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NOTE.—As far as possible, the country of origin quoted in the items refers to the original source.

LIST OF ABBREVIATIONS OF TITLES AND JOURNALS.

A.	Abstracts from the Scientific and Technical Press.
Aeron. Eng.	Aeronautical Engineering (U.S.S.R.)
Aer. Res. Inst. Tokyo	Aeronautical Research Institute of Tokyo.
A.C.I.C.	Air Corps Information Circular.
Ann. d. Phys.	*Annalen der Physik*
Army Ord.	Army Ordnance.
Autom. Eng.	Automobile Engineer
Autom. Ind.	Automotive Industries.
Autom. Tech. Zeit. ...	Automobile Technische Zeitschrift.
Bell Tele. Pubs. ...	Bell Telephone Publications.
Bur. Stan. J. Res. ...	Bureau of Standards (U.S.A.) Journal of Research.
Chem. Absts.	Chemical Abstracts.
Chem. and Ind. ...	Chemistry and Industry.
Comp. Rend.	Comptes Rendus de L'Académie des Sciences.
Eng. Absts.	Engineering Abstracts.
E.N.S.A.	Revenue Technique de l'Association des Ingénieurs de l'Ecole Nationale Supérieure de L'Aéronautique.
Forschung	Forschung auf dem Gebiete des Ingenieurwesens.
Fuel	Fuel in Science and Practice.
H.F. Technik.	*Hochfrequenztechnik und Electroakustik.*
Ind. and Eng. Chem. ...	Industrial and Engineering Chemistry.
Ing.-Arch.	Ingenieur-Archiv.
Inst. Autom. Eng. ...	Institute of Automobile Engineers (Research and Standardisation Committee).
J. Aeron. Sci.	Journal of the Aeronautical Sciences.
J. App. Mech.	Journal of Applied Mechanics.

J. Am. Soc. Nav. Engs.	Journal of American Society of Naval Engineers.
J. Roy. Aero. Soc. ...	Journal of Royal Aeronautical Society.
J. Frank. Inst.	Journal of Franklin Institute.
J. Inst. Civ. Engs. ...	Journal of Institute of Civil Engineers.
J. Inst. Elec. Engs. ...	Journal of Institute of Electrical Engineers.
J. Inst. Petrol.	Journal of the Institute of Petroleum.
J. Met. Soc.	Journal of Meteorological Society.
J. Sci. Inst.	Journal of Scientific Instruments.
J.S.A.E.	Journal of Society of Automotive Engineers.
J. Soc. Chem. Ind. (Abstracts B)	Journal of the Society of Chemical Industry (British Chemical Abstracts B)
L'Aéron.	L'Aéronautique.
L.F.F.	Luftfahrt-Forschung.
Luschau.	Luftfahrt-Schrifttum des Ausiandes.
Met. Mag.	Meteorological Magazine.
Met. Prog.	Metal Progress.
N.A.C.A.	National Advisory Committee for Aeronautics (U.S.A.).
Phil. Mag.	Philosophical Magazine.
Phil. Trans. Roy. Soc.	Philosophical Transactions of the Royal Society.
Phys. Berichte. ...	Physikalische Berichte.
Phys. Zeit.	Physikalische Zeitschrift.
Proc. Camb. Phil. Soc.	Proceedings of Cambridge Philosophical Society.
Proc. Inst. Rad. Engs.	Proceedings of Institute of Radio Engineers.
Proc. Roy. Soc. ...	Proceedings of Royal Society.
Pub. Sci. et Tech. ...	Publications Scientifiques et Techniques du Ministère de l'Air.
Q.J. Roy. Met. Soc. ...	Quarterly Journal of the Royal Meteorological Society.
R. and M.	Reports and Memoranda of the Aeronautical Research Committee.
Rev. de l'Arm. de l'Air	Revue de l'Armée de l'Air.
Riv. Aeron.	Rivista Aeronautica.
Sci. Absts. (A. or B.)	Science Abstracts (A or B.).
Sci. Am.	Scientific American.
Sci. Proc. Roy. Dublin Soc.	Scientific Proceedings of Royal Dublin Society.
Tech. Aéron.	La Technique Aéronautique.
Trans. A.S.M.E. ...	Transactions of the American Society of Mechanical Engineers.
Trans. C.A.H.I. ...	Transactions of the Central Aero-Hydrodynamical Institute, Moscow.
U.S. Nav. Inst. Proc.	U.S. Naval Institute Proceedings.
Verroffent (Siemens)	Vercffentlichungen aus dem Gebtete der Nachrichtentecgnik (Siemens).
W.R.H.	Werft Reederei Hafen.
W.T.M.	Wehrtechnische Monatschefte.
Z.A.M.M.	Zeitschrift für Angewandte Mathematik und Mechanik.
Z.G.S.S.	Zeitschrift für Das Gesamte Schiess und Sprengstoffwessen mit der Sonderabteilung Gasschutz.
Z. Instrum.	Zeitschrift für Instrumentenkunde.
Z. Mech.	Zentralblatt für Mechanik.
Z. Metallk.	Zeitschrift für Metallkunde.
Z.V.D.I.	Zeitschrift des Vereines Deutscher Ingenieure.

Technical Problems of Anti-Aircraft Artillery. (K. Becker, Luftwissen, Vol. 8, No. 1, Jan., 1941, pp. 8-13.) (90/1 Germany.)

The article is mainly of interest as illustrating equipment utilised by the German air force in 1938. (Stereoscopic range finder—4 m. base, compact sound detector; mobile searchlights of 60 cm. and 150 cm. aperture, fire control, gear, 8.8 cm. anti-aircraft gun.) The latter fires a 9 kg. projectile at a muzzle velocity of 820 m./sec. It is stated that accuracy falls off rapidly due to wear of barrel and special arrangements are made for a quick exchange of worn parts. A diagram showing distribution of splinters (so-called butterfly diagram) for the 8.8 cm. shell is given, as well as shell trajectories at 10° intervals of the angle of elevation. The same diagram also contains the loci of constant longitudinal dispersion (both along the trajectory and in a horizontal direction) and constant lateral dispersion. It appears that a target placed at an altitude of 3,000 m. and at a distance of 5,000 m. is reached at a muzzle elevation of 35°. Under these conditions, the 50 per cent. longitudinal dispersion along the trajectory amounts to 40 m. In addition to this ballistic dispersion, errors due to the fire control gear itself must be considered.

Canopy Unit for Protecting Vital Plant during Raids. (The Engineer, Vol. 171, No. 4,450, 25/4/41, p. 275.) (90/2 Great Britain.)

A special arrangement of bracing members reduces the floor space required to support the canopy, which is adjustable for angle. It is made up of two H-section 5 in. by 3 in. steel upright stanchions mounted on base plates and carrying a pivoted angle steel frame. The latter carries three ¾ in. " Durasteel " (composite steel and asbestos) panels, giving a total area of cover of about 45 square feet. The canopy is strong and resilient enough to carry a considerable debris load and gives some protection from H.E. splinters and more complete protection from blast, debris and incendiary bombs.

Aircraft Armour. (H. J. Alter, Army Ordnance, Vol. 21, No. 125, March-April, 1941, pp. 497-498.) (90/3 U.S.A.)

The use of protective armour has a marked effect on the morale of the aircraft crew. The plane may be subjected to different types of ammunition fire, depending on whether it emanates from ground troops, anti-aircraft batteries or hostile aircraft. Ground troops use calibre 0.30 or 0.50 ball, tracer or armour piercing ammunition. Anti-aircraft batteries fire 3 to 5 in. shells, whilst hostile aircraft may employ 0.30 or 0.50 ammunition or cannon firing 20 or 37 mm. explosive shells. The structure of a modern aeroplane is rarely damaged to any serious extent by small bore ammunition and in many cases has even survived direct hits from large shells.

Both shell splinters and small bore ammunition, however, may damage personnel and equipment, since the normal covering of the aeroplane gives practically no protection. Ground troops and A.A. fire usually strike from below. Aircraft attacks are generally from the rear (15° below to 45° above the horizontal), but multi-seat fighters may attack from the lower forward hemisphere. The thickness of armour plate required will depend on the calibre and angle of impact of the bullet as well as on the " tumbling effect " of structural parts or equipment in the path of the bullet (*e.g.*, nose wheel helps to protect pilot and main landing wheels protect oil and fuel tanks against fire from below, auxiliary equipment in the cabin may help to deflect lateral bullets, etc.).

Homogeneous armour plate is generally preferred to the hard faced type since it can be formed into contours and is easier to manufacture. Moreover, experience has shown that the dispersion of the shots in aerial combat is such that impacts on the plate are nearly always more than 8 in. apart. Homogeneous plates ½ in. thick will stop a 0.5 calibre armour-piercing bullet at 100 yards (20° impact). Three inches of bullet proof glass will do the same. In the former case, the bullet is shattered without appreciable cracking of the plate. In the case of the glass, however, the bullet is imbedded and visibility destroyed over a radius of 6 to 10 in. Flexible mounting of the armour plate is of no benefit for normal and dangerous at oblique angles of impact, since in the latter case the plate subjects the fastening bolts to excessive shear. Composition plates offer possibilities of saving weight, but are bulky and difficult to instal. Special shapes reducing penetration by means of blisters, pyramids or curved surfaces are feasible.

Armour plating should be installed so that it is accessible for replacement or repair. In order to save weight, it must be situated as closely as possible to the part needing protection. A critical comparison must be made between thin plates at oblique angles and thicker plates for more normal angles of impact. In any case, the tumbling action of the aircraft structure itself must be utilised to the full.

At the present time, the preponderance of attacks in the air will be from the rear at almost normal angles. The heaviest armour will be used to protect the pilot's head and back. The seat also requires armouring for protection against ground fire. Bullet proof glass is generally thought sufficient protection from fire coming from the forward hemisphere.

Studies on the Subsonic Flow of a Compressible Fluid Past an Elliptic Cylinder. (S. Tomotika and Kō Tamada, Aeronautical Research Institute, Tokyo, Vol. 15, No. 201, November, 1940, pp. 481-551.) (90/4 Japan.)

In the present paper, the two-dimensional irrotational subsonic flow of a compressible fluid past an elliptic cylinder placed at an arbitrary inclination to the undisturbed stream has been re-investigated by Poggi's method with the object of studying the manner in which the value of the so-called critical Mach number for the elliptic cylinder varies with the angle of attack as well as with the thickness ratio of the ellipse. (The critical Mach number is the value at which the local speed of sound is first attained in the field of flow, and according to the results of recent experimental investigations, it has a close connection with the important phenomenon called the compressibility burble.)

Speaking generally, the effect of compressibility is to reduce M critical by about 10 per cent. One of the interesting results obtained is that when the angle of attack has any value between 0° and 90°, the curve of the critical Mach number plotted against the thickness ratio t has a maximum at a certain definite value of t.

The effect of compressibility on the moment exerted by the fluid pressure about the centre of the ellipse is very marked. If M_1 = moment with compression, M_2 = moment without compression. M_1/M_2 is of the order of 1.5 and 1.2 for Mach numbers of 1 and 0.6 respectively. Up to Mach number 0.4 the results are in agreement with the simple Prandtl-Glauert expression.

Asymptotic Solution of Southwell and Squire's Equations of Fluid Motion for Larger Reynolds Numbers. (J. H. Preston, Phil. Mag., Vol. 31, No. 208, May, 1941, pp. 413-24.) (90/5 Great Britain.)

The asymptotic solution of Southwell and Squire's equations has been obtained directly from their original integral equation. This is found to lead to the same results as a simplified boundary layer theory developed by Burgers and to give the same position for breakaway as the "outer solution" first approximation by an entirely different method developed by Kármán and Millikan for the solution of the boundary layer equations. The results are in qualitative agreement with experiment, thus bearing out the remark of Southwell and Squire—that their modification to Oseen's equation should give an indication of the changes of flow pattern with Reynolds number, differing but little from Oseen's approximation at low Reynolds numbers. The solutions have been applied to the calculation of skin friction of elliptic cylinders. In the limiting cases of the plate and circle the results agree with those already obtained by Piercy and Winny and by Burgers.

In the case of the general cylinder, Piercy, Whitehead, and the present author have recently obtained an approximate solution of the boundary layer equations by the same method,* but the first approximation differs from that given here, no breakaway of the flow occurring. It is suggested that, starting with the asymptotic solution discussed above, successive approximations might be more rapidly convergent than those in reference (1) and preferable to the more usual method of solution in series.

Contribution to the Aerodynamics of the Fuselage. (H. Milthopp, L.F.F., Vol. 18, No. 2-3, 29/3/41, pp. 52-66.) (90/6 Germany.)

The contribution of the fuselage and engine nacelles towards the total aerodynamic forces on the aircraft are considered for a number of important conditions of flight, special consideration being given to the wing fuselage combination. By means of conformal transformation, a simple wing equivalent to this com-

* Piercy, Preston, and Whitehead. "On the Approximate Prediction of Skin Friction and Lift." Phil. Mag. (7), p. 791 (November, 1938).

bination can be obtained for which the lift distribution is determined. From this the relative proportion of the load carried by the wing and fuselage can be calculated. The distribution of the load along the fuselage and the corresponding shift in the neutral stability point are estimated approximately from simple impulse considerations. In the case of side slip, the displacement flow of the fuselage causes an additional anti-symmetrical lift distribution along the wing, which in its turn results in a rolling moment of considerable magnitude. In addition, the side slip of the fuselage produces a lateral wind at the vertical fin and rudder and leads to appreciable modifications in the directional stability and damping during yaw.

In this connection some reference is made to N.A.C.A. Tech. Note No. 730.

Results Obtained by Measurements of Wing Stresses in Flight. (H. W. Kaul and B. Filzek, Luftwissen, Vol. 8, No. 1, Jan., 1941, pp. 20-25.) (90/7 Germany.)

Wing stressing occurring during flight is expressed in terms of the acceleration of the aircraft at its centre of gravity, and is evaluated by counting the number of acceleration peaks lying within definite equal acceleration increments Δb, irrespective of whether or not the acceleration falls to 1 g. after each peak. Measured results are plotted as a distribution polygon of relative frequencies, *i.e.*, the fraction of the total number of measured peak values falling within one particular stress group is plotted against the stress, expressed as a fraction of the additional gust load. Statistical results of wing stress measurements during flight, previously published by the D.V.L. (H. Freise, Jahrb, Luftfahrtforsch., 1938, Vol. 1, pp. 289-93) are supplemented by selecting aircraft used for definite purposes (*e.g.*, transport, aerobatics) and carrying out measurements during flight over long periods, with the aircraft in normal practical operation. In the case of the new commercial aircraft tested—Ha 139B and FW 200 (Condor)—the load frequencies in the individual stress classes were found to be considerably lower than those obtained in previous measurements on older types of commercial aircraft. This fits in with experience from the North Atlantic flights (Ha 139B) that the total gustiness over the ocean is less than that over land, and with the prediction made for modern landplanes (Condor), namely, that the total gustiness encountered would be smaller owing to the ability of the aircraft to select the most undisturbed stratum.

Relative load frequencies obtained during aerobatic flight in the Bucker "Jungmeister" were approximately in accordance with the distribution of stress for aerobatic flight proposed in previous publications. The absolute total frequencies per flying hour were higher than in earlier measurements on account of the very short pauses between various aerobatic figures. The positive maximum load factors during aerobatics, and those obtained in gust stress measurements on the He 70, in certain cases exceed the safety load factors prescribed in the German strength specifications.

Spring Type Shock Absorbers. (Luftwissen, Vol. 8, No. 1, Jan., 1941, pp. 25-26.) (90/8 Germany.)

The following types are discussed and illustrated:—

1. Telescopic steel tube, kept apart by the insertion of individual circular springs, arranged inside one another, so that under compression the outer rings expand and slide over the inner set, which at the same time contract. The arrangement is characterised by a considerable amount of friction damping.
2. As above, except that spring element consists of a number of spiral springs placed in series. Damping obtained by means of a separate

friction element sliding on the internal wall of one of the tubes, or oil damping by means of throttling is provided.

3. As above, except that damping is produced by a separate piston fitted with non-return valve.

The circular spring type of shock absorber with inherent friction damping has the advantage of simplicity and requires practically no servicing and maintenance. The addition of oil damping complicates the design, but makes it possible to adjust the spring characteristics under practical conditions. In addition to the above type utilising mechanical springs, shock absorbers utilising both air and oil for this purpose are also in use. In these designs, small deflections (such as arising when rolling on the ground) are balanced by air pressure only. The main landing shock is absorbed by oil, damping being either by means of piston displacing oil or by throttling the air circuit.

Acoustical Studies of the Flutter of an Airscrew. (J. Obata and others, Aeron. Res. Inst., Tokyo, Vol. 15, No. 202, Nov., 1940, pp. 555-90.) (90/14 Japan.)

The natural frequencies of a non-rotating airscrew blade can be determined in a variety of ways. The simplest method consists in clamping the blade to a firm support, striking it with a hammer and determining the resultant vibrations electrically. In an alternative method, the airscrew is mounted on the shaft of a D.C. motor, the armature of which is supplied with alternating current of various frequencies whilst the field is directly excited. The author used both methods on five three-bladed aluminium alloy airscrews of approximately 2.9 m. diameter and of similar form. The fundamental bending frequency for all the blades was of the order of 35 vibrations/sec. with a first order torsional of the order of 315 vibrations/sec.

From an analysis of the flutter sound of the rotating airscrew, it was concluded that the following three modes of blade vibration are mainly responsible for the phenomenon :—

(1) Third order bending, 115 vibration/sec.
(2) First order torsional, 315 vibration/sec.
(3) Second order torsional, 590 vibration/sec.

When driven by an electric motor, only modes (2) and (3) (torsional) were observed. The third order bending vibration, however, may occur in flight.

Longitudinal Stability and Airscrew Rotation. (Inter. Avia., No. 759, 9/4/41, p. 8.) (90/15 U.S.A.)

Tests carried out at the Guggenheim Aeronautics Laboratory of the California Institute of Technology with a " powered " model of the Curtiss-Wright twin-engined transport showed just the reverse of the results obtained by Seifert in Germany (Jahrbuch der Deutschen Luftfahrtforschung, 1938) which indicated an improvement in static longitudinal stability by the use of airscrews swinging up and out. The author shows that the effect of opposite-rotating airscrews on static longitudinal stability depends upon the lift coefficient and on the design of the aircraft itself. A determination of the value of the opposite sense of rotation is not possible before, among others, the following problems have been clarified: (1) The effect of nacelle location relative to the wing; (2) the effect of tail location relative to both wing and thrust line; (3) determination of the quantitative effect of rotational components of the slipstream; (4) complete survey into the slipstream velocities at tail positions, and effect of the slipstream in changing the downwash at the tail. The tests carried out so far have shown, nevertheless, that for stability the tail should either be completely in the slipstream or completely out of it.

The Influence of Fuselage, Engine Nacelles and Wing Flaps on the Breakaway of the Flow at the Wing. (G. Hartwing, L.F.F., Vol. 18, No. 2-3, 29/3/41, pp. 40-46.) (M.A.P. Translation No. 1,203.) (90/16 Germany.)

The model experiments were carried out by the Focke Wulf Company in connection with development work of the Condor type of aircraft. The breakaway of the flow was studied by taking photographs of silk threads attached to the surface of the wing. Three tapered wing models of the same span (1.32 m.), thickness and chord distribution, but differing in plan form, were used, the wing profile belonging to the N.A.C.A. *22* series (Tech. Rept. No. 460). Range of incidence up to maximum lift was covered, at two angles of yaw (0° and 9°), the wind speed being 32 m./sec. throughout.

Wing models 1 and 2 were of the same triangular shape without twist or dihedral, and differed only in having either the leading or trailing edge straight (*i.e.*, perpendicular to the fuselage axis). Model 3 corresponds to the Condor arrangement, with symmetrical taper as well as twist and dihedral. All the three wing models tested by themselves showed insufficient lateral control at maximum lift conditions, due to breakaway of the flow at one of the wing tips. In each case the instability started at the rear edge, spreading outwards and forwards. There was not much to choose between any of the wing plans, but on the whole the wing with the straight trailing edge appears to be the most critical.

Matters were, however, completely changed when model 3 was fitted with fuselage and engine nacelles. The breakaway now starts at the wing root fillet and is confined to the central section of the wing span. The air flow at the wing tips remains sound over the whole experimental range, even with flaps and ailerons fully extended on the model.

The difference in behaviour is associated with changes in the cross flow at the wing, which flow apparently extends above the surface to a distance of the order of 30 per cent. of the wing chord.

Measurements with the Six-Component Balance on a Model of a Single Float Seaplane. (O. Pabst, L.F.F., Vol. 18, No. 2-3, 29/3/41, pp. 47-51.) (90/17 Germany.)

The experiments had as their objects the determination of the aerodynamics load on the structure of a seaplane whilst still attached to the catapult on the ship's deck. Due to the motion of the ship, the plane may be subjected to considerable angles of roll (*i.e.*, 30°) whilst the relative wind may strike the structure at any lateral angle between 0° and 360°.

Experiments were accordingly carried out over this range of yaw and roll, but at a fixed angle of incidence of 5.5° (corresponding to the setting on the catapult). The model of a single float biplane with wing tip floats had a span of 1,235 mm. and a maximum length of 1,125 mm. The wind speeds utilised ranged from 17 to 32 m./sec. In order to cover the wide range of settings readily, the normal suspension system of the six component balance (Goettingen type) of the Focke Wulf laboratory was modified. As before, the model is held at three points, two of which are at the front on the same lateral axis whilst the rear point of attachment lies on the axis of symmetry of the wing. The wire suspension to one of the front points is in the form of a pyramid, ending in a triangular frame work attached to one of the lift balances. Forces in all three directions are transmitted. The other front point is held by only two wires attached to a cross bar suspended from a second lift balance, only horizontal (drag) and vertical (lift) force being measured. The rear suspension is by means of a single wire to a third lift balance, only vertical forces being transmitted. Horizontal (drag) force components at the two front suspension points are transmitted by means of ball bearing links to two drag balances respectively, whilst a third link attached to the pyramid frame enables its lateral

(cross wind) force to be measured. All the links are carried by the balance table so that a single rotation of the latter turns both the model and suspension without any additional adjustment being required. This is a great improvement on the original balance in which the adjustment for yaw was separate from the balance and required several observers for its manipulation. The experimental results are given graphically and cover normal, longitudinal and lateral force coefficients as well as rolling, pitching and yawing moment coefficients over the range 0°-360° of lateral wind, with rolling angle as parameter. The normal force coefficient with flaps extended is also given. Speaking generally, the results do not differ markedly from those obtained by Kohler over the same range (L.F.F., Vol. 14, 1937, p. 583) for a seaplane resting on the water.

The Influence of Mach Number on the Efficiency of Airscrew. (H. Wolff, Vol. 18, No. 2-3, 29/3/41, pp. 67-69.) (90/18 Germany.)

In a previous paper (L.F.F., Vol. 14, 1937, pp. 168-172) Weinig has shown that the effect of high tip speeds on the efficiency of airscrews can be represented by a correction factor η_u, which is a function of Mach number (for the blade tip) and average lift coefficient of the blade only. The following theoretical values were obtained by Weinig for various values of the lift function $\bar{c}_a$.

	η_μ / Lift function $\bar{c}_a$		
M	.2	.8	1.2
0.5	—	0.99	0.98
0.7	0.99	0.97	0.95
1.0	0.96	0.89	0.79

In the above, the lift function is given by

$$\bar{c}_a = \frac{\pi k_a}{\frac{2}{3} z l_m/_D}$$

where k_a = thrust coefficient $= \dfrac{S}{\rho/2\, u^2 F}$

and $l_m/_D$ = mean chord/diameter of blade

$$= 4\int_0^1 \frac{1}{D}\left(\frac{r}{R}\right)^3 d\left(\frac{r}{R}\right)$$

z = number of blades.

In the present paper the author describes flight tests carried out on the Focke Wulf Condor, from which η_u is deduced by noting the apparent increase in drag of the aircraft with airscrew r.p.m., although v/u was maintained constant (v = flight speed, u = airscrew tip speed). The values obtained for η_u check up well with some N.A.C.A. full-scale tests (Tech. Rept. 639) and show an appreciably greater effect at high c_a and Mach numbers than Weinig's theoretical values. On the other hand, the flight tests show no compressibility effect at Mach numbers below about 0.65. Apart from the blade profiles being suited for high speed work (thin sections with maximum thickness at 40 per cent. chord and beyond) it appears that efficient operation at high Mach numbers require an almost constant pitch distribution between 0.7 R and the blade tip. The blade width of such airscrews must also be greater than is common practice to-day.

Fuel Vapour Lock (C.F.R. Report). (Inter. Avia., No. 744-5, 16/1/41, pp. 13-14.) (90/19 U.S.A.)

The formation of vapour lock in fuel systems depends, for a given fuel, on its vapour pressure, the external pressure on the fuel and the fuel temperature. In order to avoid an excessive formation of vapour (in some cases even the

boiling of fuel), such as can occur on high altitude flights after a take-off at high temperatures and with fuel of high vapour pressure, several solutions have been suggested. The use of fuels of lower vapour pressure would naturally result in an improvement but has the disadvantage that special fuel would be required to start the engines and the fire hazard would increase. Furthermore, the desire of lower vapour pressure is contrasted by the demand for fuels of increasingly high octane ratings. Another possibility consists in the increase of the fuel tank pressure, either by supercharging or suitably controlled tank ventilation.

The cooling of the fuel in the tanks is cited as another method to prevent trouble resulting from vapour lock formation; however, this would be accompanied by a considerable weight increase and would therefore be impracticable for smaller aeroplanes. All the suggestions mentioned above have grave disadvantages, so that efforts will probably be made also in the future to prevent vapour lock by the suitable installation of the fuel systems in the aircraft alone. (1) The fuel system must be so installed that vapour removal is easy and that there are no vapour traps. (2) The pressure drop through the system must be minimised by decreasing the flow resistence in fittings, elbows, tee outlets, etc. (3) Pressure losses due to interior or external accelerations acting on the fuel flow, must be avoided; it is recommended not to feed the fuel to the engines by means of suction pumps located near the power plant but to force it to the engines by means of pumps situated near the tanks. In order to facilitate the task of the manufacturers, the C.F.R. Committee has completed the standardisation of streamline tube fittings, elbows, etc., and will shortly extend its investigations also to lubricants.

Essolube HD—New Type of Engine Lubricant. (Ind. and Eng. Chem., News Ed., Vol. 19, No. 5, 10/3/41, p. 282.) (90/20 U.S.A.)

The Standard Oil Co. of New Jersey has announced a type of engine lubricant, Essolube HD, developed to overcome piston varnishing, ring sticking, and other major lubrication troubles which have limited output of many heavy duty, high speed Diesel and petrol engines.

This new lubricant marks the first time the petroleum industry has been able to offer highly detergent or washing properties incorporated in a highly stable, high viscosity index base oil. The new Essolube HD has a viscosity index of approximately 100—nearly twice that previously available in special detergent oils meeting the full range of known heavy duty engine requirements. The new lubricant, in addition to inherent natural resistence to oxidation and high temperature has an exceptionally high ability to wash out sludge deposits, protect bearings from corrosion, and prevent to a large extent deposits of varnish on pistons, valve stems, rings, and other engine parts. It also has a valuable rust preventive action.

Oxidation of Petroleum Lubricants. (L. L. Davis and others, Ind. and Eng. Chem., Ind. Ed., Vol. 33, No. 3, March, 1941, pp. 339-350.) (90/21 U.S.A.)

The oxidation of petroleum lubricants is an autocatalytic reaction, the initial phases of which have been investigated by an oxygen absorption test. Effects of crude source, refining, accelerators, and inhibitors may be thus studied.

Two types of inhibitors are distinguished—true anti-oxidants and precipitants. The latter only are effective against metallic accelerators. Oxidation products are proximately separable by solvents and absorption methods. Ultimate analyses of insolubles and oil-soluble resins, stepwise separated from used oil, show decreasing oxygen contents.

Practical engine tests must finally determine the choice of inhibitors. Such tests emphasise the advantages of certain sulphur-bearing derivatives over simple anti-oxidants.

Lubricating Oil Addition Agents. (O. M. Reiff, Ind. and Eng. Chem. Ind. Ed., Vol. 33, No. 3, March, 1941, pp. 351-357.) (90/22 U.S.A.)

New types of metal salt addition agents for lubricating oils have been developed from alkylated phenolic compounds. By the introduction of alkyl substituents derived from petroleum wax, multi-functional addition agents are formed which are capable of imparting combined properties such as four-point depressant action, improved viscosity index, and anti-oxidant value to lubricating oils. The effectiveness of the multi-functional addition agents is improved by the introduction of metal substituents, particularly in respect to anti-oxidant value. Attention is directed to the importance of the type of solubilising radical as well as the kind of metal substituent in the formation of metal salt addition agents having anti-oxidant value.

Spontaneous Ignition of Hydrocarbons. (C. W. Sortman and others, Ind. and Eng. Chem., Vol. 33, No. 3, March, 1941, pp. 357-360.) (90/23 U.S.A.)

Spontaneous ignition temperatures in air, and the corresponding time lags, have been determined for a variety of hydrocarbons at atmospheric pressure by the oil-drop or Moore method, using a steel crucible and different air flow rates and liquid drop sizes. Under some conditions of air and liquid feed the readily ignited hydrocarbons, such as cetane and heptane, show two separate temperature zones of non-ignition above the minimum ignition temperature, a behaviour heretofore unobserved; under other conditions one or both of these zones are eliminated. The conditions of air and liquid feed also have a marked effect on the ignition time lag, especially at low temperatures. Addition of tetraethyl lead completely inhibits ignition up to about 850-1,000°F. (454-538°C.).

Temperature and Latent Energy in Flame Gases. (W. T. David, The Engineer, Vol. 171, No. 4,450, 24/4/41, p. 268-270.) (90/24 Great Britain.)

Flame gases are not just hot normal gases. It has been shown that they contain a long-lived latent energy which probably resides as an excess of intra-molecular energy in a proportion of the tri-atomic molecules formed during combustion. The excess intra-molecular energy in these abnormal molecules appears to be of a type which cannot be handed over to the translational degrees of freedom during molecular collisions.

In virtue of the long-lived latent energy, the ideal flame gas temperature, calculated upon the basis of accurate specific heat and dissociation data, is not usually attained.

Owing to latent energy the ideally calculated pressures are not fully attained in closed vessel explosions, even after allowing for the heat loss which takes place during explosion.

The latent energy seems to disappear and the abnormal molecules to become normalised when the flame gases come into contact with surface. An experiment which seems to prove this is described. It may be that the effectiveness of flame gases in many industrial processes results from the unloading of latent energy upon surface.

Recent Developments in Internal Combustion Engines. (J. T. Davies, J. Royal Soc. Arts, Vol. 89, No. 4,581, Feb. 21, 1941, pp. 171-210.) (90/25 Great Britain.)

The author deals with his subject matter in three lectures, of which the first briefly enumerates present fields of application of I.C. engines (marine, stationary, rail and road transport and aircraft), the second deals with fuels and lubricants, and the third gives some account of supercharging and emergency fuels (gas and coal dust). Engines for marine and stationary work as well as rail and heavy road transport operate almost exclusively on oil fuels, whilst petrol still holds the field for aircraft and light road transport.

In dealing with developments the author naturally gives prominence to fields in which he is personally interested and in the present lectures considerable space is devoted to the rating of oil fuels in terms of ignition lag and to inertia scavenging of the Kadenacy type. The importance of improving the efficiency of supercharge and scavenge pumps is stressed, but no indication of development work on these important accessories is given.

It appears that two-stroke working, both for oil and petrol, will become more general in the future as the simplest method of improving power output for a given weight of mechanism. In the author's opinion, the abundance of high quality liquid fuel in this country has detrimentally affected our export market, in so far that British designs are generally not flexible enough. In conclusion, the author utters a plea for subsidised research and the placing of extensive Government contracts.

The Ageing (Precipitation Hardening) of Aluminium Alloys. (A. Von Zeerleder, Flugwehr and Technik, Vol. 2, No. 11-12, Dec., 1940, pp. 261-263.) (90/26 Switzerland.)

The age hardening of duralumin has been known for over thirty years. A scientific explanation of the process is only of relatively recent date. The phenomenon was discovered more or less accidentally by Wilm in 1909, although the ground had been prepared by systematic research. Wilm was investigating the possibility of utilising light alloys for cartridge cases and had prepared a large number of Al-Cu-Mg-Mn alloys of variable composition for this purpose. The metal sheets were prepared from the castings by cold rolling, which, in order to prevent cracking, had to be carried out in stages with interposed periods of annealing. Wilm investigated the effect of sudden quenching in water from various annealing temperatures and it so happened that a batch had been quenched prior to closing down the laboratory for the week-end. Fortunately a Brinell hardness determination was however made in order to obtain some idea of the success of the heat treatment. Fuller tests carried out after a " rest " period of forty-four hours showed a considerable improvement of the material and revealed the process of " ageing." According to modern views, the ageing is due to a gradual precipitation of very finely divided copper from the Cu-Al mixed crystals present at higher temperatures ($> 500°C.$) and " frozen " by the sudden quenching. These crystals are unstable at lower temperature and the tendency towards a new equilibrium exerts powerful forces on the space lattices which are reflected in improved strength characteristics.

If such " aged " material is reheated to a critical temperature of about 130°C., the molecular tensions are released, the copper comes out of solution in a coarse form and the alloy becomes soft.

Ordinary Al-Cu alloys show only slight " ageing " at room temperatures in the presence of Mg however, the effect is completed in about 96 hours, one half of the final improvement being reached in less than four hours. For certain purposes, *e.g.*, rivets, this rapid ageing is detrimental and such alloys will either have to be worked within a short time of heat treatment, or the ageing slowed down by storing at a lower temperature (ice box). Both these alternatives have their drawbacks and recently a new Ac-Cu-Mg alloy (Avonal NL) has been developed, rivets of which can be kept for periods up to ten hours before becoming too hard for use. It is possible to slow up the ageing process still further and obtain Al-Cu-Mg alloy which require prolonged annealing at 100-150°C. before the full strength is developed by precipitation hardening (Super Avional). Unfortunately such alloys are much more sensitive to corrosion than the normal product and require " cladding " or other suitable form of protection.

The corrosion difficulty can be overcome and the advantage of high ageing temperature retained by substituting silicon for copper in the alloy. The resultant

product is known as Anticorodal, and although not as strong as alloys of the Dural type, it can be stored indefinitely in the semi-hard condition. It is relatively easy to work, the finished product receiving its maximum strength after annealing to 150°C. for about four hours.

It must, however, not be forgotten that whilst the ageing process can thus be speeded up by annealing at elevated temperatures, leading to an improvement in the material, any prolonged exposure to temperatures in excess of about 130°C. leads to a coarse precipitation and a reduction in the final strength value.

Alloys showing the characteristics of age hardening are thus unsuitable for structural parts subjected to prolonged periods of elevated temperatures.

Displacements Determined by Airy's Stress Functions. (H. M. Westergaard, J. App. Mech., Vol. 8, No. 1, March, 1941, pp. 1-2.) (90/27 U.S.A.)

Airy's stress function defines a plane state of stress by simple formulæ. When the constants of elasticity are known the function will also define the strains, but the determination of the displacements is less direct. The solution described in this paper may be interpreted as a variant of Love's solution. Simple formulæ are obtained by the use of functions of a complex variable.

Influence Surfaces for Stresses in Slabs. (F. M. Baron, J. App. Mech., Vol. 8, No. 1, March, 1941, pp. 3-13.) (90/28 U.S.A.)

This investigation presents a formal analytical solution of some problems involving influence surfaces for stresses in slabs. It deals primarily with the determination of influence diagrams for stresses in homogeneous elastic slabs and is based upon the extension of Müller-Breslau's principle established in structural mechanics. The analysis is based upon the classical procedure of obtaining a solution of Lagrange's differential equation of the deflected middle surface of the slab satisfying at the same time all of the boundary conditions at the various edges.

The influence surface for a bending moment at a point on the fixed edge of an infinitely long rectangular slab, with a fixed edge transverse to two parallel simply supported edges, is defined by a function in finite form. Contour lines of the influence surfaces for the bending moments at the quarter points and at the mid-point of the fixed edge are given.

Influence functions are stated for the moments at the mid-point and at a point on the fixed edge of a circular slab with a fixed edge. Contour lines of the influence surfaces are given.

Each solution defining an influence surface for a stress at a given point of a homogeneous elastic slab may also be used to solve the related two-dimensional problem of stresses in a slice. A slab is converted into a slice when the loads applied transversely to the slab are replaced by forces that are parallel to the middle plane of the slice and produce no bending or transverse shears.

An Eddy Current Method of Flaw Detection in Non-Magnetic Metals. (R. Gunn, J. App. Mech., Vol. 8, No. 1, March, 1941, pp. 22-26.) (90/29 U.S.A.)

An equipment suitable for the location of surface or submerged flaws in non-magnetic metals is described. A predetermined pattern of electrical eddy currents is induced in a perfect test sample by alternating magnetic fields. Sensitive pick-up coils properly disposed in relation to the eddy currents measure only the departures of the eddy current pattern from the pattern in the perfect sample. The departures are indicated on a meter or may be recorded. Performance data are given for a universal type of search unit especially adapted for general surveys.

An Extension of the Photo-elastic Method of Stress Measurement to Plates in Transverse Bending. (J. N. Goodier, G. H. Lee, J. App. Mech., Vol. 8, No. 1, March, 1941, pp. 27-29.) (90/30 U.S.A.)

The well-known photo-elastic method for models in plane stress is extended to plates bent transversely by cementing together two similar plates with a thin layer of reflecting material between them. The light thus traverses twice one half of the full plate thickness, in which the stress in the simplest case is all of one sign, so that a net optical effect is obtained. Measurements on a strip of celluloid in pure bending, and with circular holes, yield results in conformity with theory; but a Bakelite model with circular holes showed discrepancies indicating that the cement bond between the Bakelite and the reflecting layer (aluminium foil) was not adequate. Results of measurements on semi-circular notches in a strip under pure bending are also given. The difficulties and potentialities of the method are discussed.

Rubbers Natural and Synthetic. (J. W. Schade, J. Aeron. Sci., Vol. 8, No. 5, March, 1941, pp. 177-182.) (90/33 U.S.A.)

The meaning of the word rubber has changed since the advent of synthetic materials similar to the natural product. It is now used to designate a class of flexible elastic materials rather than a particular hydrocarbon product of natural origin. The synthetic rubbers are classified into five types. The mechanical properties of all types are determined not by the kind of chemical elements composing them, but rather by the arrangement of these elements, the size of the molecules and by structures produced by vulcanisation. All rubbers are modified by addition of other materials to fit them for a variety of uses. Differences in chemical composition and in the properties of natural and synthetic rubbers are shown in tabular form.

Mechanically, natural rubber is not surpassed by any synthetic rubber. However, in resistance to swelling by organic liquids, such as petrol and oils, and to deterioration by sunlight or oxidising agents, synthetic rubbers have been found superior. These characteristics directed commercial applications to those fields where these properties are particularly needed.

Aircraft Plywood and Adhesives. (T. D. Perry, J. Aero. Sci., Vol. 8, No. 5, March, 1941, pp. 204-216.) (90/34 U.S.A.)

At the period of the 1914 War, either casein (made from the curds of soured milk) or albumen (a dried blood product coagulated under heat) were considered the most durable adhesives for aircraft construction. Neither of these products resisted moulds or fungi. Casein is not very resistant to water. Albumen is better in this respect, but deteriorates seriously with age. After 1930, adhesives made of synthetic resins revolutionised the plywood industry (phenol and urea form aldehydes). These new compounds are characterised by good water resistance, they are not attacked by mould and fungi and are much less damaging to edge tools than the caseins (adhesives). Recently so-called " plastic " aircraft has received much publicity. These planes are made of moulded plywood, the only novel feature being the method of applying the pressure as well as the unusually large size of the moulded unit. The fundamental principle involved is that of using an inflated or deflated rubber bag as one of the halves of a pair of moulding dies. Typical examples of such dies are illustrated. The conventional method of manufacturing aircraft plywood with synthetic resin adhesives has been the use of the steam heated plater in a hydraulic press. Recently, for thick sections, heating by means of high frequency electrostatic fields has been successfully carried out.

The author gives some details of wood and plywood construction (spars, ribs, gussets, skin covering, high density reinforced plates, propellers and bending).

Useful tables of the weight, tensile, and bearing strength of a number of representative plywoods are given (including high density woods).

A bibliography of fifty-eight items concludes the paper.

Quenching Stresses in Aluminium Alloys. (Zeerlander, J. Inst. Met., March, 1941, pp. 87-99.) (90/35 Great Britain.)

This paper deals with the internal stresses in Avional D alloy set up by quenching, and of the possibility of eliminating them by subsequent cold work. The method used for determining the stresses consisted in measuring the dimensional changes of the stock during step-by-step removal of the outer layers. The variables studied are: Time between solution treatment and quenching, temperature and nature of the quenching medium, temperature of ageing, and cold working before or after ageing. It is shown that the stresses are materially reduced and may even be reversed by cold working before or after ageing. Illustrated by one photograph and 12 graphs.

(Abstract supplied by Met. Vick. Research Dept.)

Theory of the Plastic Properties of Solids. (Sictz and Read, J. App. Phys., Feb., pp. 100-118, and March, 170-186, 1941.) (90/36 Great Britain.)

From the viewpoint of direct experimental observation, the plastic properties of solids may be classified into five categories, namely: (*a*) Slip, (*b*) creep, (*c*) twinning, (*d*) rupture, and (*e*) fatigue. The phenomenon of slip is dealt with at considerable length and the various physical aspects of hardening are briefly mentioned.

Illustrated by one photograph, 13 diagrams and 25 graphs.

(Abstract supplied by Met. Vick. Research Dept.)

Protective Finishes for Aluminium Aircraft Surfaces. (Cordy, Steel, 10/3/41, pp. 66, 72 and 102.) (90/37 Great Britain.)

Corrosion may easily reduce the endurance limit of aluminium alloy by as much as 67 per cent. and hence the retention of maximum physical properties which is so necessary in aircraft construction, necessitates adequate attention to corrosion prevention. In this article the author details the factors involved and various means of corrosion prevention and describes the practice employed by the Curtiss-Wright Corp. of U.S.A., which involves the production of a tough protective film. (Illustrated by three photographs.)

(Abstract supplied by Met. Vick. Research Dept.)

Induction Hysteresis. (Holslag. Weld. Ind., April, 1941, pp. 70-72.) (90/39 Great Britain.)

Details are given in this paper of methods of application of induction hysteresis to preheating, welding and normalising. It is claimed that this relatively new process is a definite proved advance in welding and is particularly applicable to power plant high-pressure piping, boilers, valves and turbine connections.

(Abstract supplied by Met. Vick. Research Dept.)

Relaxation of Metals at High Temperatures. (Trumpler, J. App. Phys., March, 1941, p. 248-253.) (90/40 Great Britain.)

The term " relaxation " is used when an initially pure elastic strain is gradually transformed into a permanent strain while the length of the bar remains unchanged. Details are given of an apparatus designed and built primarily to duplicate such conditions in connection with the study of bolt materials for steam turbines. It is claimed that the unusual accuracy and the exceptionally good test results obtained from the automatic relaxation machine during more

than two years of operation indicate that the type of test may well become a standard creep test. (Illustrated by one diagram, one photograph and eight graphs.)

(Abstract supplied by Met. Vick. Research Dept.)

Investigation on the Mechanism of the Cementation of Metals. (M. Goto and others, Aeron. Res. Inst., Tokyo, Vol. 15, No. 200, Oct., 1940, pp. 431-476.) (90/41 Japan.)

Cementation is a method of coating the surface of one metallic material with another metal, by which the material to be coated is surrounded with the coating material in powdered form, and the vapour of the coating metal is diffused into the other material. Within this definition come the carburising process, the nitriding process, etc., but it is a question whether cementation can be effected perfectly when the vapour pressure of the material to be coated is far greater than that of the coating metal, as in the case of applying molybdenum to nickel.

In the present experiments, round bars of nickel surrounded by molybdenum powder were cemented under various conditions of heating temperature, heating period, heat treatment after cementation diffusion agent, etc., but adequate cementation could not be effected. The test results were studied by means of microscopic examination and X-ray analysis in order to obtain some idea of the mechanism of cementation, and as a result a two-stage heating process was developed by means of which it is possible to effect adequate cementation. The concentration of the molybdenum of the cementation coating was determined by X-ray analysis, and its density was examined by means of hydrochloric acid corrosion.

Tests were also made with some nickel alloys, and the effects of the alloying elements were partially clarified.

Magnesium in Aircraft. (Inter. Avia., No. 759, 9/4/41, pp. 8-9.) (90/42 U.S.A.)

In order to improve the aerodynamic refinement of an aeroplane, very smooth surfaces are required, and great demands are placed on the buckling strength of the aircraft skin, for example in dives. By means of flush riveting, spot welding and other methods, satisfactorily smooth surfaces can be obtained; however, the strength of thin gauge skins is not sufficient to maintain the surface smoothness also under great loads, as a result of which increasingly heavy skins will be required in monocoque construction. Furthermore, the loads placed on the skin by the local formation of compressibility shock, resulting from the velocity of sound being exceeded locally, can grow to such an extent that heavier sheet than heretofore must be employed. According to the Dow Chemical Co. (Spring Session of the Society of Automotive Engineers) magnesium alloys are quite suitable for use as skin material in view of their low specific gravity.

Importance of Suitable Direction of Deflection of Flight Control Instruments. (E. Everling, Luftwissen, Vol. 8, No. 1, Jan., 1941, pp. 26-27.) (90-43 Germany.)

The direction of deflection of a flight control instrument should be such that its reading can be converted mechanically and unconsciously by the pilot into the correct control movement. This is particularly important when he has to change from normal to blind flight, since during a right hand turn, for example, a visible object on the ground moves apparently to the left whilst the pointer on the turn indicator moves to the right. Systemmatic tests have, therefore, been made to discover how men of various degrees of technical suitability and training operated the rudder and aileron controls on seeing a deflection of the turn indicator or compass. The instruments were arranged so that they could also deflect in the reverse direction. The test persons comprise ages between 12 and 62 and included pilots, women pilots, students, and apprentices with and without technical

knowledge. The reaction time and time taken to adjust the controls for steering by the compass or turn indicator were recorded in each case with the instrument pointers deflecting in both normal and reverse directions. The results showed that a pilot would respond to the compass, and probably also to the turn indicator, with quicker and more accurate control movements if these instruments were made to deflect in the reverse direction. This could be done by a simple technical modification in the case of the turn indicator and in the case of the compass by allowing only the rear part of the rose to be visible.

An Instrument for Measuring Short Intervals of Time. (E. A. Walker, J. of Franklin Inst., Vol. 231, No. 4, April, 1941, pp. 373-379.) (90/44 U.S.A.)

This paper describes a meter for measuring short intervals of time. Full-scale deflections of 0.001, 0.1 and 1.0 second can be obtained by the use of a selector switch. This meter will indicate the length of time a contact remains closed, or the interval of time between the closing of one circuit and the opening of another. The device has a linear scale for any chosen range. It measures time by the charge which flows to a condenser during the interval. The charge is found by reading the potential difference on the condenser with a sensitive vacuum tube voltmeter. The limit of accuracy as determined by test appears to be the accuracy with which the ammeter in the plate circuit can be read. The theory of the circuit and its advantage over other devices for the same purpose are discussed.

The Daytime Photo-electric Measurement of Cloud Heights. (M. K. Laufer and L. W. Foskett, J. Aeron. Sci., Vol. 8, No. 5, March, 1941, pp. 183-187.) (90/46 U.S.A.)

A photo-electric detector is used in conjunction with a modulated beam of light for the measurement by triangulation of the height of clouds during the daytime. An A.C. operated mercury arc lamp is used to obtain the modulated beam. An electronic " synchronous switch " is used to eliminate the effect of the varying background brightness of the clouds. The shot noise of the photo-tube resulting from the relatively high brightness of the clouds during the daytime limits the detection. Dark overcast clouds at an elevation of 9,000 feet have been detected.

Electrical Apparatus for Testing Reaction—Time and Hand and Eye Co-ordination. (R. C. Woods and A. S. McDonald, J. Inst. Elect. Eng., Vol. 88, Part 1, No. 4, April, 1941, pp. 189-194.) (90/47 Great Britain.)

The adoption of machine accounting in an engineering works necessitated the addition to the existing battery of psychological tests for the selection of staff, of reaction time and hand-and-eye co-ordination tests.

Two new instruments, consisting almost wholly of standard telephone components, are described, their operation sequences are given and reference is made to the accuracy of the reaction tester.

The results of the practical tests with these instruments are shown and simply discussed.

The instruments, simple to operate and both accurate and reliable, were adequate for their purpose, and it is suggested that they may have a wider application.

Visibility and Seeing. (M. Luckiesh and F. K. Moss, J. of Franklin Inst., Vol. 231, No. 4, April, 1941, pp. 323-343.) (90-48 U.S.A.)

Visibility is defined as an attribute of the physical characteristics of the object of regard as determined introspectively by an observer possessing normal vision. Therefore seeing may be defined as a function of the visibility of the object and the visual efficiency of the observer. Techniques for the appraisal of visual efficiency have long been available to visual science; and techniques for the appraisal of visibility are needed in illuminating engineering and throughout all

practices involving seeing. The significance of visibility, as a factor in seeing, is presented through the medium of correlations with certain psycho-physiological effects resulting from seeing under conditions which afford various degrees of visibility. These analyses reveal that visibility and ease of seeing are closely related. The frequency of involuntary blinking has been developed as a criterion of ease of seeing and correlated with measurements of visibility. By these correlations, visibility measurements become of the utmost importance in the science of seeing whose most important objectives involve measurements and interpretations in the realm of supra-threshold seeing.

Training of the Aeronautical Engineer in Germany. (G. Doetsch and G. Seidel, Luftwissen, Vol. 8, No. 1, Jan., 1941, pp. 14-19.) (90/49 Germany.)

In Germany there are two methods of training aeronautical engineers:— 1. Starting from the elementary schools (after study of special craftsmanship or from the higher schools with the higher or medium school certificate), a two years practical training course at an engineering school is taken, finishing with the technical school engineering examination. This training is intended for practical engineers with sufficient theoretical fundamentals for general work. 2. Starting from the higher schools with the school leaving certificate, a one-year practical course in a works is followed by study at the technical high school, ending with the diploma examinations. This training is intended to provide the scientific and highly qualified engineers for leading positions and research work. Details of craftsmanship and works course are given.

At the technical high schools the study of aeronautics falls into three main branches:—

(*a*) Aircraft construction.

(*b*) Engine construction.

(*c*) Aircraft handling and operation (equipment, armaments, navigation).

The technical high schools include centres at which all three special branches are studied (Berlin, Brunswick and Munich), and those dealing more especially with practical instruction in aircraft construction (Aachen, Danzig, Darmstadt, Stuttgart, and Vienna, aero engines also at Stuttgart). Finally the University of Göttingen, with its chair of applied mechanics, and the Kaiser-Wilhelm-Institut fur Strömungsforschung offer facilities for aerodynamic research. Sample curricula for the various stages of instruction are given. Student flying groups have been organised at various colleges and universities (Flugtechnische Fachgruppen und Flugtechnische Arbeitsgemeinschaften).

U.S.A. Aviation Exports. (American Aviation, Vol. 4, No. 20, 15/3/41, p. 38.) (90/50 U.S.A.)

Great Britain purchased U.S. aviation products totalling $134,543,037 during 1940, or more than 43 per cent. of the year's aeronautic shipments valued at $311,757,326, according to figures released by the Motive Products Division Department of Commerce. Second best 1940 customer for U.S. aeronautic exports was France, whose $75,463,921 purchases represented 24 per cent. of the total value.

The year's exports included 3,532 aircraft valued at $196,352,315; 4,986 engines for $49,873,823; engine parts and accessories $19,724,433; instruments and parts $7,303,386; propellers and parts $9,967,196; parachutes and parts $1,068,779; and other parts and accessories $27,467,394.

The 1940 exports account for 46 per cent. of the grand total value of aeronautic shipments, $677,606,199, since they were first reported separately June 1, 1911.

Value of aeronautic exports to the 14 " million dollar " markets for 1940, as compared with the preceding two years, are shown as follows (to the nearest million):—

	1940 $	1939 $	1938 $
United Kingdom	135	35	4
France	75	42	—
Canada	34	3	4
Australia	16	2	1
China	11	1	6
Netherlands Indies	6	6	8
Sweden	5	—	1
Finland	4	—	—
Union of S. Africa	4	—	—
Brazil	3	2	2
Turkey	2	1	3
Norway	1	—	—
Argentina	1	2	6
Belgium	1	—	—
Percentage of total ...	96	83	55
Number of other markets	70	77	73

A Mechanical Method for Graphical Solution of Polynomials. (S. L. Brown and L. L. Wheeler, J. of Frank. Inst., Vol. 231, No. 3, March, 1941, pp. 223-243.) (90/52 Great Britain.)

A mechanical synthesiser with thirty harmonic elements (fifteen sine components and fifteen cosine components) may be used to graph a polynomial in a complex plane. The sum of the sine components is recorded by a tracing point which moves vertically. The sum of the cosine components is recorded by horizontal motion of a drawing board.

Expansion of the polynomial by De Moivre's theorem expresses the function as a sum of sine terms and a sum of cosine terms. The polynomial may then be graphed by the machine, and thereby the complex roots determined. A number of typical curves are given to illustrate the machine method of determining real, imaginary, and complex roots.

An auxiliary method is described which gives all the real roots of the polynomial from a single graph.

Determination of the Average Life of Vacuum Tubes. (D. K. Gannett, Bell Laboratories Record, Vol. 18, No. 12, August, 1940, pp. 378-382.) (90/53 U.S.A.)

Analysis of many field trials on tubes used in telephone plants has shown that, after an initial period which varies with the types of tube, but is usually about 4,000 hours, the rate of failure expressed in per cent. of tubes remaining in service tends to become constant. In other words, the tubes fail at random and the logarithm of the per cent. of tubes surviving plotted against time results in a straight line, which renders extrapolation easy. If the life curve is accurately exponential, it can be shown that the average life corresponds to the time when about 37 per cent. of the tubes remain in service. Analysis of test results show that it is possible to predict average life on this basis, provided the initial period (for which the exponential law does not hold) has been passed through.

Various types of life curves are illustrated, showing life period varying between 12 and 25,000 hours, depending on type of equipment.

It is interesting to note that the exponential life curve implies that the probable further life of a group of used tubes which are still good is the same as the probable life of a group of new tubes (neglecting initial period). The short lived tubes having been weeded out, there is thus no advantage of replacing the whole set by new tubes.

LIST OF SELECTED TRANSLATIONS.

NOTE.—Applications for the loan of copies of translations mentioned below should be addressed to the Secretary (R.T.P.), Ministry of Aircraft Production, and copies will be loaned as far as availability of stocks permits. Application should not be made to the Royal Aeronautical Society. Suggestions concerning new translations will be considered in relation to general interest and facilities available.

Lists of selected translations have appeared in this publication since September, 1938.

LIST 32, MAY, 1941.

AERO- AND HYDRODYNAMICS.

TRANSLATION NUMBER AND AUTHOR.		TITLE AND REFERENCE.
1174	Schrenk, O. ...	*Boundary Layer Control by Suction.* (Luftwissen, Vol. 7, No. 12, Dec., 1940, pp. 409-14.)
1175	Ackeret, J.	*The Effect of Compressibility on Air Flow.* (Flugwehr und-Technik, Vol. 2, No. 1, Jan., 1940, pp. 18-20.)

ENGINES AND ACCESSORIES.

1168	Muller, F. O. ...	*Conditions of Acceleration in Spherical Crank Drives and Related Mechanisms.* (Z.V.D.I., Vol. 73, No. 4, 26/1/29, pp. 117-125.)
1169	Englisch, C. ...	*Sealing of Piston Rings in Internal Combustion Engines.* (A.T.Z., Vol. 41, No. 22, 25/11/38, pp. 579-84.) (Translated by the Bristol Aeroplane Company, Ltd.)
1172	Poggi, L.	*Kinematical-Dynamical Studies of a Novel Crank System for Engines with Parallel Cylinders.* (L'Aerotecnica, Vol. 20, No. 5, May, 1940, pp. 374-97.)

MISCELLANEOUS.

1171	Lohner, H.	*Condensation Trails.* (Luftwissen, Vol. 7, No. 10, Oct., 1940, pp. 337-9.) (Translated by S.R.E. Department, Admiralty.)
1173	Gorsky, V. P. ... Chessalov, A. V. ...	*Investigation of Uncontrolled Swerve (Ground Looping) at Take-off in a Cahi-6 Aircraft.* (Aeron. Eng., U.S.S.R., Vol. 12, No. 3, March, 1938, pp. 7-23.)
1176	Meier-Muller, H. ...	*On the Medico-Psychological Aspect of Flying Accidents.* (Flugwehr und-Technik, Vol. 2, No. 1, Jan., 1940, pp. 12-14; No. 2, Feb., 1940, pp. 40-42.)
1177	Schmidt, O. Von ...	*A New Path of Sound Waves in the Atmosphere.* (Luftwissen, Vol. 7, No. 11, Nov., 1940, pp. 382-5.)

List 33, June, 1941.

Engines and Accessories.

Translation Number and Author.			Title and Reference.
1178	Pistolesi, E.	...	*Review of Modern Variable Pitch Airscrews.* (L'Aerotecnica, Vol. 20, No. 10, Oct., 1940, pp. 747-760.)
1181	Riabouchinsky, D.	...	*Introduction to the Study of Moto-Propulsor Groups Producing Supersonic Velocities.* (D. Riabouchinsky, Pub. Sci. et Tech. du Ministère de l'Air, No. 157, 1939.)
1182	Caroselli, H.	...	*Pressure Gooling for Liquid-Cooled Aero Engines.* (Luftwisse, Vol. 7, No. 11, Nov., 1940, pp. 373-381.)
1197	Hollbach, O.	...	*Aero Engine Accessories.* (Export Handbook of the German Aircraft Industry, 1939, pp. 143-169.)

Materials.

1186	Burger, H.	...	*Torsional Strength of Motor Car Frames (The).* (Forschung, Vol. 10, No. 4, July-August, 1939, pp. 170-174.)
1190	Ploch, C. H.	...	*Automatic Riveting in Aircraft Construction.* (Luftwissen, Vol. 8, No. 2, Feb., 1941, pp. 36-42.)

Miscellaneous.

1180	Ferrari, C.	...	*The Determination of the Projectile of Minimum Wave Resistance.* (Proc. Ac. Turin., Vol. 74, 1939, pp. 675-693, and Vol. 75, 1939, pp. 61-96.)
1183	Klanke, G.	...	*De-icing Experiments on Sail Planes.* (Luftwissen, Vol. 7, No. 11, Nov., 1940, pp. 388-392.)
1184	Hollbach, O.	...	*Navigational Instruments.* (Export Handbook of the German Aircraft Industry, 1939, pp. 125-132.)
1187	Doetsch, G. Seidal, I.	... ...	*The Training of Aeronautical Engineers in Germany.* (Luftwissen, Vol. 8, No. 1, Jan., 1941, pp. 14-19.)

TITLES AND REFERENCES OF ARTICLES AND PAPERS SELECTED FROM PUBLICATIONS RECEIVED IN R.T.P.3 DURING MARCH, 1941.

Notices and abstracts from the Scientific and Technical Press are prepared primarily for the information of Scientific and Technical Staffs. Particular attention is paid to the work carried out in foreign countries, on the assumption that the more accessible British work (for example, that published by the Aeronautical Research Committee) is already known to these Staffs.

THEORY AND PRACTICE OF WARFARE.

ITEM NO.		TITLE AND JOURNAL.
75/1	Germany ...	*Focke-Wulf 200K (Kurier) Four-Engined Bomber.* (Aeroplane, Vol. 60, No. 1,552, 21/2/41, p. 215.)
75/2	Italy ...	*Caproni Reggiane Re 200 (Falcho) Single-Seat Fighter.* (Aeroplane, Vol. 60, No. 1,552, 21/2/41, p. 222.)
75/3	Great Britain	*Identification of Aircraft. Comparison of Handley Page "Hereford" and Dornier Do 215.* (Flight, Vol. 39, No. 1,678, 20/2/41, p. 150.)
75/4	Great Britain	*Lessons of the Tactical Employment of Fighters and Bombers in the Present War. IV.* (N. Macmillan, Flight, Vol. 39, No. 1,678, 20/2/41, pp. 155-7.)
75/5	U.S.A. ...	*Export of Aircraft from U.S.A.: American Aircraft Quality and Present Rates of Production and Export.* (B. Foster, Flight, Vol. 39, No. 1,678, 20/2/41, pp. 158-60.)
75/6	U.S.A. ...	*Republic "Lancer" Pursuit-Interceptor.* (Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 168 and 236.)
75/7	U.S.A. ...	*Mobile Fire-Fighting Unit.* (Aero Digest, Vol. 38, Jan., 1941, p. 212.)
75/8	Great Britain	*New Fleet Air Arm Types (Grumman "Martlet" Single-Seat Deck-Landing Fighter and Fairey "Fulmar" Two-Seat Naval Fighter).* (Airc. Eng., Vol. 13, No. 144, Feb., 1941, pp. 37-9.)
75/9	U.S.A. ...	*The Truth about our National Defence Programme: Why Aircraft Production has Lagged—and How Much.* (T. P. Wright, Aviation, Vol. 40, No. 1, Jan., 1941, pp. 31-3 and 130-8.)
75/10	Germany ...	*Warplane Factories in Germany: The Junkers Diesel Engine Factory.* (P. H. Wilkinson, Aviation, Vol. 40, No. 1, Jan., 1941, pp. 48-9.)
75/11	U.S.A. ...	*Lear Avia "Bale-Out" Siren.* (Aviation, Vol. 40, No. 1, Jan., 1941, p. 70.)
75/12	U.S.A. ...	*Curtiss "Mohawk" and "Tomahawk" Pursuit Planes (P40 and P36A).* Flight, Vol. 39, No. 1,679, 27/2/41, pp. a-c.)
75/13	Japan ...	*Nippon's Air Power.* (Flight, Vol. 39, No. 1,679, 27/2/41, pp. e-174.)
75/14	U.S.A. ...	*American Views on Production Rates in the Present Air War.* (T. P. Wright, Flight, Vol. 39, No. 1,679, 27/2/41, pp. 175-6.)

ITEM NO.		TITLE AND JOURNAL.
75/15	Great Britain	*Blenheim IV and Heinkel He IIIK Silhouettes.* (Flight, Vol. 39, No. 1,679, 27/2/41, p. d.)
75/16	U.S.A. ...	*New Plan for Building Bombers by the Automobile "Big Three" (Ford, General Motors, Chrysler).* (Autom. Ind., Vol. 84, No. 2, 15/1/41, pp. 57, 68, 96.)
75/17	Germany ...	*Note on Various Types of Parachute.* (Der Flieger, Vol. 19, No. 11-12, Nov.-Dec., 1940, pp. 298-300.)
75/18	Germany ...	*The Parachute (continued).* (Der Flieger, Vol. 20, No. 1, Jan., 1941, pp. 18-19.)
75/19	U.S.A. ...	*Fire-Extinguishing Effectiveness of Chemicals in Water Solution.* (H. D. Tyner, Ind. and Eng. Chem. (Ind. Ed.), Vol. 33, No. 1, Jan., 1941, pp. 60-5.) (Abstract available.)
75/20	Great Britain	*Fire Detection Devices, with Special Reference to the Detection of Incendiary Bombs.* (J. Inst. Elec. Engs., Vol. 88, Part I, No. 2, Feb., 1941, pp. 88-92.)
75/21	U.S.A. ...	*Army Air Corps Training of Pilots.* (U.S. Air Services, Vol. 26, No. 2, Feb., 1941, pp. 17 and 38.)
75/22	Italy ...	*Breda 65 Attack-Bomber.* (Aeroplane, Vol. 60, No. 1,553, 28/2/41, p. 254.)
75/23	U.S.A. ...	*Boeing 314A Flying Boats.* (Aeroplane, Vol. 60, No. 1,553, 28/2/41, p. 262.)
75/24	U.S.A. ...	*The Four-Engined Boeing B-17B.* (Airc. Prod., Vol. 3, No. 29, March, 1941, pp. 97-101.)
75/25	U.S.A. ...	*Features of the "Tomahawk" (Curtiss P.40).* (Airc. Prod., Vol. 3, No. 29, March, 1941, pp. 109-10.)
75/26	Germany ...	*A History of External Ballistics.* (F. Klemm, W.T.M., Vol. 45, No. 1, Jan., 1941, pp. 1-8.) (Abstract available.)
75/27	Switzerland...	*Sound Locators. Fundamental Principles.* (O. Born, Flugwehr und-Technik, Vol. 2, No. 11-12, Nov.-Dec., 1940, pp. 251-5.) (Abstract available.)
75/28	Germany ...	*Training of the German Parachute Troops.* (Flugwehr und-Technik, Vol. 2, No. 11-12, Nov.-Dec., 1940, p. 255.)
75/29	Germany ...	*Junkers Ju 88 Bomber.* (Flugwehr und-Technik, Vol. 2, No. 11-12, Nov.-Dec., 1940, pp. 264-5.)
75/30	France ...	*The Influence of the 24-Cylinder (2,000 h.p.) Engine on the Development of the Fighter Bomber.* (C. Rougeron, Inter. Avia., No. 751, 20/2/41, pp. 1-3.) (Abstract available.)
75/31	Germany ...	*Wiener-Neustaedter WN16 Experimental Tricycle Aircraft compared with Focke-Wulf FW198 Destroyer.* (Inter. Avia., No. 751, 20/2/41, p. 6.)
75/32	U.S.A. ...	*U.S.A. Air Corps Equipment.* (Inter. Avia., No. 751, 20/2/41, pp. 6-7.)
75/33	U.S.A. ...	*Curtiss CW21B Interceptor Fighter.* (Inter. Avia., No. 751, 20/2/41, pp. 7-8.)
75/34	U.S.A. ...	*Consolidated B-24 Four-Engined Tricycle Bomber.* (Inter. Avia., No. 751, 20/2/41, p. 9.)
75/35	U.S.A. ...	*Air Escorts for British Convoys.* (Inter. Avia., No. 751, 20/2/41, pp. 10-11.)
75/36	Germany ...	*External Bomb Load on He III.* (Inter. Avia., No. 751, 20/2/41, p. 11.)
75/37	U.S.A. ...	*U.S.A. Parachutist Training.* (Inter. Avia., No. 751, 20/2/41, pp. 13-14.)

ITEM NO. TITLE AND JOURNAL.

75/38 U.S.A. ... *U.S.A. Naval Airships.* (Inter. Avia., No. 751, 20/2/41, p. 14.)

75/39 France ... *French Estimate of the Strength of the German Air Force.* (Inter. Avia., No. 751, 20/2/41, p. 15.)

AERO- AND HYDRODYNAMICS.

75/40 Great Britain *The Wind Tunnel with Open Working Section.* (N. Simmons, Phil. Mag., Vol. 31, No. 205, Feb., 1941, pp. 89-102.) (Abstract available.)

75/41 Great Britain *On Turbulent Liquid Motion Outside a Circular Boundary.* (M. Ray, Phil. Mag., Vol. 31, No. 205, Feb., 1941, pp. 144-55.) (Abstract available.)

75/42 Great Britain *The Air-Jet with a Velocity exceeding that of Sound.* (J. Hartmann and F. Lazarus, Phil. Mag., Vol. 31, No. 204, Jan., 1941, pp. 35-50.)

75/43 Great Britain *Effect of Temperature on the Adiabatic Compressibility of Liquids.* (M. R. Rao, Nature, Vol. 147, No. 3,722, 1/3/41, pp. 268-9.)

75/44 Great Britain *Wind Tunnel Correction for a Circular Open Jet. Tunnel with a Reflexion Plate.* (B. Davison and L. Rosenhead, Proc. Roy. Soc., Vol. 177, No. 970, 24/2/41, pp. 366-82.) (Abstract available.)

75/45 Great Britain *The Invariant Theory of Isotropic Turbulence.* (H. P. Robertson, Proc. Camb. Phil. Soc., Vol. 36, Part 2, April, 1940, pp. 209-223.)

75/46 Great Britain *Hydrodynamical Images (Circular Cylinder in a Two-Dimensional Flow).* L. M. Milne-Thomson, Proc. Camb. Phil. Soc., Vol. 36, Part 2, April, 1940, pp. 246-7.)

75/47 Great Britain *Note on the Slow Motion of Fluid (past a sharp edge projecting into the stream).* (W. R. Dean, Proc. Camb. Phil. Soc., Vol. 36, Part 3, July, 1940, pp. 300-313.)

75/48 Japan ... *Velocity Distribution in a Plane Jet.* (T. Okaya and M. Hasegawa, Proc. Phys.-Math. Soc., Japan, Vol. 22, Sept., 1940, pp. 771-80.) (Sci. Absts. " A," Vol. 44, No. 517, Jan., 1941, p. 6.)

75/49 Japan ... *Wave Resistance of a Plane Plate.* (Y. Nomura, Sci. Rept., Tohôku Univ., Vol. 29, Sept., 1940, pp. 268-86.) (Sci. Absts. " A," Vol. 44, No. 517, Jan., 1941, p. 6.)

75/50 U.S.A. ... *Theorems on the Motion of Incompressible Viscous Fluids.* (G. Young, Bull. Math. Biophys., Vol. 2, Dec., 1940, pp. 145-55.) (Sci. Absts. " A," Vol. 44, No. 518, Feb., 1941, p. 31.)

75/51 U.S.A. ... *Flow of Muds, Sludges and Suspensions in Circular Pipes.* (D. H. Caldwell and H. E. Babbitt, Ind. and Eng. Chem. (Ind. Ed.), Vol. 33, No. 2, Feb., 1941, pp. 249-56.)

75/52 U.S.A. ... *The Mathematical Theory of Non-Uniform Gases (Book Review).* (S. Chapman and T. G. Cowling, New York: The Macmillan Co., 1939, 404 pp. Price $7.50.) (J. Frank. Inst., Vol. 231, No. 2, Feb., 1941, pp. 198-9.)

75/53 Great Britain *Experiments on Turning Vanes at an Expansion (Wind Tunnel Design).* (D. C. MacPhail, R. and M., No. 1,876, 25/4/39.)

ITEM NO.		TITLE AND JOURNAL.
75/54	Great Britain	*Cascade Theory and the Design of Fan Straighteners.* (A. R. Collar, R. and M., No. 1,885, 22/1/40.) (Abstract available.)
75/55	Great Britain	*Flow of an Ideal Fluid Past a Cascade of Blades.* (W. Merchant, R. and M., No. 1,890, 8/7/40.)
		AIRCRAFT AND AIRSCREWS.
75/56	U.S.A. ...	*Vought Sikorsky Helicopter VS-300.* (Aeroplane, Vol. 60, No. 1,552, 21/2/41, pp. 233-4.)
75/57	Great Britain	*History of the Fairey Aviation Company.* (Flight, Vol. 39, No. 1,678, 20/2/41, pp. 151-4.)
75/58	U.S.A. ...	*How to Speed Up Production.* (Paper to S.A.E. National Aircraft Meeting.) (P. G. Zimmerman, Canadian Aviation, Vol. 14, No. 1, Jan., 1941, pp. 37-9.)
75/59	U.S.A. ...	*Ryan Trainer ST-3.* (Canadian Aviation, Vol. 14, No. 1, Jan., 1941, p. 58.)
75/60	U.S.A. ...	*The Hazards of Icing. Hints for Pilots.* (F. Smith, Aero Digest, Vol. 38, No. 1, Jan., 1941, p. 43.)
75/61	U.S.A. ...	*Chicago Municipal Airport: Improved with a System of Dual Runways.* (Aero Digest, Vol. 38, No. 1, Jan., 1941, p. 44.)
75/62	U.S.A. ...	*Airlines' Radio Requirements met with a 24-Pound Receiver.* (D. S. Little, Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 45-6 and 236.)
75/63	U.S.A. ...	*A New Radio Aid to Air Navigation: RCA Omni-directional Beacon.* (D. G. C. Luck, Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 49-56 and 232.)
75/64	U.S.A. ...	*Possible Future Speed of Aircraft.* (P. Autry, Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 132 and 235.)
75/65	U.S.A. ...	*Analysing the Requirements of Supercharged Cabins.* (D. Gregg, Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 136-43.)
75/66	U.S.A. ...	*Consolidated Aircraft Designs in Current Production XP3Y-1, PB2Y-2, Model 31, XPBY-5A, B-24).* (Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 145-7, 211 and 231.)
75/67	U.S.A. ...	*Down-Wind versus Up-Wind Turns.* (R. R. Bloss, Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 155 and 232.)
75/68	U.S.A. ...	*Consolidated's Tooling Methods Simplify Production.* (P. Koenig, Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 156-9.)
75/69	U.S.A. ...	*Novel Assembly Methods Used for Boeing A-314.* (Aero Digest, Vol. 38, No. 1, Jan., 1941, p. 160.)
75/70	U.S.A. ...	*Flexible Electrical Distribution Aids in Aircraft Assembly.* (L. F. Kummel, Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 163 and 232.)
75/71	U.S.A. ...	*The Ryan ST-3 Trainer.* (Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 164-7 and 235.)
75/72	U.S.A. ...	*"Airlite" Electrical Generator for Light Aircraft.* (Aero Digest, Vol. 38, No. 1, Jan., 1941, p. 212.)
75/73	U.S.A. ...	*Instrument Flying (Book Review).* (P. V. H. Weems and C. A. Zweng, Weems System of Navigation, Annapolis, 321 pp. Price $4.) (Aero Digest, Vol. 38, No. 1, Jan., 1941, p. 102.)

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75/74	Germany ...	*The Junkers V.P. Airscrew.* (Airc. Eng., Vol. 13, No. 144, Feb., 1941, pp. 33-4 and 37.)
75/75	U.S.A. ...	*Gust Load Factor Principles: A Simplified Explanation for Aeroplane Pilots.* (F. R. Shanley, U.S. Civil Aeronautics Journal, Vol. 1, No. 17, 1/9/40.) (Airc. Eng., Vol. 13, No. 144, Feb., 1941, pp. 42-3.)
75/76	U.S.A. ...	*Pressurised Cabin Control.* (H. E. W. Tinker and H. S. Hubbard, Aviation, Vol. 40, No. 1, Jan., 1941, pp. 38, 119 and 124.)
75/77	U.S.A. ...	*Instrument Approach Guide for Blind Landing.* (A. A. Barrie, Aviation, Vol. 40, No. 1, Jan., 1941, pp. 39 and 124.)
75/78	U.S.A. ...	*Applying Automotive Methods to Aircraft Production.* (D. R. Berlin and P. F. Rossmann, Aviation, Vol. 40, No. 1, Jan., 1941, pp. 42-3, 122 and 144.)
75/79	U.S.A. ...	*Testing and Aviation Floodlight.* (H. W. Wrigley, Aviation, Vol. 40, No. 1, Jan., 1941, p. 64.)
75/80	U.S.A. ...	*Simplifying Aeroplane Maintenance: Self-Sealing Coupling makes Possible Faster Exchange of Aircraft Power Units.* (F. P. Hirsch, Aviation, Vol. 40, No. 1, Jan., 1941, p. 69.)
75/81	U.S.A. ...	*Firestone Static Conductor Tyres Discharge Static Electricity.* (Aviation, Vol. 40, No. 1, Jan., 1941, p. 70.)
75/82	U.S.A. ...	*Procedure Handbook for Aircraft Stress Analysis (Book Review).* (Nye, Hamilton and Eames, Aviation Press, San Francisco, 334 pp. Price $4.) (Aviation, Vol. 40, No. 1, Jan., 1941, p. 99.)
75/83	U.S.A. ...	*Airports: Some Elements of Design and Future Development (Book Review).* (J. W. Wood, Coward-McKann, New York, 364 pp. Price $12.50.) (Aviation, Vol. 40, No. 1, Jan., 1941, p. 100.)
75/84	Great Britain	*Producing the "Shadow" Blenheim: Part II. Building the Front and Rear Sections of the Fuselage: Works Layout and Equipment.* (B. Foster, Airc. Prod., Vol. 3, No. 28, Feb., 1941, pp. 45-54.)
75/85	Germany ...	*Do 18 New Version with BMW Radial Engines.* (Der Flieger, Vol. 19, No. 11-12, Nov.-Dec., 1940, pp. 296-7.)
75/86	Germany ...	*Variable Pitch Propellers (Curtiss: Escher-Wyss).* (Der Flieger, Vol. 19, No. 11-12, Nov.-Dec., 1940, pp. 313-6.)
75/87	Italy ...	*Speed of Aircraft and Factors Affecting it.* (A. Ferri, L'Ingegnere, Vol. 14, No. 9, 15/9/40, pp. 688-93.)
75/88	Germany ...	*Drag of Aero Engine Radiators.* (H. Helmbold, Schriften der deutschen Akademie der Luftfahrtforsch, No. 14, 1938-9, pp. 1-14.) (Available in R.T.P.3.)
75/89	Great Britain	*The Engineering Outlook. III. Aircraft.* (Engineering, Vol. 151, No. 3,918, 14/2/41, pp. 134-5.)
75/90	Great Britain	*Method for Estimating Top Speeds of Aircraft.* (Aeroplane, Vol. 60, No. 1,553, 28/2/41, pp. 250-1.)
75/91	U.S.A. ...	*Applications of Electric Power in Aircraft.* (T. B. Holliday, Autom. Ind., Vol. 84, No. 4, 15/2/41, pp. 164, 188.)

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75/92	Great Britain	*Producing the "Shadow" Blenheim: Part III. Assembly Processes in the Main Erecting Hall: Final Adjustments and Flight Tests.* (B. Foster, Airc. Prod., Vol. 3, No. 29, March, 1941, pp. 79-84.)
75/93	Great Britain	*Airscrew Assembly: Application of Conveyor and Rail Track Systems.* (Airc. Prod., Vol. 3, No. 29, March, 1941, pp. 90-4.)
75/94	U.S.A. ...	*Standardisation in Aircraft Manufacture: Discussion at S.A.E. National Aircraft Production Meeting.* (Airc. Prod., Vol. 3, No. 29, March, 1941, pp. 105-8.)
75/95	U.S.A. ...	*Development of the C.A.A. Instrument Landing System at Indianapolis.* (W. E. Jackson, A. Alford, P. F. Byrne and H. B. Fischer, Trans. Amer. Inst. Elect. Eng., Vol. 59, 1940, pp. 849-58.) (Sci. Absts. "B," Vol. 44, No. 517, Jan., 1941, pp. 18-19.)
75/96	U.S.A. ...	*Technical Progress in Aviation.* (J. C. Hunsaker, Mech. Eng., Vol. 63, No. 2, Feb., 1941, pp. 95-97.) (Abstract available.)
75/97	U.S.A. ...	*Recent Progress in Aeronautics—Progress Report (Aerodynamics, Accessories, Power Plants, Meteorology).* (Mech. Eng., Vol. 63, No. 2, Feb., 1941, pp. 101-4, 116.) (Abstract available.)
75/98	U.S.A. ...	*Aeroplane Performance Testing at Altitude.* (A. C. Reed, J. Aeron. Sci., Vol. 8, No. 4, Feb., 1941, pp. 135-50.) (Abstract available.)
75/99	U.S.A. ...	*Shear Centre of a Multi-Cell Metal Wing.* (H. W. Sibert, J. Aeron. Sci., Vol. 8, No. 4, Feb., 1941, pp. 162-6.) (Abstract available.)
75/100	Switzerland...	*Escher-Wyss Variable Pitch Propeller—Constructional Principles.* (A. von der Mühll, Flugwehr und-Technik, Vol. 2, No. 11-12, Nov.-Dec., 1940, pp. 258-60.) (Abstract available.)
75/101	U.S.A. ...	*Beechcraft 18S Twin-Engined Transport.* (Inter. Avia., No. 751, 20/2/41, p. 8.)
75/102	U.S.A. ...	*U.S.A. North Atlantic Flying Boat Service.* (Inter. Avia., No. 751, 20/2/41, p. 17.)

ENGINES AND ACCESSORIES.

75/103	Great Britain	*Proposed Automatic Venting Valve for Aircraft Hydraulic Systems.* (Aeroplane, Vol. 60, No. 1,552, 21/2/41, p. 231.)
75/104	U.S.A. ...	*Franklin Six-Cylinder Engine.* (Aero Digest, Vol. 38, No. 1, Jan., 1941, pp. 148-52 and 231.)
75/105	Germany ...	*The Shape of Piston Ring Grooves. The Importance of the Radius of Curvature at the Base of the Grooves in Resisting High Stresses.* (E. Mickel, Luftwissen, Vol. 6, No. 12, Dec., 1939, pp. 305-8.) (Airc. Eng., Vol. 13, No. 144, Feb., 1941, pp. 35-7.)
75/106	Germany ...	*Junkers Jumo 205 and 207 Diesel Engines.* (Aviation, Vol. 40, No. 1, Jan., 1941, pp. 63 and 106.)
75/107	U.S.A. ...	*The Guiberson Oil Engine: Nine-Cylinder Radial Air-Cooled Power Unit Used for Light Tanks.* (Autom. Eng., Vol. 31, No. 407, Feb., 1941, p. 60.)

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75/108	Great Britain	*Oil Engine Design: the Combined Effect of Swirl and "Swish" (Transverse Flow) on Combustion.* (Autom. Eng., Vol. 31, No. 407, Feb., 1941, pp. 63-4.) (Abstract available.)
75/109	Great Britain	*Heat Flow in Engines.* (E. A. Smith, Flight, Vol. 39, No. 1,679, 27/2/41, pp. 180-1.)
75/110	Germany ...	*Hirth HM515: a New German Aero Engine* (60 *h.p.*). (Der Flieger, Vol. 19, No. 11-12, Nov.-Dec., 1940, p. 304.)
75/111	Germany ...	*Gaskets in Aircraft and Engine Construction.* (H. Diegmann, Der Flieger, Vol. 20, No. 1, Jan., 1941, pp. 16-17.)
75/112	Germany ...	*Some Dynamic Problems of Piston Engines (Crankshaft Vibration).* (R. Grammel, Schriften der deutschen Akademie der Luftfahrtforsch., No. 5, 1938-9, pp. 1-17.) (Available in R.T.P.3.)
75/113	Germany ...	*Vibrations of the Engine Airscrew System.* (K. Lürenbaum, Schriften der deutschen Akademie der Luftfahrtforsch., No. 5, 1938-9, pp. 19-44.) (Available in R.T.P.3.)
75/114	Great Britain	*Efficiencies of the Centrifugal Pump.* (J. Jennings, Engineering, Vol. 151, No. 3,918, 14/2/41, pp. 122-3.)
75/115	U.S.A. ...	*Proposed Atmospheric Correction Formula for Diesel Engines.* (Autom. Ind., Vol. 84, No. 3, 1/2/41, pp. 120-1.)
75/116	U.S.A. ...	*Apparatus for Determining Diesel Fuel-Spray Characteristics.* (H. F. Bryan, Autom. Ind., Vol. 84, No. 3, 1/2/41, pp. 121-2.)
75/117	U.S.A. ...	*"Averaging" Ignition Lag Meter for Compression Ignition Engines.* (A. E. Traver and W. S. Mount, Autom. Ind., Vol. 84, No. 3, 1/2/41, pp. 122-3.) (Abstract available.)
75/118	U.S.A. ...	*Comparison of Automatic Types of Exhaust Gas Analysers.* (J. L. Dilworth, Autom. Ind., Vol. 84, No. 3, 1/2/41, pp. 123-4.) (Abstract available.)
75/119	U.S.A. ...	*Lubrication of Diesel Engines.* (G. J. McNab, W. C. Winning, B. G. Baldwin and F. L. Miller, Autom. Ind., Vol. 84, No. 3, 1/2/41, p. 124.) (Abstract available.)
75/120	Germany ...	*B.M.W. Engines, based on Pratt and Whitney Prototypes.* (Aeroplane, Vol. 60, No. 1,553, 28/2/41, pp. 252-3.)
75/121	U.S.A. ...	*The Making of Reduction Gears for Wright Aircraft Engines.* (L. Peat, Autom. Ind., Vol. 84, No. 4, 15/2/41, pp. 151-5, 190.)
75/122	U.S.A. ...	*Development of the Radial Engine for Military Uses.* (H. L. Brownback, Autom. Ind., Vol. 84, No. 4, 15/2/41, pp. 156-60.)
75/123	U.S.A. ...	*Modern Aircraft Engine Testing (Paper to S.A.E. Annual Meeting).* (W. D. Gove, Autom. Ind., Vol. 84, No. 4, 15/2/41, p. 166.)
75/124	Great Britain	*The "Electrogear."* (Railway Electrical Engineer, Feb., 1941, pp. 29-31, 38.) (Met. Vick. Tech. News Bull., No. 752, 7/3/41, p. 1.)

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75/125	U.S.A. ...	*Propulsive Effects of Radiator and Exhaust Ducting.* (M. Rauscher and W. H. Phillips, J. Aeron. Sci., Vol. 8, No. 4, Feb., 1941, pp. 167-74.) (Abstract available.)
75/126	U.S.A. ...	*Hydraulic Couplings for Internal Combustion Engine Applications.* (N. L. Alison, R. G. Olson and R. M. Nelden, Trans. A.S.M.E., Vol. 63, No. 2, Feb., 1941, pp. 81-90.) (Abstract available.)
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75/162	U.S.A. ...	*Nylon for Parachutes.* (Aviation, Vol. 40, No. 1, Jan., 1941, p. 83.)
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75/164	U.S.A. ...	*Honed Microfinish for Aircraft Parts.* (Autom. Ind., Vol. 84, No. 2, 15/1/41, pp. 59-62, 96.)
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75/179	Great Britain	*Identification of Light Scrap.* (Engineer, Vol. 171, No. 4,442, 28/2/41, p. 145.) (Abstract available.)
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75/182	Great Britain	*The Welding, Soldering and Brazing of High Nickel Alloys.* (Engineering, Vol. 151, No. 3,918, 14/2/41, p. 124.)
75/183	Great Britain	60 *KVA. Half Cycle Bench Mounting Spot Welder.* (Engineering, Vol. 151, No. 3,918, 14/2/41, p. 130.)
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Wireless and Electricity.

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