support. The critical load varies from the value for a simple two-bay strut when the spring constant is zero to the value for the strut with locked middle joint when the spring constant is infinite. The other new problem is that of a straight bar buckled to an arch and supporting lateral load on the convex side. The ends are held a fixed distance apart, and the problem is to find the lateral load necessary to cause collapse. It is found that

$Lq_{cr} = 23.2\ P_{eu}a/L$ where q_{cr} is the intensity of the critical lateral load, a the initial deflection of the buckled bar, L the length and P_{eu} the Euler load for the bar. The arched bar collapses unsymmetrically.

Physical and Metallurgical Properties of Lead-Calcium Alloys for Storage Cells. (E. E. Schumacher and G. S. Phipps, Bell Tele. Pub. No. B.884, Oct., 1935.) (619 U.S.A.)

Lead-calcium alloys containing from 0.04 to 0.10 per cent. calcium have combined physical, metallurgical, and electro-chemical properties which recommend them as a superior material for storage cell grids and plates. Batteries containing elements made of these alloys, when properly heat-treated, should have a high efficiency and long service life. These new alloys can be satisfactorily cast, rolled, welded, machined, and burned.

Nitriding of Austenitic Steels. (B. Jones, Met. Prog., Vol. 29, No. 2, Feb., 1936, p. 39.) (763 U.S.A.)

The hardening effect due to nitriding varies considerably with the composition of the steel and temperature as well as pressure of gas. Valve stems (heat resisting Cr-Ni steels) offer a new field of application.

Photo-Elastic Study of Stresses Due to Impact. (Z. Tuzi and M. Nisida, Phil. Mag., Vol. 21, No. 140, Suppt., Feb., 1936, pp. 448-473.) (860 Great Britain.)

To analyse quick variations of internal stresses, *e.g.*, in vibrating specimens or in impact phenomena, kinematography or photo-elastic fringes at very high speeds was devised. As the light source, an ordinary carbon arc lamp has been used with heavy current and with a red filter, selecting a very narrow band.

The study was limited to a certain section and an exposure of about 1/5,000-1/50,000 sec. has been achieved.

Subsidiary Whirling of Rotors Due to Speed Oscillation. (D. Robertson, Phil. Mag., Vol. 21, No. 140, Suppt., Feb., 1936, pp. 474-501.) (861 Great Britain.)

Whirling of a shaft is most commonly caused by unbalance, but it may also be produced in a number of other ways. By itself speed oscillation is not a source of whirling, but it does induce additional subsidiary whirls in a rotor which already has an unbalanced whirl. These subsidiary whirls are usually quite small.

Meteorology and Physiology

Physiology and Mechanical Flight. (M. Tricot, L'Aerophile, Vol. 43, No. 11, Nov., 1935, pp. 325-329.) (331 France.)

A plea is entered for a more extensive study of animal flight. A bird's wing exercises a forward thrust both on the up and down stroke. This appears to be closely related to wing curvature and the shape of the wing roots (body fairing). The interaction of body and wing produces a complicated system of airflow which requires further study.

Ice Formation on Aeroplanes. (H. Noth and W. Polte, Luftwissen, Vol. 2, No. 11, Nov., 1935, pp. 304-311.) (336 Germany.)

Meteorological conditions likely to produce ice formation are described and possible precautions in mapping out a flight are detailed.

The considerations only apply to Mid-European conditions. In these regions, a cloud formation resembling high altitude fog is often associated with regions

of high pressure during winter. Clouds are seldom higher than 6,000 feet and super-cooled rain is likely to be met with. This condition is the most dangerous for ice formation on aircraft.

(See Translation No. 286.)

A Subjective Photometer. (W. D. Wright and J. H. Nelson, J. Sci. Inst., Vol. 12, No. 12, Dec., 1935, pp. 373-377.) (391 Great Britain.)

The object of the photometer is to measure the variation of sensitivity of the eye for different conditions of the visual mechanism and the principle employed is that of binocular matching, in which a patch viewed in the left eye is compared in intensity with a similar patch viewed in the right eye. A calibrated photometer wedge provides the necessary intensity control. Applications of the apparatus include measurements on the effect of adaptation and on the extent of the loss of vision in cases of uniocular blindness.

The Theory of General Circulation Applied to the Temperature Distribution of the Atmosphere. (G. Debebant and others, Comptes Rendus, Vol. 201, No. 5, 29/7/35, p. 346.) (491 France.)

The author had previously applied the condition of minimum dissipation to the study of solar problems. (Comptes Rendus, Vol. 199, 1934, p. 1287.) A similar method applied to the configuration of the atmosphere leads to expressions for the variation of temperature with height for the troposphere and stratosphere which are in general agreement with experimental data.

Condensation Nuclei and Particles in Suspension in the Atmosphere. (O. Thellier, Comptes Rendus, Vol. 201, No. 5, 29/7/35, p. 348.) (492 France.)

Condensation nuclei and suspended particles were measured by the methods of Aitken and Owens respectively. The average number of nuclei per cc. of air in Paris is of the order of 60,000, whilst the particles in suspension are very much less (order of 100-600).

Whilst the nuclei do not show any regular variation, the suspended particles undergo well marked diurnal and seasonal changes and also determine atmospheric visibility.

A Practical System for Radiometeorography. (L. F. Curtiss and A. V. Astin, J. Aer. Sci., Vol. 3, No. 2, Nov., 1935, pp. 35-39.) (520 U.S.A.)

A description is given of a complete system based on the Olland telemeteorograph, for obtaining meteorological and similar data from instruments attached to sounding balloons by means of a radio transmitter. In this way records are obtained instantaneously by a receiver located on the ground. A wave length of 5 metres is used permitting convenient use of half-wave tuned doublet antennas for transmission as well as reception. The radio transmitter is " keyed " in such a way that signals are emitted only during several short contacts per minute, thus greatly reducing the size of the plate batteries required. Complete apparatus for attachment to balloon weighs less than 2lbs. and has been received clearly at altitudes of 23 kilometres (14.3 miles) and at distances of 80 miles. A method of direction finding for pulses used in this system is described.

The General Circulation Theory Applied to the Atmosphere—the Law of Rotation and the Field of Pressure. (G. Debebant and others, Comptes Rendus, Vol. 201, No. 8, 19/8/35, pp. 453-456.) (543 France.)

On the basis of minimum thermal dissipation the authors have previously obtained expressions for the temperature distribution in the atmosphere (Abstract No. 103).

Using the principle of minimum mechanical dissipation, expressions are obtained for the pressure distribution and direction of prevailing winds for various altitudes and latitudes. The authors claim satisfactory agreement with observations.

The Tyndallometer—a New Instrument for Rapid Measurement of Atmospheric Dust Content. (M. Bereck, K. Marmichen and W. Schafer, Z. für Instrumentenkunde, Vol. 56, No. 2, pp. 49-56.) (766 Germany.)

The instrument made by Leitz depends on the scattering of light by dust particles, and enables rapid variations to be followed.

The apparatus is very compact and easily carried by the observer.

Fifteen references.

Directed Vision. (Y. Le Grand, Comptes Rendus, Vol. 202, No. 7, 17/2/36, pp. 592-594.) (807 France.)

The resolving power of the human eye diminishes rapidly with illumination. This is mainly due to losses between lens and retina. These losses vary considerably with the optical path and the author describes various methods of investigation.

Variation of Smoke and Dust Content of Town Air. (R. Herman-Montague and L. Herman, Comptes Rendus, Vol. 202, No. 6, 10/2/36, pp. 501-503.) (810 France.)

Experiments were carried out at Lyons, using an Owens apparatus. The results are very similar to those obtained in London. Tests carried out in Berlin show considerably less dust in the afternoon.

Method for the Rapid Determination of CO_2 Content of Atmospheric Air. (A. Kling and M. Rouilly, Comptes Rendus, Vol. 202, No. 4, 27/1/36, pp. 318-320.) (812 France.)

The air is bubbled at a fixed rate through a standard caustic soda solution treated with phenol thalein. The volume of air required to cause the indicator to react is proportional to the CO_2 content.

Miscellaneous

A Method of Numerical Solution of Differential Equations. (V. M. Faulkner, Phil. Mag., Vol. 21, No. 141, March, 1936, pp. 624-640.) (864 Great Britain.)

A modification of the Adams method for the solution of certain non-linear differential equations is described. The following advantages are claimed:—

1. Increased accuracy with the use of differences up to the same order.
2. An indication of the accuracy of the integrators is possible.

Upkeep Overhaul in French Civil Aviation. (Luftwissen, Vol. 3, No. 2, Feb., 1936, p. 39.) (878 Germany.)

The Government has delegated the control of all civil aircraft to the aeronautical section of the Bureau Veritas, which body keeps representatives on all the larger aerodromes. The officials have entry to all repair shops and are specially requested to watch that during overhaul no unauthorised changes are carried out.

As far as engines are concerned, the tendency is to cut out top overhauls as much as possible and have complete overhauls at stated intervals. These depend on the design of the engine and its particular use.

The Process of Parachuting. (Abstract: P. A. Richard, L'Aérophile, Vol. 43, No. 12, Dec., 1935, pp. 357-367; Luftwissen, Vol. 3, No. 2, Feb., 1936, pp. 51-52.) (887 Germany.)

A good parachute should have a time of opening of 2 to 3 seconds and a terminal velocity of 5 m./sec. This entails deceleration of the order of 7 g. which can be borne by the human organism without deleterious after effects. Immediately after landing, however, beginners show high blood pressure and considerable excitement. The free drop stage before opening of parachute is generally completely forgotten.

When fully open the parachute has a resistance coefficient of the order of 1.3.

Long-legged individuals have a distinct advantage in reducing landing impact.

Seaplanes

Tank Tests of Three Models of Flying Boat Hulls of the Pointed-Step Type with Different Angles of Dead Rise—N.A.C.A. Model 35 Series. (J. R. Dawson, N.A.C.A. Tech. Note No. 551, Jan., 1936.) (751 U.S.A.)

The pointed-step type hull irrespective of angles of V (or dead rise) is especially suited for seaplanes with high get-away speeds.

Research in the R.A.E. Tank. (L. C. Coombs, Z. Mech., Vol. 4, No. 2, 22/2/36, pp. 87-88.) (873 Great Britain.)

Reference is made to the effect of wing stubs on flying boat resistance. The position of the wing stub is of great importance, since it may be subject to wave and spray action during the take-off.

If properly placed, stubs of the type fitted to the Dornier boats add very little to the hydrodynamic resistance. Wind tunnel tests show that they can add appreciably to the aerodynamic lift when the machine is airborne.

Seaplane Take-off Weights. Parts I, II and III. (E. T. Jones, Z. Mech., Vol. 4, No. 2, 22/2/36, pp. 88-90.) (874 Great Britain.)

The importance of a suitable compromise between the requirements for top speed and those for highest possible lift for take-off is stressed.

The optimum wing setting considering take-off only is of the order of 12°. This would entail a very high drag of the float when airborne.

The provision of split flaps or sliding hinge bellows capable of quick movement when unsticking is recommended.

Variable pitch airscrews require modified hull design in order to become effective.

The effect of wind can generally be allowed for with fair accuracy. The effect of surface roughness of the water is difficult to assess.

Take-off Performance of Flying Boats. (A. Gassner, Aero Digest, Vol. 27, No. 5, pp. 24-25.) (882 U.S.A.)

Important factors influencing take-off are wing setting and trim, and the ratio of flying weight to the third power of the maximum boat width. A rapid unsticking requires at least 25 per cent. excess of thrust over water resistance. Seven representative American flying boats, including the Douglas Dolphin are considered. These range in gross weight from 10,000 to 50,000lbs.

The Reduction of Ships' Resistance by the Lift of Supporting Surface (Hydrovanes). (W. Graff, Werft-Reederei-Hafen, 1935, No. 22, pp. 334-338.) (916 Germany.)

In the case of a wing, the ratio of drag to lift is equal to the tangent of the gliding angle and is designated by E.

In the case of a ship, a similar expression can be obtained for the ratio of resistance to displacement $W/D = E^1$.

It is obvious that a combination of ship and hydrovane can only reduce the overall resistance to propulsion if E^1 for the normal ship is $> E$ for hydrovane.

Values of E^1 for various types of surface craft under various operative conditions are known to vary app. as v^2/l where l is the cube root of the displacement. Generally speaking, E^1 is less than 0.08 (ocean liner, cruiser, torpedo boat, cargo boat).

Values of E, on the other hand, do not vary much with speed and dimension of wing so long as incidence is constant and favourable. The values are, however, affected considerably by interference with the hull and drag of supports.

A lower limit for E appears to be 0.08, which happens to be the upper limit for the usual ship construction.

From this it follows that the fitting of hydrovanes is only profitable for high speed surface craft of relatively small dimensions. Torpedo boats are too large to benefit.

The author works out the case of a 30-ton speed boat running at 50 knots. Without hydrovanes this boat requires over 1,000 h.p. If the hull is lifted out of the water by means of the vanes, only 600 h.p. are required for the same speed.

In order to get the boat to unstick, however, at least 700 h.p. are required, the h.p. diminishing rapidly to 600 as the boat hull lifts clear.

This power reserve could be reduced if the angle of incidence of the hydrovanes could be altered so as to lift the boat at a lower speed. Apart from mechanical difficulties, this introduces the danger of cavitation.

From the shape of the power curves it appears that hydrovane boats can only be justified if operated at maximum speeds. At intermediate speeds the boat may take considerably more power than a normal boat. If, therefore, a large speed range is required, it is essential to provide some method of folding up the hydrovane surfaces.

Wind Channels

Tests in the Variable-Density Wind Tunnel of Related Airfoils having the Maximum Camber Unusually Far Forward. (E. N. Jacobs and R. M. Pinkerton, N.A.C.A. Report No. 537, 1935.) (416 U.S.A.)

A family of related airfoils having the position of maximum camber unusually far forward was investigated in the variable-density tunnel as an extension of the study recently completed of a large number of related airfoils. The new airfoils gave improved characteristics over those previously investigated, especially in regard to the pitching moment. Some of the new sections are markedly superior to well-known and commonly used sections and should replace them in application, requiring a slightly cambered section of moderate thickness, having a small pitching moment coefficient.

Wind Tunnel Tests of a 10-foot Diameter Gyroplane Rotor. (J. B. Wheatley and C. Bioletti, N.A.C.A. Report No. 536, 1935.) (435 U.S.A.)

1. The model tests, because of the excessive size of the rotor hub, are unreliable as regards the lift-drag ratio of a gyroplane rotor.
2. The pitch setting is the critical parameter that determines rotor characteristics.

3. A change in solidity causes a proportional change in rotor force coefficients only at high tip-speed ratios.
4. The rate of change of rolling moment with feathering angle is not materially influenced by pitch angle or solidity and decreases dangerously at low tip-speed ratios.
5. The maximum resultant force coefficient is obtained with a pitch setting of 5°.
6. A feathering angle considerably greater than 10° is required to obtain zero rolling moment at high tip-speed ratios for pitch settings greater than 4°.

The Large Wind Tunnel of Chalais-Meudon. (A. Lapresle, Z. Mech., Vol. 4, No. 2, 22/2/36, p. 72.) (871 Germany.)

The tunnel is of the Eiffel type, using a sealed experimental chamber in which the pressure is below atmospheric.

The jet is 11 m. long and 16 × 8 m. section. Six fans (10-bladed) are used, absorbing approximately 1,000 h.p. each.

Wireless

Extension of a Previous Formula for Earth Absorption in Wireless Telegraphy. (K. F. Niessen, Ann. d. Phys., Vol. 24, No. 1, Sept., 1935, pp. 31-48.) (100 Germany.)

The author considers the presence of both displacement and conductor currents for various values of the dielectric constant and conductivity of the earth's surface.

If T represents the fraction of the radiated energy absorbed by the ground

$$T = f(n, d, x)$$

where n = ratio of characteristic parameters (air and earth) in the Hertz vectorial function.

d = ratio between height of vertical dipole and wave length radiated.

x = an expression depending on relative magnitude of displacement and conduction current.

The functional relationship is shown graphically in various ways.

Generation and Application of High Tension Direct Current. (H. Grünewald, Z.V.D.I., Vol. 79, No. 46, 16/11/35, p. 1375-1385.) (256 Germany.)

The various methods for generating high tension direct current are described in detail.

Nature provides an example of direct generation in the thunderstorm. Working on similar lines, but with more modest results, are the various types of electrostatic or influence machines. The more usual technical process is the rectification of high tension alternating current. This can be carried out either by means of mechanical circuit breakers, gas valves, or arcs.

As an alternative the high tension alternator can be fitted with special commutators which may be either stationary or rotary. An example of the latter type is the Swedish Glesium process in which its alternating wave form is distorted so as to render longer rest periods of zero current available for the commutator.

A very extended bibliography of 110 references is attached.

Photoradio Apparatus and Operating Technique Improvements. (J. L. Callahan and others, Proc. Inst. Rad. Eng., Vol. 23, No. 12, Dec., 1935, pp. 1441-1482.) (402 U.S.A.)

A brief review of photoradio reception and progress up to 1928 is included in the introductory part of the paper.

Improvements to terminal equipment which make possible greater fidelity of half-tone transmission over long-distance radio circuits are described. Radio circuit distortion is discussed and compensation methods suggested. A mathematical analysis of the photoradio keying is appended.

The Theory of Dauzere on the Conductivity of the Air in Regions likely to be Struck by Lightning. (E. Mathias, Comptes Rendus, Vol. 201, No. 5, 29/7/35, p. 317.) (489 France.)

The danger of a particular spot A being struck by lightning depends on the total conductivity s and the conductivity gradient r of the air in the vicinity. Whilst high values of r and s are essential they do not necessarily lead to A being struck, unless vertical air currents assist the passage of the ions. On account of the greater mobility of the negative ions, equalisation of potential by the motion of such ions is more readily accomplished and is generally less dangerous (St. Elmo's fire). In the case of very severe storms, lightning carried by positive ions will strike the spot emitting the negative ions.

The presence of St. Elmo's fire is not, therefore, an invariable safeguard against being struck by lightning.

Operation of Ultra-High Frequency Vacuum Tubes. (F. B. Llewellyn, Bell Tele. Pub. No. B.890, Oct., 1935.) (620 U.S.A.)

Previous electronics analyses are extended by the introduction of more general boundary conditions. The results are applied to the calculation of the rectifying properties of diodes at very high frequencies and to the amplifying properties of negative grid triodes at both low and high frequencies. The effect of space charge on the various capacitances in triodes is discussed, and formulas for the amplification factor and plate impedence are presented in terms of the tube geometry. Finally, a discussion of the input impedence of negative grid triodes is given together with a comparison of the theoretical value with the results of measurements made by several well-known experimenters.

Earth Potential Measurements during the International Polar Year. (G. C. Southworth, Bell Tele. Pub. No. B.892.) (681 U.S.A.)

Most of the data point toward the generally accepted view that there is a close relation between earth resistivity and the direction and magnitude of earth potentials. However, there are some inconsistencies noted which tend to make this less definite.

A Note on the Source of Interstellar Interference. (K. G. Jansky, Bell Tele. Pub. No. B.897, July, 1935.) (682 U.S.A.)

It is concluded that the source of these radiations is located in the stars themselves or in the interstellar matter distributed throughout the milky way.

Because of the similarity in the sound produced in the receiver head set, it is suggested that these radiations might be due to the thermal agitation of charged particles.

Radio Compass. (L'Aérophile, Vol. 44, No. 2, Feb., 1936, p. 43.) (849 France.)

The principle of the American instrument (B.N.S.) is illustrated with the help of a wiring diagram. Reference is also made to a French compass (Busignies L.M.T.) of greater sensitivity and therefore more suitable for navigation outside the regular channels. Both instruments are direct reading, zero being indicated when the plane heads in the direction of the emitting station.

The "Telefunken" Wireless Direction Finder. (Luftwissen, Vol. 3, No. 2, Feb., 1936, pp. 40-43.) (883 Germany.)

The instrument functions on the well-known principle of heart-shaped response curve when a line and frame aerial are combined. By putting the non-directional area in series with one or other of the branches of the frame the heart-shaped response curve undergoes virtual reflection.

The response is only unaffected if the plan of the frame aerial is perpendicular to the direction of the wireless wave. A small deviation causes, however, considerable differences as the line aerial is switched over. This forms the basis of the instrument, the difference in response being indicated either by ear or eye.

The complete instrument including battery weighs 27 kg.

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