ABSTRACTS AND NOTICES

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Aircraft Design

Statistical Presentation of Flying Performances. (H. B. Helmbold, Z.F.M., Vol. 22, No. 21, 14/11/31, pp. 629-636.) (5.1/23451 Germany.)

The author introduces quantities of the dimensions of velocity and horse-power, expressed as functions of the weight, span, density and effective surface of resistance. On dividing the variables of velocity and power by these quantities, non-dimensional variables are obtained in terms of which the relation between velocity and power is readily expressed. Another non-dimensional quantity is the ratio of density at a given height from the density at sea level as a function of height from the international standard atmosphere. A large number of relations between pairs of non-dimensional variables are plotted graphically from tests on different types of machines for comparison, and the results are closely grouped on corresponding rectilinear loci. The numerical values of the non-dimensional variables are worked out for the Junkers' aeroplane and Junkers' engine to first and second approximations. The method is intended to give a reliable basis of comparison for the qualities of different types of machines.

Recent Problems in Aircraft Structural Design. (S. Bergmann and H. Reissner, Z.F.M., Vol. 23, No. 1, 14/1/32, pp. 6-12.) (5.15/23452 Germany.)

The paper is marked " Report No. 1 " and deals with buckling of thin plates supported at the boundary. The writer starts with Southwell and Skan's solution for isotropic plates (Proc.Roy.Soc. A.105, 1924) and the extension of the results by the authors and other writers to anisotropic plates.

The present paper carries the approximation further and has Southwell's solution as a lower limit. The formation and solution of the differential equation do not lend themselves to abstracting in detail. The method consists essentially

in finding the smallest particular value of a partial differential equation of the fourth order with two independent variables proportional to the Cartesian co-ordinates. The solution is expressed in trigonometrical series and completed by the determination of the coefficients.

The types of buckling are shown graphically by contour lines resembling those of Southwell's paper but considerably deformed.

Thirty-three references are given.

Graphical Solution of Beam Problems. (M. Watter, Aero Digest, Vol. 20, No. 3, March, 1932, pp. 33-35.) (5.25/23453 U.S.A.)

A graphical method of applying Berry functions to the solution of beam problems is outlined, and a worked out example is given.

Stress Calculations in Redundant Wing Structures. (A. E. Russell, Flight, Vol. 24, No. 13, 25/3/32, pp. 260a-260e.) (5.25/23454 Great Britain.)

A numerical example is worked out by a method of least work where a redundant wire is cut and increased stresses are imposed on the structure.

*Meopham Aeroplane Crash, Junkers F.*13, *German Investigation.* (267th D.V.L. Report, H. Blenk, H. Hertel and K. Thalan, Z.F.M., Vol. 23, No. 3, 15/2/32, pp. 73-86.) (5.152/23455 Germany.)

A comprehensive investigation was made at the D.V.L. on the possible causes and probable initial point of failure. The English experience, chiefly with biplanes, that if the wing fails first, the aeroplane reaches the ground with undamaged tail structure, is held not to apply to monoplanes of the Junkers type, in which subsequent rupture of the wing during fall is considered probable. A number of resonance effects were investigated and statical and dynamical limits of strength were determined. Full scale tests were carried out using a stream of smoke as an indicator of the motion of the air, and photographs show steady and turbulent types of flow under different conditions. Indicators were mounted on parts of the structure and records of vibrations were obtained. The results are given in thirty-three paragraphs.

Without excluding the possibility of the English explanation its probability is considered small in view of the German investigations. The suggestion appears to be that in bad weather without instruments for blind flying a steep dive through a cloud followed by a sharp pull-up, possibly accentuated by a gust of wind, may have produced an unusual accumulation of stresses sufficient to rupture the wing.

It is remarked that over a hundred aeroplanes of this type have been flying for years without an accident of this type.

Development of an Aeroplane Free from Auto-Rotation in Steep Landing. (W. Schmidt, Z.F.M., Vol. 22, No. 18, 28/9/31, pp. 546-549, and No. 19, 14/10/31, pp. 569-578.) (5.202/23456 Germany.)

Auto-rotation, the effective cause of spin, is due to the sharp peak in the lift curve or more rigorously in the normal component curve near stalling, which gives two values of the incidence and drag for one value of the normal force through the range covered by the peak.

The suggestion is made that a wing profile should be selected in which the peak disappears or becomes negligibly small. Four types of profile are considered and the peak of the normal component coefficient is seen to disappear or become negligible with Gottingen symmetrical profiles number 429 and 537.

A wing was constructed with a variable section showing a high lift profile at the base and tapering to a thin symmetrical profile at the tip. The coefficients of lift, drag and moment about the leading edge are shown graphically

against incidence and in a polar diagram. Distribution of lift along the span is also given and owing to the concentration near the centre heavy eddies must be given off along the trailing edge. Apparently this model was dropped.

Comparison is made of the lift curves of a free plate with 4-1 aspect ratio and Gottingen profile 537, 5-1 aspect ratio, the lift curves against incidence being very nearly identical.

As a further development the symmetrical profile is cut parallel to the spar in seven places and the partial sections are extended so as to give doubled effective chord, with seven slots at right angles to the surface. The lift incidence curve of a similar arrangement is given in Fig. 14. Experiments on a Handley Page slotted wing suggest that the lift will continue rising up to 90° incidence. On applying the principle to the wing tips only, the lift maximum is reached at increased incidence but then collapses suddenly, which gives the conditions for auto-rotation.

A further type of wing was examined in the wind channel with wing tips only spread out in a grid as described above. An end plate was inserted between the wing proper and the grid extension. In this form the normal reaction is rising up to 90° and no auto-rotation could be imposed.

Another wing with the grid extending over about one-third of the span from the wing tips was tested. Unexpectedly auto-rotation set in with this wing.

The article concludes with a summary of the analysis of auto-rotation, the numerical results being exhibited graphically.

Undercarriages, Floats and Hulls

Wave Resistance and its Practical Application. (G. Weinblum, Z.V.D.I., Vol. 75, No. 6, 6/2/32, pp. 127-131.) (5·51/23457 Germany.)

Michell's expression for wave resistance is quoted and the physical assumptions on which it is based are recapitulated. A non-dimensional resistance coefficient is defined and its values, plotted against a non-dimensional velocity coefficient, show marked oscillations. Observed values plotted on the same scale for comparison show much less marked oscillations. The centre of pressure and distribution of pressure on a hydroplane surface are also discussed.

Fifteen references are given.

Flow about Ship Models. (W. P. Roop, J. Franklin Inst., Vol. 213, No. 2, Feb., 1913, pp. 195-209.) (5·51/23458 U.S.A.)

A comparison is made of measured resistances as determined by Reynolds, Froude, Prandtl and others with special attention to the transition from linear to turbulent flow. The experimental results are plotted in the manner first applied at the Gottingen Aerodynamical Laboratory (Vol. 3, 1927).

Model Towing Tests on Seaplane Floats. (P. Schröder, Werft-Reederei-Hafen, Vol. 11, No. 16, 22/8/30, pp. 349-356.) (5·51/23459 Germany.)

The lay-out of the experiment is described and the difficulties of obtaining determinate conditions are admitted in the course of subsequent discussion.

Fig. 1 shows a tabular diagram of the arrangement of the forty individual tests applied. Resistance is shown as a function of speed for six different loadings. The influence of the wings and structure on the starting performance is discussed from the point of view of separation of the various quantities involved.

In Fig. 2 the moment is plotted against speed for incidences of 1°, 3°, 5°, 7° and 9°.

In Fig. 4 resistance is plotted against lift for eighteen different speeds at trim angle of 1°.

The methods are applied to the design of a projected trans-Oceanic Rumpler seaplane by scaling up in the ratio of 16 to 1. The results predicted for the full size machine are shown graphically and include the lift of the floats, the resistance and the moments at incidences of 1°, 3°, 5° and 7°. These are applied to the prediction of the starting performance, in which all the quantities are plotted against speed for two positions of the c.g.

Stresses on Floats and Hulls during Starting and Alighting. (R. Verduzio, L'Aerotecnica, Vol. 11, No. 11, Nov., 1931, pp. 1343-1405.) (5.56/23460 Italy.)

The author gives a compact summary of work on shocks on seaplane floats and hulls during starting and alighting, carried out in Great Britain, Germany, U.S.A., etc.

Eighteen references are given.

Reduced Effective Mass of an Aircraft Landing on One Wheel. (J. Taub, Z.F.M., Vol. 23, No. 1, 14/1/32, pp. 23-24, 265th D.V.L. Report.) (5.55/23461 Germany.)

In accordance with elementary rigid dynamics impact on one of a pair of wheels, not applied at the effective centre of percussion, is reduced by a factor depending on the maximum value of the radius and product of gyration of the whole machine with respect to the line of impact reaction. Mean values of this factor are tabulated for different distributions of mass. With highly centralised masses the minimum calculated figure is 0.20, while the minimum experimental value is 0.39. The nature of the stresses produced is not discussed.

Airscrews

Vibration of Elastic Beams with Application to Airscrew. (K. Hohenemeser, Z.F.M., Vol. 23, No. 2, 28/1/32.) (5.65/23462 Germany.)

The equations are formed for the natural period of a cantilever elastic beam for the fundamental mode and the overtones. Deflections are shown graphically for the first and second overtones. An example is worked out for an airscrew blade and the numerical results are tabulated for the principal mode and for the first and second overtones. It is shown that the latter may arise with engines of more than five cylinders.

Mutual Influence of Engine and Airscrew Characteristics. (J. D. Blyth, Flight, Vol. 24, No. 9, pp. 174a-174d.) (5.65/23463 Great Britain.)

The relations between engine performance and airscrew characteristics are worked out numerically for the use of designers.

Variable Pitch Airscrew, Marchetti. (L'Aerophile, No. 12, 15/12/31, p. 371.) (5.658/23464 France.)

The airscrew is constructed of duralumin, absorbs 550 h.p. at 2,000 r.p.m. and weighs 80 kg. complete. Diameter 3 m. Pitch variable from 1.5 m. to 2.5 m.

It is stated that the range of the Marchetti aeroplane, holder of the long distance record, was increased 15 per cent. by the use of this airscrew.

Controllable and Automatic Airscrews. (D. A. Dickey and O. R. Cook, S.A.E. Jrnl., Vol. 30, No. 3, March, 1932, pp. 105-111.) (5.658/23465 U.S.A.)

A comprehensive technical account is given, illustrated by 10 photographs of five hubs, one made by the Army Air Corps, the others by private firms.

Adjustable pitch airscrews which can only be set on the ground with a stationary engine are fairly general. The greatest difficulty is the design of an

airscrew within the limitations of weight and space. The automatic airscrew is the only one to be considered for fighting aircraft, and shows least progress. Controllable airscrews with two or at most three pitch positions, controlled by the pilot in flight, offer a reasonable compromise.

A satisfactory design has not yet been produced.

Variable Pitch Airscrew. (G. Leparmentier, Vol. 2, p. 94, Reports of First International Congress de la Sécurité Aérienne.) (5.658/23466 France.)

A description is given with four photographs and a sketch of an airscrew with automatic variable pitch. The pitch is determined by the balance of centrifugal and aerodynamical forces and shaft torque. At no torque the airscrew may act as a brake.

Automatic Variable Pitch Airscrew. (H. C. H. Townend, J.R. Aer. Soc., Vol. 36, No. 254, Feb., 1932, pp. 111-126.) (5.658/23467 Great Britain.)

A description is given with a photograph and diagram of an automatic variable pitch airscrew designed on the same principle as the Leparmentier airscrew (see foregoing abstract). The relations between torque, aerodynamic forces, and incidence are discussed analytically and plotted graphically. It is possible to arrange the guides so that in case of engine failure the blades assume the position of minimum head resistance.

Instruments

Manometry of Explosions. Comparative Performance of Some Diaphragm Type Explosion Manometers. (Fuel, Vol. 11, No. 3, March, 1932, p. 118, U.S. Bureau of Mines Technical Paper 496 (1931).) (6.251/23468 Great Britain.)

Five manometers were compared, using H_2/air mixtures. The records of the instruments show fair agreement during the pressure rise but diverge at the maxima and in the subsequent cooling curves.

Mechanical defects are discussed in detail.

Aircraft Vibration. (H. Constant, J.R. Aer. Soc., Vol. 36, No. 255, March, 1932, pp. 205-250.) (6.48/23469 Great Britain.)

A description is given of the Cambridge vibrograph, with an example of the diagrams traced and a brief discussion of the principles of analysing them. The physiological effects are briefly considered. A large number of numerical cases is exhibited graphically of the periodic forces imposed by engines and airscrews and various aerodynamic effects and the resulting vibrations set up. The discussion brought out sufficiently the considerable difficulties of measurement and interpretation.

The paper is the most substantial quantitative contribution to the subject yet published and will no doubt be esteemed as such in the design room.

A Recording Theodolite. (R. H. Ward, Army Ord., Vol. 12, No. 70, Jan.-Feb., 1932, pp. 272-275.) (9.61/23470 U.S.A.)

A descriptive technical account is given of a theodolite combined with a film camera, illustrated by a diagram of the optical system and two photographs of the apparatus. The elementary trigonometry of the problem is exhibited graphically. One theodolite is placed at each end of a measured base. When the film records both the position of the target and of the shell burst the magnitude of the error can be readily reduced. The apparatus appears to be suitable for reducing results after firing practice and as such would have value in training A.A.C. gunners, but would not be applicable to fire control under service conditions.

Stability and Control

Stability and Controllability. (J. Biche, Rev. Soc. Aeron., No. 1, Jan., 1932, pp. 12-19.) (7.2/23471 France.)

The equations of longitudinal and lateral stability are applied to considerations of design of controls.

Tail-less Aeroplanes. (M. Schrenk, Z.V.D.I., Vol. 76, No. 3, 16/1/32, pp. 63-66.) (7.25/23472 Germany.)

A brief summary is given of the stability, controllability, moments of inertia and other properties of tail-less aircraft. Two photographs of a German type, with engine and airscrews and some graphical stability characteristics are reproduced. The advantages incidental to this type of construction are not underestimated, and a favourable view of its future is taken. Fifteen references are given.

Safety in Spinning. (H. B. Irving and A. V. Stephens, J.R. Aer. Soc., Vol. 36, No. 255, March, 1932, pp. 145-204.) (7.62/23473 Great Britain.)

A previous paper by Gates and Bryant, R. & M. 1001, summed up comprehensively progress in the investigation of spinning to the date of publication. The present paper gives an equally comprehensive survey of subsequent progress, principally in obtaining numerical values for the aeroplane characteristics which come into the problem, and applying them to determine rules of design for minimising the danger of spin. To summarise the paper it would be necessary to refer to almost every aerodynamical and dynamical characteristic of the aeroplane. A comparatively small number of these characteristics, however, are shown to have the principal effect in determining spin characteristics, and practical rules are laid down for the guidance of designers.

Control Beyond the Stall. (G. Lachmann, J.R. Aer. Soc., Vol. 36, No. 256, April, 1932, pp. 276-338. Paper read before Roy. Aer. Soc., 17/12/31.) (7.72/23474 Great Britain.)

Much interesting material is given from the history of the development of the slot as a means of preventing stall. Recent developments are fully discussed. Munk's statement is quoted that 90 per cent. of known wing profiles are incapable of being rendered stable by wing slots, a restriction which designers do not apply with sufficient care. The fitting of slots is most effective with wings of rectangular plan at the tips. Rounded tips are unstable. At times it is desirable to disturb the smooth flow of the wing tip prematurely. This may be done by closing the slot or by operation of a hinged plate at right angles to the flow. The closing of the slot may be automatic. Alternatively the slot or the " spoiler " plate may be connected to the aileron. Diagrams show the mechanism applied. The nature of the flow behind the wing is a more highly complicated matter and receives correspondingly elaborate treatment. The principle of setting the tail wing high to avoid interference may be effective in normal flight but in stalled flight the author considers that the contrary is the case and that the disturbed region at stalling incidence will affect a high set tail unit more heavily than a low set unit.

The technique of stalled landings is discussed at length.

The paper may be regarded as a comprehensive report of developments of control and stability in sequel to R. & M. 1000.

Fog, Flying and Landing

Flying and Landing in Fog, a Radio System. (H. Diamond and F. W. Dunsmore, Aeron. Eng., Vol. 4, No. 1, March, 1932, pp. 13-20.) (7.8/23475 U.S.A.)

A descriptive account is given of the application of a system of radio beacons developed by the Bureau of Standards (see previous abstracts Nos. 17/20361 and 19/21325, etc.). Seven photographs of the apparatus are given and seven diagrams of installation and connections. A sketch shows the complete installation in an aeroplane.

Engine Design

Thermodynamics

Combustion Process in I.C. Engines, Electrical Method of Investigation. (K. Schnauffer, Z.F.M., Vol. 22, No. 17, 14/9/31, pp. 526-530.) (8.13/23476 Germany.)

The flame travelling through the cylinder is associated with changes in the ionisation of the gas, which factor can be recorded electrically. Knocking is due to a very rapid completion of the combustion which has been originated by a relatively slow flame travel. It appears that different types of knocking arise from pre-ignition, excessive turbulence, and over-heating.

A number of photographs are reproduced.

Photographic Investigation of Flame Movements in Gaseous Explosions. (W. A. Bone and R. P. Fraser, Phil. Trans. of Royal Society, Vol. 230, No. A.690, 16/12/31, pp. 363-385.) (8.13/23477 Great Britain.)

Detonation is distinguished from the initial phase of an explosion not merely by much faster propagation of ignition but also by a more intense combustion on the flame front. During the initial uniform movement a relatively small portion of the explosive mixture is burnt in the flame front itself, and the reaction may be completed by shock waves.

Experiments were carried out in open tubes mostly on CO mixture, and a series of beautiful photographs is shown.

Process of Combustion with Spark Ignition. (K. Schnauffer, Z.V.D.I., Vol. 76, No. 3, 16/1/32, p. 69.) (8.13/23478 Germany.)

Photographic records of the process of combustion of spark ignition are discussed in a short note. Two flame photographs and accompanying pressure diagrams are reproduced and their interpretation is discussed. Five references are given.

Combustion in a High Speed C.I. Engine. (A. M. Rothrock, N.A.C.A. Report, No. 401, Jan., 1932.) (8.25/23479 U.S.A.)

Combustion should begin before the injection ends. The tendency to detonate decreases as the compression ratio is raised. Supercharging the engine much improves combustion by the combined effect of increase of density and temperature of the inlet air in decreasing the ignition delay. Twenty-seven recent references are given.

Effect of Orifice Length-Diameter Ratio on Fuel Sprays for C.I. Engines. (A. G. Gelalles, N.A.C.A. Report, No. 402, Jan., 1932.) (8.25/23480 U.S.A.)

High speed cinematographs were made of individual fuel sprays from various nozzles, the discharge taking place into air at room temperature and at various pressures.

The results were modified by helical grooves on the stem of the injection valve.

Generally speaking, best penetration and highest coefficient of discharge were obtained for a length-diameter ratio varying between 4 and 7.

Supercharging

Supercharging. (R. J. Nebesar, Aer. Eng., Vol. 4, No. 1, pp. 1264a-1264e. Paper read before A.S.M.E.) (8.235/23481 U.S.A.)

The elementary relations between power and flying of supercharged engines are discussed with reference to change of altitude and density. Supercharged power against altitude curves are given for the Wright Whirlwind Jupiter and Packhard Diesel engines. The effect of increasing the linear dimensions of the aircraft is also considered.

The Design of Turbo-Blowers. (R. Müller, Z.V.D.I., Vol. 75, No. 22, 30/5/31, pp. 689-695.) (8.25/23482 Germany.)

A semi-empirical expression is constructed for the flow of gas through the various stages of a turbo-blower taking into account friction, leakage, and internal or external cooling. The calculated configuration of flow through the blading is compared with observations, with reference to instability and losses.

The Effect of Increased Carburettor Pressure on Engine Performance at Several Compression Ratios. (O. W. Schey and V. G. Rollin, N.A.C.A. Report, No. 404.) (8.275/23483 U.S.A.)

The boost pressures ranged up to 5lbs. per sq. in., the compression ratio varying between 3.5 and 7.5 The increase in B.M.E.P. was of the order of 40 per cent. At any one compression ratio the effect of boost on fuel consumption on a net b.h.p. basis is negligible. Since the experiments were carried out on a single-cylinder 5 by 7 engine, a definite saving in specific fuel consumption can be expected on a multi-cylinder engine from improvement in distribution.

New Working Method for Carburettor Engines. (Z.V.D.I., Vol. 76, No. 2, 9/1/32, p. 46.) (8.281/23484 Germany.)

It is proposed to compress a very rich incombustible mixture and inject highly compressed air at the end of the stroke. Control is either by varying the amount of mixture or the amount of air injected.

Ignition is either by spark or by the heat of compression. High efficiency and freedom from detonation is claimed for this scheme.

Heavy Oil C.I. Engines

Development of Heavy Oil Engines for Cars and Aircraft. (W. Schwerdtfeger, Autom. Tech. Zeit., Vol. 34, No. 30, 31/10/31, pp. 677-679.) (8.25/23485 Germany.)

" Figure of merit " is defined as the product of the r.p.m. and the mean effective pressure divided by cylinder volume. Seventy-four engines are listed and the quantities referred to are tabulated. The results are also plotted graphically. Junkers 600 h.p. 1100 r.p.m. 2-stroke cycle engine shows the highest figure. As might be expected the figure for engines with a 2-stroke cycle is about double that of engines with a 4-stroke cycle.

Two New Maybach C.I. Engines. (A. E. Thiemann, Autom. Tech. Zeit., Vol. 34, No. 29, 20/10/31, pp. 659-660.) (8.25/23486 Germany.)

The main dimensions and characteristics are given of 150 h.p. and 410 h.p. types with side and end elevation sketches and photographs of the crankcase,

crankshaft and piston. A diagram of performance is also given showing a minimum consumption of slightly under 180 gr. of fuel per h.p. hour for 100 h.p. and 270 h.p. respectively, at 800 r.p.m. in both cases.

High-Speed Diesel Engine. (Z.V.D.I., Vol. 76, No. 10, 5/3/32, pp. 233-234.) (8.25/23487 Germany.)

The commercial 6-cylinder engine develops 375 h.p. at 900 r.p.m. The B.M.E.P. is 75lbs. per sq. in., consumption .36lbs. per b.h.p. hour, weight approximately 15lbs. per h.p.

With a supercharger the power is increased to 500 h.p. without change of specific fuel consumption. The use of aluminium, steel and cast iron in the construction is of interest. Several parts are fitted with needle bearings.

The Compression Stroke of the Pre-Combustion Chamber Oil Ignition Engine. (K. Schlaefke, Z.V.D.I., Vol. 75, No. 33, 15/8/31, pp. 1043-1046.) (8.38/23488 Germany.)

The author attempts an analysis of the pressure and temperature in the cylinder and ignition chamber.

The results are presented in a graphical form and expressions are obtained for different crank angles. Eleven references are given.

The Pratt and Whitney Petrol Injection Engine. (L'Aeron., No. 153, Feb., 1932, pp. 59-61.) (8.292/23489 France.)

The experimental engine follows the general lines of the Hornet. Spark ignition is retained but the carburettor has been replaced by nine injection jerk pumps. Governed by altering the stroke. The suction stroke of the pump is gradual, the injection stroke very rapid, the plunger being returned against a variable stop by a very strong spring.

The injection pumps are fed by a separate fuel circulating pump, special care being taken to prevent the entry of gas bubbles into the injection system.

Crankshaft Torsion

Vibrating Dampers for Crankshafts. (O. Föppl, Z.V.D.I., Vol. 75, No. 32, 8/8/31, pp. 1028-1029.) (8.36/23490 Germany.)

It is found that an elastic coupling with appropriate torsional characteristics increases the damping effect and permits a reduction in the size of the damper.

Crankshaft Failures in Civil Aviation. (E. Everling, Autom. Tech. Zeit., Vol. 35, No. 1, 10/1/32, pp. 22-23.) (8.36/23491 Germany.)

The D.V.L. has collected specimens of crankshaft fractures which have taken place during recent years in six-cylinder engines. The fractures generally occur near the airscrew end and are spiral. They are due to resonance, which is effectively eliminated by a suitable damper.

In no case was failure due to faulty material. In forging the shaft care should be taken that the grain of the steel follows the crank throw.

Practical Investigation of Torsional Oscillations. (K. Lürenbaum, Z.F.M., Vol. 23, No. 4, 29/2/32, pp. 105-113, 268th D.V.L. Report.) (8.36/23492 Germany.)

A description is given of the D.V.L. recording torsion meter, and specimens of the time and duration records are reproduced. The records are made by scratching on a glass plate. The elastic properties and internal damping of the rubber coupling are exhibited graphically. Several records are reproduced on an enlarged scale. The airscrews are connected to the engine by a long shaft

denoted as a "distant drive," the properties of which are investigated, and the results are shown graphically for different conditions.

Records of two radial engines are shown, one of a 9-cylinder radial of a natural period of 3,400, the other a 5-cylinder radial with a natural period of 10,600. A table gives numerical results of 13 tests on six engines under different conditions, and gives the fudamental period, the ratio of the first critical speed to the fundamental, the maximum amplitude at the free end of the shaft, the maximum resulting stress, the ratio of the latter to the mean stress, maximum calculated resonance torsion, and remarks on the nature of the damage, if any. Damping is discussed and a satisfactory characteristic is shown for a Junkers L88 engine with internal damping.

Influence of Method of Fuel Supply on Torsional Oscillations. Relation between Order of Firing a Nine-Cylinder Engine and Torsional Oscillations. (K. Schlaefke, Autom. Tech. Zeit., Vol. 34, No. 33, 30/11/31, and No. 34/35, 15/12/31.) (8.36/23493 Germany.)

Pp. 759-780. A comparison between carburettor engines and direct injection engines is made by means of graphical representation of indicated pressure and direct variation. The harmonics are shown graphically and show that the direct injection engine suffers more from torsional resonance on the fifth harmonic. Below the corresponding speed there is not serious difference between the two types of engine.

Pp. 781-783. The natural periods are determined and exhibited graphically for the first and second natural periods. The mean indicated pressure and the torque are shown as functions of the r.p.m. The harmonics are plotted for six different orders of firing, the amplitudes of the fourth and eighth harmonics being independent of the order, the fifth, sixth and seventh harmonics showing wide variations in the amplitudes according to the order of firing, but in no case equalling the amplitude of the eighth harmonic, which in turn is only 60 per cent. of that of the fourth harmonic.

Forces on Crank Pins. (Karl Herr, Autom. Tech. Zeit., Vol. 34, 1931, Nos. 27, 28, 30, 33, 34, 35 and 36.) (8.36/23494 Germany.)

An exhaustive study is given of the variation of the forces on the crankpin round a complete cycle of two strokes. The elementary formulæ are developed. Ten force-vector diagrams are drawn, two for each cycle of four strokes. The components along the crank and along the connecting rod are shown for 24 angular positions. From these subsidiary diagrams are derived showing the variation of the pressure on the crankpin, etc., both in polar form and in cartesian co-ordinates. Numerical calculations are carried out in conjunction with the diagrams.

Piston Rings

Piston Ring Mounting. (L'Aeron., No. 152, Jan., 1932, p. 18. French Patent No. 685506. P. Clerget.) (8.38/23495 France.)

The piston has detachable lands fixed in position by steel wedges, so that the ring need not be opened out when fitting to the piston.

Cooling

Interchange of Heat between Pipe and Water. (W. Nusselt, Forschung, Vol. 2, No. 9, Sept., 1931, pp. 309-313.) (8.4/23496 Germany.)

The experimental arrangements of Th. Burbach (1930) and of Eagle and Ferguson (Proc. Roy. Soc., London, Vol. 127, No. 540, 1930) are shown in diagrams. A form is assumed for the relation sought as a product of indeter-

minate powers of non-dimensional quantities. The experimental results are tabulated and plotted and numerical values are introduced for the indeterminate indices and for a multiplying constant. Similar treatment is applied to the experiments of Eagle and Ferguson.

The author considers that a good fit has been obtained in both cases with his empirical formula. Three references are given.

Transference of Heat from a Hot Tube to Water. (G. Ackermann, Forschung, Vol. 3, No. 1, Jan.-Feb., 1932, pp. 42-50.) (8.4/23497 Germany.)

Experiments were carried out with a horizontal tube at rest in still water, and the cooling is due principally to convection currents. The physical discussion follows briefly the same lines as Nusselt (see foregoing abstract). The experimental apparatus is described and illustrated and the numerical observations are tabulated and shown graphically. Comparison with Nusselt's formula shows close agreement over a considerable range of temperatures.

New American Investigation of Heat Transference and Laminar Flow. (H. Kraussold, Forschung, Vol. 3, No. 1, Jan.-Feb., 1932, pp. 21-24.) 8.4/23498 Germany.)

Péclét introduced the non-dimensional quantity vl/K (v=velocity, l=linear dimension, K=thermometric conductivity) in a discussion on convection currents. This is analogous to Reynolds number vl/ν in the equations of viscous fluid motion. In the present paper the empirical expression due Léveque is quoted, in which Péclét's number and the ratio of diameter to standard length of pipe appear as non-dimensional parameters. The American results are plotted graphically on logarithmic scales showing the quantity of heat transferred as a function of Péclét's number in comparison with the values calculated from Léveque's formula and for a more elaborate formula due to the author. Léveque's formula involves the product of the $\frac{2}{3}$ power of the parameters, while the author's formula involves empirical indices expressed to the 4th and 5th significant figures. The experimental points are grouped along a straight line, but do not agree closely with the empirical formulæ. Eleven references are given.

High Temperature Liquid-Cooled Aircraft. (A. Nutt, Aero. Digest, Vol. 20, No. 3, Mar., 1932, p. 36.) (8.44/23499 U.S.A.)

It is stated that a saving of 0.2lbs. per h.p. in weight and 35 per cent. area in the radiator are obtained by using ethylene glycol as cooling medium. Graphical representations of performance show minimum consumption at about 140°C. radiator temperature. Absolute ethylene glycol has b.p. of 197°C. which falls to 160°C. with 4 per cent. water content and 144°C. with 10 per cent. water.

Lubrication

Wing Radiator Development. (G. A. Luburg, Aeron. Eng., Vol. 4, No. 1, March, 1932, pp. 37-40.) (8.444/23500 U.S.A.)

A brief technical description is given of types of tube and comparative heat dissipation of six types of radiator is shown graphically. The dimensions, weight, cooling area, weight of water, horse-power, etc., are given for eleven high-speed aeroplanes. Five references are given.

Lubricating Oil at Low Temperature. (S. Erk, Z.V.D.I., Vol. 76, No. 2, 9/1/32, pp. 33-36.) (8.54/23501 Germany.)

Physical characteristics of oils at low temperatures such as the " pour-point " are compared amongst themselves and with absolute viscosity determinations. Similar factors influence lubricating quality or " oiliness " and the point of coagu-

lation, and the latter appears to be a useful criterion for lubricating quality at much higher temperatures.

Phenomena of Lubrication in Bearings. (W. Nücker, Forschungsheft, 352, Jan.-Feb., 1932.) (8.54/23502 Germany.)

A description is given of the elaborate experimental installation with photographs and diagrams showing the general arrangement of the details of the apparatus for measuring temperature, pressure, thickness of film, position of shaft, axis of bearing, etc. The very extensive experimental data obtained are plotted in a series of diagrams. The theoretical work of Reynolds and Michell, elaborated by numerous subsequent writers, is discussed, and calculated and experimental values are compared, and generally speaking, agree with a high degree of accuracy. Fifty-two references are given.

Fuels

Low Temperature Tars. (G. T. Morgan, J. Soc. Chem. Ind., Vol. 51, No. 9, 26/2/32, pp. 67-80T.) (8.6/23503 Great Britain.)

A comprehensive survey is given of the method of analysing low-temperature tars developed at the Chemical Research Laboratory, Teddington. Distillation up to 120° at atmospheric pressure removes water and light oils. Successive extractions with aqueous alkalis and dilute mineral acids separates the major fractions, phenols, bases, and neutral oils. A second distillation up to 120° under 2 mm. air pressure separates the second light oil fraction. Of the imposing range of substances separated only fuels for internal combustion engines need be mentioned here. The annual reports of the Fuel Research Station state that one ton of coal may furnish 15 gallons of motor spirit, b.p. 230-60°.

The use of phenols as auto-detonants is also discussed.

Compression Ignition Characteristics of Ignition-Engine Fuels. (A. W. Pope and J. A. Murdock, S.A.E. Jrnl., Vol. 30, No. 3, March, 1932, pp. 136-142.) (8.64/23504 U.S.A.)

The fuel is tested under motoring conditions in a variable compression engine running at 600 r.p.m. with pre-heated air. The critical compression ratio at which auto-ignition just takes place is taken as the grading characteristic. The lower the value the better the fuel for compression ignition. A good Diesel fuel auto-ignited at CR.8, while high grade petrol required CR.14.

Ethyl lead scarcely affected compression ratio for auto-ignition, but a benzol blend giving equivalent octane number increased the critical compression ratio.

Rationalisation of Fuel Consumption. (A. E. G. Report, Autom. Tech. Zeit., Vol. 34, No. 36, 31/12/31, pp. 803-807.) (8.64/23505 Germany.)

The exhaust gases were analysed and the proportions of CO_2, CO, H_2, $CH_4 + C_2H_6$ are shown graphically. The ratio CO/CO_2 is shown as a measure of poisonous quality. The carburettor spray was examined and photographs show the size and distribution of the drops. A description of the research apparatus is given with photographs and diagrams.

Total Heats and Specific Heats of Synthetic Paraffinic Distillates and Some Petroleum Fractions. (A. J. E. Swann, Fuel, Vol. 11, No. 3, March, 1932, pp. 113-118.) (8.64/23506 Great Britain.)

The specific heat shows a linear increase with temperature from 0°C. to 100°C. The total heat curve is consequently parabolic, and this relation holds from 0°C. to 150°C.

Investigation of the Knocking of Carburettor Engines. (L. Auer, Z.V.D.I., Vol. 75, No. 22, 30/5/31, pp. 679-680.) (8.645/23507 Germany.)

A modification of the Midgley bouncing pin is described. Both intensity and the time of the knock are recorded, not only at the cylinder wall, but also at the piston crown. It appears that the knock depends on the rate of flame propagation. If the latter exceeds a certain amount the ignition is propagated by an explosion wave.

Fuel Injection System. (A. V. D. Willgoos, U.S. Air Services, Vol. 17, No. 2, Feb., 1932, pp. 35-36.) (8.68/23508 U.S.A.)

A brief technical description with a photograph is given of the fuel injection system tested in flight on a Pratt and Whitney Hornet engine. The system is still in an experimental stage.

Carburettor. (Solex Co., Patent No. 685699, L'Aeron., No. 153, Feb., 1932, p. 48.) (8.701/23509 France.)

A restriction between the inner tube and the surrounding sheath gives a more gradual emptying of the fuel in the well and improves acceleration.

Jerk Pump Injection for C.I. Engines. (S. W. Nixon, Autom. Eng., Vol. 22, No. 289, Jan., 1932, pp. 31-36.) (8.705/23510 Great Britain.)

The action of the jerk pump and differential needle atomiser is described in principle and illustrated by diagrams. Methods of control include variable stroke, variable valve opening, variable by-pass, and variable delivery on the suction side. Control of the rate of injection through the stroke is considered essential for successful operation. Eight pressure diagrams are reproduced showing the variation of pressure during the injection period with various types of control. It is necessary to maintain constant or preferably slightly decreasing delivery of the pump at constant control position with rising speed. A diagram shows the latter condition (slightly decreasing delivery) with two types of valve. Another diagram shows irregular control produced by poor spilling arrangements for decreasing delivery.

The action of the differential needle atomiser in atomising the solid stream by rapid vibrations is considered with reference to practical operation, and possible developments are considered.

An outline of test methods is given and typical record of delivery against hours run is reproduced. Elasticity of the fuel is an essential datum. Four numerical examples are worked out.

W.V. Piston Fuel Pump. (Autom. Tech. Zeit., Vol. 34, No. 15, 31/5/31, p. 364.) (8.741/23511 Germany.)

A section drawing is given of the W.V. piston fuel pump, with a curve of pressure and delivery plotted against r.p.m.

Transmission Gears

Elastic Coupling for Shafts. (Z.V.D.I., Vol. 76, No. 35, 29/8/31, p. 1109.) (8.75/23512 Germany.)

The coupling resembles an eccentric vane blower, the blades of which engage with slots in the casing. The drive is between the "rotor" and the "casing," the vanes being in the form of steel springs which traverse the "rotor."

Reduction Gear. (Argus Co., D.R.P. 507871, L'Aeron., No. 153, Feb., 1932, p. 51.) (8.765/23513 Germany.)

Some of the intermediate gear wheels in a planetary reduction gear are mounted on elastic shafts to maintain equal tooth loading.

Armament

Pivoting of Guns. (Methling, Z.V.D.I., Vol. 75, No. 20, 16/5/31, pp. 623-629.) (9.11/23514 Germany.)

The article deals mainly with ship mountings, but some reference is made to the mounting on lorries of anti-aircraft guns. There are 29 illustrations.

Materials

Materials of Aircraft Construction. (P. Brenner, Z.F.M., Vol. 22, No. 21, 14/11/31, pp. 637/648, 258th D.V.L. Report.) (10.1/23515 Germany.)

Wood construction. The properties of wood are considered under the headings of strength, joints and effects of humidity. The diagrams of tensile and compressive strength exhibit groups of test results for pine and spruce. The advantages of plywood are exhibited in a diagram which shows a steady falling off of the tensile strength of plain timber as the direction of application of stress varies from 0° to 90° inclination with the fibres, while properly designed plywood retains a fairly constant mean strength over the whole range. Mean test values of the strength of seven timbers in compression, tension, bending and torsion are tabulated. Splice joints, plates and clamps are considered briefly.

The relations of tensile strength and elastic modulus to moisture content are exhibited graphically.

Metal construction. The buckling strengths of various metals in use are given graphically and tabulated sketches of built-up metal wing spars are given in comparison with a built-up wooden spar. Fatigue tests are discussed and test values are plotted up to 100 million alternations.

Corrosion. The question of corrosion receives lengthy consideration, particularly with reference to riveted joints in seaplane construction, and photographs are reproduced showing the effects of corrosion of flying-boats' hulls in riveted duralumin plate. Comparative duration corrosion tests on magnalium and duralumin are given graphically and show a falling-off of tensile strength and extension of test pieces with exposure up to a hundred days.

Welding is considered briefly and microphotographs exhibit the change in grain structure of steel tube and of stainless steel plate.

The Physical Factors Determining the Path of Fatigue Fractures. (A. Thum and H. Oschatz, Z.V.D.I., Vol. 76, No. 6, 6/2/32, pp. 132-134.) (10.104/23516 Germany.)

A number of diagrams of the concentration of stress lines at sharp angles in stressed materials are reproduced. It is suggested that the fatigue follows the steepest gradient at right angles to the stress lines. In two photographs the direction of the line of fracture is held to support this view. Five references are given.

Corrosion

Corrosion Protection—Oxide Films. (Z.V.D.I., Vol. 75, No. 35, 29/8/31, p. 1110.) (10.125/23517 Germany.)

A small proportion of silicon in iron, and of antimony in aluminium, favours the formation of protective coatings under the action of air and water.

In the anodic oxidation of aluminium and the nitriding of suitable steels the protective layer is produced by reaction with chemicals.

A satisfactory theory of corrosion has not yet been established, and methods are empirical.

Welding

Autogenous Welding. (Z. Metallk., Vol. 24, No. 1, Jan., 1932, pp. 19-22.) (10.14/23518 Germany.)

The well-known incidence of corrosion round rivets is avoided by welded joints. Methods of welding in use are discussed and illustrated with five photographs of welds and a number of sketches. Eleven references are given.

Electron and Welding. (H. A. Horn and K. Tewes, Autom. Tech. Zeit., Vol. 34, No. 33, 30/11/31, pp. 762-765.) (10.28/23519 Germany.)

The authors state that welding of magnesium plates and castings is now practicable. Precautions to be taken in welding are stated and illustrated by sketches. A photograph shows a weld in detail from both sides, and six examples of welded objects are given. These vary from a fuel tank to a motor bus frame. Corrosion difficulties are briefly discussed and it is stated that the weld suffers less than the main body of the metal. The outstanding advantage of electron is the s.g. of 1.8 to 1.83, about two-thirds that of competing aluminium alloys. The chief weakness is liability to corrosion.

Alloys

Magnesium Alloys. (G. D. Welty, S.A.E. Jrnl., Vol. 30, No. 3, March, 1932, pp. 112-115.) (10.232/23520 U.S.A.)

The mechanical properties of aluminium and magnesium alloys for heat-treated castings and forgings are specified, and six photographs of castings in magnesium alloy are reproduced; practice in casting, forging, machining and treatment against corrosion are discussed. The quantity of magnesium castings used for aircraft in the U.S.A. has increased from 900lbs. in 1926 to 64,500lbs. in 1931.

Aluminium Alloys, Protection Against Corrosion. (R. W. Buzzard and W. H. Mutchler, N.A.C.A. Tech. Note, No. 400, Nov., 1931.) (10.262/23521 U.S.A.)

The whole question of protection of aluminium alloys against corrosion is surveyed in the light of experience at the Bureau of Standards. The indisputable superiority of alclad is re-stated but its higher initial cost and slightly decreased mechanical properties apparently suffice to restrict its use. The development of protective coatings for aluminium alloys therefore remains important. A complete specification is given of the various methods of applying coatings and of test methods by exposure to weather and corrosion.

Protective methods are divided into three broad classes :—

(*a*) Production of an oxide film on the surface of the material.

(*b*) Non-metallic coatings applied directly to the surface.

(*c*) Metallic coatings applied by electro-chemical or mechanical processes.

A number of these are effective in a temperate climate at a distance from the sea. Exposure to sea water is a much severer test, and the only effective type of protection appears to be the application of paint to an anodised surface. Under static test, corrosion in the last case was just beginning after three years' exposure, but it failed to penetrate the aluminium layer of alclad in the same period. Ten references are given.

Wind Tunnels and Testing Gear

Wind Tunnel Correction. (L. Poggi, L'Aerotecnica, Vol. 11, No. 4, April, 1931, pp. 424-445.) (11.16/23522 Italy.)

The effect of the walls of a wind tunnel on an eddy are discussed by the method of conformal transformation, and expressions are obtained in terms of

elementary functions and numerical values tabulated. The results are compared with Prandtl's simpler formula for a circular tunnel and also with the results of T. Osaki for a slightly different problem.

Acknowledgment is made to Prof. v. Karman, under whose direction the work was carried out.

Lift Coefficient of a Model, Effect of Walls on a Wind Tunnel. (T. Sasaki, Rept. Aer. Inst., Tokyo Imperial University, Nos. 46, Dec., 1928, and 77, Dec., 1931.) (11.16/23523 Japan.)

In sequel to the earlier paper the author extends his analysis to include the effects of exit and collector walls for channel wall interference in terms of sigma, zeta, theta, and Weierstrass functions. In a note the author accepts a correction (by Rosenhead) which removes a discrepancy between his results and Glauert's results by an approximate summation.

See previous abstracts (Rosenhead) Nos. 17/20336 and 20/22144.

X-Ray Test of Structures. (Aviation, Vol. 31, No. 2, Feb., 1932, p. 75.) (11.34/23524 U.S.A.)

It is stated that a portable X-ray apparatus mounted on casters is in use at a Curtiss-Wright airport for the rapid examination of the condition of the spars, etc., on a fluorescent screen. Where defects are indicated an X-ray photograph is taken.

Airships

World Travel of the Graf Zeppelin. (Luftwacht, No. 12, Dec., 1931, p. 532.) (12.1/23525 Germany.)

The airship has carried out 232 flights of 350,000 kilometres total distance in 3,500 hours.

A regular trans-Atlantic airship service in the near future between Europe and South America is projected with a 72 hours' run to Pernambuco. A new Zeppelin is under construction to be equipped with oil engines and filled with helium.

Comparison between Akron and Graf Zeppelin. (H. Ebner, Z.V.D.I., Vol. 76, No. 2, 9/1/32, p. 37-40.) (12.1/23526 Germany.)

The Akron has a capacity of 184,000 m.^{3} against the Zeppelin 105,000 m.^{3} the length of the two ships being practically identical (app. 238 m.). In many respects the constructional features of the Akron seem to follow those of the R.101 except that no steel is employed in the framework. It is interesting to note that the gas bags contain no gold-beater's skin, reliance being placed on rubber and wax. The ship is filled with helium. The eight Maybach petrol engines are inside the ship and exhaust water recovery plant is fitted. A maximum speed of 135 km./hr. was expected at 3,000ft. Apparently this was not achieved on the first trial flights. It is estimated that the ship has a cruising radius of 17,000km. and can remain in the air for over a week.

Wireless

Eleven-Year Solar Activity Period, Influence on Propagation of Wireless Waves. (H. Plendl, Proc. I. Rad. Eng., Vol. 30, No. 3, March, 1932, pp. 520-539.) (13.3/23527 U.S.A.)

From author's summary :—Researches concerning the propagation of short and border waves, conducted by the German Air-Travel Research Laboratory during the years 1930 and 1931, reveal results which are not quite in harmony with similar, but far more complete, investigations carried out in the years 1927-28.

The suspicion arises that one is here dealing with an influence exerted by the eleven-year period of solar activity upon the propagation of short and border waves, especially as such an influence upon long waves has been repeatedly established. The present work deals with the explanation of these phenomena.

Kennelly-Heaviside Layer Heights for Frequencies between 1,600 *and* 8,650 *kc. per Second.* (T. R. Gilliland, G. W. Kenrick and K. A. Norton, Bur. St. J. Res., Vol. 7, No. 6, Dec., 1931, pp. 1083-1104.) (13.31/23528 U.S.A.)

From authors' summary :—The results of observations of the height of the Kennelly-Heaviside layer carried out near Washington, D.C., during 1930 are presented. Evidence for the existence of two layers (corresponding closely in virtual height to the E and F regions discussed by Professor Appleton) is found during daylight on frequencies between three and five megacycles. The modification in the virtual height of the higher F layer produced by the existence of a low E layer is investigated theoretically, and the possibility of large changes in virtual height near the highest frequency returned by the E layer is pointed out. A number of oscillograms showing the characteristic types of records observed during the tests are presented together with a graph of average heights from January to October, 1930.

Phase and Amplitude Measurements of Electro-Dynamic Loud Speakers. (W. Binder, Phys. Zeit., Vol. 33, No. 2, 15/1/32, pp. 85-87.) (13.32/23529 Germany.)

A description is given of methods of measurement and typical curves are reproduced.

Simultaneous Radiotelephone and Visual Range Beacon for Airways. (F. G. Kear and G. H. Wintermute, Proc. I. Rad. Eng., Vol. 30, No. 3, March, 1932, pp. 478-515.) (13.6/23530 U.S.A.)

From authors' summary :—Increased use of the airway radio services by transport operators has resulted in a demand for continuous range beacon service. At the same time the weather broadcast information has increased in importance and the interruptions to beacon service have become more frequent. To eliminate difficulties arising from this conflict, a transmitting system has been developed which provides simultaneous transmission of visual range beacon and radiotelephone signals.

The transmitting set consists of a two-kilowatt radiotelephone transmitter operating into a non-directive antenna system and an additional set of amplified branches supplying power through a goniometer into two loop antennæ. The two antenna systems are symmetrically disposed with respect to each other and coupling effects are balanced out to prevent distortion of the space pattern. The phase of the currents in the different antenna systems is controlled by a phase-shift unit and means for checking the adjustment of this phase relationship continuously is provided.

The equipment on the aeroplane to receive this service is changed only by the addition of a small filter unit which keeps the low-frequency reed voltages from reaching the head telephones and the voice frequencies from the reed indicator.

Numerous flight tests on the system have shown it to provide very satisfactory service under adverse interference conditions.

Television. (C. O. Browne, J.I.E.E., Vol. 70, No. 423, March, 1932, pp. 340-353.) (13.7/23531 Great Britain.)

In a previous paper a graphical method of determining the magnitude and phase of the electric field in the neighbourhood of an aerial was developed on the

assumption that the effect of the aerial could be neglected. An indication was given of the development required for taking into consideration the image in the earth's surface. The method is now worked out more fully. A formula is deduced for the field near the earth's surface due to a doublet, with indications of its extension to the determination of the field at various distances. The polar distribution is shown graphically for eight arrangements of aerials, four with and four without reflector wires. A graphical representation of observed field strengths as a function of distance for given values of the dielectric constant, and varying values of the ratio of conductivity to frequency, exhibit the results as lying within a narrow band, which is taken as satisfactory.

Photography

Photograph Taken in the Dark by Infra-Red Light. (Ind. & Eng. Chem., Vol. 24, No. 1, Jan., 1932, pp. 8 and 12.) (14.10/13532 U.S.A.)

Photographs were taken on a special plate, hypersensitised with ammonia, of interiors in visual darkness illuminated with infra-red light by a battery of fifteen one-kilowatt lamps through a Wratten 87 filter screen. A photograph is reproduced.

Progress in Photogrammetry. (O. Lacmann, Z.V.D.I., Vol. 75, No. 33, 15/8/31, pp. 1047-1053.) (14.14/23533 Germany.)

A photographic survey department, equipped with the latest apparatus, has been set up in the Technical High School of Berlin in co-operation with D.V.L. Twenty-two photographs of apparatus are reproduced.

Acoustics

Measurement of Noise. (G. Bakos and S. Kagan, Z.V.D.I., Vol. 76, No. 7, 13/2/32, pp. 145-150.) (15.2/23534 Germany.)

From a large number of subjective measurements a scale of intensities is formed and exhibited graphically as a family of curves, from threshold intensity to 100 decibels and for frequencies from zero to 800 hertz. The upmost curve, with a different run indicates the intensity at which noise becomes painful. Mechanical apparatus for measuring intensity in terms of energy is described and records of observations are reproduced graphically and compared with the results obtained by Barkhausen's apparatus and by the method of comparison. The two former agree fairly well. The latter sometimes shows considerable discrepancies. Thirteen references are given.

Accidents

Aeroplane Accident Statistics, 1930. (L. Weitzmann, Z.F.M., Vol. 23, No. 1, 14/1/32, pp. 13-24, 264th D.V.L. Report.) (16.0/23535 Germany.)

An elaborate tabular and graphical analysis is given of the accidents occurring in Germany in 1930. There are 24 tables and 18 graphical diagrams covering a corresponding range of cross analyses. The elaborate statistics are not amenable to brief summarising.

Rocket Propulsion

Rocket Propulsion for Aeroplanes. (H. Oberth, Flug., No. 11-12, Nov.-Dec., 1931, pp. 1-3.) (17.2/23536 Austria.)

In order to obtain data for the ultimate design of a jet propelled aeroplane, considerable experiments will have to be carried out with rockets of the projectile type. These may be utilised to carry mails and would land by means of a parachute.

As these rockets increase in size they will become ultimately able to dispense with a parachute and land by gliding flight, the rocket being governed entirely by means of automatic apparatus. Only after these developments have been carried out will it be possible to design a man-carrying machine working on the same principle.

Gliding

Results of Rhon Gliding Competition, 1931. (W. Georgii, Z.F.M., Vol. 23, No. 4, 29/2/32, pp. 97-102.) (17.4/23537 Germany.)

Table I. gives particulars of eight duration flights which totalled 18¼ hours, the maximum of a single flight being 9 hours.

Table II. shows distances and heights flown in the performance competition. Distances vary from 31 km. to 120 km., and heights from 400 m. to 2050 m.

Two maps show the directions of the flights and the nature of the country traversed. Two diagrams show the position of cumulus clouds during the high-flying competition, with some indications of temperature gradients, moisture, etc.

Weather Conditions

Military Aviation in Indo-China. (Auphan, Rev. F. Aer., No. 30, Jan., 1932, pp. 3-10.) (19.1/23538 France.)

Conditions of operating aeroplanes in a tropical region are illustrated by numerous air photographs.

Meteorograph. (H. Kirsten, Z.V.D.I., Vol. 76, No. 5, 30/1/32.) (19.1/23539 Germany.)

A compact meteorograph with wireless sending apparatus for use in pilot balloons is described and illustrated by a photograph and a diagram. Temperature, pressure and humidity are measured on arcs of a graduated circle and the readings are transmitted by short wave. The design is the joint work of the D.V.L. Aeronautical Observatory, Lindenberg, and the Askania Works, Berlin. It was used on the Polar Expedition of the Graf Zeppelin and an example of the results obtained is quoted showing that up to 10.5 km. the temperature in the polar regions fell steadily and thereafter remained constant or increased slightly. This fixes the limit of the stratosphere at the given time and place to a height of 10.5 km. Five references are given.

Ice Prevention

Ice Prevention by Exhaust Heat. (T. Theodorsen and W. C. Clay, N.A.C.A. Report, No. 403, Feb., 1932.) (19.15/23540 U.S.A.)

A brief summary is given of previous work on the processes of ice formation and methods of preventing it. The application of exhaust heat has been postponed by the complications involved in design, construction and operation.

Part I. of the combined report deals with the elementary theory of the transfer of heat in which Nusselt's formula for pipes is used as a standard. The experimental arrangement of a model wing in the wind tunnel is fully described, with photographs. The rates of heat transmission from aerofoils with a source temperature of 54°F. for angles of incidence 0°, 6°, 12°, 18°, and for aerofoils of different sections, the velocities varying from 30 to 90 m.p.h., are given in seven diagrams; and two diagrams show the coefficient of heat loss per sq. foot per hour against the log of the speed.

In Part II. problems of design are considered. Three methods are applied :—

(1) Direct heating by exhaust gas.
(2) Supply of hot air direct from the cylinders of air-cooled engines or from air heaters in the exhaust pipe.
(3) Supply of steam from a small boiler heated from the exhaust pipe.

The circulation systems for the heating medium used in the experiments are shown by diagrams and photographs and conclusions are drawn for guidance in practical design. Ample heat is available from the exhaust or radiator and successful application is a matter of technical development.

Ice Hazard. (W. C. Gear, Aeron. Eng., Vol. 4, No. 1, March, 1932, pp. 33-36.) (19.15/23541 U.S.A.)

A brief account is given of the application of inflatable tubes on the leading edge, the deflation and inflation of which breaks up any ice formation. A diagrammatic drawing shows the method of mounting in the channel for research on ice formation. Nine references are given.

Matters affecting Pilots

Physiological Sensitivity to Vibrations. (H. Reiher and F. J. Meister, Forschung, Vol. 2, No. 11, Nov., 1931, pp. 381-386.) (19.29/23542 Germany.)

Intensity is divided into classes: zero class, imperceptible; 1a, 1b, 1c, just perceptible, readily perceptible, and strongly perceptible; 2a and 2b, unpleasant and extremely unpleasant; the last two carrying risk of definite injury.

Experiments were carried out with a controllable platform and the observations are plotted on a log amplitude-frequency diagram which brings out the five classes as grouped along approximately straight line loci.

The Effect of Accelerations on Human Beings. (J. L. Nayler, J. Roy. Aer. Soc., Vol. 36, No. 255, March, 1932, pp. 251-254.) (19.29/23543 Great Britain.)

The author surveys a variety of conditions, including accidental falls, which impose accelerations rising to as much as 10 or 12 times gravity. These are compared with illustrative figures of stresses imposed by aerobatics.

Lighting

Air-Route Lights. (Franck, Rev. F. Aer., No. 30, Jan., 1932, pp. 68-80.) (21.095/23544 France.)

The elementary formulæ of illumination are given, and on this basis the required distribution of lights along a route is laid down.

Rules of navigation are tabulated for aircraft meeting under twelve possible conditions.

Fog Penetration

Fog, Transmission of Visible Infra-Red and Ultra-Violet Radiation. (S. H. Anderson, Aeron. Eng., Vol. 4, No. 1, March, 1932, pp. 1-12.) (21.22/23545 U.S.A.)

The elementary theory of absorption, scattering, diffusion and refraction is given, and the principal results are quoted.

A full technical investigation, illustrated by plan and end and side elevations, is given of the laboratory apparatus for producing artificial fogs in a chamber consisting of a 20-foot length of 6-inch steel pipe.

The fogs were prepared by expanding and cooling saturated air in the presence of tobacco smoke or tobacco smoke mixed with hygroscopic magnesium chloride. Moisture condensed on these particles and the diameter of drops selected by deposition on a small metal rod charged to high voltage was determined by micrometer microscope. The mean diameter of the drops thus determined is given as 6 micro-metres and 8 micro-metres respectively (micro-metre $= m \times 10^{-6}$).

A range of wave lengths, from 0.3 micro-m. to 2.64 micro-m. was covered by the investigations. This range was divided into fifteen sub-divisions corresponding approximately to ultra-violet, violet, blue, green, yellow, red and nine sub-divisions of the infra-red range.

The first eight sub-divisions were selected by use of light filters in conjunction with the selectivity of the photo-electric cells used for measuring intensity. The seven remaining sub-divisions in the ultra-red were obtained by spectrometer.

Five types of photo-electric cell and two types of thermo-pile were used for determining the intensity transmitted. Curves of transmission are given for different wave lengths and for different concentrations of fog particles. Minima were found in each case in the visible range with a slight rise in the ultra-violet range and a considerable rise on the ultra-red side.

Using appropriate photo-electric cells the energy received in the infra-red band was twenty times that received in the visual band.

Although the work carried out appears to be more complete and systematic than anything hitherto published a more reliable determination of the sizes of the water particles and a wider range of sizes is required to complete the investigation. This was admitted in the discussion of the discrepancy between the above results and observations made in natural fog. Ten references are given.

Light Signals in Aviation and Navigation. (I. Langmuir and W. F. Westendorp, Physics, Vol. 1, No. 5, Nov., 1931, pp. 273-317.) (21.22/23546 U.S.A.)

A comprehensive experimental investigation is made of the intensity of point light sources and diffused light sources for threshold visibility against a background of arbitrary intensity. As the background brightness increases the relative sensitivity of the eye for diffuse sources as compared with point sources decreases enormously. Photo-cells on the contrary record the total light received independently of its diffusion over an area, and the advantage increases very greatly with the background intensity. A description is given of a photo-electric receiver tuned to a diffuse light signal of given frequency. The receiver current is used to control a directional needle which indicates a change of 1.5 per cent. on an average brightness of about one-sixth of the visual threshold of the eye for a flashing point source with a completely dark background. The application of the method to diffuse light in a fog is discussed. The elementary mathematical equations are formed and solved. It is concluded that the instrument would be effective in a fog over a distance of several miles. A flashing arc beacon is described which is designed to throw a wide angle beam against a cloud or fog bank and thereby create a surface source of diffused light with economy of electrical power.

Aerodynamics and Hydrodynamics

The Conditions for Dynamic Similarity. (W. Herrmann, Z.V.D.I., Vol. 75, No. 20, 16/5/31, pp. 611-616.) (22.1/23547 Germany.)

An historical survey is made of the development of the conceptions of dynamical similitude, from Galileo and Newton to the present day. The characteristic non-dimensional expressions introduced by Newton, Froude, Reynolds and Cauchy, are formed, and some more general examples are discussed. Thirteen references are given.

Stability of Laminar Motion of Viscous Fluids. (A. Rosenblatt, Phil. Mag., No. 85, March, 1932, pp. 714-722.) (22.1/23548 Great Britain.)

A finite disturbance, vanishing exponentially both with time and distance, is assumed and the Stokes' function is written down to meet these conditions. A differential equation is formed and elaborate transformations and integrations are carried out largely in terms of Bessel functions. It is shown that the assumed

series for the Stokes' function is absolutely and uniformly convergent within a finite range and satisfies the conditions of viscous fluid motion.

(Abstractor's note:—The interpretation of the results as denoting stability of laminar flow under the assumed disturbance does not appear to be a necessary consequence).

Equations of Motion of a Viscous Fluid. (J. Prescott, Phil. Mag., No. 85, March, 1932, pp. 615-623.) (22.1/23549 Great Britain.)

The author criticises proofs based on the analogy with elastic theory and the assumption of Stokes' proof that there is a linear relation between stress and rate of strain. He proceeds from the simplest case of motion in parallel plane laminæ with uniform velocity gradients, introducing Stokes' assumption of a linear relation between rate of strain and stress in this particular case. He builds up 2-dimensional and finally 3-dimensional relations step by step, each step tacitly involving Stokes' assumption. The proof does not appear to differ in any essential particular from that given in Lamb's Hydrodynamics and merely postpones the formation of expressions involving 3-dimensional strain.

Slow Motion of Fluids. (W. R. Dean, Phil. Mag., No. 85, March, 1932, pp. 585-600.) (22.1/23550 Great Britain.)

The application of a method of bi-harmonic analysis by Professor A. E. H. Love, is considered with reference to the analogy with slow motion of viscous fluids, particularly in 2-dimensional flow past obstacles. A considerable development of the analysis is carried out in application to 2-dimensional flow through a channel partly closed by a vertical barrier.

The Flow in a Water Turbine. (F. Busmann, Forschungsheft, No. 349, Oct., 1931.) (22.1/23551 Germany.)

A description is given with a diagram and photographs of an experimental turbine and methods of exploring the velocity field. The usual equations of reaction and hydraulic efficiency are formed and a large number of experimental values of pressure distribution and velocity is given in over 50 diagrams. The direction of flow is indicated by the etching of the blades by the stream. By use of a cylindrical glass casing visual and photographic observations of the flow were made. Comparisons with 2-dimensional results obtained by conformal transformation were unsatisfactory. Comparison with the polar curves of individual profiles gave fair agreement. Seventeen references are given.

Quasi-Laminar Flow. (R. L. Peek and W. R. Erickson, Bell Tele. B.632.) (22.1/23552 U.S.A.)

The authors discuss departure from Poiseuille's law by some plastic fluids. The modifications due to transition from viscous to plastic flow are developed by an approximate semi-empirical method for flow down a cylindrical tube and compared with the Bingham-Buckingham formula. The physical implications of the theoretical treatment are discussed. A large number of experimental results is tabulated and exhibited graphically. The difficulties of interpretation are made clear.

Physical Concepts of Plastic Flow. (R. L. Peek and D. A. McLean, Bell Tele. B.633.) (22.1/23553 U.S.A.)

The physical considerations of the foregoing abstract are discussed at greater length along similar lines. A more general form of Bingham's equation is presented and three examples of delivery against pressure are plotted for different assumed values of the coefficients. A still more elaborate form is assumed with three arbitrary coefficients and examples are plotted of the result of fitting the

equation to experimental values. In ordinary viscous flow the delivery is proportional to the pressure gradient. The experimental results for semi-plastic substances exhibit the delivery as increasing rather more rapidly than the pressure difference. There is obviously no difficulty in fitting an expression with three arbitrary coefficients to experimental curves of this simple nature. The physical interpretation of the coefficients is not obvious.

Flow through Nozzles and Orifices. (R. Witte, Z.V.D.I., Vol. 75, No. 48, 28/1/31, p. 1454.) (22.2/23554 Germany.)

Pressure measurements at the wall of the tube are subject to the effects of compression or expansion of the air as it passes through the metering device. The author investigated the distribution of pressures over a wide range and found that the standard German metering devices, properly used, showed errors not exceeding 1 per cent.

Flow in Roughened Tubes. (J. Nikuradse, Z.A.M.M., Vol. 11, No. 6, Dec., 1931, pp. 409-411.) (22.2/23555 Germany.)

Tubes were roughened by dusting the inner surface with sand grains. Taking k to denote the mean size of the grains and r the diameter of the tube the resistance was determined for four values of k/r for a range of Reynolds numbers from 2.6 to 6.0.

For the largest value of k/r there is a rapid transition from laminar flow to turbulent flow. For the lowest value there is an intermediate range in which Blasius' relation is satisfied (resistance varies as $r^{-\frac{1}{4}}$) with rapid transition to the final state, resistance proportional to the square of the velocity.

For $k/r=0.0328$ the contract of the experimental curve with the straight line representing Blasius' relation is shorter and the transition to the final state is slower.

For $k/r=0.0163$, after a slight tendency to follow the Blasius relation the curve passes more rapidly to the final state.

Flow of Compressible Liquid in a Wind Channel. (S. G. Hooker, Proc. Roy. Soc., Vol. 135, No. A.827, 1/3/32, pp. 498-511.) (22.4/23556 Great Britain.)

A convergent-divergent nozzle formed by rotating an arc of a circle about an external axis parallel to the chord is discussed by means of a method due to J. I. Taylor. The velocity potential is expanded in series satisfying (1) the conditions of symmetry of flow with respect to the axis of rotation and to the plane of symmetry of the nozzle at right angles to the axis; (2) the former condition only. The constants are determined by equating coefficients and numerical results are calculated. Graphical representations are also given and appear to give a good fit with points plotted from Stanton's experimental work.

Eddy Diffusion in the Atmosphere. (O. G. Sutton, Proc. Roy. Soc., Vol. 135. No. A.826, 1/2/32, pp. 143-165.) (22.4/23557 Great Britain.)

The work of G. I. Taylor, L. F. Richardson and W. Schmidt, the resulting differential equation used by Taylor and Schmidt, and the suggested solutions are discussed by purely statistical methods. Expressions are given for instantaneous and continuous point and line sources. The results are compared with experiments on scattering of groups of balloons and on smoke diffusion. A particular form of the general solution is obtained which fits fairly well with most observations up to distances of 600 km.

Flow of Gases at Low Pressures. (H. Ebert, Phys. Zeit., No. 4, 15/2/32, pp. 145-151.) (22.4/23558 Germany.)

Transition from types of flow indicated by hydrodynamical theory when the mean free path is small compared with the dimensions of the conduit, to " molecular flow," where the mean free path is large compared with the dimensions of the tube, is discussed mathematically, and experimental results are tabulated and drawn graphically for comparison. Fifteen references are given.

Gap Losses at Aerofoil Tips. (O. Flachsbart, Z.A.M.M., Vol. 11, No. 6, Dec., 1931, pp. 411-414.) (22.4/23559 Germany.)

Water turbine blades rotating with their tips near the casing present a problem in induced resistance analogous to that of an aerofoil of span nearly equal to the width of the channel in which it is mounted.

For small gaps (1 cm. and less) the measured " gap loss " (the proportional increase of resistance) is less than the calculated figure. As might be expected the thicker the wing the greater is the deficiency. Above 1 mm. the observed values approach the calculated curve asymptotically.

The flow of air through the gap is shown diagrammatically with and without end plates on the wing. Two photographs are reproduced with $TiCl_4$ as indicator.

Turbulent Motion in Tubes, Experimental Investigation. (A. Naumann, Forschung, Vol. 2, No. 3, March, 1931, pp. 85-98.) (22.5/23560 Germany.)

The flow of water in a glass tube was recorded by cinematograph for different Reynolds numbers Special attention was paid to the inflow portion of the tube. The entry has two critical numbers, the lower corresponding to the beginning of a periodic vortex street and the higher critical number corresponding with the setting up of general turbulence. There is a relationship between the flow in the tube entry and that existing round a body in a stream. Both flows go through the same history—laminar flow, vortex street, turbulence.

The amount of disturbance reaching the stream from the so-called inlet vortex can be estimated from the vortex distance and contraction. General turbulence begins when the circulation of the introduced disturbance is approximately equal to that of the existing velocity profile. This also holds for the inlet region and is in agreement with the known increase of the critical number with a shortening of the lead in.

The Flow of Gases through Throttling Devices. (W. Nusselt, Forschung, Vol. 3, No. 1, Jan.-Feb., 1932, pp. 11-20.) (22.5/23561 Germany.)

In discussing the application of dynamical similitude, the equations of viscous fluid motion and of continuity, the equation of condition for a gas, and the adiabatic conservation of energy equation are used. From the form of these equations six non-dimensional parameters are obtained by means of which the relations between pressure and delivery are expressed non-dimensionally. The expression is found for the delivery under adiabatic expansion and this quantity divided by Poiseuille delivery is taken as the coefficient of the nozzle. Experimental values of delivery and contraction are plotted against the pressure drop and lie fairly well on unicursal curves. The critical pressure drop ratio for air is found to be 0.245. For well rounded nozzles the critical ratio is 0.528.

Elasticity of Materials

Box Girders, Torsional Stiffness, Theoretical and Experimental Investigation. (S. F. v. Boutteville, Forschung, Vol. 3, No. 1, Jan.-Feb., 1932, pp. 25-42.) (23/23562 Germany.)

Prandtl's soap-film analogy is referred to in respect of its experimental difficulties, and Kelvin's hydrodynamical analogy is preferred as giving more useful

results. The method depends on choice of approximations, which are given in an original form and applied to a number of examples. The numerical results to first and second approximations are tabulated for comparison with experimental results, the discrepancy being generally well within ±10 per cent. with occasional slightly higher values. A number of fields of stress are shown graphically.

Safety in Structural Design. (A. Thum, Z.V.D.I., Vol. 75, No. 23, 6/6/31, pp. 705-708.) (23/23563 Germany.)

Maximum stress does not necessarily occur at minimum cross section, and additional grooves may reduce the stress maxima. Notch test results vary widely with material. Notched high tensile silica steels may have ultimate fatigue strength no higher than softer steels, with one-third of the ultimate tensile strength under steady loads.

In design of springs a softer steel may give better fatigue results than a high tensile steel.

Residual Stresses in Cold Drawn Tubes. (N. Dawidenkow, Z. Metallk. Vol. 24, No. 2, Feb., 1932, pp. 25-29.) (23/23564 Germany.)

Specimens are cut from portions of the tube after drawing, and changes in curvature, etc., due to internal stresses, are measured. Successive thin layers are dissolved from the inner and outer surfaces and changes in diameter are measured. Sufficient data having been accumulated, the determination of the residual stresses is discussed mathematically. The results are compared with experiment and the comparison is shown graphically.

Fatigue Tests of Nickel Tubing for Fuel Pipes. (R. Worthington, Autom. Ind., Vol. 66, No. 5, 30/1/32, p. 164.) (23/23565 U.S.A.)

Curves of resistance under repeated loadings are given for annealed and unannealed copper and nickel pipes. The tests were carried out by the U.S. Army Air Corps, Wright Field. The numerical ratio in favour of nickel is striking, two comparative figures quoted being $40\frac{3}{4}$ hours for nickel and $5\frac{1}{2}$ hours for copper, both annealed; and $91\frac{3}{4}$ hours for nickel and 8 hours for copper, both unannealed.

Properties of Some Materials under Dynamic Loads. (M. Hempel, Forschung, Vol. 2, No. 9, Sept., 1931, pp. 327-334.) (23/23566 Germany.)

Some steel, brass and aluminium specimens were subjected to loads by setting loaded rods in vibration. The internal hysteresis was investigated by observing the time decrement under various conditions over a range of amplitudes. A number of results is recorded graphically. Photographs of typical fractures are reproduced. The gradual change of the elastic limit by hardening is brought out and the course of development of fractures is discussed.

Miscellaneous Unclassified

Symbolic Calculus. (B. van der Pol and K. F. Niessen, Phil. Mag., No. 85, March, 1932, pp. 537-577.) (23567 Great Britain.)

The authors prefer J. R. Carson's nomenclature and point of view (Electric circuit theory and operational calculus, 1926) to the notions of operator and operand in the original sense of Heaviside's operational calculus. The relation between the " original " function and its " image " is defined by an integral equation of a special type. The rules for reduction and transformation are given. A large number of applications are given and include summation of series, expression of B functions in terms of gamma functions, evaluations of integrals, particularly those involving Bessel functions.

Aircraft as an Instrument of Polar Research. (W. Bruns, Z.F.M., Vol. 23, No. 3, 15/2/32, pp. 65-72.) (23568 Germany.)

The subject is discussed in general terms and also with reference to the recent expedition of the Graf Zeppelin. The instrument equipment is described and illustrated by several photographs. An example of photogrammetric mapping is reproduced, the course of the ship and the positions of the photographic exposures being shown on the map.

Comparison of European and American Air Lines. (P. Goldsborough, Luftwacht, No. 12, Dec., 1931, p. 534.) (23569 Germany.)

The author (President of Northern Air Lines (U.S.A.)) travelled much on European air lines in 1930. The slower speed, less comfort and absence of passenger night flying are noted.

Political frontiers in Europe raise difficulties of language and regulations unknown in U.S.A.

Statistical Survey of Aircraft Industry. (Aviation, Vol. 31, No. 3, March, 1932, pp. 101-139.) (23570 U.S.A.)

A series of statistical articles gives a comprehensive survey of commercial aviation activities in U.S.A. covering air routes in operation, number of passengers carried, mail subsidies (nearly $20,000,000 in 1931), seasonal distribution of the flights, regularity coefficient and accidents, aviation schools licensing requirements in various States, distribution of licences, aircraft pilots and mechanics. A brief note is given on military and naval activities. Statistics are given of Canadian and European activities.

Refuelling—U.S.A. (Luftwacht, No. 12, Dec., 1931, p. 545.) (23571 Germany.)

During last year's manœuvres, fuel tank wagons were successfully employed. Each wagon can supply three aircraft simultaneously up to 40 gallons a minute. In Cleveland 110 reconnaissance machines were fuelled in under two hours.

The Development of American Civil Aviation. (Luftwacht, No. 12, Dec., 1931, p. 537.) (23572 Germany.)

In the U.S.A. there are 136 lines in regular operation under control of 43 companies. The most favoured machine is the single engine 500 h.p. eight-passenger cabin type with a single pilot, who also operates the wireless installation. Over long distances the pilots are changed but the machine goes on. On variable traffic the multi-engined aircraft carrying 15-20 passengers is less economical.

German-Russian Civil Aviation. (Luftwacht, No. 12, Dec., 1931, p. 537.) (23573 Germany.)

On November 23rd, 1931, the Deruluft Aviation Company completed its tenth year of service. During the past year over 3,600 passengers and 145 tons of post and goods have been carried on its two main routes, Berlin-Moscow and Konigsberg-Leningrad.

Development of More Rapid Post and Passenger Services on German Air Lines. (E. Schatzki, Z.F.M., Vol. 23, No. 1, 14/1/32, pp. 1-6.) (23574 Germany.)

A large number of statistics of aeroplanes and engines are tabulated and plotted graphically. A selection of the most suitable combinations for German air lines is discussed on the basis of these statistics.

Military Air Ambulances. (Beyne, Rev. F. Aer., No. 30, Jan., 1932, pp. 81-94.) (23575 France.)

The article is a lengthy precis of a paper in the archives De Medecine et de Pharmacie Militaires, December, 1931, discussing the scope of aeroplane ambulances in war. An analysis is given of statistics from the war classifying the wounded according to the degree of urgency of treatment, and hence of priority for air transport to hospital.

Aircraft for Ambulance Service. (Tech. Aeron., No. 121, Nov., 1931, pp. 287-291.) (23576 France.)

Reference is made to the offer of an award for aeroplane ambulances for military service. Desirable qualities are briefly specified and a list of aeroplanes designed or adapted to the purpose is given with brief details of their capacity. Experiences in Syria and Morocco are quoted. The allotment of ambulance aeroplanes to units is outlined by a medical officer. Requirements in time of war in competition with military demands could only be drawn from the available reserve of commercial machines.

General Maintenance. (H. C. Downey, Aeron. Eng., Vol. 4, No. 1, March, 1932, pp. 21-32.) (23577 U.S.A.)

A large number of useful hints are given for mechanics, inspectors, and ground engineers. Four references are given.

Application of Soft Rubber to the Production of Graphical Stress Fields. (H. Stoll, Forschung, Vol. 2, No. 9, Sept., 1931, pp. 313-318.) (23578 Germany.)

The two-dimensional problem is discussed. The plain surface of the unstrained rubber is ruled with a net-work of squares and is photographed before and after the application of the selected stress conditions. The ease of mapping the strain field is offset by the rapid departure from proportionality of strain and stress with increasing load and the consequent difficulties of interpretation in terms of stress. Seven references are given.

Optical Glass in America. (H. F. Kurtz, Vol. 12, No. 70, Jan.-Feb., 1931, pp. 251-254.) (23579 U.S.A.)

A brief descriptive account with eight photographs is given of the optical glass industry in America, the creation of which was due to war conditions. The difficulties met with and the poor average quality produced during the war are fully discussed. Apparently only one manufacturing plant remains, the average product of which is stated to exceed the European standards. Experimental optical glasses are produced on a small scale at the Bureau of Standards.

Oil Pipe Coupling. (Autom. Tech. Zeit., Vol. 34, No. 15, 31/5/31, p. 364.) (23580 Germany.)

A description with a diagram is given of an oil pipe coupling in which a union is locked by means of two spring levers of the type commonly applied to bottle stoppers. The levers force the conical ends of the pipes to be coupled on to a short union pipe with a double conical rubber washer. It is stated that pipe breakages are much reduced by the device.