# ABSTRACTS AND NOTICES

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## *Aircraft Design*

*Pressure Distribution Tests on a Series of Biplane Wing Models. Effects of Changes in Various Combinations of Stagger, Gap, Sweepback and Decalage, Parts I, II and III.* (M. Knight and R. Noyes, N.A.C.A. Technical Notes, Nos. 310, 325 and 330.) (5.1/12301 U.S.A.)

(NOTE.—Decalage = mutual incidence of biplane wings or the difference of wing setting.)

*Part I, No.* 310, *July*, 1929.

Two equal parallel wings without decalage were tested:—

(1) The gap/chord ratio was unity and the stagger was varied from −25 per cent. chord to +75 per cent. chord.

(2) The stagger was zero and the gap/chord ratio was varied from 50 per cent. chord to 150 per cent. chord.

*Part II, No.* 325, *October*, 1929.

With gap/chord unity and zero stagger, dihedral, sweepback and overhang:—

(1) The decalage was varied from −6° to +6°.

(2) With zero decalage, etc., the dihedral was varied from zero for both wings to +3° for either wing.

(3) The sweepback was varied from zero for both wings to 5° and 10° for either wing.

(4) The span ratio (overhang) of lower/upper wing was varied from 1.25 to 1.00, 0.80 and 0.60.

The incidence on each test was varied from −8° to 90°.

*Part III, No.* 330, *December*, 1929.

The following variations were applied:—

| | | | |
|---|---|---|---|
| Gap/chord ... ... ... ... | .75 | to | 1.25 |
| Stagger/chord ... ... ... | +.50 | to | −.50 |
| Mutual incidence (decalage) ... | +3° | to | −3° |
| Sweepback ... ... ... ... | 0° | to | 10° |

These were combined in pairs. The incidence was varied up to 90° for use in stalled flight and spin. The results are exhibited graphically.

*The Torsional Strength of Wings.* (C. P. Burgess, N.A.C.A. Report No. 392, December, 1929.) (5.21/12302 U.S.A.)

Author's Summary :—A simple method for calculating the position of the elastic axis of a wing structure having any number of spars is described. It is shown that strong drag bracing near the top and bottom of a wing greatly increases the torsional strength. An analytical procedure for finding the contribution of the drag bracing to the torsional strength and stiffness is described, based upon the principle of least work, and involving only one unknown quantity. The validity of the new method of analysis is tested by applying it to a two-fifths scale model of the large steel tubular 3-spar wing of the Huff-Daland XHB monoplane. The calculated stresses are checked by comparison with the strains observed by means of electric telemeter strain gauges secured to the spars during sand load tests in the static testing laboratory of the Army Air Service Engineering Division at Dayton, Ohio.

*Calculation of Wings under Torsion.* (L. Virmoux, Rev. Gen. de l'Aer., Vol. X, 1929, pp. 115-138.) (5.21/12303 France.)

Two wing spars connected by ribs are considered under arbitrary systems of load forces. The method of least work is applied to determine the otherwise indeterminate stresses. The resulting integrals are evaluated graphically and the stresses determined in a numerical example. In the forward spar the shear is reduced 42 per cent. and the bending moment by 63 per cent., but a torsional moment is produced equal to about 1/3rd of the maximum bending moment. In the rear spar the shear is reduced by 33 per cent. and the bending moment by 49 per cent., but a torsional moment is produced equal to about 1/6th of the maximum bending moment.

*Calculation of Cantilever Wings.* (K. Friedrichs and Th. Karman, Z.A.M.M., Vol. IX, Part 4, August, 1929, pp. 261-269.) (5.214/12304 Germany.)

1. The spars and ribs may be considered as a statically indeterminate system, and the stress strain relations determined by the method of least strain energy, or the ribs may be replaced by a continuous connecting sheet and a differential equation constructed for the required relations.

When the spar section is constant or varies according to a simple relation the second method is simpler, otherwise it has no advantage. The limited object of the paper is to show that the former method can be solved step by step after the manner of Clapeyron's method for continuous beams.

2. Clapeyron's equation of three moments is formulated and integrated to give deflections.

3. The strain energy is expressed in terms of the moments and differentiated to give Clapeyron's equation of three moments.

4. Neglecting the torsion of the ribs themselves, a corresponding expression for the strain energy of a wing frame is obtained and differentiated to give the equation of bending moments.

5. Simple geometrical interpretations are given in terms of the torsional strain of the spars.

6. When the ratios of the moments of the spar sections is constant the expression may be simplified.

The " elastic axis " is defined, and used to simplify the integral expressions for strain energy.

7. To take account of the ribs, expressions for jumps in the spar bending moments and for the strain energy of the ribs must be introduced.

8. A generalisation for more than two spars is suggested.

9. The equations of three moments now give a recursion series in which three unknown moments enter at a time and can be determined by steps. An

example arrives at an expression for torsion in agreement with a result obtained by the alternative method.

10. A worked-out numerical example with variable spars is compared with measured torsion observed at Aachen Aerodynamical Laboratory. The mean values agree closely, the individual values for each spar less closely on account of simplifying assumptions.

*Structural Strength of Aeroplanes.* (A. S.Niles, S.A.E. Jnl., Vol. XXVI, No. 2, February, 1930, p. 226.) (5.26/12305 U.S.A.)

Recent criticisms of the U.S. standards of structural strength in aeroplanes are discussed. Loads actually recorded in flight for 18 different machines in 16 different positions are tabulated. A combination of stress calculations and sand loads is recommended for load factor determinations.

*Landing Impact on Seaplane Floats.* (Th. v. Karman (translated), N.A.C.A. Tech. Note 321, October, 1929.) (5.27/12306 Germany.)

An increase of effective mass on striking the water is assumed on the basis of the impulsive setting in motion of a long flat plate in mathematical hydrodynamics. Half this value is taken as estimating the increase of effective mass at a free surface. The normal velocity is obtained from the vertical rate of descent and the taper of the float.

Equating moments before and after impact an expression is obtained for the impulsive pressure which increases with the square of the velocity of impact, from which the value of 0.5 atmospheres for 3.4 m/s may be calculated.

This figure was obtained by direct pressure measurements for a speed estimated at from 3.3 to 4.1 m/s so that the order of agreement is fair.

*Effect of a Circular Hole on the Stress Distribution in a Beam under Uniform Bending Moment.* (Z. Tuzi, Phil. Mag., Vol. IX, No. 56, February, 1930, pp. 210-224.) (5.29/12307 Great Britain.)

A new material, Phenolite, stated to be optically five times more sensitive than xylonite, was used to study experimentally the stresses round a circular hole in a plate under uniform bending moment. A brief mathematical solution of the problem is worked out, and sufficient numerical figures were computed for comparison with experiment. The experimental results are given in diagrams, and a comparison with mathematical theory in a table. Six very clear photo-elastic photographs are reproduced.

*The Progress of Aerodynamic Research in* 1929. (E. Relf, Aircraft Eng., Vol. II, No. 11, January, 1930, pp. 5-6.) (5.3/12308 Great Britain.)

A brief survey is given of work of interest done in the past year. It is stated that the results of the Schneider Cup competition machines and the aerodynamical results of the R.100 and R.101 were predicted with satisfactory accuracy by wind tunnel work.

*Sailing Ships and Aeroplanes.* (Capitaine de Vaisseau Changeux, Rev. F. Aer., No. 4, Nov., 1929, p. 467.) (5.3/12309 France.)

An elementary account of the reactions on the sails and keel of a ship is given, and the possible application of wing forms to sails is discussed.

*On the Evaluation of the Polar Curves of an Aircraft in Flight.* (Huguenard, Magnan and Sainte-Laguë, Bul. Tech., No. 62, October, 1929.) (5.3/12310 France.)

The aeroplane is photographed in flight by a cinema camera with a grating of known dimensions in the plane of vision. Allowance for wind is made by

smoke emitted by the aircraft. The effect of airscrew interference is allowed for by a system of Venturi-tubes arranged in the slip stream. During the experiments a flight of swallows was photographed. Their apparent gliding ratio was about 19, that of the aeroplane being 5.1.

*Collection of Wind Tunnel Data on Commonly Used Wing Sections.* (F. A. Louden, N.A.C.A. Report No. 331, January, 1930.) (5.31/12311 U.S.A.)

This report was prepared at the request of the N.A.C.A. in the Bureau of Aeronautics of the Navy Department in order to group in a uniform manner the aerodynamic properties of commonly used wing sections as determined from tests in various wind tunnels.

The data have been collected from reports of a number of laboratories, including:—Large wind tunnel, Göttingen Laboratory; variable density wind tunnel, Langley Memorial Aeron. Laboratory; 7½ft. wind tunnel, Massachusetts Institute of Technology; 5ft. wind tunnel, McCook Field; 8-by-8ft. wind tunnel, Washington Navy Yard.

Where necessary, transformation has been made to non-dimensional coefficients and tunnel wall interference corrections have been applied. Tables and graphs present the data in the various forms useful to the engineer in the selection of a wing section.

*Tests of Large Airfoils in the Propeller Research Tunnel, including Two with Corrugated Surfaces.* (D. H. Wood, N.A.C.A. Report No. 336, 1/1/30.) (5.31/12312 U.S.A.)

Author's Summary:—This report gives the results of the tests of seven 2-by-12ft. airfoils (Clark Y, smooth and corrugated, Göttingen 398, N.A.C.A. M-6, and N.A.C.A. 84). The tests were made in the Propeller Research Tunnel of the National Advisory Committee for Aeronautics at Reynolds Numbers up to 2,000,000. The Clark Y airfoil was tested with three degrees of surface smoothness.

The effect of small variations of smoothness of an airfoil is shown to be negligible. Corrugating the surface causes a flattening of the lift curve at the stalling point and an increase in drag at small flying angles.

*Aerodynamics of Tapering Wings.* (Ed. Amstutz, Aero Rev., Vol. V, No. 2, Feb., 1930, pp. 31-33.) (5.31/12313 Switzerland.)

The tapering wing construction has the advantage of yielding a wing root of considerable strength but increases longitudinal moments and drag.

*Aerodynamics of Aeroplane Wings.* (E. Carafoli, Rev. Gen. de l'Aer., No. 10, 1929, pp. 1-112.) (5.31/12314 France.)

Starting with the equation of hydrodynamics of a perfect fluid, the author develops systematically the hydrodynamical methods required later. He then discusses Joukowsky's method and its elaborations by Blasius, Munk, v. Mises, v. Karman, and others. He develops the theory of the velocity and pressure fields round a rotating wing for a perfect fluid but introduces a "correcting factor" for applications. He then discusses the Lanchester-Prandtl theory of "fixed" and trailing vortices. The method of images is discussed with applications to interference of walls, etc., on the flow round lifting wings, but without reference to the recent complete solutions obtained by English, French and Japanese writers.

The article is an excellent statement of application of hydrodynamical theory to aeronautics.

*Pressure Distribution on a Slotted R.A.F. 31 Aerofoil in Variable Density Tunnel.* (E. N. Jacobs, N.A.C.A. Tech. Note No. 308, June, 1929.) (5.313/12315 U.S.A.)

Measurements were made at one atmosphere and at twenty atmospheres, the latter being considered less accurate. The respective curves are plotted in broken and full line exhibiting scale effects.

In particular the sharp peak in the lift curve is flattened out at full scale Reynolds numbers.

*Distribution of Pressure on Aerofoils with Trailing Flaps.* (O. Loeser, N.A.C.A. Tech. Note No. 326, Oct., 1929.) (5.313/12316 U.S.A.)

The incidence, flap and setting angle were varied separately and normal forces, centre of pressure, and hinge moments were measured, the latter somewhat roughly ($\pm$ 15 per cent.).

A large mass of results is given graphically.

*Experiments on Autorotation of an Aerofoil.* (S. Ober, N.A.C.A. Tech. Note No. 319, Sept., 1929.) (5.315/12317 U.S.A.)

Measurements were made on three rectangular aerofoils, an 18in. × 3in. Clark Y of wood, an 18in. × 3in. Clark Y of duralumin with adjustable sweepback, and an aerofoil of wood with 30° sweepback 3in. chord (normal to edge) and variable span.

As the sweepback varies from 0° to 50° the autorotation decreases and dies out slowly at the latter angle.

The incidence increased up to 50° or 60°, after which autorotation ceased. At 90° a different type altogether set in, and is called windmill autorotation; but one blade is travelling backwards.

The results as a whole are given in a series of graphical representations.

*The Generation of Sea Waves in Ship-Model Experiments.* (G. Kempf and H. Hoppe, Werft. 10, 192-196 (Eng. Abstr. No. 40, July, 1929, p. 162).) (5.32/12318 Germany.)

The Hamburg ship tank has recently been fitted with an artificial wave maker, for the study of the effect of waves on resistance and for measurements of pitching, rolling and heaving. The resistance depended on the size of the wave, and, in certain cases, the increase was 20 per cent.

*Model Experiments on the Maier Ship Form.* (H. Kloess, Werft. 10, 97 (Eng. Abstr. No. 40, July, 1929, p. 163).) (5.32/12319 Germany.)

The Maier hull form has a triangular run and entrance transverse sections, a cut-away entrance and run and a defined locus of the centroid of semi-transverse sections. In tests of two models of identical principal dimensions the Maier form had 18 per cent. less resistance. Similar advantages were found in a design for shallow water navigation.

*Ship Wake and the Frictional Belt.* (G. S. Baker, N.E.C. Inst. Eng. and Sh. Trans., Vol. XLVI, Pt. 2, p. 83 and Pt. 3, p. 141.) (5.32/12320 Great Britain.)

Author's Summary:—The first part of the paper gives the details of the wake of a plank with both smooth and rough surfaces. These are compared with various other results. The extension of these results to the estimation of ship wake is considered, first as regards the width of wake belt and its " rubbing " or gliding velocity against the hull, and secondly as regards the effect of " form " on the wake belt. The second part of the paper deals with wake measurements made on two vessels. Details are given of the pitot tubes used in these tests

and of the results obtained in the first case on the " Snaefell " at a Reynolds number of $5.0 \times 10^8$ and in the second case on the " Ashworth " at a Reynolds number of $4.3 \times 10^8$. The test results on the former are compared with those obtained on a model 1/18 full size at its corresponding speed. Formulæ for width of wake belt and for the distribution of velocity in the belt are given, and the general effect of roughness is discussed. As the work is still proceeding only the more obvious conclusions are given.

The discussion is continued (Part 3, p. 141) in terms of the turbulent boundary layer, and the figures are quoted from marine practice. Width of boundary layer along the ship's side is given as 50 cms. from the U.S.A. investigation and 2 metres from the German investigation. The influence of aerodynamical research in naval architecture is marked.

*The Influence of Impeller Blade Nose Form on Cavitation in Centrifugal Pumps.* (H. Potter, Z.A.M.M. 9, 84-101 (Eng. Abstr. No. 40, July, 1929, p. 143).) (5.32/12321 Germany.)

Cavitation is influenced not only by the shape of the nose but also by that of the shoulders and of the blades. The influence of neighbouring blades is slight. Fluctuations in flow may cause appreciable increase of local suction and thus of cavitational erosion.

*Flow with Velocity Potential through a Lattice of Blades with Arbitrary Profiles, at Rest or in Motion.* (W. Spannhake and W. Barth, Z.A.M.M., Vol. IX, Pt. 6, December, 1929, pp. 466-480.) (5.32/12322 Germany.)

Previous writers have contented themselves with linear blades (Kutta, Konig, Spannhake) or logarithmic spiral blades (Sorensen, Schulz, Busemann) which lend themselves to conformal transformation. In the present paper a method of building up the flow round a set of blades of any form is developed by distributions of sources and sinks, by successive approximations.

*Discharge Coefficients of Nozzles and Orifices in Thin Plates.* (R. Witte, Z.V.D.I., Vol. LXXIV, No. 2, 11/1/30, p. 47.) (5.32/12323 Germany.)

The discharge coefficients of throttle plates for various ratios for diameter of hole to tube showed considerable variation at small Reynolds numbers. The standard nozzle showed similar variations. More consistent nozzle results can be obtained by suppressing the cylindrical portion. Small variations in the type edge of the orifice affected the results. At high Reynolds numbers these variations disappear and both meters are considered to be accurate within $\frac{1}{2}$ to 1 per cent. if the conditions of steady flow are not disturbed. A straight entry of 15 diameters generally produces steady flow. Honeycombs in the pipe circuit are not considered advisable.

*D.V.L. (German) Full-Scale Experiments; the Heinkel H.D. 44 and the Albatros L. 79 " Kobold."* (Airc. Eng., Vol. II, No. 11, January, 1930, p. 20.) (5.322/12324 Germany.)

Some details are given of these aeroplanes, of which the first is designed for carrying different engines, and the second for the study of symmetrical wing profiles.

*Flow through Pipe Orifices at Low Reynolds Numbers.* Johansen, F.C., Proc. Roy. Soc., Vol. CXXVI, No. A.801, pp. 231-245.) (5.325/12325 Great Britain.)

A visual study of a fluid flowing through a circular opening in a diaphragm in a pipe for Reynolds numbers varying from 30 to 2,000. The configuration of flow passes steadily from laminar through sinuous and regularly periodic to

turbulent flow. Four apertures were used each of which gives a unicursal curve throughout the whole range.

*Discharge Coefficients for Standard Nozzles and Orifices for Pipes with Diameters Ranging from 100 to 1,000 mms.* (M. Jacob and F. Kretzschmer, Forschungsarbeiten, No. 311, 35 pp. (Eng. Abstr. No. 39, April, 1929, p. 16).) (5.325/12326 Germany.)

The coefficient of the nozzle was found to increase with the value of the Reynolds number measured at the throat of the nozzle. Between R = 100,000 and R = 1,000,000 the coefficient is found to change from .96 to .99 with an accuracy of ± 1 per cent. For an orifice in a pipe the discharge coefficient depended both on Reynolds number and on pipe diameter, the accuracy being ±2 per cent. Extrapolation may be permissible from results at Reynolds numbers exceeding 1,000,000 but not from low values of R, as the type of flow appears to change.

*Measuring the Flow of Steam by Calibrated Nozzles and Especially by Orifices with Narrow Edges.* (L. Kohler, Soc. Ind. Mul. 94, 667-699 (Eng. Abstr. No. 39, April, 1929, p. 17).) (5.325/12327 Germany.)

For accurate metering of steam a specially shaped orifice with a narrow edge of not more than 1/50th of its diameter is recommended. With strict attention to dynamic similarity the discharge coefficients obtained under a set of standard conditions can be used over wide limits. An accuracy of .5 per cent. is claimed.

*Determination of Coefficient of Friction in Long Distance Gas Leads.* (E. Guman, V.D.I., Vol. LXXIV, N. 4, 25/1/30, pp. 107-110.) (5.325/12328 Germany.)

Experiments were carried out on a concrete pipe 10in. in diameter and approximately 30 miles long. For Reynolds numbers between $10^6$ and $1.5 \times 10^6$ the coefficient of friction was approximately 1.05. The results agree fairly well with a calculated figure for methane.

*Airflow through Suction Valve of Conical Seat.* (K. Tanaka, Aeron. Res. Inst., Tokyo, Reports Nos. 50 and 51, Oct., 1929.) (5.325/12329 Japan.)

The author selects four different types of flow. At the same time measurements were made of air velocities as functions of pressure drop and of valve lift. The results are given both in tables and graphically. The effects of changing the form of valve and rounding off the corners are also discussed. Values calculated approximately on the assumption of adiabatic efflux, taking equal effluxes to calculated pressure heads, are somewhat lower than the observed ones.

In Part 2 the methods of conformal transformation are applied to obtain calculated values of efflux for a given head under various conditions as to shape of orifice, channel walls, etc. These involve elliptic functions in general. Four cases are worked corresponding to the four types of flow mentioned in Part 1 and further types of flow are suggested. The calculated results are tabulated for comparison with the experimental results. The third type of flow is the simplest and a diagram shows close agreement between calculation and experiment. In the second and third types of flow the discrepancies are more considerable and somewhat erratic. In the second type of flow the agreement seems less convincing but it is not unsatisfactory. In the first type of flow the same remarks apply. In case 4 the order of the discrepancies appears to lie between that of case 3 and those of cases 1 and 2.

Seventy excellent photographs exhibiting the configuration of flow through valves with conical seats are reproduced.

*Variable Flow in Pipes.* (H. Bateman, Phys. Rev., Vol. XXXV, No. 2, 15/1/30, pp. 177-183.) (5.325/12330 U.S.A.)

Brief general reference is made to previous work on the flow of a viscous fluid in pipes and channels.

For long channels or pipes (neglecting end effect and assuming laminar flow) solutions are offered as definite integrals for particular assumptions as to time—variable pressure gradient along the axis.

*Water Pressure Distribution upon a Seaplane Float.* (F. L. Thompson, N.A.C.A. Report, No. 290, 1928.) (5.34/12331 U.S.A.)

The apparatus for measuring the pressure consists of a series of pistons of unequal external and equal internal areas. The latter are subjected to equal pneumatic pressure adjusted so that increasing water pressure will move the pistons successively. The number of pistons displaced at any instant is indicated by electric transmission.

*Gearing of Aircraft Propellers.* (T. P. Wright and R. E. Johnson, S.A.E., Vol. XXV, No. 6, Dec., 1929, pp. 667-672.) (5.451/12332 U.S.A.)

The authors discuss the advantages and disadvantages of reduction of gearing between engine crankshaft and propeller hub.

*Snow-Landing Carriage.* (Aviation, Vol. XXVIII, No. 2, 11/1/30, p. 74.) (5.5/12333 U.S.A.)

A photograph is given of a combination of wheels and short flat skids for landing on snow.

*American Civil Aviation Machines.* (K. H. Ruhl, Z.V.D.I., No. 45, 9/11/29, pp. 1603-1608.) (5.6/12334 Germany.)

American civil aviation on the large scale is the product of the last two years, when a change over from post, freight and occasional passenger traffic to whole time passenger traffic occurred. The article describes the most important types of American aircraft. Both monoplanes and biplanes are built. The characteristic of the American design is the general use of chrome-molybdenum steel for fuselage, the tubular members being generally welded. For the rest of the structure a mixture of light alloy and wood is employed. The air-cooled engine holds the field at the moment.

## *Navigation*

*Echo Sounding.* (Hydro. Rev. 5, pp. 107-139 (Eng. Abstr., No. 39, April, 1929, p. 25).) (6.332/12335 Monaco.)

The systems of echo sounding are discussed :—(1) Langevin-Florisson, (2) Marti, and (3) Behm. The first is of the super-sonic type and details are given of the electric emitter, the super-sonic projector and the optical detector in the form of a Dubois oscillograph. The Marti system is of the echo type and usually employs an electric hammer which strikes the side of the ship and so emits the sound wave. The Behm echo sounder described employs the explosion of a cartridge under water as the source of sound, the complete instrument weighing less than 20 lbs.

*A Course-Shift Indicator for the Double Modulation Type Radio Beacon.* (H. Diamond and F. W. Dunmore, Bur. Stan. J. Res., Vol. III, No. 1, July, 1929, pp. 1-11.) (6.35/12336 U.S.A.)

A description is given of the system instituted by the Bureau of Standards, with a diagram of the connections, a photograph of the apparatus and charts of records. It is stated that its chief advantage over the reed indicator lies in

the extremely sharp indication of course made possible by its use. The disadvantages are those of greater weight, greater signal strength required for operation, and greater chance of injury to moving parts. From the point of view of freedom from atmospheric disturbances or other interferences the reeds are, under constant conditions of use, much preferable, since much sharper tuning may be obtained mechanically at the low modulating frequencies employed.

*Surface Heat-Flow Gauge.* (A. Blackie, J. Sc. Inst., Vol. VII, No. 1, Jan., 1930, pp. 7-14.) (6.531/12337 Great Britain.)

In calculating the loss of heat on the surface a coefficient of emissivity is assumed and Stefans' law is used for radiation loss. A simple empirical formula is given for convection loss in the absence of draughts due to external causes. The second formula also involves a coefficient which depends on the size, shape and position of the surface, and it is difficult to estimate. The instrument described is applied to a portion of the surface, and the flow of heat from surface to instrument is measured directly. Both the surface presented to the radiating object and the parallel surface presented to the external air are mat-blacked, so that when steady conditions are reached the total flow of heat is noticed only to the extent of the difference between the mat-black surface and a perfectly black body. The somewhat complicated details of the operation and of the necessary precautions are described and the result is stated to be within a few per cent. of direct calculation from the surface temperatures.

*Relative Visibility of Luminous Flashes from Neon Lamps and from Incandescent Lamps with and without Red Filters.* (F. C. Breckenridge and J. E. Nolan, Bur. Stan. J. Res., Vol. III, No. 1, July, 1929, p. 11.) (6.61/12338 U.S.A.)

Author's Summary:—The visibility of light derived from an incandescent lamp with a red filter has been tested in comparison with that of light from a neon lamp and also with that of a similar incandescent lamp without the filter. Especial attention was given to producing beams having similar candle-power distributions. The tests include a variety of clear, hazy, rainy, and foggy weathers and ranges up to 7 km. The results indicate no advantage in the case of the neon lamp and a loss of visibility in all weathers from the use of the filter.

*Endurance Tests on Ball Bearings.* (O. Föppl, Masch, 8.189 (Eng. Abstr. No. 40, July, 1929, p. 149).) (6.751/12339 Germany.)

Three types of ball bearings were tested under direct loads with and without axial loads. Two of the bearings were rigid, the third being self-aligning. The effect of the load on the life of the bearing was small. The rigid bearing containing a large number of balls was superior to the self-aligning type.

*Speech Power and its Measurement.* (L. J. Sivian, Bell Tel. Lab. B.433, November, 1929.) (6.76/12340 U.S.A.)

A review is given of the various instruments for measuring the intensity of sound waves, commencing with the Rayleigh disc and the hot wire microphone, and other instruments measuring the pressure rather than the energy in which they resemble the mechanism of the ear. Preference is expressed for an instrument comparatively recently designed in the Bell Laboratory which gives oscillograms of the instantaneous pressures throughout the duration of the sound. A similar device has been evolved by the Siemens group in Germany. The average flow of energy in an ordinary speaking voice is of the order of 10 microwatts, the average pressure about 5 bars.

(Abstractor's note.—This is the unit of pressure in the C.G.S. system and corresponds to one microbar in the inconsistent meteorological usage.)

*The Measurement of Noise. Experiments Carried Out during the German Competition for Engine Silencers.* (Prof. Wawrziniok, Autom. Tech. Zeit., Vol. XXXII, No. 35, 20/12/29, pp. 832-834.) (6.76/12341 Germany.)

The noise to be measured is directly compared with the standard noise, the two sounds being alternately emitted through a loud speaker placed in a sound insulated room. Balance is obtained by reducing the intensity of the reproduction of the noise to be measured till the ear can no longer distinguish between the two loud speaker notes emitted at regular consecutive intervals. The amount of resistance in the circuit measures the intensity.

*Acoustic Wave Filters.* (G. W. Stewart and C. W. Sharp, J. of Opt. Soc. Am., Vol. XIX, No. 1, July, 1929, pp. 17-28.) (6.76/12342 U.S.A.)

Author's Summary :—The simplified theory of Stewart and the less approximate theory of Mason are compared with experimental measurements with respect to the mid-series characteristic acoustic impedance of a high-pass, a low-pass and a single-band-pass filters. The comparison is made over a large range of frequencies, including a considerable portion of both the attenuation and transmission regions. There is remarkable agreement between theory and experiment, considering the approximations that are made in the theories. For the low-pass filter there seems to be no appreciable advantage of the more accurate theory of Mason. In the other two cases, however, there is a distinct superiority for this theory. For purposes of ascertaining cut-offs and the characteristic impedance for the low-pass filter the simpler theory of Stewart is more readily applicable.

*Analysis of Measurement of Noise Emitted by Machinery.* B. A. G. Churcher and A. J. King, Jrnl. I.E.E., Vol. LXVIII, No. 397, Jan., 1930, pp. 97-131.) (6.76/12343 Great Britain.)

Author's Summary :—The physical magnitudes involved in the measurement of the sound set up by a vibrating body are discussed generally, together with the characteristics of the ear. The characteristics that should be possessed by sound-measuring apparatus intended for use in engineering problems are stated, and a brief survey is made of existing types of apparatus. The principle, development and final form of an apparatus, which enables a complete analysis of a complex sound to be made, are described, together with the methods employed to verify the accuracy. A special laboratory which has been set up for acoustical work is described. Some sound-test results on engineering apparatus are given as examples.

*Measuring Apparatus.* (J. Zahradnicek, Phys. Zeit., Vol. XXX, No. 24, 15/12/29, p. 925.) (6.95/12344 Germany.)

Two instruments are described, with illustrations; the first a new extensometer, and the second an instrument for measuring the thermal expansion of rods.

*Instruments: Exhibition of the Physical and Optical Society.* (J. Sc. Inst., Vol. VIII, No. 2, February, 1930, pp. 49-76.) (6.95/12345 Great Britain.)

An extensive report is given of the principal exhibits.

*Guggenheim Competition.* (U.S. Air Services Mag., Vol. XXV, No. 2, February, 1930, p. 43.) (7.0/12346 U.S.A.)

The first prize in this competition has been awarded to the Curtiss Aeroplane Co. A descriptive account is given with a dimensioned diagram, and a photograph showing the automatic slot open, and the weathercock ailerons.

*Kinematographic Measurement of the Motion of an Albatross L.68 Aeroplane in a Spin.* (W. Hübner and W. Plaines, Z.F.M., No. 30 (Eng. Abstr., No. 39, April, 1929, p. 186).) (7.14/12347 Germany.)

The spins were carried out vertically above the camera at low altitudes. Full details of the method of analysis are given. For the particular aeroplane chosen (L.68) the spin was steady at an angle of incidence of 38°.

## *Aircraft Engines*

*The Development of the Aero Engine.* (Report at General Meeting of D.V.L., Z.V.D.I., Vol. LXXIII, No. 52, 27/12/29, pp. 1863-1864.) (8.0/12348 Germany.)

The following papers were presented :—

1. The development of the aero engine.
2. The influence of engine weight on performance.
3. Crankshaft oscillation.
4. Thermodynamic development.
5. Laboratory installations.

The development of aero engines during recent years has been in the direction of increased performance per litre of stroke volume, the weight per litre not changing materially, with consequent decrease of reliability. It is recommended that engines should be run for type reliability tests under high overload on the basis of which a guarantee of minimum life at a definite fraction of the test load might be possible. The ratio, test load/normal load, would correspond to the structural factor of safety of an aircraft.

*Investigation of (Torsional) Oscillations in the Engines of the "Graf Zeppelin."* (145th Report of D.V.L., W. Kamm and A. Stieglitz, Z.F.M., Vol. XX, No. 18, 28/9/29, pp. 465-474.) (8.22/12349 Germany.)

The "Graf Zeppelin" was equipped with 5 Maybach engines, type VL-2, 12 cyl., 550 h.p., 1,600 r.p.m. On 16th May, 1929, the airship started on a flight to U.S.A. Within 30 hours 4 out of 5 engines broke down, through fracture of the engine shaft or of the clamps fixing the balance masses to the shaft. All the fractures had the characteristics of fatigue failure. The engine which remained in service (36 hours) developed a crack in the balance-mass clamp on further test at a total of 52 hours, while the other four engines had run from 350 hours to 450 hours on previous tests. The only change in the conditions was an increase in the tension of the springs in the spring coupling. A previous abstract (No. 11741, Issue No. 12) referred to the carrying out of stress investigations. The present article gives additional data and torque diagrams. In particular the effect of altering the spring tension in the spring coupling is exhibited. With the particular tension used in the unsuccessful flight, the maximum torque reached 400 m.k.g. at 1,375 r.p.m., whereas with the previous setting the maximum was 240 m.k.g. at the same r.p.m., and with the setting since adopted the maximum is 200 m.k.g. at 1,240 r.p.m. In the last case there is indication of a serious rise towards a higher value above 1,600 r.p.m., which is, however, the maximum service speed.

*Torque Measurements by Magnetisation (Inverse Wiedemann Effect.* (T. Kobayasi, Report No. 52, Aero. Res. Inst., Tokyo, Imperial University, Vol. LV, No. 11, pp. 425-445.) (8.22/12350 Japan.)

Application of torque to a round mild steel bar carrying an axial electric current produces axial magnetisation.

A diagram shows the arrangement whereby a shaft interposed between engine and brake flywheel carries electric current, while a fixed coil enclosing the shaft measures the variation of the magnetic flux by an oscillograph. The relation

between change of torque and change of flux is calibrated, and the oscillograph record yields by integration the torque curve itself.

Calibration curves and torque diagrams are reproduced. A modification of the procedure permits of the use of a.c. current, and an example of a torque diagram, thus obtained, is reproduced. Various corrections are discussed.

*Stresses in a Strip with a Circular Hole.* (R. C. J. Howland, Phil. Trans. Roy. Soc. A.229, 6/1/30, pp. 49-86.) (8.24/12351 Great Britain.)

A series of biharmonic stress functions is defined, the first of which gives zero stress at the hole and residual stresses at the edge, the second removes the residual stresses at the edge, but introduces residual stresses at the hole and so on alternately. Numerical results are computed and tabulated and are compared with Coker's experimental results by the stress optical methods.

The calculated maximum stresses are, in general, higher than those given by stress optical methods.

*Torsion of Round Shafts of Variable Diameter.* R. Sonntag, Z.A.M.M., 9, 1-22 (Eng. Abstr. No. 40, July, 1929, p. 117).) (8.22/12352 Germany.)

Approximate solutions for the differential equation determining the stresses in twisted shafts are given in terms of simple formulæ. Consideration is given to the effect of sudden changes in diameter.

*Researches on the Piston Ring.* (Keikiti Ebihara, Inst. Phys. and Chem. Res., Sc. P., No. 182, 79 pp. (Eng. Abstr. No. 40, July, 1929, p. 94).) (8.24/12353 Japan.)

The gas tightness of the ring depends very little upon the number of rings fitted, but chiefly on the closeness of the fit between the ring surface and the cylinder wall. An instrument is described for determining this fit with great accuracy.

*Effect of Fuel on Cylinder Temperatures and Performance of a Cowled Wright J.5 Engine.* (O. W. Schey, N.A.C.A. Tech. Note No. 328, Nov., 1929.) (8.24/12354 U.S.A.)

Author's Summary :—Sixty-nine iron-constantan thermo-couples and three recording pyrometers were used for obtaining measurements of cylinder temperatures. The test conditions in the tunnel simulated those of full throttle climbing on a hot day. All tests were conducted at air speeds of approximately 80 m.p.h. Six different sizes of jets, varying from No. 51 to No. 46 drill size, inclusive, were used to vary the rate of fuel flow. The cylinder temperatures with the leanest mixture were in some cases almost 800°F. Enriching the mixture by varying the jet size from No. 51 to No. 46 resulted in a mean reduction of about 200°F.

*The Effect of Cowling on Cylinder Temperatures and Performance of a Wright J.5 Engine.* (O. W. Schey and A. E. Biermann, N.A.C.A. Report No. 332, January, 1930.) (8.38/12355 U.S.A.)

For the cabin fuselage with the N.A.C.A. cowling, which completely enclosed the engine and took in all of the cooling air through a 28-inch diameter opening in the nose, the drag was reduced 40 per cent. at 100 miles per hour, as compared with the same unit with no cowling on the engine. The mean temperatures of the spark-plug boss and the cylinder head were slightly reduced for the same test conditions, but the barrel temperatures were increased.

*The Lubrication of Engines.* (O. Thornycroft and C. H. Barton, Airc. Eng., Vol. II, No. 12, Feb., 1930, p. 36.) (8.4/12356 Great Britain.)

The article gives a survey of lubrication as it appears to the chemist. Much useful information from practice is given.

*Friction Coefficient Research.* (L. Illmer, S.A.E., Vol. XXVI, No. 1, Jan., 1930, pp. 67-86.) (8.4/12357 U.S.A.)

Author's Abstract:—A comprehensive survey directed towards perfect oil-film lubrication. An endeavour is made to correlate empirically the experimental results obtained by different investigators and to establish certain underlying principles common to all such tests in which the frictional resistance depends primarily upon fluid shear. A reasonably reliable but relatively simple method for predetermining certain kinds of friction losses has been deduced.

*Carbon Deposits from Lubricating Oils. Experiments with Heavy Duty Engines.* (C. J. Livingstone and W. A. Gruse, Ind. Eng. Chem., 1929, 21, 904-908, cf. B. 1926, 571 (Brit. Chem. Abstr. B, Vol. XLVIII, No. 51, 20/12/29, p. 1003).) (8.41/12358 U.S.A.)

Prolonged road tests of sleeve-valve engines have shown that cleaning of the engine ports when lubricated with naphthenic base oils was necessary every 9,000 miles and with paraffinic oils every 2,000 miles. This is not borne out by carbon residue tests. Special tests are described for the suitability of oils for sleeve-valve engines.

*Reaction between Lubricating Oils and Phosphorus Pentoxide.* (C. C. Furnas, Ind. Eng. Chem (Anal.), 1929, 1, 185 (Chem. Abstr. and Ind. Supplement, Vol. XLVIII, No. 52. 27/12/29, p. 1039).) (8.41/12359 U.S.A.)

Under certain experimental conditions it was found that phosphorus pentoxide dust produced a thick gummy deposit when added to lubricating oil at a temperature of about 30°C. The addition of water caused the gum to disappear.

*Technique of Practical Lubrication.* (A. Mosser, Petroleum, 1929, 25, Motorenbetrieb, 2, No. 12, 3-10 (Brit. Chem. Abstr. B, 31/1/30 and 7/2/30, p. 85).) (8.41/12360 Germany.)

Hot running engines give better experimental results with clear cylinder oils of low flash point than with dark asphaltic cylinder oils of high flash point.

*The Relation between Physical Characteristics and Lubricating Values of Petroleum Oils.* (E. D. Ries, Ind. Eng. Chem. Anal. Ed. 1, 187-91 (1929) (Chem. Abstr., Vol. XXIII, No. 22, 20/11/29, p. 5564).) (8.41/12361 U.S.A.)

Paraffin base oils have a smaller decrease of viscosity from 100°F. to 210° than naphthene base oils. Of the oils tested, vacuum distilled paraffin base oil had its viscosity least affected by temperature.

*The Pyrogenation of Mineral Oils.* (G. Dixmier, Chimie and Ind. Special No., 272-4 (Feb., 1929) cf. C.A. 22, 4238 (Chem. Abstr., Vol. XXIII, No. 16, 1929, p. 4054).) (8.41/12362 France.)

In oxidation tests it is important that the reaction should not be limited to the surface of the oil. To obtain data applicable to engine conditions the surface in contact with the oil should be continuously changed.

*The Oxidation of Mineral Oils.* (M. van Rysselberge, Chimie and Ind. Special No., 275-88 (Feb., 1929) (Chem. Abstr., Vol. XXIII, No. 16, 1929, p. 4052).) (8.41/12363 France.)

The work of Moureu has suggested that the oxidation of lubricating oil could be affected by the addition of so-called anti-oxygen compounds. It is suggested that moderately fine oils receive a certain amount of protection by

primary oxidation of the contained resinous compounds. In fully refined oils such protection is absent and oxidation will yield free acids. The new line of investigation is considered to be of importance, and further report is in hand.

*New Methods of Testing Oils.* (B. Marschalko and I. Barna, Intern. Congress Testing Materials, 1927, II, 415-27 (Chem. Abstr., Vol. XXIII, No. 16, 1929, p. 4053).) (8.41/12364 U.S.A.)

The stability of lubricating oil is determined by heating a thin film of oil in oxygen. The carbon dioxide and water formed are absorbed chemically and the quantity of oxygen consumed is the measure of the stability.

*Methane.* (42nd Meeting of the German Chemical Society, Z.V.D.I., Vol. LXXIII, No. 45, 9/11/29, p. 1619.) (8.5/12365 Germany.)

A method is described for separating methane from coke oven gas. The methane is compressed and used as fuel for internal combustion engines, and in certain parts of Germany can compete in price with petrol.

*Aircraft and Motor Car Fuels.* A Symposium of four Papers. (E. Rackwitz and A. Philippovich, D.V.L. Reports Nos. 151-2-3-4, L.F.F., Vol. V, Pt. 4, 28/11/29, pp. 157-162.) (8.51/12366 Germany.)

1. The testing of aircraft fuels in Germany.
2. Fuel specifications for aircraft and motor cars.
3. The behaviour of fuels at low temperatures as determining their suitability in aircraft.
4. The sulphur content of fuels and its importance in the running of aircraft engines.

German fuel specifications alone require engine tests in addition to physical and chemical tests, but probably other countries will soon follow. Assessment of quality may be made by comparison with a standard fuel or by performance in a standard engine under specified conditions. As a compromise the German fuel specification simply requires that "the fuel must function without difficulty in an air-cooled Siemens or water-cooled B.M.W. cylinder of 6 compression ratio." Sulphur is permitted up to .30 per cent. compared with the British limit of .05 per cent. without undue corrosion. In discussing the stability of mixed fuels at low temperatures it appears that German benzol often contains traces of water, and to prevent ice formation in petrol-benzol mixtures the addition of small quantities of methyl alcohol is recommended.

*Flame Characteristics of "Pinking" and "Non-Pinking" Fuels.* (G. B. Maxwell and R. V. Wheeler, J. Inst. Petroleum Tech. 15, 408-15 (1929), cf. C.A. 22, 3038 (Chem. Abstr., Vol. XXIII, No. 22, 20/11/29, p. 5566).) (8.51/12367 U.S.A.)

It is concluded that the phenomenon of pinking is due to stationary waves set up in front of the initial flame, combined with sufficient residual energy to maintain a shock wave in that portion of the medium which has already been traversed by the flame. Turbulence prevents detonation both by accelerating the combustion behind the flame and by preventing the formation of stationary waves in front of the flame. Dopes, such as tetraethyl lead, act by reducing the amount of residual energy and rendering the combustion continuous behind the flame front.

*The Pyrolysis of the Paraffins.* (E. N. Hague and R. V. Wheeler, Fuel, Vol. VIII, No. 12, Dec., 1929, pp. 560-587.) (8.51/12368 Great Britain.)

A study was made (1) of the changes in composition of the gases when maintained at different temperatures during measured intervals of time, (2) of

the effect of allowing the gas to flow through a heated tube in a circulation apparatus, and (3) of the products obtained when a stream of hydrocarbon, in larger quantities than in (1) and (2), passed through a heated tube. The most striking feature is the similarity in behaviour of all the hydrocarbons, methane included, at the higher temperatures. Below 750°C., when the primary decompositions are taking place, each hydrocarbon follows its own course, but at the higher temperatures the (secondary) reactions are similar for all.

*Distillate Yields in Cracking.* (S. A. Kiss, Ind. and Eng. Chem., Vol. XXII, No. 1, Jan., 1930, p. 10.) (8.51/12369 U.S.A.)

Author's Abstract :—The law of the monomolecular reaction velocity has been applied to the calculation of distillate yields in cracking. Several formulæ have been developed, covering three types of cases—cracking with by-products, cracking without by-products, and cracking with by-products and secondary decomposition.

Some formulæ have been established giving the cracking rate as function of the temperature.

*Studies on Production of Acetylene from Methane—Cracking under Vacuum.* (K. Frolich, A. White and H. P. Dayton, Ind. and Eng. Chem., Vol. XXII, No. 1, p. 20.) (8.51/12370 U.S.A.)

Author's Abstract :—A study of the cracking of substantially pure methane has been made at temperatures above 1,000°C., and pressures ranging from atmospheric down to 25 mm. Acetylene is a main primary product but has a marked tendency to polymerize into benzene and similar compounds, or decompose further into carbon and hydrogen so that it becomes necessary to employ exceedingly short times of contact. Within the range studied it has not been shown that pressure below atmospheric has any appreciable effect on the acetylene yield.

*Aviation Fuel from Natural Gas.* (Messrs. Oberfell, Legalski and Parker, U.S. Air Service Mag., Vol. XXV, No. 2, February, 1930.) (8.51/12371 U.S.A.)

Numerous data are given of the results of fractional distillation of fuel recovered from natural gases. Tables of the effect of higher paraffins are given. Certain advantages are claimed for this type of fuel.

*Gasoline Content of Natural Gas.* (M. Shepherd, Bur. of Stds. Jnl., Vol. II, No. 6, June, 1929, pp. 1145-1199.) (8.51/12372 U.S.A.)

A systematic standard method is laid down and photographs of the apparatus and diagrams of the progressive fractionation are given.

*German Patent No.* 482931, *September* 10*th,* 1926. (8.51/12373 Germany.)

Mixtures of mineral oils and aliphatic alcohols are rendered stable by treatment with nascent hydrogen. The emulsions are used in the textile industry and as fuels.

*Content of Gum and Gum-Forming Substances in Motor Fuel.* (Autom. Tech. Zeit., Vol. XXXII, No. 34, 10/12/29, p. 794.) (8.51/12374 Germany.)

In the usual copper dish method of testing for gums and fuels the catalytic effects of the dish and variation in the rate of evaporation are apt to lead to erratic results. It is proposed to use pyrex glass instead of the copper and to determine the dissolved gum content by heating 50 cc. samples in a slow current of steam between 160° and 180°C. for 10 hours. The potential gum content is determined by heating 25 cc. of the petrol in a half litre pyrex glass for 5

hours with oxygen under pressure. The dissolved gum only is responsible for producing deposits on the valve stems. Fuel with a gum content up to 40 milligrams per 100 cc. are generally stable for at least a year, and may be used.

*Experimental Plant for Production of Oil from Wood.* (Ind. and Eng. Chem. (News Edition), Vol. VIII, No. 1, 10/1/30, p. 5.) (8.511/12375 U.S.A.)

An experimental plant has been set up by the Swedish Academy of Scientific Engineering for the production of oil from wood waste on a semi-industrial scale. The wood is hydrogenated under high pressure, under the Bergius system; and the yield is stated to be better than that from brown or black coal.

*Primary Thermal Decomposition of Coal.* (R. Holroyd and R. V. Wheeler, Fuel, Vol. IX, No. 2, February, 1930, p. 76.) (8.511/12376 Great Britain.)

The third of a series of articles giving data of the thermal decompositions of various coals at low temperatures, particularly the yield of oils.

*Low Temperature Carbonisation of Fuel.* (Jnl. I.E.E., Vol. LXVIII, No. 398, pp. 205-236.) (8.511/12377 Great Britain.)

A symposium of papers by:—

(1) S. McEwen, U.S.A., giving figures from American practice showing the discouraging amount of about 3 gallons of light oil per ton.

(2) Prof. P. Rosin, giving figures from German practice, particularly of brown coal carbonisation, showing 7 per cent. production of tar. The fractionation of the tar in turn gives 3 per cent. petrol, 2 per cent. light oil, 65 per cent. fuel oil and 12 per cent. paraffin, so that the total yield of oil is between 5 per cent. and 6 per cent. of the coal.

(3) E. H. Smythe and E. G. Weeks, giving figures from English practice, quoting yield per ton of coal as motor spirit 1 gallon, white spirit 1 gallon, and heavier products.

*Chemistry of Gum Formation by Cracked Gasoline.* (Le R. G. Story, R. W. Provine and H. T. Bennett, Ind. Eng. Chem., 1929, 21, 1079-1084 (British Chemical Abstr., B, Vol. XLIX, No. 3, 17/1/30, p. 45).) (8.512/12378 U.S.A.)

Cracked petrols rapidly absorb oxygen, especially when exposed to light, yielding cloudy deposits of a gummy nature. The copper dish test for gum content is unreliable, since it depends on the quantity of oxygen present, the volatility of the fuel and the catalytic influence of the dish. Steam distillation gives a lower result, since it only deals with dissolved gum and gives no indication as to potential gum formation.

*Manufacture of Non-Knocking Engine Fuels of the Benzine Type by Destructive Hydrogenation.* (I. G. Farbenind, B.P. 296, 984, 22/8/28, Ger., 10/9/27 (Brit. Chem. Abstr. B, Vol. XLIX, No. 3, 17/1/30, p. 48).) (8.514/12379 Great Britain.)

A mixture of American crude oil and coal tar in the proportion of 3 – 1 is hydrogenated at 200 atmospheres and 460°C. This produces a volatile fuel of high knock ratio. When crude oil alone is hydrogenated the compression ratio of the resultant fuel is considerably lower, and requires the addition of dopes.

*Anti-Knocks.* (A. Scharschmidt and H. Hofmeier, 42nd Meeting of the German Chemical Socy., Z.V.D.I., Vol. LXXIII, No. 45, 9/11/29, p. 1620.) (8.514/12380 Germany.)

The decomposition of dopes such as iron carbonyl or lead ethyl depends on the nature of the fuel used. Iron carbonyl is considerably more effective than lead tetraethyl in suppressing detonation.

*Methanol.* (Chem. and Met. Eng., January, 1930, Vol. XXXVII, 1, p. 60.) (8.516/12381 U.S.A.)

U.S.A. consume approximately 10,000,000 gallons of methanol per year. During 1929 the output of synthetic methanol amounted to 4½ million gallons. A production of 7,000,000 gallons is estimated for the year 1930.

*Development in Fuelling Stations for Airports.* (Luftwacht, No. 11, Nov., 1929, p. 517.) (8.546/12382 Germany.)

An account is given of the principles of rapid fuelling of aeroplanes at main and intermediate airports, with a photograph of the installation at Halle, which is much frequented by aeroplanes *en route,* and a diagram of the fuelling arrangements at Böblingen, near Stuttgart. Figures are also given of the delivery in litres per minute of the installations at several airports.

*Some Recent Researches on Flame Movement in Gaseous Explosions.* (R. P. Fraser, J. Soc. Chem. Ind. Trans. and Comm., 21/2/30, p. 99.) (8.57/12383 Great Britain.)

From the study of photographs mainly of flame arrest and of compression waves set up by burning gases, in tubes, it appears that detonation is immediately produced by the flame on overtaking a shock wave but never by a shock wave on overtaking the flame. Pressure waves probably play a predominant part in producing knock. The author considers photographic records of combustion as the only satisfactory basis of studying engine phenomena.

*Gaseous Explosions. Effect of Lead Tetraethyl on Rate of Rise of Pressure.* (M. S. Carr and G. G. Brown, Ind. Eng. Chem., 1929, 21, 1071-1078, cf. A., 1928, 1331 (Chem. and Ind. Supplement, Vol. XLVIII, No. 52, 27/12/29, p. 1037).) (8.57/12384 Great Britain.)

From experiments with fuel mixtures of different strength and different rate of burning, it is suggested that the accelerating effect in fast burning mixtures is due to explosive decomposition of tetraethyl lead in the flame front. In slow burning mixtures the decomposition proceeds through the mixture at a greater rate than the inflammation, and retards the rate of the ultimate flame progression.

*A Theory of Flame Motion.* (P. J. Daniell, Proc. Roy. Soc., Vol. CXXVI, No. A. 802, 3/2/30, p. 393.) (8.57/12385 Great Britain.)

The velocity is defined as the rate of flow of gas in an indefinitely long tube required to maintain the flame surface at rest. The rate of the chemical reaction is the fundamental factor. The usual variables also enter into the equations. Attention is restricted to velocities slow in comparison with the velocity of sound in the gas, where the results fail. Differential equations of the motions are formed and solved, and some numerical results are given. There are no comparisons with experiments.

*Combustion of Hydrogen.* (F. Harber, 42nd Meeting of the German Chem. Socy., Z.V.D.I., Vol. LXXIII, No. 45, 9/11/29, p. 1619.) (8.57/12386 Germany.)

The combustion of hydrogen is a chain reaction: (i) production of 2 hydroxyl molecules from the direct action of a hydrogen and oxygen molecule, generally requiring activating heat and only occurring at high enough temperatures; (ii) combination of a hydroxyl molecule with a hydrogen molecule forming water and atomic hydrogen, without activating energy; (iii) recombination of atomic hydrogen and molecular oxygen to reform hydroxyl molecules, without activating energy. The chain proceeds till one hydroxyl molecule and one hydrogen molecule yield water by direct addition.

*Auto-Ignition Temperatures.* (H. J. Masson and W. F. Hamilton, Ind. and Eng. Chem. 20, 813-816 (Eng. Abstr. No. 39, April, 1929, p. 99).) (8.57/12387 U.S.A.)

The auto-ignition temperatures of pure substances are affected heavily by contamination either of the substance or of the surface of the apparatus. Activation of the platinum surface gradually increased the ignition temperature and finally by nearly 100° in the course of six weeks of repeated measurements.

*Spontaneous Combustion of Mixtures of Air and Hydrocarbons—Influence of Concentration.* (P. Mondain-Monval and B. Quanquin, Comp. Rend., Vol. CLXXXIX, No. 26, 23/12/29, pp. 1194-1196.) (8.57/12388 France.)

From the study of flame records as well as indicator diagrams it is concluded that an exothermic flameless reaction precedes under suitable conditions the normal inflammation of the mixture.

*Effects of Air Flow on the Penetration and Distribution of Oil Sprays.* (A. M. Rothrock and E. G. Beardsley, N.A.C.A. Tech. Note No. 329, Dec., 1929.) (8.57/12389 U.S.A.)

Author's Summary :—The fuel oil was injected at 6,000 lbs. per sq. in. pressure. Four nozzles were tested, one containing seven orifices and three containing single orifices with diameters of 0.006, 0.012 and 0.022in. respectively.

Curves and photographs are presented showing the airflow throughout the chamber and the effects of the airflow on the fuel spray characteristics. It was found that the moving air had little effect on the spray penetration except with the 0.006in. orifice, but did affect the oil particles on the outside of the spray cone. After spray cut-off the airflow rapidly distributed the atomized fuel throughout the spray chamber.

A list of 9 references and numerous diagrams and photographs of flow are given, and curves of velocity, penetration, etc.

*Diffusion Flames.* (S. P. Burke and T. E. W. Schumann, Ind. and Eng. Chem. 20, 998-1004 (Eng. Abstr. No. 39, April, 1929, p. 100).) (8.57/12390 U.S.A.)

An equation is evolved for determining the shape of diffusion flames which arise when combustion coincides with a mixture of gas and air. The results are confirmed by experiment, which also indicate that preheating of the gas or air has no effect on the size of the flame.

*Diesel Engines.* (V.D.I., Vol. LXXIV, No. 2, 11/1/30, p. 57.) (8.59/12391 Germany.)

The firm of Burmeister and Wain have built a double acting 2-stroke engine possessing a novel type of exhaust valve. The scavenging air is introduced in the middle of the cylinder, the exhaust valves at either end are pistons which uncover radial slots. The valve pistons are linked up to the crankshaft in such a manner that they share in the work of expansion, and contribute approximately 10 per cent. to the total work of the crankshaft.

*Diesel Engine Scavenging.* (A. Schor, Werft, 10, 131-134 (Eng. Abstr. No. 40, July, 1929, p. 105).) (8.59/12392 Germany.)

Crankcase scavenging is not sufficiently powerful for engines in excess of 400 b.h.p. For higher powers the author favours the direct driven piston pump unless electric power is available, in which case a considerable saving in floor space is gained by using an electrically driven turbo-blower.

*The Junkers Heavy Oil Engine.* (L'Aérophile, Vol. XXXVII, No. 23-24, 1/12/29, p. 371.) (8.59/12393 France.)

The engine has double opposed pistons and six cylinders in line, bore 120, combined double stroke 210 mms., crankshaft speed 1,600 r.p.m., maximum power 700 b.h.p., fuel consumption .39 lbs. per b.h.p./h., compression ratio 14, airscrew speed 11,000 r.p.m. The reduction gear is incorporated in the spur-wheel transmission between the two crankshafts.

*Experimental and Analytical Determination of the Motion of Hydraulically Operated Valve Stems in Oil Engine Injection Systems.* (A. G. Gellalles and A. M. Rothrock, N.A.C.A. Report No. 330, January, 1930.) (8.59/12394 U.S.A.)

The computed motion of the valve is expressed by a simple linear differential equation connecting the hydraulic pressure with the valve motion. A correction is made for viscous resistance along fine bore tubes on the assumption of laminar motion. A description is given of photographic apparatus for recording the actual motion of the valve stem. The results are compared in a number of diagrams and show appreciable lag behind the computed values both in opening and closing. The lag increases with the length of the fine bore tube, and the maximum valve lift is reduced. Roughly the former is of the order of 1/1,000th of a second of time, or 20 per cent. of the time of opening; and the latter of the order of 1/200th of an inch or about 20 per cent. of the total lift.

*The Packard Heavy Oil Engine.* (L'Aérophile, No. 23-24, 1/12/29, p. 370.) (8.59/12395 France.)

9-cylinder radial. 4-stroke cycle, with a single valve used alternately for exhaust and inlet, bore 127 mm., stroke 140 mm., explosion pressure about 1,000 lbs. per sq. in., normal rating 160 h.p. at 1,600 r.p.m. Weight/h.p. 6 lbs., fuel consumption .35 lbs. per b.h.p./h.

*The Clerget Heavy Oil Engine.* (L'Aérophile, Vol. XXXVII, No. 23-24, 1/12/29.) (8.59/12396 France.)

Air-cooled, radial, 4-stroke, cylinder governed by lifting the exhaust valve and with an injection pump for each cylinder, bore 120 mm., stroke 180 mm. rated at 100 h.p. for 450 lbs. weight. Satisfactory flight tests are said to have been carried out.

*Combustion Chamber Research.* (H. S. Glyde, Autom. Eng., Vol. XX, No. 264, February, 1930, p. 62.) (8.6/12397 Great Britain.)

Experiments were carried out in a series of 5-valve turbulent heads of the Ricardo type, the head clearance varying from .02 to .27 of an inch. Indicator diagrams were taken and attempts were made to connect the rate of pressure rise with the H.U.R.C. and general running conditions of the engine. It was found that the critical part of the diagram from the point of view of roughness of running was that joining the compression with the explosion pressure line. By suitably dimensioning the combustion head higher rate of pressure rise can be combined with high H.U.C.R. and smooth running. This is obtained by igniting a stagnant isolated layer of gas making up 10–25 per cent. of the clearance volume. On these principles the recently patented Ricardo short absorber head is based.

*The Effect of Supercharger Capacity on Engine and Airplane Performance.* (O. W. Schey and W. D. Gove, N.A.C.A. Report No. 327, December, 1929.) (8.62/12398 U.S.A.)

A Roots' blower with theoretical swept volume of .382 cu. ft. was used in conjunction with a Liberty engine developing 350 h.p. near the ground. Ground

level pressure was restored at 7,000, 11,500, 17,000 and 22,000 feet respectively, the ratio between engine and supercharger varying from 1.6 to 3. For reliability excessive clearance of the impellors was necessary with considerable drop below the efficiency obtained in the laboratory. A maximum efficiency of approximately 50 per cent. was obtained at the lowest altitude. At 20,000 feet the efficiency was 35 per cent. This indicates an upper limit for the capacity of superchargers of this type.

*Intermediate Superheating by Means of Hydrogen Combustion.* (Wilke, Glaser's Ann. 104, 74 (Eng. Abstr. No. 40, July, 1929, p. 98).) (8.83/12399 Germany.)

Water is electrolysed under high pressure into hydrogen and oxygen and the resultant gases are caused to recombine in the steam passage between the high and low pressure steam turbine, as steam at high temperature which superheats the surrounding steam by intermingling. A combined efficiency of 52 per cent. is estimated.

*The Lorraine Reduction Gear.* (Dipl. Ing. Schneider, Ill. Flug., Vol. XI, 11/11/29, pp. 227-228.) (8.84/12400 Germany.)

The main feature of this planetary reduction gear is copious lubrication by an oil bath, which effects considerable cooling of the gear wheels. Details of gear and mounting are shown.

*Critical Vibrations of Coupled Systems.* (E. Schwerin, Z. Tech. Phys. 10, 37-46 (Eng. Abstr. No. 40, July, 1929, p. 122).) (8.221/12401 Germany.)

In coupled systems the elasticity and the coupling may vary with time. As an example the two-bar drive of an electric locomotive is considered and it is shown that the critical periods are nearly those of a system with constant coefficients, equal to the mean value of the variable coefficients actually existing.

*Star Wheel Drives.* (A. Bock, Z.V.D.I., 73, 397-401 (Eng. Abstr. No. 40, July, 1929, p. 118).) (8.89/12402 Germany.)

The star-wheel drive, a modification of the well-known Maltese cross, has periods of rest and movement which can be varied within wide limits. Methods of design are given for ensuring structural strength and determining the ratio of working stroke to rest.

## *Armament*

*Calculation of Bomb Trajectories.* (G. Bruno, Not. Tec., Vol. VIII, No. 11, Nov., 1929, pp. 1-23.) (9.31/12403 Italy.)

For speeds below 240-260 metres/sec. formulæ are developed and tabulated and specimen trajectories are worked out.

*Artificial Cloud* (Rev. F. Aer., No. 6, Jan., 1930, pp. 97-98.) (9.35/12404 France.)

The chemical firm of Stolzenberg has produced a mobile unit, suitable for emitting 500,000 cubic metres of phosphorus smoke per minute, under steam pressure, used at about one mile from the object to be screened, the orientation depending on the direction of the wind. They have also produced a compressed air smoke-emitter for aircraft in which chloro-sulphonic acid, titanium-tetrachloride, or silicon-tetrachloride may be the active agent. The French reviewer discussed the possible application of the smoke-emitter as an offensive weapon, the aeroplane offering a more effective vehicle than gas and smoke shells fired by artillery.

*Armour Plate.* (R. E. Paine, Army Ordnance, Vol. X, No. 58, Jan.-Feb., 1930, p. 239.) (9.43/12405 U.S.A.)

Discussion is chiefly of protection against armour-piercing bullets and small calibre projectiles. Tables of composition, treatment, Brinell hardness and ballistic tests are given. Micro-photographs of steel plates after firing are reproduced.

## *Materials, Etc.*

*New Iron Alloy for Electric Resistances.* (Ind. and Eng. Chem., News Edition, Vol. VIII, No. 1, 10/1/30, p. 5.) (10.11/12406 U.S.A.)

A new resistance alloy patented in Sweden of the composition aluminium 1-5 per cent., chromium 10-22 per cent., cobalt and titanium 1-3 per cent., the rest iron, has resistance of the order of 100 microhms per cc. In tests for stability under heat six hours at 1,200°C. produced a loss of weight of .07 per cent.

*The Iron Nitrogen System.* (Messrs. Epstein, Cross, Groesbeck and Wymore, Bur. St. Jrnl., Vol. III, No. 6, pp. 1005-1027.) (10.11/12407 U.S.A.)

Nascent nitrogen from ammonia passed over hot iron produced three nitrided layers containing $Fe_2N$, $Fe_4N$ and $Fe_6N$ respectively.

On re-heating nitrogen is liberated from 300°C. upwards. A new molecular interpretation of X-ray analysis is given, and a new diagram of FeN systems is offered tentatively.

Nitriding steels were examined and the texture of the nitride layer is described. Fifty micro-photographs are reproduced.

*Sprayed Molten Cadmium Coatings.* (L. Pessel, Ind. and Eng. Chem., Vol. XXII, No. 2, p. 119.) (10.15/12408 U.S.A.)

Comparative tests were carried out with steel plates sprayed respectively with molten zinc and molten cadmium. The tests were decisively in favour of cadmium protection which reduced the corrosion to 1/15 or less of the amount observed for zinc protection.

*A Soldering Process for Steel Cylinder Covers for Diesel Engines.* (Dr. Ing. Fr. Sass, V.D.I., Vol. LXXIII, No. 51, 21/12/29, pp. 1811-1814.) (10-18/12409 Germany.)

Cylinder covers of Diesel engines have been successfully welded in an atmosphere of hydrogen using a special solder, allowing the use of forged units with considerable reduction in weight and improvement in heat transmission. The process might be equally successful in aero-engine cylinders.

*Ultralumin, a New Light Alloy.* (F. Bollenrath, L.F.F., Vol. VI, No. 1, 12/12/29, pp. 18-32.) (12410 Germany.)

Ultralumin is a copper aluminium alloy containing small quantities of manganese and nickel as well as traces of thorium and cerium. When heat treated the alloy has properties very similar to those of duralumin; the ageing, however, can be carried out much faster. In this state the material withstands shock well. The methods of tests are described fully. A bibliography is given.

*Experiments on the Influence of Temperature on the Notch Resistance and Hardness of Aluminium Alloys.* (W. Schwinning and F. Fischer, Z.F.M., Vol. XXII, No. 1, Jan., 1930, pp. 1-7.) (10.2101/12411 Germany.)

The notch resistance of aluminium alloys increases as the temperature is lowered over the full range examined, +200 to −200°C., especially that of pure

aluminium. Steels generally show a marked drop in notch resistance below 0°C.

*The Causes of Ignition of Aluminium Powder in Manufacture.* (F. Ritter, Z.V.D.I., Vol. LXXIV, No. 5, 1/2/30, pp. 145-148.) (10.2101/12412 Germany.)

Explosion of aluminium dust is due in every case to rapid oxidation. A certain minimum temperature is required and a certain minimum diameter of dust particle. The ratio of surface to weight increases rapidly as the diameter decreases. It appears that particles of the order of .6 $\mu$ are definitely explosive. It is recommended that the dust should be treated with a fatty compound and the temperature kept below 50°C.

*Beryllium; Thermal and Electrical Properties.* (E. J. Lewis, Phys. Rev., Vol. XXXIV, No. 12, 15/12/29, p. 1575.) (10.2104/12413 U.S.A.)

Author's Summary:—*Specific Heat.*—The specific heat of beryllium was obtained from cooling data by equating the heat loss per cm. length per unit time from beryllium to that from zinc. The values obtained increase rapidly with a rise in temperature from 0.0389 at −175.6°C. to 0.593 at 190°C.

*Thermal Conductivity.*—The modified Forbes method of Bidwell was used to determine the thermal conductivity of this metal. Values of $k$ were calculated with three different sets of distances from the first junction as origin for each run at a given surrounding temperature. $k$ was found to increase with a rise in temperature from 0.232 at −176.2°C. to 0.508 at 190.4°C.

*Specific Resistance.*—The specific resistance varies according to the heat treatment given the sample. Values recorded in this article are those obtained after a steady condition had been established after repeated treatments from liquid air temperature to 700°C. Measurements made on two samples check each other closely. They are: 1.56 microhms at −191°C.; 6.76 microhms at 22°C.; 19.05 microhms at 305°C.; and 40.00 microhms at 690°C.

*Temperature Coefficient of Resistance.*—The temperature coefficient of resistance, $\alpha$ is not constant over the above range. It increases with a rise of temperature, but not linearly. The graph of this quantity plotted against temperature shows three distinct sections, $\alpha$ has the following values: 0.000371 at −190°C.; 0.00667 at 20°C.; 0.00800 at 310°C.; 0.00858 at 500°C.; and 0.01196 at 685°C.

*Thermo-Electric Power.*—The thermo-electric power of beryllium against lead seems to vary linearly with temperature. However, at −50°C. the graph of the thermo-electric power plotted against temperature shows a break. This, considered in connection with the results obtained for the temperature coefficient of resistance, suggests the probability of a change in allotropic form.

*Wiedemann-Frantz-Lorentz Law.*—The Wiedemann-Frantz-Lorentz law, that $k/\alpha T$ is a constant, is not obeyed by this metal.

*Beryllium.* (42nd Meeting of the German Chem. Socy., Z.V.D.I., Vol. LXXIII, No. 45, 9/11/29, p. 1619.) (10.2104/12414 Germany.)

Beryllium is 17 times more transparent to short waves than aluminium and is being applied to the construction of X-ray tubes. Copper beryllium alloy containing 2 to 3 per cent. of beryllium is characterised by good electrical conductivity, high chemical resistance and extreme hardness. It is estimated that beryllium will soon be producible at a cost of 1s. a gramme.

*Beryllium as a Possible Structural Metal.* (C. B. Sawyer, S.A.E., Vol. XXVI, No. 1, January, 1930, p. 98.) (10.2104/12415 U.S.A.)

Several sources are now offering beryl in carloads at prices from $50 to $60 per ton. Other sources will certainly appear. A steady contract with a

reliable firm for considerable quantities would doubtless produce beryl at $20 to $30 per ton. The ore cost per pound of the metal would then lie between 37 and 56 cents.

*Deep Impregnation of Timber by the Kyan Process.* (W. Kinberg, Tek. Tids. (Kemi), 58, 94 (Eng. Abstr. No. 39, April, 1929, p. 46).) (10.32/12416 Sweden.)

Timber is normally impregnated with dilute mercury chloride solution for preservation against fungi. In the new process of " kyanising," steam treatment before immersion increases the depth of impregnation from 5 mms. to 30 or 40 mms.

*Appearances of Buckling or Bulging in Flat Plates under Shearing Stress.* (F. Bollenrath, L.F.F., Vol. VI, No. 1, 12/12/29, pp. 1-17.) (10.61/12417 Germany.)

Since celluloid can be caused to undergo considerable elastic deformation before buckling the phenomenon was first studied with this material. The results were confirmed, using plates of duralumin and brass. Buckling is preceded by the formation of regular folds in the material. Considering these folds as waves there exists a definite relationship between the width of the plate and the wave-length. The ratio of these two quantities is independent of the thickness of the plate and the material. An extensive bibliography is given.

*Fatigue Tests on Materials.* (P. Ludwik, Z.V.D.I., Vol. LXXIII, No. 51, 21/12/29, pp. 1801-1810.) (10.621/12418 Germany.)

A survey of the subject with numerous references and extensive graphs and tables of results. Carbon and alloy steels and non-ferrous alloys are included. The shape, hardness, and finish of notches are considered in relation to their effects. The creeping limit, fatigue limit and temperature effects are discussed. Hysteresis is taken in relation to the elastic stresses in the crystal framework.

*Fatigue Strength of Steam Turbine Blades.* (H. F. Moore, S. W. Lyon and N. J. Alleman, Univ. Ill. Eng. Expt. Stn. Bulletin, No. 183, 32 pp. (Eng. Abstr. No. 39, April, 1929, p. 38).) (10.621/12419 U.S.A.)

Samples were cut out of blades of copper nickel or iron nickel alloy and tested in a revolving machine for bending fatigue. The highest endurance limit (18.8 tons per sq. in.) was obtained with " cyclops metal," nickel 19 per cent., chromium 7.5 per cent., iron, manganese and silicon 73.5 per cent.

*Young's Modulus Determined with Small Stresses.* (D. K. Froman, Phys. Rev., Vol. XXXV, No. 3, 1/2/30, p. 264.) (11.24/12420 U.S.A.)

Author's Abstract:—An interferometer method similar to that used by E. Gruneisen was used to determine the extensions of metallic rods of brass, steel, copper, aluminium and nickel under small stresses. The largest stresses applied were considerably less than those usual in commercial testing. For substances examined, Young's Modulus was found to increase very rapidly as the stress increased from zero, reach a maximum at a comparatively small stress, and then to decrease almost exponentially to the ordinary value. The annealing of the rod may be connected with this divergence from Hooke's law with small stresses, as slight differences were found on re-annealing some of the rods used.

## Airships

*H.M. Airship* 100. (E. N. Wallis, Airc. Eng., Vol. II, No. 11, Jan., 1930, p. 7.) (12.11/12421 Great Britain.)

An unpublished lecture at the Royal Aeronautical Society. The article, illustrated by five photographs and a diagram, discusses in general terms the shape, volume, position of cars, girder construction, and constructural details.

A further editorial article follows (p. 10) giving the principal particulars of the R.100 with two photographs of an engine car partly assembled and completed.

*Full-Scale Turning Characteristics of the U.S.S. Los Angeles.* (F. L. Thompson, N.A.C.A. Report No. 333, January, 1930.) (12.12/12422 U.S.A.)

A description is given of the method employed and results obtained in full-scale turning trials on the rigid airship U.S.S. Los Angeles, carried out in conjunction with pressure distribution and stress investigations by representatives of the National Advisory Committee for Aeronautics and the stress investigation by the Bureau of Aeronautics. The method of determining turning characteristics by recording instruments aboard the airship appears to be satisfactory, with the exception that a better method of determining the small angular velocities of airships should be devised.

*Flight Tests on U.S.S. Los Angeles—Stresses and Strength Determination.* (C. P. Burgess, N.A.C.A. Report No. 325.) (12.2/12423 U.S.A.)

In continuation of Report No. 324 (see Abstract No. 11740, issue No. 12) on pressure distribution, an investigation is made of the resulting stresses. Normal flight in disturbed weather produced stresses twice as great as extreme manœuvres in still air. It is explicitly stated that no light was thrown on the forces in a storm such as destroyed the Shenandoah. The design assumptions of the German builders, the Zeppelin Company, were closely confirmed.

## Wireless

*Naval Wireless Telegraph Communications.* (G. Shearing and J. W. S. Dorling, J.I.E.E., Vol. LXVIII, No. 398, pp. 237-264.) (13.0/12424 Great Britain.)

Author's Summary:—The Paper gives a short account of the development of wireless telegraph apparatus for naval purposes. The historical development is referred to, the wireless telegraph lines required for naval ships are outlined and the essential requirements and chief features of some of the apparatus used under sea-going conditions are briefly described. The organisation for giving effect to the policy of H.M. Board of Admiralty is also indicated.

*Piezo Oscillators.* (E. L. Hall, Bur. St. Jrnl. of Res., Vol. IV, No. 1, p. 115.) (13.21/12425 U.S.A.)

A description is given of the laboratory apparatus and methods of testing Piezo oscillators as frequency standards. Photographs and diagrams of the apparatus used are given and two test results are reproduced. Piezo oscillators are considered the most suitable frequency standards available for radio stations.

*Radio Landing Beam Development.* (Aviation, Vol. XXVII, No. 26, 28/12/28, p. 277.) (13.4/12426 U.S.A.)

It is stated in a note that a beam transmitter flush with the ground in the centre of the landing area emits a beam 20 ft. wide which runs nearly parallel with the surface of the earth for two miles, then curves upwards. The cost of the equipment is estimated at £200. No technical data are given.

*Notes on the Effect of Solar Disturbances on Trans-Atlantic Radio Transmission.* (C. N. Anderson, Bell Tel. Lab., No. B. 427, October, 1929.) (13.5/12427 U.S.A.)

In 1923, when the relation between abnormal long wave radio transmission and solar disturbances was first noted, the outstanding abnormality was the great decrease in night time signal field strength accompanying storms in the earth's magnetic field. The present notes show the effects of individual storms on 60 kc. trans-Atlantic radio transmission and also give some indication as to their effect on short wave radio transmission.

*Short Period Radio Fading.* (T. Parkinson, Bur. St. Jrnl., Vol. II, No. 6, June, 1929, pp. 1057-1075.) (13.5/12428 U.S.A.)

Seventeen graphical records are reproduced. Particular attention was given to changes of intensity lasting for minutes or seconds only. Variation of indirect ray, interference of ground and indirect rays, direction changes, refraction by a rising ionised layer, the unexplained rotation of the plane of polarisation are the principal factors discussed. A further programme of research is proposed.

*A Synchronous Time Scale for the Braun Tube—Cathode Ray Oscillograph.* (E. Hudec, Z.H. Freq. Tech., Vol. XXXIV, No. 6, Dec., 1929, p. 207.) (13.5/12429 Germany.)

To obtain from the beam of the cathode ray oscillograph several superimposed curves on the photographic plate, it is necessary to superimpose an additional current or voltage which varies synchronously with the previous current or voltage. To obtain synchronisation a condenser charged by means of a constant current and discharged through a series of valves, constitutes a voltage governor.

*Uni-Directional Radio Beacons for Aircraft.* (E. Z. Stowell, Bur. St. J. Res., 1, 1011-1022 (Eng. Abstr. No. 40, July, 1929, p. 213.) (13.71/12430 U.S.A.)

The directional system of wireless designed by the U.S. Bureau of Standards has two radiating loops inclined at an angle, producing a radiation diagram equivalent to two " figures of eight," has now been developed to give a uni-directional field. The paper describes the most sensitive arrangement of the circuit for aircraft use.

*Comparison between Selenium and Photo-Electric Cells.* (F. Schroter and W. Ilberg, Phys. Zeit., No. 22, 15/11/29, p. 801.) (13.8/12431 Germany.)

The internal resistance of selenium cells is a function of illumination and not of applied voltage, but that of the photo-electric cell is a function of both. Where the light varies with moderate frequency the sensitivity of either type is obtainable with equal accuracy by suitable arrangement of the electrical circuit. At high frequencies the photo-electric cell has the advantage.

*A New Type of Photo-Electric Cell.* (B. Lange, Phys. Zeit., Vol. XXXI, No. 3, 1/2/30, pp. 139-140.) (13.8/12432 Germany.)

Known photo-electric cells are inefficient on account of the large work of emission of the expelled electron. In the new cell the photo-electrons are emitted directly into a uni-polar semi-conductor placed in immediate contact with a

second metallic electrode which completes the circuit. A cell constructed on these principles, using copper electrodes and a thin layer of cuprous oxide to act as semi-conductor, had an efficiency roughly ten times that of the normal gas type. The author suggests that by the use of suitable materials this method might render possible an efficient direct conversion of light into electrical energy.

## *Photography*

*Aerial Photography.* (Army Ordnance, Vol. X, No. 58, Jan.-Feb., 1930, p. 277.) (14.0/12433 U.S.A.)

Estimates of cost are given of a survey of 2,200 sq. miles carried out for the U.S.A. Geodetic Survey by an Army Air Corps expedition.

*Photographic Photometry.* (G. R. Harrison, Jnl. Opt. Socy. Am., Vol. XIX, No. 5, November, 1929, pp. 267-316.) (14.7/12434 U.S.A.)

A comprehensive discussion of principles, with a list of methods and apparatus used. The photographic technique is considered, the selection and calibration of standards of distribution of homo-chromatic and hetero-chromatic work is laid down. A list of 88 references is given.

## *Miscellaneous*

*U.S. Naval Ordnance.* (Rear-Admiral W. D. Leahy, Extracts from Annual Report for 1929, Army Ordnance, Vol. X, No. 58, Jan.-Feb., 1930, p. 258.) (15.21/12436 U.S.A.)

Details of issues of A.A.C. guns both to ships and land defences are included.

*Preventing and Extinguishing Aircraft Fires.* (Lt.-Cmdr. C. G. McCord, Aviation, Vol. XXVII, No. 26, 28/12/29, p. 1265.) (16.12/12437 U.S.A.)

Author's Summary:—Several important conclusions are given from tests at the Naval Aircraft Factory, under the supervision of the author, together with a discussion of present development and suggested improvements in practice.

*The Danger of Lightning to Airships.* (Capt. Breithaupt, Ill. Flug., Vol. XI, No. 11, 11/11/29, p. 12.) (16.22/12438 Germany.)

The following precautions are recommended when flying through a thunderstorm:—

1. The gas cells should be sufficiently deflated so that no hydrogen is blown off, even under rapid variation of altitude in squalls.
2. No water or other ballast should be ejected, except in closed containers.
3. Wireless antennæ should be pulled in.
4. With sufficient warning by the meteorological service, it may be possible to avoid a thunderstorm altogether.

*Rotors.* (Flug., Vol. XII, No. 2, 22/1/30, Patent Notices, p. 62.) (17.4/12439 Germany.)

German patent No. 486206 has been taken out by Dr. Betz, of Göttingen, as the result of wind tunnel experiments on the effect of interference between the surface of the rotor and the surrounding air stream. It is claimed that considerable increase in propulsion efficiency is obtained by the arrangement of suitable vent holes.

*Air Route Organisation in U.S.A.* (Airc. Eng., Vol. II, No. 11, Jan., 1930, p. 16.) (20.4/12440 Great Britain.)

An extract is given from an official report covering the area required to lay out the landing strip with regard to prevailing winds, lighting, signalling, etc. The equipment of intermediate landing grounds is dealt with and a few cost figures are given.

*Marking the Modern Air Route.* (A. K. T. Smith, Airc. Eng., Vol. II, No. 11, Jan., 1930, pages 11-15.) (20.5/12441 Great Britain.)

The author deals with the practice in this country with respect to boundary markings, obstruction lights, wind indicators, aerodrome flood lighting and beacons, etc.

The effect of wave length on visible range is discussed, in particular the possible advantages of neon lighting in a fog. It is concluded that the advantages of the latter are restricted to very special conditions.

*Tank Organisation.* (S. E. Brett, Army Ordnance, Vol. X, No. 58, Jan.-Feb., 1930, p. 236.) (0.0/12442 U.S.A.)

The design, maintenance, technical crew and technical employment of tanks is discussed.

Absence of A.A.C. protection is commented on.

On page 275 the Society of Automotive Engineers discusses the problem of tank design.

*Standards Committee, U.S.A.* (S. A.E., Vol. XXVI, No. 1, Jan., 1930.) (0.0/12443 U.S.A.)

Reports from the following twelve divisions of the Standards Committee are printed in this number:—

(1) Agricultural power equipment.
(2) Aircraft engine division.
(3) Ball and roller bearings division.
(4) Electrical equipment division.
(5) Iron and steel division.
(6) Lighting division.
(7) Motor boat division.
(8) Non-ferrous metals division.
(9) Passenger car division.
(10) Production division.
(11) Screw thread division.
(12) Tyre and rim division.

*Aviation Progress under the Soviet.* (V. M. Petliakov, Aviation, Vol. XXVIII, No. 3, 18/1/30, p. 109.) (0.0/12444 U.S.A.)

A descriptive account of the activities, technical and flying, of the Soviet Government, with illustrations and some details of the laboratory equipment and of several aeroplanes.

*Work of D.V.L. for* 1928/29. (H. Fassbender, Z.V.D.I., Vol. LXXIII, No. 51, December, 1929, pp. 1823-5.) (0.0/12445 Germany.)

A statistical statement is given of the work done on aerodynamics, structures, engines, materials, navigation, wireless telegraphy, full-scale experiments, and inspection, with references to papers published.

*Efficiency of Sand Blast.* (K. Zentner, Sci. Acad. Proc. (Sitz. Ber.), Vienna, Vol. CXXXVIII, Part 8, 1929, pp. 663-700.) (0.0/12446 Austria.)

The problem proposed is the determination of the ratio of kinetic energy imparted to sand and air in unit time. The losses by the air resistance of the walls, and of the particles as they are accelerated from rest, are evaluated by semi-empirical equations involving experimental coefficients. The efficiencies found are small—4 per cent. and less—from which it is clear that mechanical convenience is the consideration, not mechanical efficiency.

CORRIGENDUM.—Issue No. 12, Abstract No. 11662, from Aircraft Eng., Gt. Britain. Country of origin: For U.S.A. read Gt. Britain.