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(Prepared by R.T.P.)

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On the Calculation of the Quantity of Bombs Required for the Destruction of Various Targets. (A. S. Palchikov, Air Fleet News, U.S.S.R., Vol. 23, No. 7, July, 1940, pp. 27-31. R.T.P. Translation No. 1126.) (85/1 U.S.S.R.)

The nature of the target determines the number of bombs required as well as the methods of approach and bombing to be adopted. A railway station of average size will require at least 80 hits with 100 kg. H.E. with a fair sprinkling of splinter bombs in order to be put completely out of action for 5-6 hours.

Open tracks and small stations are usually badly protected and can be attacked from low altitudes. Cuttings with high embankments are specially vulnerable. Clay and sandy soil will require 100 kg. H.E. bombs, rocky soil 250 kg. bombs. Any risk of the bomb richochetting and rolling down the slope should be allowed for by fitting instantaneous fuses. Hydro electric power plants present a difficult problem. The power units in the dam will require at least five direct hits with 500 kg. H.E. bombs.

After reviewing other types of targets the author concludes that hasty or insufficient preparation for the raid will nullify the effect and lead to a possible waste of expensive material.

Some General Mathematical Considerations on the Possible Errors of A.A. Fire. (H. Brandli, Flugwehr und Technik, No. 9-10, 1939, pp. 247-248; No. 11-12, 1939, pp. 275-277; No. 1, 1940, pp. 9-12.) (85/2 Switzerland.)

The space position of a shell at a given time t is determined by the azimuth and elevation of the gun at the instant of firing W and the time interval $T=t-W$ which has elapsed. All shells which have been in the air for the same time interval T but were fired with different elevation and azimuth settings will lie on a surface which is symmetrical about a vertical axis passing through the zenith point of the gun. At any instant t the target aircraft will be on such a surface T and a hit at this instant is only possible if the gun has been fired at a time $W=t-T$, and if azimuth and elevation are appropriate. If azimuth and elevation at time W are in error, the shell at time t_1, although on the same T surface as the aircraft at the same instant t, will pass the target at a certain distance y_1. This distance is not necessarily the minimum distance y between shell and aircraft at some subsequent time $t+\Delta t_1$. The author shows, however, that the difference between y and y_1 is unlikely to exceed 3 per cent. If we neglect the motion of the aircraft target, *i.e.*, consider it fixed in space at time t, the shell

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will pass this position at a minimum distance y_2 at time $t+\Delta t_2$. Unless y is very large, y_2 again will not differ from y by more than 6 per cent. Any one of the three vectors y, y_1 or y_2 can thus be employed to specify the accuracy of the fire of contact fuse ammunition. In the case of time fuses, however, the error is determined by the position of the aircraft at the instant of the shell explosion. Even if the shell is fired at the correct time W, therefore, the vector error x will depend on the fuse setting as well as on azimuth and elevation at time W. If the aircraft is assumed to be fixed at the instant t, the shell burst will occur at a distance x_1 from this fictitious position. This vector can also be employed for estimating the accuracy of fire. The percentage difference between x and x_1 depends primarily on the ratio of shell to aircraft speed and may thus be considerable ($\sim$ 50 per cent.).

In the training of A.A. personnel, it is very important that some idea of the progress achieved be obtained at an early stage and before actual firing trials are carried out. The author suggests that some of the vectors discussed could be incorporated in simple training devices, but no details are given as to the means of achieving this.

Fluid Flow in Pipe Lines and Fittings. Moore, J., Junior, Inst. Eng., Oct., 1940, pp. 1-13.) (85/3 Great Britain.)

The problem of determining the effect of changes in direction or cross section of pipes and pipe fittings on pressure loss in pipe flow is approached from two points of view, viz., determining the equivalent length of straight pipe and using straight pipe formulæ, or employing formulæ applicable only to the particular type of fitting. Following a theoretical treatment of the problem, experiments on different types of fittings are described, and calibration curves are reproduced. From these curves values of c and n in the formula $P=c\phi^n$ are derived, where P is the pressure drop and ϕ the rate of flow. It is emphasised that the " equivalent length " is dependent on the rate of flow, and the same value can only be used for all discharges if n is the same for the pipe as the fitting.

(Abstract supplied by Research Department, Metropolitan-Vickers.)

Economic Pipe Size with Transportation of Viscous and Non-viscous Fluids. (B. R. Sarchet and A. P. Colburn, Ind. and Eng. Chem. (Industrial Ed.), Vol. 32, No. 9, Sept., 1940, pp. 1249-1252.) (85/4 U.S.A.)

The economic pipe size, for which the sum of pipe and pumping costs is a minimum, has been derived for both the turbulent and viscous regions of flow. The resulting equations are represented by convenient nomographs. By solving the optimum diameter equations simultaneously with the critical Reynolds number, a convenient relation has been found to indicate whether any given flow will be turbulent or viscous in a pipe of optimum diameter. Although the optimum velocity of many liquids in turbulent flow runs from 3 to 4 feet per second, much lower optimum velocities are calculated for very viscous liquids.

The Analogy of Fluid Friction and Heat Transfer. (B. A. Bakhmeteff, Trans. A.S.M.E., Vol. 62, No. 7, Oct., 1940, pp. 551-553.) (85/5 U.S.A.)

The author discusses a previous paper by von Kármán (Trans. A.S.M.E., Vol. 61, 1939, pp. 705-710.)

According to the momentum heat transfer analogy of Reynolds the overall heat transfer number for turbulent convections $C_H=C_f/_2$ when C_f=friction coefficient. Now experiment shows that $C_H > C_f/_2$ and this discrepancy has been repaired by Taylor, Prandtl and von Kármán by introducing the effect of the laminar layer at the wall, across which the heat transfer is by conduction. The author questions the validity of the form of this correction factor on physical grounds and proposes an alternative treatment in which the Reynolds analogy is expressed in terms of energy instead of momentum. This leads to the expression $C_H = C_f$ instead of $C_f/_2$ after allowing for the effect of the laminar boundary layer

$$C_H = \eta C_f$$

where

$$\eta = 1/(1 + N\sigma/2\ C_f)$$

and

$$\sigma = \text{Prandtl number.}$$

Experimental results can be represented satisfactorily by making N = constant, although somewhat greater accuracy requires N to be of the form $N = N_0/_{\sigma m}$.

The Effect of Compressibility. (J. Ackeret, Flugwehr und Technik, Vol. 2, No. 1, Jan., 1940, pp. 18-20.) (85/6 Switzerland.)

It has been shown by Prandtl that the aerodynamic forces on a given wing profile at a given incidence and Mach numbers up to 0.6 are approximately the same as those acting on a transformed profile in incompressible flow. The transformation is very simple and amounts to an increase of all the ordinates of the profile (including incidence) in the ratio $1/\sqrt{(1 - M^2)}$.

A thin profile at a certain incidence is thus equivalent to a thicker profile at a larger incidence, *i.e.*, both lift and profile resistance increase with increase of Mach number M and high speed profiles must therefore be thin. Up to $M = 0.6$, the increase in profile drag can, however, be kept small. At higher values of M, the increase in drag becomes catastrophic and the simple Prandtl correction factor no longer applies. It is known that this rapid increase in drag is associated with the appearance of shock waves. The energy dissipated in such waves is, however, relatively small so long as M remains in the neighbourhood of unity and the author suggests that the increase in drag observed under these conditions is due to the reaction of the pressure wave on the boundary layer. Optical investigations have shown that at these high air speeds, the boundary layer breaks away in the neighbourhood of the maximum cross section and the aerodynamic shape of the wing is ruined. Experiments are in hand with a view to increasing the stability of the boundary layer and preventing separation at high Mach numbers. The author hopes to report on these at some future date.

Heat Exchanger for Aircraft (German Patent No. 673,301, Dornier Works, Friedrichshafen). (Flugsport, Vol. 31, No. 9, 26/4/39, Patent Section No. 7, p. 27.) (85/7 Germany.)

Principal claim: Heat exchanger, built into leading edge of wing or other parts of the aircraft exposed to the incident air stream, characterised by the fact that a number of heat transfer elements are arranged either in series or in parallel and inter-connected by means of suitable passages in such a way that the direction of flow of both the entry and exit air can be varied by the operation of shutters or their equivalent. The temperature of the exit air is thus controllable over wide limits. The diagrams accompanying the original abstract show a radiator element of the honeycomb type installed in a cylindrical tube forming part of the leading edge of the wing. Three control positions are shown in action:—

(1) The incident air enters through a slot in the lower edge of the wing nose and is led through a channel to the rear of the radiator. After passing through the radiator the heated air flows through a channel close to the leading edge of the wing.

(2) The incident air enters the front of the radiator through a passage near the nose and leaves through slots in the upper wing surface near the point of maximum suction.

(3) Same as (2), except that the heated air is collected in a channel inside the lower wing surface.

Shear Centre of a Leading-Edge Wing Beam. (H. W. Sibert, J. Aeron. Sci., Vol. 7, No. 12, Oct., 1940, pp. 520-523.) (85/8 U.S.A.)

Several years ago Hatcher (J. Aeron. Sci., Vol. 4, No. 6, pp. 233-238) outlined a method based on the least work of shear stresses for determining the shear centre of a sheet metal box spar of constant cross section. His analysis produced a double integral for the unknown shear stress at a chosen point and a second double integral for the moment of the shear stresses on a cross section, but he gave no method for evaluating these double integrals when the mathematical equation of the skin contour is unknown, which is usually the case in leading-edge wing beams. Later, Newell (J.S.A.E., Vol. 45, No. 3, pp. 385-388) obtained the shear centre of a leading-edge wing beam of constant cross section by evaluating two analogous double integrals by the strip method.

Previously, the author had reduced the double integral for the shear stress at a given point to a single integral, which could be evaluated by Simpson's rule when the equation of the skin contour was unknown, and had expressed the double integral for the moment of the shear stresses as an area, which could be measured with a planimeter.

Unfortunately, the author's final results were expressed in an unnecessarily complicated form, which decreased considerably their value to a designer. This defect is remedied in this article, and the two fundamental double integrals are so expressed that the calculations involved will be considerably shorter than those required for the strip method.

The Utilisation of Different Kinds of Wood in Built-up Airscrews. (K. Riechers, Z.V.D.I., Vol. 84, No. 20, 18/5/40, pp. 339-342.) (85/9 Germany.)

The efficient utilisation of large powers in a single airscrew operating at high altitudes necessitates the utilisation of blades of considerable width, since the number of blades which can be used is limited to three or four by the variable pitch mechanism, which otherwise becomes unduly complicated. At the same time the diameter of the blade is fixed, since the tip speed must not exceed the velocity of sound.

Although metal airscrews are at present in general use, it appears that this type becomes very heavy when applied to units of the order of 2,000 h.p., such as will be required in the near future. For this reason, blades made of resin treated and compressed wood are receiving attention, on account of the relatively low density of this material (1.35) combined with satisfactory strength. The author describes the manufacture of treated wood propellers in which the various constituent layers are of different density. The C.G. of the blade can be located in the proximity of the root, which is threaded and provided with a steel shell for location in the hub. The threads are filled with plastic material and the blade end of the shell is bevelled and fitted with a rubber insert. A photograph shows a four-bladed propeller of this type, 4.5 m. diameter and absorbing 2,000 h.p. at 1,100 r.p.m. No weights are given. In order to reduce visibility, it is stated that all propellers are now given a coat of dull green paint.

Terminal Velocity Dives. (B. Worley, Aeronautics, Vol. 3, No. 3, Oct., 1940, pp. 34-36.) (85/10 Great Britain.)

The terminal velocity of a body dropped from any altitude is reached when the air drag equals the weight. A solid dural sphere 4 feet in diameter weighs about 6,000 lb. and reaches a terminal velocity of 850 m.p.h. at 5,000 feet. A hollow sphere of the same size, with walls 1/10 in. thick weighs 75 lb. and its terminal velocity at the same altitude is only 95 m.p.h. A glider weighing 700 lb. would reach a T.V. of about 300 m.p.h. under similar conditions. Neglecting propeller drag and compressibility effects, a modern single-seat fighter weighing 6,000 lb. will have a terminal velocity of over 700 m.p.h. With the propeller locked (*i.e.*, rotation prevented by brake) and zero incidence (blades broadside to the air) the T.V. is reduced to 425 m.p.h. If the propeller during the dive is driving the throttled engine, the T.V. will depend on the pitch setting and except for zero and 90° pitch setting, the T.V. will be greater than with the propeller locked. Although at zero pitch, the propeller is at rest, the speed of rotation will increase extremely rapidly with increase of pitch, reaching a maximum at about 10° setting. Smaller engine r.p.m. will be produced at large pitch settings, but in this range the terminal velocity is scarcely affected. The same phenomena, but in an accentuated form are produced if the engine throttle is opened up during the dive, *i.e.*, the possibility of engine damage limits the T.V. to power dives below the throttled value (in other words, the power dive cannot be as steep). If a free wheel were provided between engine and propeller, limitations of engine r.p.m. no longer arise and provided the propeller is built strong enough, a braking effect similar to that of the throttled engine case can be obtained. The disadvantage of this method lies in the fact that it may be difficult to restart the engine after a prolonged dive. The same drawback applies to the blocked propeller. As a result of all these considerations, it appears that the present method of reducing T.V. by means of air brakes attached to the wings provides the only practical solution of the problem.

(Abstractor's Note.—Most of the above is based on N.A.C.A. Technical Report No. 641.)

Static Thrust and Power Characteristics of Six Full-Scale Propellers. (E. P. Hartman and D. Biermann, N.A.C.A. Report No. 684, 1940.) (85/11 U.S.A.)

Static thrust and power measurements were made of six full-scale propellers. The propellers were mounted in front of a liquid-cooled engine nacelle and were tested at 15 different blade angles in the range from $-7\frac{1}{2}°$ to 35° at 0.75 R. The test rig was located outdoors and the tests were made under conditions of approximately zero wind velocity.

Aerofoil characteristics computed from the static test data, by the single point method developed by Lock, were considerably different from the aerofoil characteristics computed from wind tunnel test data for the same propeller and nacelle.

The tests showed a marked variation of static thrust and power coefficients with tip speed for the range of blade angles from about $7\frac{1}{2}°$ to $17\frac{1}{2}°$. A propeller with R.A.F. 6 aerofoil sections showed the greatest effect of compressibility and a propeller with N.A.C.A. 2,400-34 series sections showed the least effect. A propeller with a wide blade showed much less effect of compressibility than a similar propeller with a blade of normal width.

Effect of Exit-Slot Position and Opening on the Available Cooling Pressure for N.A.C.A. Nose-Slot Cowlings. (G. W. Stickle, I. Naiman and J. L. Crigler, N.A.C.A. Report No. 687, 1940.) (85/12 U.S.A.)

An investigation of full-scale nose-slot cowlings has been conducted in the N.A.C.A. 20-foot wind tunnel to furnish information on the pressure drop available for cooling. Engine conductances from 0 to 0.12 and exit-slot conductances from 0 to 0.30 were covered. Two basic nose shapes were tested to determine the effect of the radius of curvature of the nose contour; the nose shape with the smaller radius of curvature gave the higher pressure drop across the engine. The best axial location of the slot for low-speed operation was found to be in the region of maximum negative pressure for the basic shape for the particular operating condition. The effect of the propeller operating condition on the available cooling pressure is shown. The cooling pressure for low air speed depends markedly on the blade section near the hub. The maximum pressure drop $\Delta p/q$ obtained for the high speed condition with an engine conductance equivalent to that of a modern double-row radial engine and a propeller with good blade sections near the hub is 1.45 and, for the take-off condition, is 3.75; for a propeller with a round blade shank, the values are 1.23 and 1.65 respectively.

Aerodynamic Characteristics of Horizontal Tail Surfaces. (A. Silverstein and S. Katzoff, N.A.C.A. Report No. 688, 1940.) (85/13 U.S.A.)

Collected data are presented on the aerodynamic characteristics of 17 horizontal tail surfaces, including several with balanced elevators and two with end plates. Curves are given for coefficients of normal force, drag, and elevator hinge moment. A limited analysis of the results has been made. The normal force coefficients are in better agreement with the lifting surface theory of Prandtl and Blenk for aerofoils of low aspect ratio than with the usual lifting line theory. Only partial agreement exists between the elevator hinge moment coefficients and those predicted by Glauert's thin aerofoil theory. Experimental results of the effect of end plates are in good agreement with theory.

Preliminary Wind Tunnel Investigation of an N.A.C.A. 23012 *Aerofoil with Various Arrangements of Venetian Blind Flaps.* (C. J. Wenzinger and T. A. Harris, N.A.C.A. Report No. 689, 1940.) (85/14 U.S.A.)

An investigation has been made in the N.A.C.A. 7 by 10-foot wind tunnel of a large chord N.A.C.A. 23012 aerofoil with several arrangements of venetian blind flaps to determine the aerodynamic section characteristics as affected by the over-all flap chord, the chords of the slats used to form the flap, the slat spacing, the number of slats, and the position of the flap with respect to the wing. Complete section data are given in the form of graphs for all the combinations tested.

The optimum arrangement of the venetian blind flap was a combination in which the flap was located near the wing trailing edge. These arrangements of the venetian blind flap were superior to any flaps previously tested for producing lift and giving low drag coefficients at high lift coefficients. The wing with this flap, however, had very large pitching moment coefficients. When operated as split flaps, the venetian blind flaps were inferior to the simple split flap in producing lift.

Longitudinal Stability and Control, with Special Reference to Slipstream Effects. (S. Katzoff, N.A.C.A. Report No. 690, 1940.) (85/15 U.S.A.)

Data obtained in the N.A.C.A. full-scale wind tunnel concerning the effects of interference and of propeller operation on longitudinal stability and control have been studied. The data include pitching moments for various power conditions for aeroplanes with tails removed and with tails set at various stabiliser and elevator angles. A number of surveys of the dynamic pressure and the flow direction in the region of the horizontal tail surface are also included. Results are given for eight aeroplanes, including a model of a four-engine aeroplane tested both as a tractor and as a pusher and a model of a two-engine pusher. The effects are shown of propeller operation on the downwash angles and the dynamic pressures at the tail and on the pitching moment contribution of the propeller and the wing.

The rate of increase of effective downwash angle ϵ_{eff} with angle of attack α, $d\epsilon_{eff}/d\alpha$, was considerably increased by propeller operation in the case of the gull wing and the parasol wing monoplanes, only slightly increased in the case of the four-engine pusher, and increased hardly at all in the case of the two-engine pusher. The downwash angle itself, however, was increased by propeller operation over the entire angle-of-attack range in the case of the pusher models.

The slipstreams at the tail locations were well defined, especially with the pusher models, and had approximately the same diameters as the propellers. In the case of the four-engine pusher, there appeared to be a definite shearing of the slipstream due to the trailing vortex sheet.

The largest observed variation in downwash angle across the elevator hinge line was 15° for the case of the two-engine pusher model, T'_c having a value of 0.435. The values of q/q_0 across the elevator hinge line for the same case varied between 1.0 and 3.2.

Free-Spinning Wind Tunnel Tests of a Low Wing Monoplane with Systematic Changes in Wings and Tails v. Effect of Aeroplane Relative Density. (O. Seidman and A. I. Neihouse, N.A.C.A. Report No. 691, 1940.) (85/16 U.S.A.)

The reported tests are a continuation of an N.A.C.A. investigation being made in the free-spinning wind tunnel to determine the effects of independent variations in load distribution, wing and tail arrangement, and control disposition on the spin characteristics of aeroplanes.

The standard series of tests was repeated to determine the effect of aeroplane relative density. Tests were made at values of the relative density parameter of 6.8, 8.4 (basic), and 12.0; and the results were analysed. The tested variations in the relative density parameter may be considered either as variations in the wing loading of an aeroplane spun at a given altitude, with the radii of gyration kept constant, or as a variation of the altitude at which the spin takes place for a given aeroplane. The lower values of the relative density parameter correspond to the lower wing loadings or to the lower altitudes of the spin.

For all tail and wing arrangements, the lower values of the relative density parameter gave faster recoveries from steeper spins and the higher values gave slower recoveries from flatter spins than for the basic loading condition. In general, as the relative density parameter decreased, the rate of vertical descent decreased, the spin coefficient $\Omega b/2V$ increased, and the sideslip became more outward. The importance of aeroplane relative density, wing arrangement, and control manipulation increased as the effectiveness of the tail unit decreased.

Steam Turbine Blading (with Discussion). (R. C. Allen, Trans. A.S.M.E., Vol. 62, No. 8, Nov., 1940, pp. 689-710.) (85-17 U.S.A.)

This paper reviews the blading design practice associated with modern high pressure high temperature steam turbines. The design problems encountered in the development of partial admission impulse blading for topping units are described, as well as the current engineering practice employed in the manufacture of such blading. The stress analysis used in the construction of full admission blading is reviewed. The design procedure adopted for high tip speed last row blading and the natural limits in capacity imposed on 3,600 r.p.m. turbine construction are also discussed. Materials for turbine blading are considered, as well as the metallurgical problems associated with the fabrication and welding of the high grade alloy steels now available.

Exhaust Pipe Pressure Waves. (L. J. Kastner, Engineering, Vol. 150, No. 3,901, 18/10/40, pp. 301-303.) (85/18 Great Britain.)

It has been known for some time that in certain circumstances the discharge of the exhaust gases from an engine cylinder may give rise to a vacuum which can be employed for improving the scavenge of the engine. Until recently the general opinion appears to have been that attempts to employ this vacuum were unlikely to prove successful in practice; this view was possibly based on an insufficient understanding of the phenomena involved.

It appears that two distinct phenomena are responsible for this vacuum; firstly, a sufficiently sudden discharge from the cylinder itself may give rise to a transitory fall of pressure below atmospheric and, secondly, a periodic wave may be formed in the engine exhaust pipe, fluctuating between positive and negative values of pressure. In the former case, the magnitude of the depression will be controlled to a certain extent by the ratio of the area of the port to the cross sectional area of the cylinder, and also by the rapidity with which the port is opened. In the latter case, the amplitude of the depression will depend on a number of factors, the most important being the dimensions of the exhaust pipe itself.

The present article is confined entirely to a discussion of the production of pressure waves in the engine exhaust system, and no attempt is made to analyse conditions in the cylinder due to the sudden discharge of gases therefrom.

In a brief article it is clearly impossible to do more than indicate the nature of exhaust pipe waves, to give some idea of the factors governing wave form and frequency, and to suggest how such waves may be usefully employed. A calculation of the absolute amplitude of the wave at any instant is difficult and laborious, and the results obtained do not repay the trouble involved, since all that is required in practice is a knowledge of the approximate wave form and frequency in relation to the valve timing.

Infinitely Variable Mechanical Gears. (F. G. Altmann, Z.V.D.I., Vol. 84, No. 20, 18/5/40, pp. 333-338.) (85/19 Germany.)

Infinitely variable gears may be of the friction or oscillating linkage type. In the latter case speed variation is obtained by altering the effective amplitude of oscillation of the link, the conversion to rotary motion being produced by the introduction of a ratchet or self-blocking free wheel. The former does not enable stepless variation in speed of rotation, since the number of possible speed ratios depends on the number of teeth utilised per power stroke. The self-blocking free wheel resembles a normal roller bearing, except that driving elements of suitable shape are inserted between the rollers. These elements are so shaped that the effective linkage angle with the diameter of the circular assembly is less than the angle of friction, external contact being assured by means of a suitable spring. The incorporation of such a device enables the construction of truly infinitely variable gears which, moreover, operate without noise.

The double energy conversion in mechanical gears of this type introduces special design problems which are discussed and diagrams are given which enable the velocity and force range to be estimated. Commercial forms of such gears, such as the Greenig-Galloway, Gyrel and Morse are described. It appears that the very high standard of manufacture required to ensure efficient operation will present difficulties.

Piston Deposits, Ring Sticking, Varnishing and Ring Clogging (Condensed from J. Inst. Petrol.). (W. A. Gruse and C. J. Livingstone, Engineer, Vol. 170, No. 4,429, 29/11/40, pp. 352-3.) (85/20 Great Britain.)

Engine varnishing, ring sticking, and oil ring clogging are more or less closely related. Oxidation of the oil, chiefly in the crank case, to unstable products, followed by the decomposing of these products at hot points in the engine, play an important part in all three.

It is recognised that increased outputs necessarily involve higher piston and cylinder wall temperatures. However, it does not seem necessary that crank case temperatures must also be higher. Since the effect of increased temperature on rate of oxidation is enormous—a 20 deg. Fah. rise means approximately a doubling of the oxidation rate—every decrease in crank case temperature means a real improvement. While it is true that the oil is exposed to more severe conditions for short time periods, it must be remembered that the bulk of the oil spends most of its time at the crank case temperature. It seems reasonable, therefore, to hope that engine designers can arrange to keep crank case oil temperatures low. They will thus take an unnecessary load off the oil, leaving it in better condition to carry the necessary load it encounters on the piston, cylinder walls, and bearing surfaces.

Performance of Modern Aircraft Diesels (with Discussion). (P. H. Wilkinson, J.S.A.E., Vol. 47, No. 5, Nov., 1940, pp. 474-81.) (85-21 U.S.A.)

A definite future exists for air-cooled four-stroke aircraft Diesel engines in the 400 to 600 h.p. class; the aircraft Diesel is at least on a basis of parity with the gasoline aircraft engine in the 1,000 h.p. water-cooled and liquid-cooled high performance class, and since the Diesel can be conveniently fitted with a turbo supercharger, there are definite advantages to be derived from the use of a two-stroke Diesel of proved worth.

The author last year visited Diesel aircraft centres in France, Germany, England, and the United States.

In reviewing the advantages of Diesel aircraft engines, he groups them as, economic advantages such as reduced fire hazard, low fuel operating costs, and large pay load and flight range possibilities; and mechanical advantages, such as reliability and efficiency.

Correlation of Cooling Data from an Air-Cooled Cylinder and Several Multi-Cylinder Engines. (B. Pinkel and H. H. Ellerbrock, N.A.C.A. Report No. 683, 1940.) (85/22 U.S.A.)

The theory of engine cylinder cooling developed in a previous report was further substantiated by data obtained on a cylinder from a Wright R-1820-G engine. Equations are presented for the average head and barrel temperatures of this cylinder as functions of the engine and the cooling conditions. These equations are utilised to calculate the variation in cylinder temperature with altitude for level flight and climb. A method is presented for correlating average head and barrel temperatures and temperatures at individual points on the head and the barrel obtained on the test stand and in flight. The method is applied to the correlation and the comparison of data obtained on a number of service engines.

When the cooling pressure drop was suddenly increased and also when the throttle was suddenly opened, a time duration of approximately four minutes was required for the temperature rise to equal 90 per cent. of the total rise to equilibrium temperature.

Hydrogenation of Petroleum. (E. V. Murphree, C. L. Brown, E. J. Gohr, Ind. and Eng. Chem. (Industrial Ed.), Vol. 32, No. 9, September, 1940, pp. 1203-1212.) (85/23 U.S.A.)

The present status of high pressure hydrogenation of petroleum is discussed as to theory and commercial application. Particular reference is made to the production of aviation gasoline, motor fuel, aviation blending agents, and Diesel fuel, and the conversion of heavy asphaltic fractions. Yields and inspection data on these operations are included. Economics are discussed, and it is shown that for a 30 cent spread between crude and fuel oil price, hydrogenation in competition with thermal cracking for production of motor fuel will show a 20 per cent. return on the added investment for hydrogenation.

Thickness of a Liquid Film Adhering to a Surface Slowly Withdrawn from the Liquid. (F. C. Morey, Bur. Stan. J. Res., Vol. 25, No. 3, Sept., 1940, pp. 385-93.) (85/24 U.S.A.)

When a solid body is immersed in a bath of liquid and withdrawn, a film of the liquid adheres to the solid surface and gradually drains back into the bath when the motion ceases. The relationship existing between the average film thickness, the speed of withdrawal, and the kinematic viscosity of the liquid is the subject dealt with in this paper.

According to the generally accepted theory the film thickness varies with the square root of the product of the speed and the kinematic viscosity. It was noticed that corrections based on this relationship and used in the calibration of a gas measuring standard were not satisfactory. Therefore an experimental apparatus was designed to test the theory. Analysis of the data revealed that within the range of speeds used the theory does not correctly predict the film thickness, and an empirical equation of the form

$$t = k\,(vs)^n$$

was employed, in which t is the average film thickness, v is the kinematic viscosity of the liquid, s is the speed of withdrawal of the surface, k and n are quantities varying slightly with the liquid used. The approximate values of k and n found by experiment are 0.015 and 0.63 respectively.

Nine liquids were tested, including mineral, vegetable, and animal oils, and synthetic organic compounds of oily nature.

Measurement of Blade Temperature of a Gas Turbine Under Load. (H. H. Berg, Z.V.D.I., Vol. 84, No. 19, 11/5/40, pp. 329-330.) (85/25 Germany.)

The D.V.L. have carried out temperature measurements on the rotors of gas turbines, making use of a special radiation pyrometer. The radiation is concentrated by means of a concave mirror on a Moll thermopyle. The corrosive nature of the exhaust gas gave troubles at first, which were finally overcome by using a special Rhodium mirror and ventilating the box housing with an air jet. Apart from only giving mean values, this method suffers from the defect that the instrument can only be focussed on the trailing edge of the blade. For this reason, complementary tests with thermocouples inserted at various points on the rotor were carried out. This necessitated the provision of rubbing contacts which presented considerable difficulties in view of the high speed of rotation ($\sim$ 25,000 r.p.m.). A type of disk commutator utilising composite copper carbon bushes was finally evolved, in which the bushes are only held in contact for a short time. The heat generated at this point is automatically compensated as far as the temperature measurement is concerned by a suitable arrangement of the electric circuit.

Metal Electric Strain Gauge. (Sci. Am., Vol. 163, No. 5, Nov., 1940, p. 265.) (85/26 U.S.A.)

Stress and stress distribution in such structures as the complicated members of aeroplanes, automobiles, railroad equipment, and bridges may now be determined and analysed by a new strain gauge. This device makes use of the fact that strain changes the electrical resistance of metallic conductors. It combines the accuracy of the testing laboratory with simplicity, convenience, and reliability. It is simply cemented to the member to be studied, has no clamps, no moving parts, no inertia distortion, and no hysteresis. Once in place, a strain gauge may be left permanently installed for months during which a complete study of the part on which it is attached may be made.

The SR-4 metalectric strain gauge is simply a small grid of specially selected metallic conductors; its overall dimensions are $\frac{3}{4}$ by $1\frac{3}{8}$ by $\frac{1}{4}$ inches. It may, therefore, be installed in places inaccessible to other forms of stress analysers.

This new gauge is particularly suited to machinery operating at high speeds because it has no detectable inertia effects and has been tested at frequencies of over 30,000 cycles per second, with no indication as to any upper limit to the response.

Simultaneous Recorder for Engine r.p.m. and Boost Pressure—Type Peravia R.D. 239. (Flugwehr und Technik, Vol. 2, No. 1, Jan., 1940, pp. 20-21.) (85/27 Switzerland.)

Boost and atmospheric pressure are measured by means of aneroid capsules which are compensated for temperature changes. The readings are continuously recorded on a moving strip of paper with a wax surface, the stylos being fitted with hard steel points. No ink is thus required. The movement of the paper is by clockwork which is rewound by a flexible shaft attached to the engine. The same shaft also drives a visible rev. counter which is incorporated in the instrument. This counter works on the integrating principle and its readings are transferred to the paper at regular intervals by means of a third stylo. The clockwork mechanism driving the band also provides the latter with time marks at regular intervals.

No weights and sizes are given.

Stress Strain Analysis. (Machinist, 21/9/40, pp. 322-323.) (85/28 Great Britain.)

Qualitative pictures of areas of strains and their directions can be seen in various types of brittle coating, and research work has recently been directed to the production of lacquers for coating and to methods of calibration, which might enable accurate quantitative measurements of strains and stresses in the coated body. The technique of applying the coating and carrying out a quantitative calibration is described. Since the lacquer is not affected by compression strains, measurement of compression stresses is obtained by placing the tested material under full load, applying the coating, and releasing the load, so placing the coating under equal tensile strains.

(Abstract supplied by Research Department, Metropolitan-Vickers.)

Metrovick Resistance Welding Machines. (Dorrat, M.-V. Gazette, Sept., 1940, pp. 52-62.) (85/29 Great Britain.)

Some of the special resistance welding machines devised by M.-V. are described. Spot welding machines range from light duty bench type welders, where pressure and length of weld are controlled by the operator, to the heavy duty type, with which infinite variation of welding heat may be obtained by means of "phase control" incorporated in the ignition control system, and also by electrically operated air valves, a definite pressure cycle may be applied during welding. The M.-V. portable spot welding machine and the aircraft type spot welding machine are also described. Butt welding machines, where correct balance between pressures, "push-ups" and welding currents is essential, and seam welding machines are briefly reviewed.

(Abstract supplied by Research Department, Metropolitan-Vickers.)

Electro-Deposition of Alloys. (Metallurgia, Oct., 1940, pp. 184-5.) (85/30 Great Britain.)

Progress in this field during the last ten years is briefly reviewed and some important developments are discussed. The requirements of alloy plating on a commercial scale, and factors influencing deposition are enumerated. Recent research is reported to have shown that the *pH*, the nature of addition agents or salts, and metal impurities in the bath are of great importance in determining the character of the plate. Problems associated with plating with many different alloys are discussed, and certain special applications of alloy plating are described, electro-deposited copper and graphite bearings being noted particularly.

(Abstract supplied by Research Department, Metropolitan-Vickers.)

Bearing Metals. (M. Melhuish, Autom. Eng., Vol. 30, No. 402, Oct., 1940, pp. 303-6.) (85/31 U.S.A.)

The bearing alloys used at the present time may be divided into eight groups:—

(1) Tin base alloys, in which the matrix consists of practically pure tin, containing compounds of tin and antimony, and tin and copper.

(2) Lead base alloys, whose base is chiefly lead or lead and tin, containing a compound of tin and antimony.

(3) Alloys consisting of a solid solution of copper and tin (or copper and zinc), and containing compounds of copper and tin and phosphorus, *i.e.*, bronzes and phosphor bronzes.

(4) Alloys consisting of a solid solution of copper and tin (sometimes containing zinc, nickel, etc.), and containing free lead, *i.e.*, the lead bronzes.

(5) Zinc base: Zinc base metals generally contain anything over 70 per cent. zinc hardened with copper.

(6) Aluminium alloys whose base is chiefly aluminium with the addition of silicon, copper, manganese, tin and titanium as hardening agents.

(7) Powdered metals: These can be made of many mixtures and are generally bonded under pressure and sintered. Some are impregnated with oil for use as self-oiling bearings.

(8) Plastic bearings: Usually made from Phenol Formaldehyde or Urea-Formaldehyde types of synthetic resins.

Although white metal lined bearings will stand up to heavy duty in Diesel engines provided the bearing area is designed to reduce the load to a reasonable figure, it would seem that engine builders are still seeking a material that has a high fatigue strength, and high resistance to the heavy and pounding loads it is called upon to carry while retaining the advantages of a high grade tin base babbitt. This is apparent from the fact that alternative bearing metals are being used with varying success. Whether it is possible to evolve a metal having the characteristics mentioned above is a problem which must be left to the metallurgists.

Mechanical and Physical Properties of High Duty and Alloy Cast Irons. (J. W. Donaldson, Metal Treatment, Summer, 1940, pp. 51-57, 61.) (85/32 Great Britain.)

Properties of cast iron such as resistance to corrosion, wear and heat, and machinability, which are not intrinsic properties, depend, with the exception of the last, on the conditions which the material has to withstand in service and are largely related to composition and structure. Austenitic irons, such as Nicrosilal and Ni-resist, have a much better resistance to wear, corrosion, and heat than irons with a pearlitic structure, but are brittle and lack the strength of pearlitic irons. Pearlitic cast irons show the best wear resistance when they contain small, well distributed graphite, and when the phosphide eutectic is also well distributed. They have little resistance to corrosion, however, and in this respect are similar to carbon and low alloy steels. Special irons to resist chemical corrosion, in addition to the austenitic irons, are high silicon irons containing 15 per cent. silicon and irons containing 10 per cent. chromium. The latter iron has also a good heat resistance, a property which is still more fully developed with 30 per cent. chromium, giving a strong, tough, machinable iron. An iron containing aluminium and chromium has also been successfully developed recently for heat resistance.

Another property of cast iron which has been brought into prominence in recent years is its damping capacity or capacity for dissipating vibrational energy. This property, which is developed in materials showing a large amount of plastic deformation and having a low modulus of elasticity, both of which cast iron possesses, absorbs stresses developed under working conditions and which, if they become superimposed, proved dangerous. In this respect it renders cast iron suitable for the manufacture of cast crankshaft.

SUMMARY OF STATIC, IMPACT, HARDNESS, AND FATIGUE TESTS ON HIGH DUTY AND ALLOY CAST IRONS (GOUGH AND POLLARD).

Material.	Copper-Chromium Iron.	Inoculated Iron.	Chrome-Molybdenum Iron.	Nickel-Chromium Iron.
Tensile limit of proportionality, tons per sq. in. ...	15.5	2.5	2.5	2.2
Ultimate tensile strength, tons per sq. in. ...	32.3	23.3	20.8	18.8
Modulus of elasticity, lb. per sq. in. × 10^6 ...	26.8	21.7	20.1	18.7
Brinell hardness ...	260.0	245.0	280.0	265.0
Torsional limit of proportionality, tons per sq. in. ...	15.6	4.3	2.7	2.7
Torsional modulus of rupture, tons per sq. in.	38.6	31.9	32.7	21.1
Total twist at fracture ($L/D=8\frac{1}{3}$), degrees ...	96.0	82.0	53.0	16.0
Modulus of rigidity, lb. per sq. in. × 10^6 ...	11.4	8.6	8.6	7.1
Izod, notch bar, ft./lb. ...	1.2	1.5	0.8	0.4
Wohler fatigue limit, tons per sq. in....	±21 to ±19	±12.9	±9.4	±8.9
Alternating torsional fatigue limit, tons per sq. in. ...	±14.7 to ±13.9	±9.7	±8.4	±7.1
Fatigue resistance as determined using combined stress machine — Cycles of reversed bending stresses — Fatigue limit, tons per sq. in.	±18.2	±12.9	±10.8	±10.6
Fatigue resistance as determined using combined stress machine — Cycles of reversed bending stresses — Endurance ratio	0.564	0.554	0.519	0.564
Fatigue resistance as determined using combined stress machine — Cycles of reversed shearing stresses — Fatigue limit, tons per sq. in.	±14.4	±11.4	±10.9	±8.9
Fatigue resistance as determined using combined stress machine — Cycles of reversed shearing stresses — Endurance ratio	0.446	0.489	0.524	0.473

New Type of Safety Glass. (British Plastics, Vol. 12, No. 137, Oct., 1940, p. 163.) (85/33 Germany.)

The I.G. Farbenindustrie of Germany has developed a new type of safety glass which leaves no splinters and provides remarkable adherence between laminations. Two thin sheets of glass are held together by an interlay of plastic material. This plastic is produced by polymerising 16 molecules of vinyl acetate and one molecule of dimethyl maleate, which is then saponified by acetylation with butylaldehyde. To 100 parts of the resultant substance are added 66 parts of isoheptylic ether salt of diglycolic acid, and the whole is plasticised with 11 parts of methoxy-butanol. This is then heated to 80°C. and thoroughly mixed together. It can then be rolled into a sheet which is pressed between two thin sheets of ordinary glass and heated to 120°C. The whole is finally cooled under pressure. Adherence between the glass and the plastic is said to be very remarkable.

Improvements in Cutting Oils. (A. G. Arend, Chem. and Ind., Vol. 59, No. 46, 16/11/40, pp. 771-772.) (85/34 Great Britain.)

Cutting oils are expected to minimise the power consumed, provide lubrication between the tool and the work, dissipate heat and cool both metal surfaces, increase the life of the tool, flush away turnings and chips, and prevent corrosion.

For reliable film strength, lard oils, mineral-lard oil blends, and sulphurised oils predominate, but lard oil has a good record for most metals for purely cutting purposes. Cotton seed oil, although it has certain chemical disadvantages, is considered the best representative of the vegetable oils, whereas what are known as " straight " mineral oils very largely owe their popularity to the economy gained, rather than to any special qualities.

To-day, alkaline solutions are only to be seen in use in certain grinding operations to assist in cooling, and laying the dust, rather than in any cutting or lubricating capacity.

The introduction of sulphur to cutting oils produced a marked change, as almost any class of steels or alloy steels could be machined at any desired speed, and thus obviated the need for making frequent changes of the liquid medium. When properly compounded, the property of oiliness is sometimes even greater than that of pure lard oil, and the increased film strength is thought to be due to the affinity which sulphur in combination with oil has for metals.

After making analysis of a number of sulphurised oils it was found that the total sulphur content seldom exceeded 2 per cent., but with others of a much richer type, a certain sulphurous corrosion appeared on the metal, which with the cutting edges of fine tools is apt to be serious.

One method of testing whether one type of cutting oil is better than another is to take observations of the kind of chips removed by the tool, and lengthy curling chips which bear heavily on the tool suggest the need for a heavily compounded sulphurised oil, while chips which break off hard indicate that a plain compounded oil, or at least lightly sulphurised oil will suit the purpose best. Successful production of cutting oils very largely depends upon co-operation between the engineer and the oil manufacturing firm, so that all features of working at the greatest speeds will be given every consideration at the present time.

The Tinning of Piston Rings. (Engineering, Vol. 150, No. 3,906, 22/11/40, p. 410.) (85/35 Great Britain.)

The piston rings are ground accurately to size, making an allowance for the thickness of the tin deposit which is subsequently applied. As a result of the grinding operation, the periphery of the ring has a surface composed mainly of disturbed and flowed material, which would be liable to become detached and cause wear in service. In the next operation any grease present on the rings is removed in a hot alkaline bath, and they are then etched in an acid bath. The etching treatment frees the surface from loosely adherent and smeared material left by the grinding operation and leaves a pitted surface consisting of small hollows or depressions. The rings are then washed thoroughly and given a coating of 0.0005 in. (0.012 mm.) of pure tin in an electro-tinning bath of the alkaline-stannate type. After final washing and drying the rings are ready for use.

It is stated that the pitted structure of the tinned surface possesses a number of advantages. In the first place, it assists in retaining the lubricating oil on the ring during the formation of the Beilby layer. Furthermore, the coating of tin is sufficiently plastic to flow at the points of greatest pressure and thus prevents scoring while the surfaces are running in and the Beilby layer is being formed. It is emphasised that the combination of a hard network of iron phosphide, present on the surface, with plastic pure tin resembles ordinary bearing metals in which relatively hard particles are embedded in a softer matrix.

Modern Aircraft Materials and Their Testing. (K. R. Jackman, J.S.A.E., Vol. 47, No. 5, Nov., 1940, pp. 461-73, 496.) (85/36 U.S.A.)

From a quick glance at some of the newer aircraft materials and test procedures, we find that the high tensile aluminium alloys still hold the structural field, although crowded a little by some of the magnesium alloys. The alloys of beryllium hold only minor structural promise, but the pure beryllium metal may have a future for armour plate in planes. Chrome-molybdenum steel maintains its favoured position, but it has lost some ground to the stainless steels, especially of the heat treatable " M.286 " variety. Plastic and wood and plastic construction probably will not immediately replace light metal construction. Therma-plastic windows with their weight savings, are edging out those of laminated glass, but should be tested carefully for pressurised cabin uses.

The pre-stretching of aluminium alloy stiffeners offers a method of gaining strength at no cost in weight or price. Pre-compressing, theoretically of great promise, runs into practical shop difficulties on application.

The electric resistance strain gauge of the Celstrain or Baldwin-Southwark type promises to add new impetus to practical full-scale testing and research at one-tenth of the instrumentation cost of former remote recording extensometers.

Hot Strength of Various Aluminium Alloys. (A. V. Zeerleder, Inter. Avia., No. 732, 21/10/40, pp. 1-4.) (85/37 Switzerland.)

Wire specimens of the following metals and alloys have been exposed to even temperatures ranging up to a whole year and tested as to limit of stretching strain, strength and expansion after periods of 7, 15, 30, 60, 90, 180, and 360 days. The values shown in the table that follows give the effect of this long period of heating on the strength properties.

VALUES OF THE LIMITS OF STRETCHING STRAIN OF DIFFERENT WIRE SPECIMENS AFTER ONE YEAR'S CONTINUOUS HEATING AT TEMPERATURES OF 20, 50, 75, 100 AND 160 DEG. C.

Specimen.	Wire ϕ	20°C.	Continuous Heating at 50°C.	75°C.	100°C.	160°C.
Pure Al 99.5	2.4 mm.	13.6	13.2	11.0	13.1	7.4
Anticorodal B	3.0 mm.	21.5	24.2	25.9	25.3	8.4
Avional D	2.8 mm.	29.2	29.4	32.6	39.1	15.4
Copper	2.5 mm.	37.7	37.0	26.4	21.0	10.7
Nickel	2.0 mm.	76.7	78.0	80.5	77.3	74.8
Steel wire No. 1 (hard drawn) ...	2.0 mm.	78.4	79.6	76.3	81.2	74.0
Steel wire No. 2 (zinc plated) ...	2.0 mm.	112.0	116.8	109.0	119.6	112.5

VALUES OF BREAKING-STRAIN RESISTANCE.

Specimen.	Wire ϕ	20°C.	Continuous Heating at 50°C.	75°C.	100°C.	160°C.
Pure Al 99.5	2.4 mm.	16.5	16.2	16.3	14.6	10.8
Anticorodal B	3.0 mm.	32.9	33.9	35.0	34.7	14.8
Avional D	2.8 mm.	48.0	47.9	50.6	51.6	26.9
Copper	2.5 mm.	44.2	42.6	33.7	29.4	26.1
Nickel	2.0 mm.	89.0	88.1	88.8	91.4	93.3
Steel wire No. 1 (hard drawn) ...	2.0 mm.	93.6	92.0	89.6	92.3	88.9
Steel wire No. 2 (zinc plated) ...	2.0 mm.	147.1	147.0	143.0	146.7	146.8

VALUES OF EXPANSION.

Specimen.	Wire ϕ	20°C.	Continuous Heating at 50°C.	75°C.	100°C.	160°C.
Pure Al 99.5	2.4 mm.	1.5	1.8	1.2	1.5	18.0
Anticorodal B	3.0 mm.	13.2	13.2	11.6	9.2	13.2
Avional D	2.8 mm.	16.4	16.7	13.9	8.8	7.5
Copper	2.5 mm.	1.9	2.4	10.5	19.6	34.7
Nickel	2.0 mm.	1.5	1.4	1.8	3.0	5.7
Steel wire No. 1 (hard drawn) ...	2.0 mm.	1.5	1.6	1.3	1.3	1.6
Steel wire No. 2 (zinc plated) ...	2.0 mm.	5.4	5.7	5.3	5.6	5.8

During this study, the specimen wires were always tested at a temperature of 20 deg. C. after cooling down, as merely the weakening resulting from continuous heating was to be determined while the loss of strength in tests at raised temperatures was known from the investigations conducted with the material in the incompletely stabilised condition.

Particularly in the aircraft industry which always counts on comparatively short actual periods of operation a testing period extending over a whole year, which corresponds to 8,600 hours of operation of an aircraft, may surely be considered as adequate.

The admissible maximum limit of heating of aluminium alloys in the aircraft industry thus may safely be put at 130 deg. C.

Plating Wire Tips for Electrical Instruments. (Downie, Electrical Engineer, 29/11/40, pp. 88-9.) (85/38 Great Britain.)

In view of the economic advantage of using plated rather than solid tips for electrical contacts, there has been considerable research directed to the manufacture of such contacts. The present article describes methods of testing deposit thickness, preparation of the wire for plating, and the arrangement of the electrolysis bath. Every effort is made to avoid wastage, in view of the cost of the platinum-iridium or platinum-rhodium used.

(Abstract supplied by Research Dept., Metropolitan-Vickers.)

"Tocco" Process for Hardening Steel Surfaces. (Engineering, 29/11/40, pp. 426-7.) (85/39 Great Britain.)

A process has been developed in the U.S.A. whereby steel surfaces can be hardened locally to increase resistance to wear. Heating of the part is effected in a few seconds by high frequency induction, and quenching done by means of high pressure water jets. The process and the factors which influence it are discussed and data given relating to the increased hardness of the treated surface.

(Abstract supplied by Research Dept., Metropolitan-Vickers.)

An Improved Radio Sonde and its Performance. (H. Diamond, W. S. Hinman, F. W. Dunmore and E. G. Lapham, Bur. Stan. J. Res., Vol. 25, No. 3, Sept., 1940, pp. 327-67.) (85/40 U.S.A.)

The radio sonde (radiometeorograph), described in Research Paper RP 1,082, has emerged from the laboratory and been put into daily service in a widespread network of stations by the Government aerological services. The present paper describes improvements in component elements of the radio sonde system and discusses performance. Actual performance in service is stressed. The major improvement introduced is in the element for measuring relative humidity. Laboratory and flight data on the accuracy of measurement with this element at temperatures down to -60°C. are presented. The improved radio sonde is shown to be capable of measuring barometric pressure to an accuracy of 5 millibars, temperature to an accuracy of 0.75 degrees Centigrade, and relative humidity to an accuracy of 5 per cent.

Car Riding Comfort and Cushions. (W. E. Lay and L. C. Fisher, J.S.A.E., Vol. 47, No. 5, Nov., 1940, pp. 482-96.) (85/41 U.S.A.)

Methods used in studying the relations between the automobile seat cushion and its function in transporting passengers with greater comfort and less fatigue are described.

A piece of apparatus called the Universal Test Seat was constructed, whose dimensions were completely adjustable with arrangements to vary the distribution of the supporting pressure in any manner which seemed most comfortable to the passenger.

The following mechanical objectives should be attained by the cushion:—

1. To support the passenger over a large area to get the smallest unit pressure on the flesh;
2. To avoid variations in pressure from point to point over the supported area except those variations dictated by actual variations in the body of the passenger. (To obtain the surface contour and pressure distribution on the loaded cushion that is considered by the average passenger to be the most comfortable.)

By extending their analysis of the conditions required for static comfort, the authors believe that the objectives to be attained for dynamic comfort are:—

1. To avoid large changes in pressure or forces acting on the body of the passenger with respect to time;
2. Especially to avoid high rates of change, with respect to time, of either the values or direction of pressures or forces acting on the human body.

Ultra Short Wave Transmission over a 39-Mile "Optical" Path. (C. R. Englund, A. B. Crawford and W. W. Mumford, Proc. Inst. Rad. Engs., Vol. 28, No. 8, Aug., 1940, pp. 360-9.) (85/42 U.S.A.)

Continuous records of ultra short wave transmission on wave lengths of 2 and 4 meters, over a good "optical" path, have shown variations in the received signal strength. These variations can be explained as being due to wave interference; an interference which varies with the changes in the composition of the troposphere.

Some of the variations are due to changes in the dielectric constant gradient of the atmosphere near the earth. Other variations are explicable in terms of reflections from the discontinuities at the boundaries of different air masses. The diurnal and annual meteorological factors which affect the transmission are discussed.

Psycho-Medical Investigations on Flying Accidents. (H. Meier Muller, Flugwehr und Technik, Vol. 2, No. 1, Jan., 1940, pp. 12-14, and No. 2, February, 1940, pp. 40-42.) (85/43 Switzerland.)

The accidents reviewed by the author are those attributable to the failure of the pilot as distinct from those due to failure of the aircraft structure.

The failure of the pilot due to purely medical reasons is rare. Nevertheless, cases of sudden giddiness due to nicotine poisoning, after effects of flu and other diseases, as well as more dangerous collapse due to the breaking of internal abscesses have occurred. Here only a strict medical history of the pilot can be of help. In several instances pilots are known (from observation or conversation subsequently reported) to have undertaken flights for reasons of professional pride although not feeling fit. This should be severely discouraged.

Indirect medical failure due to faulty oxygen supply or exhaust gas poisoning also come under this category. Here active co-operation with experienced doctors in the early stages of the installation is often wanting.

By far the greatest number of accidents attributable to the failure of the pilot are classed under the general heading of "errors of judgment." These errors are in most cases psychological. It is most important that the pilot should have confidence, not only in the machine but also in himself. Every accident must be investigated and a reason must be given to the pilot. Too little attention is paid to the strain accompanying flying under dangerous conditions. Circumstances may arise, when the pilot is literally staring death in the face for several minutes. Although he may, and often does, get out of these situations alive and apparently none the worse, there can be no doubt that such experiences, although repressed into the subconscious, may have serious and unexpected subsequent effects on the nervous condition. Adequate rest and careful supervision will become more and more necessary.

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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. 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.

THEORY AND PRACTICE OF WARFARE.

TRANSLATION NUMBER AND AUTHOR.		TITLE AND REFERENCE.
1118	Hemardinquer, P. ...	*New Electrical and Radio-Electrical Methods for Spotting Aircraft.* (La Science et la Vie, Vol. 57, No. 276, June, 1940, pp. 603-611.)
1119	Hollbach, O. ...	*German Aircraft Construction—Export Handbook of the Aircraft Industry. Section IX A, Aircraft Armament and Sights.* (Deutscher Flugzeugbau—Handbuch der Luftfahrttechnik, 1939.)
1120	Hollbach, O. ...	*German Aircraft Construction—Export Handbook of the Aircraft Industry. Section IX B, Bombs and Bomb Release Gear for Aircraft.* (Deutscher Flugzeugbau—Handbuch der Luftfahrttechnik, 1939.)
1121	Hollbach, O. ...	*German Aircraft Construction—Export Handbook of the Aircraft Industry. Section IX D, Bomb Release Mechanism.* (Deutscher Flugzeugbau—Handbuch der Luftfahrttechnik, 1939.)
1122	Hollbach, O. ...	*German Aircraft Construction—Export Handbook of the Aircraft Industry. Section IX F, Mechanical and Optical Training Apparatus.* (Deutscher Flugzeugbau—Handbuch der Luftfahrttechnik, 1939.)
1125	Cremona, C. ...	*A Graphical Method for the Determination of the Centre of Balance for the Stabilisation of Aerial Bombs.* (L'Aerotecnica, Vol. 20, No. 1, Jan., 1940, pp. 11-19.)
1126	Palchikov, A. S. ...	*On the Calculation of the Quantity of Bombs Required for Bombing Various Targets.* (Air Fleet News, U.S.S.R., Vol. 23, No. 7, July, 1940, pp. 27-31) (condensed version.)

Translation Number and Author.	Title and Reference.
1127 Schneider, W. ...	*Investigation into the Determination of Pressures Inside Propulsive Air Waves due to Detonation and Gunfire.* (Z.G.S.S., Vol. 34, No. 8, Aug., 1939, pp. 230-4; No. 9, Sept., 1939, pp. 263-6; No. 10, Oct., 1939, pp. 284-6; No. 11, Nov., 1939, pp. 304-6; No. 12, Dec., 1939, pp. 329-31.) (War Office Translation Nos. M.I.1.T. 8,782 and 9,327.)

MISCELLANEOUS.

1123 Rubin, B. I. ...	*Electric Supply Systems for Aircraft.* (" Electricity," U.S.S.R., Vol. 61, No. 1, Jan., 1940, pp. 9-15.)
1124 Woehl, W.	*Some New Muzzle Velocity Measuring Instruments Using a Short Measurement Base.* (Beiträge zur Ballistik und Technischen Physik, 1938, pp. 117-127.) (R.D. Translation No. 908.)