ABSTRACTS AND NOTICES

FROM THE

SCIENTIFIC AND TECHNICAL PRESS

Issued by the

DIRECTORATES OF SCIENTIFIC RESEARCH AND TECHNICAL DEVELOPMENT,

AIR MINISTRY.

(Prepared by R.T.P.)

No. 40. DECEMBER, 1936.

AERODYNAMICS AND HYDRODYNAMICS.

Correction of Downwash in Wind Tunnels of Circular and Elliptic Sections. (I. Lotz, N.A.C.A. Tech. Memo., No. 801, translated from L.F.F., Vol. 12, No. 8, 25/12/35.) (Available as Translation No. 350.) (574/2908 Germany.)

Up to the present the tunnel interference effect has been determined at the centre of pressure of the middle wing section. The downwash velocity at this point can be simply determined and is equal to half the velocity with infinite flow. The latter can be represented as a two-dimensional potential flow with a system of images of the trailing vortices being set up at the boundary. In the open tunnel, the vortex images have the same sign as the original vortex; in the closed tunnel they have opposite sign. So far the value of the downwash velocities from the wing outwards to infinity were not known accurately. A first approximation was obtained by Glauert for the downwash at the tail surface in a rectangular tunnel. The present paper gives the exact solution for the induced velocities for circular and elliptic jets.

Calculated and Measured Pressure Distributions Over the Midspan Section of the N.A.C.A. 4412 Airfoil. (R. M. Pinkerton, N.A.C.A. Report No. 563, 1936.) (2953 U.S.A.)

Pressures were simultaneously measured in the variable-density tunnel at 54 orifices distributed over the midspan section of a 5- by 30-inch rectangular model of the N.A.C.A. 4412 airfoil at 17 angles of attack ranging from -20° to 30° at a Reynolds Number of approximately 3,000,000. Accurate data were thus obtained for studying the deviations of the results of potential flow theory from measured results. The results of the analysis and a discussion of the experimental technique are presented. It is shown that theoretical calculations made either at the effective angle of attack or at a given actual lift do not accurately describe the observed pressure distribution over an airfoil section. A modified theoretical calculation is developed which agrees reasonably well with the measured results. The circulation is evaluated by means of the experimentally obtained lift at the effective angle of attack; *i.e.*, the angle which the chord of the model makes with the direction of the flow in the region of the section under consideration. In

the course of the computations the shape parameter is modified, thus leading to a modified or an effective profile shape that differs slightly from the specified shape.

Electrical Stream Potential during Turbulent Flow. (H. Reichardt, Zeitschrift fur Physikalische Chemie, Vol. 174, No. 1, Sept., 1935, pp. 15-21.) (3012 Germany.)

Measurements were carried out on a capillary tube 0.082 cm. diameter and 52.84 cm. long, using distilled water. The electric stream potential E was measured using normal KCl electrodes. It was found that E was directly proportional to Dp, the pressure drop, irrespective of whether the flow was laminar or turbulent. From this it appears that the flow in the electrical double layer is always laminar, the dimensions of this layer being small compared with that of the hydrodynamic boundary layer. The author had hoped to use the electrokinetic method for a direct determination of shear at the boundary. It was, however, found impossible to obtain a surface sufficiently homogeneous to give consistent electrical properties of the boundary.

The Forces and Moments Acting on Parts of the XN2Y-1 Airplane during Spins. (N. F. Scudder, N.A.C.A. Report No. 559, 1936.) (3144 U.S.A.)

The magnitudes of the yawing moments produced by various parts of an airplane during spins have previously been found to be of major importance in determining the nature of the spin. Discrepancies in resultant yawing moments determined from model and full-scale tests, however, have indicated the probable importance of scale effect on the model. In order to obtain data for a more detailed comparison between full-scale and model results than has hitherto been possible, flight tests were made to determine the yawing moments contributed by various parts of an airplane in spins. A direct comparison between wind-tunnel and flight results will be possible as soon as the tests of a model of this airplane have been completed on the N.A.C.A. spinning balance. The pressure distribution tests incidentally demonstrated the favourable interference produced by the horizontal tail surfaces on the part of the vertical surfaces below them and the unfavourable interference produced on the part above them.

Turbulence Factors of N.A.C.A. Wind Tunnels as Determined by Sphere Tests. (R. C. Platt, N.A.C.A. Report No. 558, 1936.) (3163 U.S.A.)

Results of drag and pressure tests of spheres having diameters of 2, 4, 6, 8, 10 and 12 inches in eight N.A.C.A. wind tunnels, in the air ahead of the carriage in the N.A.C.A. tank, and beneath an autogyro in flight are presented in this report. Two methods of testing were employed, one involving measurements of sphere drag and the other measurements of the pressure difference between the front stagnation point and the rear portion of the sphere. Satisfactory correlation between the two methods was obtained experimentally, as set forth in an appendix to the report. When the Reynolds Number of a model tested in a wind tunnel is multiplied by the turbulence factor for that tunnel, the resulting value is an " effective " Reynolds number. When this method is used to obtain the scale-effect variation of maximum lift coefficient and drag coefficient at zero lift of certain well known aerofoils, data obtained in various wind tunnels under a wide variety of turbulent conditions are brought into satisfactory agreement.

A General Tank Test of a Model of the Hull of the British Singapore IIC Flying Boat. (J. R. Dawson and S. Truscott, N.A.C.A. Tech. Note No. 580, Sept., 1936.) (3210 U.S.A.)

A general test was made in the N.A.C.A. tank of a 1/12- size model of the hull of the British Singapore IIC flying boat loaned by the British Air Ministry. The results are given in charts and are compared with the results of tests of a

model of an American flying boat hull, the Sikorsky S-40. The Singapore hull has a greater hump resistance but a much lower high speed resistance than the S-40. The results of the tests are also compared with the results from tests of the same model which were made in the R.A.E. tank and the agreement is found to be close. It may be concluded that the results obtained in the smaller British tanks have not been affected by proximity of the walls and the bottom.

The Surface Tension of a Moving Mercury Sheet. (H. O. Puls, Phil. Mag., Nov., 1936, pp. 970-982.) (3359 Great Britain.)

Bond's method of using the impact of two liquid jets for the determination of surface tensions is applied to mercury. The mercury is circulated and a device for the continuous measurement of the rate of flow of the liquid is described. A method for determining the momentum of the jet is developed, from which the radius of the jet is deduced. The value of the surface tension of mercury in contact with air at 20° C is given as $475{\cdot}5 \pm 2$ dynes/cm. A survey of the results of other workers is added.

Analysis and Model Tests of Autogiro Jump Take-off. (J. B. Wheatley and C. Biolletti, N.A.C.A. Tech. Note No. 582, Oct., 1936.) (3432 U.S.A.)

An analysis is made of the autogyro jump take-off, in which the kinetic energy of the rotor turning at excess speed is used to effect a vertical take-off. By the use of suitable approximations, the differential equation of motion of the rotor during this manœuvre is reduced to a form that can be solved. Only the vertical jump was studied; the effect of a forward motion during the jump is discussed briefly. The results of model tests of the jump take-off have been incorporated in the paper and used to establish the relative accuracy of the results predicted from the analysis. Good agreement between calculation and experiment was obtained by making justifiable assumptions.

The Forces on a Solid Body in a Stream of Viscous Fluid. (T. E. Garstang, Phil. Trans. Roy. Soc., Vol. 236, No. 759, 20/10/36.) (3444 Great Britain.)

Previous work of Filson and Goldstein is extended and the work facilitated by the introduction of certain associated Legendre functions. The drag is found to be associated with one of the irrotational solutions whilst the lifting force is connected with the circulation round the diffused vortices at infinity.

The Distribution of Velocity and Temperature Behind a Grid in Air in Turbulent Motion. (R. G. Olsson, Z.A.M.M., Vol. 16, No. 5, Oct., 1936, pp. 257-274.) (3570 Norway.)

The distribution of velocity and temperature behind a system of parallel equidistant rods is investigated by means of the formulæ of L. Prandtl and G. I. Taylor. The results are checked by measurements taken in the wind channel and in the author's opinion, the agreement is satisfactory.

Two- and Three-Dimensional Motion in Incompressible Fluids Between Eccentrical Cylindrical Surfaces Rotating One Inside the Other. Contribution to the Theory of Lubrication—Part II. (H. Reissner, Z.A.M.M., Vol. 16, No. 5, Oct., 1936, pp. 275-286.) (3571 Germany.)

The author considers the motion between two finite cylinders, postulating that the pressure at the bounding cross-sections is constant. The complete solution is obtained in the form of certain double Fourier series, the coefficients of which are power series of the eccentricity. Experiments confirming the theory are described.

Electrokinetic Processes in Capillary Tubes. (H. Reichardt, Zeitschrift für Physikalische Chemie, Vol. 166, Part 5-6, 1933, pp. 433-452.) (3621 Germany.)

The transfer of an electrolyte through an insulated tube is accompanied by the generation of an electric flow potential already studied by Helmholtz. The electrification is limited to a layer in proximity to the wall, the so-called " double layer," the dimensions of which are small compared with the laminar boundary layer familiar in hydrodynamic problems. Electric forces acting on the double layer may affect the Pouseville velocity distribution and in certain cases may cause an apparent " blocking " of the tube, if the diameter is small enough. The author considers this phenomena in connection with certain osmotic processes in organic cells. (See also page 141, " Electrical Stream Potential during Turbulent Flow.")

On Some Applications of the Theory of Conformal Representation, (B. B. Lavrentieff, Proc. of Joukowsky Academy of Military Aeronautics, No. 13, 1935, pp. 18-27.) (3623 U.S.S.R.)

The theory of conformal representation is applied to wings, the contours which are arcs of circles or inverted parabolas and the conditions for maximum lift are enumerated. The theory is generally analysed and extended in several directions.

The Approximate Integration of the Boundary Layer Equation Using the Theory of Heat Transfer. (L. C. Leybenson, Proc. of Joukowsky Academy of Military Aeronautics, No. 13, 1935, pp. 38-52.) (3624 U.S.S.R.)

The author considers the case of plane surface, a circular or elliptic cylinder and a surface of revolution. For the elliptic cylinder and the surface of revolution, the point of break-away of the flow is also given.

Mechanical and Mathematical Problems Concerning the Improvement of Aerodynamic Efficiency of Wings. (B. B. Goloubeff, Proc. of Joukowsky Academy of Military Aeronautics, No. 13, 1935, pp. 7-17.) (3625 U.S.S.R.)

The theory of slots, slotted ailerons and flaps is briefly considered. Attention is called to the high air speeds existing on the upper surface of the wing near the point of break-away.

Mathematical Problems of the Motion of Gases. (F. Frankl, Proc. of Joukowsky Academy of Military Aeronautics, No. 13, 1935, pp. 28-32.) (3626 U.S.S.R.)

This work deals with the integration of the fundamental differential equation of motion for speeds below and above the velocity of sound (elliptic and hyperbolic partial derivatives). It may be considered as an introduction to the subject and copious references are made to Busemann's papers.

The Theory of the Lifting Surface. (I. Bourago, Proc. of Joukowsky Academy of Military Aeronautics, No. 13, 1935, pp. 53-84.) (3627 U.S.S.R.)

The author considers the 3- dimensional case using vectorial methods and taking into account the possibility of a surface of discontinuity developing in the wake of the body. The theory is extended to the study of the Joukowsky theorem in three dimensions.

AIRCRAFT AND ACCESSORIES.

Charts for Calculating the Performance of Airplanes having Constant Speed Propellers. (R. J. White and V. J. Martin, N.A.C.A. Tech. Note No. 579.) (2898 U.S.A.)

Charts are presented for determining the performance of airplanes having variable pitch propellers so adjusted as to maintain constant speed. The charts

are based on the general performance equation developed by Oswald (N.A.C.A. Tech. Report, No. 408). Examples of applying the charts to airplanes having both supercharged and unsupercharged engines are included.

Tests of a Wing-Nacelle-Propeller Combination at Several Pitch Settings up to 42°. (R. Windler, N.A.C.A. Report No. 564, 1936.) (3586 U.S.A.)

A 4ft. model of Navy propeller No. 4412 was tested in conjunction with an N.A.C.A. cowled nacelle mounted ahead of a thick wing in the 20ft. propeller research tunnel. A range of propeller pitches from 17° to 42° at 0.75*R* was covered, and for this propeller the efficiency reached a maximum at a pitch setting of 27°; at higher pitches the efficiencies were slightly lower. The corrected propulsion efficiency is shown to be independent of the angle of attack for the high-speed and the climbing ranges of flight. A working chart is presented for the selection of similar propellers over a wide range of aeroplane speed, engine power, and propeller revolutions.

Calculations of the Motion of an Airplane Under the Influence of Irregular Disturbances. (Robert T. Jones, J. Aer. Sci., Vol. 3, Oct., 1936, pp. 419-425.) (3520 U.S.A.)

The paper illustrates the application of mathematical advances made in electricity and other branches to problems of aeroplane dynamics. The Heaviside-Bromwich methods of solution of linear differential equations are described and it is shown how these methods avoid the consideration of boundary conditions and of particular or complementary integrals. It is pointed out that the solution of the differential equation is obtained for the case of a unit disturbance, the effect of varying disturbances may be found therefrom by Carson's Theorem. A graphical solution of Carson's Integral for irregular disturbances is given.

The procedure for obtaining unit solutions of the equations is then taken up and the analogy between Heaviside's symbolic series solution and a physical procedure of approximation is shown. It is suggested that a fictitious impulsive disturbance be used in the treatment of initial motions. Bromwich's interpretation of the operational method is briefly described and the expression of the irregular disturbance functions by definite integrals is shown.

An Airfoil Fitted with a Slotted Wing. (G. J. Higgins, J. Aer. Sci., Vol. 3, No. 12, Oct., 1936, pp. 431-433.) (3522 U.S.A.)

The use of the slotted flap on an airfoil has been found to be very advantageous in recent tests conducted in the seven by ten foot wind tunnel of the University of Detroit. A slotted flap of 30 per cent. chord fitted on a Göttingen 398 (modified) airfoil shows a large increase in lift with a very small added drag for small flap deflections. A large reduction in take-off speed with good rates of climb were found obtainable at speeds below the minimum speed for the normal airfoil. Satisfactory air braking is available at high flap deflection. Low relative drag was obtained at zero flap angle by closing the slot entirely in this condition.

Spinning and Tail Buffeting Tendencies and Means by which they can be Detected and Suppressed on a Complete Scale Model in a Wind Tunnel. (W. E. Hunt, J. Aer. Sci., Vol. 3, No. 12, Oct., 1936, pp. 444-447.) (3525 U.S.A.)

The following conclusions are drawn: (1) The vertical position of the horizontal tail surfaces for a low-winged monoplane should be well up on the fuselage, at least 25 per cent. of the root chord above the leading edge of the main wing. (2) By using leading edge slots complete control of the wing root airflow is possible throughout the normal working range of an airfoil, and indications are that they persist some way beyond. (3) Wing root fillets do not by any means

eliminate tail buffeting. (4) The conventional form of horizontal tail surfaces are not as effective, or anywhere near as powerful as the type where the horizontal surfaces move as a whole, and the former greatly aggravate buffeting conditions. (5) The relationship between the main airfoil and horizontal tail surfaces cannot be entirely satisfactory for the low-winged type monoplane and that possibly the best combination would be a high-winged monoplane with the horizontal surfaces well below. (See also Les Ailes, No. 778, 14.5.36, p. 5 and Flugsport, No. 11, 27.5.36, pp. 252-253).

Experimental Researches on the Bending-Torsional Vibrations of a Wing Model of Variable Rigidity. (P. Cicala, Laboretoro de Aeronautica del R. Instituto di Torino, No. 84.) (3636 Italy.)

Wind tunnel measurements of a model wing, 100 × 300 mm. made of Dural plate. The following were investigated: Frequency, type of vibration, phase angle and ratio of amplitudes for different angles of incidence and different ratios of bending to torsional rigidity. (The latter factor remained constant throughout.) The value of the critical air flow is very much reduced for negative angles of incidence. (From 13.5 m./sec. at 7° 25′ to 4.5 m./sec. at −18° 45′.)

This is attributed to the small value of the Reynolds number and the great thickness of the profile under test. (See also H. L. Studer, Proceeding of Institute of Aerodynamics, Zurich, No. 4/5.)

Report on the Progress of Civil Aviation, 1935. (Air Ministry, Department of the Director-General of Civil Aviation.) (3637 Great Britain.)

The appendix of this report (pp. 130-144) contains interesting statistics covering subsidies and miles flown. The following figures applying to five leading countries are of interest. The amount of German subsidy is not given in the report. The figure used has been obtained from German sources.

Country.	Miles Flown.	Subsidy (£).	Miles/£.	£/Passenger.	Passenger/Miles £.
Gt. Britain	8.4×10^6	0.47×10^6	17.8	2.2	90
France	7×10^6	1.33×10^6	5.2	22	15
Holland	3.9×10^6	0.05×10^6	87	0.75	510
Germany	9.3×10^6	1.60×10^6	5.8	9	27
U.S.A.	63.6×10^6	4.11×10^6	15.5	4.8	90

L.Z.—129 Hindenburg by W. V. Langsdorff. (H. Bechild, Frankfurt-Main, 1936 (96 pages).) (3638 Germany.)

This book gives a detailed description of the airship and includes some hitherto unpublished photographs showing various stages of manufacture: Riveting a cross frame, fixing outer cover, suspension of ballast, manufacture of fins, fixing fins and rudder, etc. Sketches show automatic and manœuvring gas valves and details of landing manœuvres and attachment to the mast are given. The following data are of interest:—Weight empty 100 tons. Useful load 30 tons. Oil fuel 60 tons. Ballast 10 tons. Total (at start) 200 tons. The 4 engines develop 4,800 B.H.P. max. and 3,600 B.H.P. cruising. Under these conditions the consumption of fuel is 600 kg./hour and the range is thus 100 hours (at 75 miles/hour) It takes 120 B.H.P. to transport 1 ton of useful load.

The Utilisation of Aerodynamic Research in the Design of Aircraft. (C. B. Millikan, Luftwissen, Vol. 3, No. 10, Oct., 1936, pp. 277-287.) (3639 Germany.)

This paper was read at the annual meeting of the Lilienthal Society in Berlin. The author is professor at the California Institute of Technology where unique facilities for co-operation with industry exist. Amongst the points treated were: (1) Rapid performance calculations for aircraft fitted with constant thrust pro-

pellers. The author is of the opinion that stratosphere flights will be a paying proposition in the near future, provided the range between objectives lies between 1,600 and 2,400 km. (See also page 143, "Charts for Calculating the Performance of Airplanes having Constant Speed Propellers.") (2) Longitudinal stability of low wing monoplanes as affected by position of tail plane. (3) Dynamic criteria for judging performance of civil aircraft. (4) Minimum profile resistance of various aeroplane parts. The author throughout stresses the importance of independent institutions carrying out research for the industry.

ENGINES AND ACCESSORIES.

New German Aero Engine. (Les Ailes, No. 799, 8/10/36, p. 3.) (3101 Germany.)

The firm of Mercedes-Benz have developed a 12 cylinder *V* engine, 32 litres. The engine is supercharged, ethylene glycol cooled and rated at 1,000 B.H.P. weight 560 kg. This engine is destined for the twin-engined universal fighter and bomber D17, of which several hundred are stated to be in existence. These machines are fitted with 2 cannons and carry 1,000 kg. of bombs. Maximum speed 490 km./hr. According to the French author, the D17 was fitted with K14 (French) engines which will now be replaced by the German (Benz) engines.

Determination of Gas Temperatures during the Expansion Stroke in the Internal Combustion Engine. (Donescu, Chem. Absts., Vol. 30, No. 19, 10/10/36, p. 6919.) (3257 France.)

Methods of measurement and calculation of combustion temperatures are critically reviewed. Calculated values of gas temperatures during and after combustion in an engine may be far from accurate owing to the simplifying assumptions necessarily required. For experimental determination of these values, the Na line reversal method is best. The theory and experimental technique of this method are fully discussed. Data are given for the combustion of C_6H_{14}, iso-octane cyclohexane and C_6H_6, and for an aviation petrol at two compression ratios and two engine speeds.

Kinetic Analysis of the Combustion Phenomenon in the Diesel Engine. (K. Neumann, Chem. Absts., Vol. 30, No. 19, 10/10/36, p. 6921.) (3260 Germany.)

Spectrum studies show that combustion in the engine takes place relatively slowly owing to diffusion in the liquid and solid phases. The velocity of combustion is given by a kinetic equation which depends on the temperature and concentration of the compounds taking part in the reaction. The separation of the reaction-velocity constant into an action constant and activation heat gives an insight into the actual course of the combustion as it is influenced by reaction restraints and reaction accelerators.

The Junkers Diesel Engine. (J. Gasterstädt, Inter. Avia, No. 373/374, 31/10/36, pp. 1-3.) (3406 Germany.)

The first engine (Jumo 204) was put into service in 1932. At the moment Junkers engines average 2,000 flying hours a month. Advance in design whilst scarcely affecting the weight/capacity ratio (55 lb./litre of swept volume) has resulted in a very marked reduction in weight/power ratio (from 2.1 lb./B.H.P. to 1.4 lb./B.H.P.) This is mainly due to improvements in B.H.P./litre output, from 28 for Jumo 204 to 42 for Jumo 206. The 2-stroke Diesel engine, on account of its low exhaust temperature, is specially suited to operating air exhaust turbines. Compensation is possible up to 30,000 feet by means of a special high pressure blower, the turbine delivering 160 B.H.P. for a weight of only 66 lb.

The Pre-Heating of Aero Engines. (E. Dierbach, Z.V.D.I., Vol. 80, No. 43, 24/10/36, pp. 1301-1302.) (3428 Germany.)

The preheater supplies about 1800 cubic feet of free air per minute at 50mm. water pressure and 150° C. The air current is directed over the engine and will raise piston and valve temperature from −20° C. to +30° C. in 15 minutes. This ensures a certain start. The plant described consists of a petrol burner supplied with both primary and secondary air by two centrifugal fans driven electrically. The air supply is sufficient to deal with three engines on an aircraft simultaneously. A considerable number of plants of this type were in use last winter by the German Lufthansa and gave complete satisfaction.

Mixture Distribution in a Single-Row Radial Engine. (H. C. Gerrish and F. Voss, N.A.C.A. Tech. Note No. 583, Oct., 1936.) (3433 U.S.A.)

The distribution of the fuel among the various cylinders of a Pratt and Whitney 1340 SlHl-G engine was determined by chemically analysing samples of exhaust gas from each cylinder. The engine operated in the 20ft. wind tunnel at different power outputs, specific fuel consumptions and engine speeds. The results showed that the variation in the quality of the mixture among the different cylinders was approximately 4 per cent. and was independent of power output, specific fuel consumption and engine speed. The results also showed that the top cylinders operated with a lower air-fuel ratio than the bottom cylinders.

Performance Problems of Aero Engines. (A. Nutt, Luftwissen, Vol. 3, No. 10, Oct., 1936, pp. 287-298.) (3640 Germany.)

This paper was read at the annual meeting of the Lilienthal Society in Berlin. The author is deputy director of design for the Wright Aeronautical Corporation and dealt exclusively with the problems of the air-cooled radial engine. Improvements in the performance of such engines are entirely due to higher operational speeds and increased boost; these are rendered possible by improved cooling (greater fin area), freedom from torsionals (Wright crankthrow vibration damper), better fuels (Octane No. 87), improved spark plugs and better oils. For the latter the absence of rating facilities (corresponding to the C.F.R. method for fuels) is a handicap and the author describes fully a method developed by his firm to overcome this difficulty. (The oil obtains performance marks depending on its behaviour in certain chemical and 50 hr. full-scale engine tests.) In connection with carburation, the icing difficulty can be met in different ways (preheated air or alcohol additions to the fuel). An obvious solution is to design the carburettor in such a way that the ice cannot build up on the throttle (S. P. Johnston, Aviation, Vol. 35, (1936) No. 5, p. 15).

THEORY OF WAR AND ARMAMENTS.

Protection Against Bombing—Design of Suitable Structure. (D. A. Priolo, Riv. Aeron., Vol. 12, No. 5, May, 1936, pp. 183-191.) (1753 Italy.)

Two types of buildings are discussed, depending on whether deflection of the bomb or absorption of the explosion is aimed at. The former is of triangular cross-section with a knife-edge roof, the slope of the walls being such that a bomb striking the building is deflected before explosion. This type can only be erected in isolated positions. In the second type, fitted with a flat roof, intermediate floors are constructed to absorb the kinetic energy of the bomb and direct its path on to the roof of the shelter proper which is placed underground in the basement of the building. This roof is designed to withstand the final explosion. Constructional details are given in sketches.

Toxic Gases. (L. A. Rouget and J. D. Rouget, Chem. Absts., Vol. 30, No. 16, 20/8/36, p. 5681.) (French patent No. 795,793.) (3407 France.)

A chlorinated soap prepared from fat acids of molecular weight below 210 is used to wash clothes which have been subjected to attack by yperite or as a protection on the skin against attack by yperite.

Restraining the Diffusion of Noxious Gases or Vapours. (E. Brezina and W. Schmidt, Chem. Absts., Vol. 30, No. 16, 20/8/36, p. 5681.) (Austrian patent No. 145,523.) (3408 Austria.)

The diffusion of noxious gases or vapours into the air is restrained by maintaining a layer of an innocuous gas over the surface from which the gases or vapours emanate. The innocuous gas is preferably heavier than the air but lighter than the noxious gas or vapour. Cooled air or CO_2 is suitable.

COMBUSTION (FUELS AND LUBRICANTS).

National Fuels and Motor Alcohol. (C. Mariller, Chem. Absts., Vol. 30, No. 17, 10/9/36, pp. 6162-6163.) (3013 U.S.A.)

The use of motor fuels containing alcohol is rapidly spreading in France. Statistical and technical data are given on the various mixtures authorised by law. To augment the fuel supply, the hydrogenation of coal, by a new process, not described, is being introduced in France. The possible use, in Diesel and semi-Diesel engines, of hydrated alcohol or of mixtures of gas oil with 90 per cent. alcohol and a small percentage of *Et* nitrate is discussed.

The Cetene Scale and the Induction Period preceding the Spontaneous Ignition of Diesel Fuels in Bombs. (M. N. Mikhailova and M. B. Neimann, Chem. Absts., Vol. 30, No. 17, 10/9/36, pp. 6176-6177.) (From Comp. Rend., Acad. Sci., U.S.S.R., No. 2, 1936, pp. 143-147.) (3014 U.S.S.R.)

A comparison was made between the cetene scales obtained with mixtures of cetene and 1-methylnaphthalene in a bomb and in a C.F.R. engine. The tests were conducted in a metal bomb heated by a nichrome spiral, and the fuel was injected into the bomb from a Bosch jet by means of a specially constructed plunger pump. The diagram from the membrane indicator gave the induction period which corresponds to the time interval between injection and spontaneous ignition. The temperature used was 580°, and this temperature and pressure correspond very closely to those obtaining in a Diesel engine at the end of the compression stroke. Induction periods are reported for mixtures of cetene and 1-methylnaphthalene as well as cetene and mesitylene, for a temperature interval of 500-600°. Cetene numbers determined in the C.F.R. engine for eight Diesel fuels are also given. The induction periods of these Diesel fuels were determined by the bomb method and from the values obtained the cetene numbers were taken from the cetene scale. A comparison of the experimentally determined cetene numbers and those determined over the induction periods showed good agreement within the limits of experimental error.

Twelve references.

New Blending Agent Makes Greatly Improved Aviation Fuel. (H. E. Buc and E. E. Aldrin, Chem. Absts., Vol. 30, No. 17, 10/9/36, p. 6177.) (From National Petroleum News, Vol. 28, No. 25, 1936, pp. 25-26 and 28-30.) (3015 U.S.A.)

As shown by tests iso—C_3H_7OH is a satisfactory blending agent, giving an octane number of 105 when blended with 74-octane number gasoline containing not more than 3 cc. of $(C_2H_5)_4$ Pb.

A New Laboratory Method for the Determination of the Volatility of Lubricating Oils for Internal Combustion Engines. (K. Noack, Chem. Absts., Vol. 30, No. 17, 10/9/36, p. 6179.) (From Angew Chem., No. 49, 1936, pp. 385-388.) (3017 U.S.A.)

A review of the following methods is given: Holde drying-oven, Allner, A.S.T.M., I.P.T. (British) and Baader. Their respective advantages and disadvantages are discussed. None of these methods is entirely satisfactory. A new method is described in detail, and the apparatus is shown. The test procedure is as follows: Heat 65 g. of oil for one hour in a brass cup with a screw cap. The heating element is an electrically heated metal block kept at 250°. Insert the brass cup into the metal block immersed in a bath of Wood's metal. Remove the oil vapours formed by means of an air current drawn through three 2 mm. openings in the cap. Adjust the air current to give a suction of 20 mm. of water. Collect the oil distillate, weighing both the distilled oil and the residue. Experimental results are reported for 12 oils varying in viscosity from 4.93° to 12.63° Engler at 50°. Weight losses ranged from 5.8 per cent. (11.55° E.) to 29.7 per cent. (5.93° E.). Repeats are within 0.5 per cent.

Fifteen references.

Motor Fuel (British patent No. 444,026). (E. Bereslavsky, Chem. Absts., Vol. 30, No. 18, 20/9/36, p. 6537.) (3037 Great Britain.)

Motor spirit is obtained by blending gasoline with anhyd. or substantially anhyd. alcohol by means of one or more secondary or tertiary hydroaromatic alcohols of formula $C_{10}H_{16}O$, $C_{10}H_{18}O$ or $C_{10}H_{20}O$, or a substance containing substantial proportions thereof, or a heavy open-chain unsaturated aliphatic primary alcohol of the above formula, or an essential oil containing such alcohol. The blender serves also as an anti-knock agent and as a lubricant and increases the H_2O—tolerance of the fuel.

Unctuosity of Lubricating Mineral Oils. (J. J. Trillat and R. Vaillé, Chem. Absts., Vol. 30, No. 18, 20/9/36, p. 6544.) (From Comp. Rend., Vol. 203, 1936, pp. 159-161.) (3038 France.)

It is shown that oleic acid is adsorbed on filter paper from paraffin oil containing the acid. A content of oleic acid of 1/3,000 was decreased to 1/20,000 by filtration through paper. Filtration through or contact with glass or cotton wool had a similar effect. Other oils containing molecules possessing a permanent electric moment (unsaturated hydrocarbons, aliphatic acids, etc.) behave in the same way. The active molecules are fixed also by metal surfaces.

Boundary Lubrication. (H. Donandt, Chem. Absts., Vol. 30, No. 18, 20/9/36, p. 6544.) (From Z.V.D.I., Vol. 80, No. 27, 4/7/36, pp. 821-824.) (3039 Germany.)

The present knowledge of boundary lubrication is reviewed and results of experiments proved that the friction coefficient of dry friction depends on the nature of the gaseous atmosphere present. It is concluded that four methods exist which increase adsorption in lubrication: (1) Increase the adsorbent power of the oil; this has been done for years, but limits are imposed by the simultaneous increase of the sensitivity to chemical agents, especially O_2. (2) Increase the adsorbent power of the bearing surfaces. (3) Increase the possibility of access of the lubricant to the bearing surfaces by making the latter uneven. (4) Add other substances, *e.g.*, graphite.

Auto-Lubricators (*French patent No.* 796,934). (F. Sattler, Chem. Absts., Vol. 30, No. 18, 20/9/36, p. 6552.) (3042 France.)

An intimate and homogeneous mixture of a metal or metallic alloy powder and powdered graphite is formed, reheated and pressed in successive steps in the same mould and without being withdrawn therefrom between the steps, to form bearings, etc., and these are afterwards tempered.

Contribution to the Theory of Detonation (*Explosives*). (W. Finkelnburg, Z.G.S.S., Vol. 31, No. 4, April, 1936, pp. 109-114.) (3046 Germany.)

Thermo and hydrodynamic considerations (Jouguet, etc.) yield a satisfactory estimate of the velocity of propagation of a detonation wave in a gaseous explosive. Such investigations, however, throw no light on the mechanism of the reaction. The author points out that in the front of the detonating wave the constituent molecules and atoms possess velocities which are the sum of those due to thermal agitation (temperature) and gas velocity proper (rate of transfer). In this way he accounts for some of the experiments of Muraour and Michel-Levy (gas glow).

Problems of Ignition and Flame Propagation. (W. Jost, Chem. Absts., Vol. 30, No. 19, 10/10/36, p. 6919.) (3255 Germany.)

It appears that the flame is propagated by the projection of activated particles as well as by conduction. The initiation of the combustion by means of a spark may introduce free radicles and atoms and these may play a part in the subsequent reaction. The presence of free ions in the flames is also discussed. It appears that considerably more experimental work is required to clarify the whole process.

The Mechanism of the Combustion of Hydrocarbons. (A. R. Ubbelohde, Chem. Absts., Vol. 30, No. 19, 10/10/36, p. 6920.) (3258 Germany.)

With paraffins containing more that 3-4 C. atoms there occurs, on ignition, reaction in the "low temperature region" (250°-320°) with characteristic chemiluminescence, vigorous dependence of the ignition temperature on composition and pressure, high sensitivity toward positive and negative catalysts such as anti-knock agents, and formation of peroxides in quantities that can be isolated. The knocking tendency in engines is related to this combustion in the low temperature area.

The Combustion Process in the Explosion Motor. (A. von Phillippovich, Chem. Absts., Vol. 30, No. 19, 10/10/36, pp. 6920-6921.) (3259 Germany.)

Various factors affecting the combustion process in the engine are studied both for the carburettor and the injection engine (compression ratio, boost, ignition, r.p.m., mixture temperature, cylinder temperature). Most of the work was done on C.F.R. cylinders. The onset of detonation was recorded by a piezo-electric indicator. The resistance to detonation cannot as yet be predicted by purely chemical means.

Some Influences of Dilution on the Explosive Combustion of Hydrocarbons. (W. A. Bone and L. E. Outridge, Proc. Roy. Soc., Vol. 157, No. 891, 2/11/36, pp. 234-248.) (3363 Great Britain.)

The paper deals with certain effects of dilution with inert gases (Ar, He, and N_2) upon explosions of equimolecular mixtures of ethylene or acetylene and oxygen, *i.e.*, $C_2H_4+O_2$ and $C_2H_2+O_2$ which normally give rise to carbonic oxide and hydrogen without any separation of carbon or steam formation. It is now

shown by chemical, photographic, and spectographic tests that sufficient dilution of such media, while not much affecting the main result, may induce some secondary carbon deposition and steam formation on explosion when the mean flame temperature is thereby reduced to a point well below 2,000°C., such result being probably due to the fall in flame temperature induced by dilution.

Combustible Gas Mixture (*British patent No.* 446,493). (Chem. Absts., Vol. 30, No. 20, 20/10/36, p. 7314.) (3379 Germany.)

The object is to obtain gas mixtures which can be liquefied at normal temperature and relatively moderate pressures (20-30 atmospheres). The main source of supply is coke oven gas and it is shown that the liquefying pressure required is mainly determined by the C_2H_6 and C_2H_4 content. If this is kept low (12.5 per cent.), the pressure needed is reduced to 18 atmospheres, whilst the presence of 35 per cent. C_2H_6 and C_2H_4 requires 30 atmospheres. Abstractor's Note.—Considerable attention is given to the use of compressed fuel gases on motor lorries in Germany at the present time.

Apparatus for Analysis of Gases such as Automobile Engine Exhaust Gases. (L. L. Vayda, Chem. Absts., Vol. 30, No. 20, 20/10/36, p. 7315.) (U.S. patent No. 2,053,121.) (3380 U.S.A.)

Unlike other well known forms of exhaust gas analysers which depend on the heat conductivity of the gas varying with its composition, the present apparatus utilises catalytic combustion to indicate how far chemical equilibrium has been established. Various structural and operative details are given.

Correlation of Tests on the Ignition Quality of Diesel Fuels carried out at Delft and Sunbury. (G. D. Boerlage and others, Chem. Absts., Vol. 30, No. 20, 20/10/36, p. 7317.) (3381 Great Britain.)

Co-operative tests of the ignition quality of Diesel fuel by the laboratory of the Royal Dutch Shell, at Delft, Holland, and that of the Anglo-Persian Oil Co., at Sunbury, showed satisfactory agreement in general, notwithstanding that eight different engines were employed. Vegetable oils and doped fuels have to be tested in the engine in which they are to be used. The proper determination of cetene number is not likely to be as exacting as that of octane number. A variation of a few points in the cetene number is not significant, especially in the upper ranges.

Surface Films and Lubrication. (D. R. Pye, J.R. Aer. Soc., Vol. 40, No. 310, October, 1936, pp. 754-768.) (3416 Great Britain.)

Friction and metallic cohesion are in the first phase essentially similar. Viscosity is important in a lubricant because between uneven surfaces the time taken to squeeze away a more viscous oil (and establish the dangerous state of boundary lubrication between two high spots) is greater than with a less viscous oil. A powerful primary film is a safeguard against seizure and depends on the presence of polar molecules together with a receptive bearing surface. It is necessary for the polarity to persist up to relatively high temperatures and oil stability is thus of importance. If after all break down occurs, the effects of the resultant seizure can be minimised by the preparation of the solid surface in such a form as to resist mutual cohesion of the molecules across the interface at the moments of breakdown of the primary film. The well known good surface qualities of cast iron are due to the presence of free graphite and in that case of other metals, similar beneficial results may result from polishing and other forms of surface treatment. (See also Abstract No. 3039 Germany.)

Pro-Knocks and Hydrocarbon Combustion. (A. R. Ubbelohde and others, Proc. Roy. Soc., Vol. 153, No. 878, 2/12/35, pp. 103-115.) (3418 Great Britain.)

In a previous paper (Phil. Trans. Roy. Soc., Vol. 234, 1935, p. 433) the authors showed that knocking in an internal combustion engine is associated with the presence of peroxide substances formed in the last part of the charge to burn. In the present paper, the authors describe further experiments with the sampling valve from which it appears that the knocking is not due to the formation of aldehyde peroxide, but that direct peroxidation of the fuel is responsible. It was also established that no NO_2 is formed during the compression stroke and that the presence of this gas is most likely due to the catalytic effect of the metal exhaust valve during the combustion stroke.

Sewer Gas for Internal Combustion Engines. (W. Ryssel, Z.V.D.I., Vol. 80, No. 43, 24/10/36, p. 1290.) (3426 Germany.)

Sewer gas is obtained in the settling tanks of the sewage farm and has the following approximate composition:—

75 per cent. methane
22 per cent. CO_2
2.7 per cent. N_2
0.2 per cent. H_2
0.1 per cent. H_2S

Its upper calorific value is approximately 7,200 *k* cal./m.^{3}. In Stuttgart (Germany) approximately 36 lorries are operated by the gas, supplied at 200 atmospheres in steel bottles. Experience has shown that 1 m.^{3} of the unpurified gas is approximately equivalent to 1 litre of petrol, the compression ratio of the engine being unaltered. There is a power drop of approximately 10 per cent. compared to petrol. The operation with sewer gas (practically methane) is characterised as very smooth. Engines remain very clean and there is no dilution of the lubricating oil. (See also Abstract No. 3379 Germany.)

Experiments with Bearings with High Pressure Lubrication. (G. Welter and W. Brasch, Phys. Berichte, Vol. 17, No. 20, 15/10/36, p. 1849.) (3446 Germany.)

Before starting the engine, the bearings are supplied with oil at sufficiently high pressure to ensure that the shaft is lifted off the bearing shell. The starting friction is thus reduced below the normal operating value and wear becomes negligible.

Coal Gas as a Fuel for Motor Car Engines. (W. Rixmann, Z.V.D.I., Vol. 80, No. 21, 23/5/36, pp. 627-632.) (3598 Germany.)

Bench tests were carried out on a six-cylinder 10.85 litre engine developing approximately 100 b.h.p. on petrol (1,400 r.p.m.). With the compression ratio unchanged (*CR* = 5.05) coal gas gave 12 per cent. less power. By raising the *CR* to 7.5 (preignition limit), this was reduced to 2 per cent. The relatively small drop in power with gas is explained by the higher volumetric efficiency of the engine in this case (80 per cent. with gas against 66 per cent. petrol). Best consumption figures are approximately 0.75 cubic metre of gas per b.h.p. hour against 260 gm. of petrol. The former was obtained at *CR* 7.5 (lower calorific value 3,420 *k* cal./m.^{3}), the latter at *CR* 5.05 (lower calorific value 9,800 *k* cal./kg.). It will be seen that the thermal efficiency is the same in spite of the difference in *CR*. Considerable difficulty is experienced to devise an automatic gas carburettor. Various designs using quantity or quality governing are described and a combination of the two methods is recommended. A considerable number of heavy vehicles using compressed coal gas are in operation in Germany. (See also Abstracts Nos. 3379 Germany and 3426 Germany.)

MATERIALS AND ELASTICITY.

Charts for Checking the Stability of Compression Members in Trusses. (K. Borkmann, N.A.C.A. Tech. Memo. No. 800, translated from L.F.F., Vol. 13, No. 1, 20/1/36, pp. 1-9.) (754/2909 Germany.)

In practice the more general method of checking the stability of trusses (as of fuselage or wing spars) has been to take the effect of fixity into account, by using fixity factors. This may lead to error, since the fixity does not only depend on the truss design but also on the stress existing in the whole system. A more accurate method is the following:—The buckling strength of a truss within a system with spatially defined nodal points is determined by resolving the entire truss into groups of members, each group being assumed rigid, but the individual groups hinged. The buckling criterion then follows from a determinant equation which is rather complicated. The charts presented in the present paper are based on the same formulæ, but reduce the amount of paper work considerably.

Viscosity of Liquid Sodium and Potassium. (Y. S. Chiong, Proc. Roy. Soc., Vol. 157, No. 891, 2/11/36, pp. 264-277.) (3365 Great Britain.)

The viscosity of liquid sodium and potassium has been measured by the oscillating sphere method, in which the liquid is enclosed in a glass sphere, and its viscosity calculated from the damping of the oscillation. The alkali metals have been chosen because their simple crystal structure has advantages for comparison with theory. The measurement was done from the immediate neighbourhood of the melting point up to about 360°C. Results obtained for both sodium and potassium are found to obey satisfactorily the two viscosity formulæ of Andrade.

Note on Fracture. (H. Jeffreys, Proc. Roy. Soc. of Edinburgh, Vol. 56, Part 2, 1936, pp. 158-163.) (3532 Great Britain.)

The usual Coulomb-Hopkins theory of fracture asserts that fracture begins at the time and place where the difference between the greatest and least of the principal stresses first reaches the strength of the material. On the more recent theory of Mieses, the stress difference is not the only determinant, but the function whose value determines whether fracture occurs or not is so nearly proportional to the square of the stress difference, that very special experimental conditions are needed to find out which criterion is the better. The form of the fracture surface is determined by change of stress arising during fractures and not by the original distribution of stress.

On the Boundary Problem of the Uniformly Loaded Circular Plate. (J. Barta, Z.A.M.M., Vol. 16, No. 5, Oct., 1936, pp. 311-314.) (3572 Austria.)

If the deflection and its normal derivative at the edge of the plate are given functions, then the deflection at an interior point may be calculated as the mean value of the deflections of all chords passing through this point, each chord being regarded as a uniformly loaded beam with corresponding deflections and derivatives at the ends.

The Transmutation of Matter by High Energy Particles and Radiations. (The 27th Kelvin Lecture.) (J. D. Cockroft, J. Inst. Elec. Eng., Vol. 79, No. 479, Nov., 1936, pp. 532-540.) (3593 Great Britain.)

One ounce of matter, completely transformed, would produce 700 million kilo. watt hours of energy. Laboratory transmutation is, however, hopelessly inefficient. The problem would come into the realm of possibility, if streams of neutrons could be employed, for such particles lose no energy to electrons and the efficiency in producing transmutations may approach 100 per cent. Unfortunately, at the present time, the neutrons themselves can only be produced by

the interaction of charged nuclei at a very low efficiency. It is of interest to note that at stellar temperature a conversion of mass into energy takes place on a large scale. It is this process which maintains solar temperature and accounts for the synthesis of the elements.

A Record of Recent Progress towards Correlation of the Chemical Composition, the Physical Constitution and the Electrical Properties of Solid Dielectric Materials. (W. Jackson, J. Inst. Elec. Eng., Vol. 79, No. 479, Nov., 1936, pp. 565-576.) (3594 Great Britain.)

The chemical and physical complexity of most of the solid dielectric materials which find application in electrical engineering practice makes an understanding of their electrical behaviour an extremely difficult matter, since the phenomena underlying conduction processes even in simple solid materials are not fully understood. A considerable amount of work has been carried out during recent years in an endeavour to clarify this behaviour, and in consequence there has been a very noticeable tendency to develop new materials on a scientific basis. The present paper is an attempt to gather together in summarised form the published information relating to this work and is an extension of a previous résumé covering liquids.

Spot-Welding and Forging of Steel. (Military Air Academy of the Red Worker and Peasants' Army, Proceedings No. 12, 1935.) (3622 U.S.S.R.)

Spot-Welding, pp. 5-68:—The factors controlling spot-welding depend on the composition of the steel. Control should be specially rigid in the case of V2A steels, whilst chrome-molybdenum steels show greater latitude. *Forging*, pp. 71-230:—The toughness, plasticity and fatigue limits of E18 steel are correlated to the degree of forging of the material. The lack of uniformity of the products of certain steelworks is pointed out and remedies are indicated. By keeping a log of the practical performance of the finished article (crankshaft) together with the source of origin, it is hoped that manufacturers will obtain the necessary incentive.

Transfer of Stress from Main Beams to Intermediate Stiffeners in Metal Sheet Covered Box Beams. (B. B. C. Lovett, J. Aer. Sci., Vol. 3, No. 12, Oct., 1936, pp. 426-430.) (3521 U.S.A.)

The authors have obtained by experimental methods an effective shear modulus for the sheet in a stiffened plane sheet beam combination under bending loads. For the combinations tested it was found that the modulus decreases rapidly under light loadings from the elastic value to some asymptotic value depending upon the sheet thickness. The thick sheet combination gave higher values of the effective shear modulus than the thin sheet.

Effect of Rivet Spacing on Stiffened Thin Sheet Under Compression. (W. L. Howland, J. Aer. Sci., Vol. 3, No. 12, Oct., 1936, pp. 434-439.) (3523 U.S.A.)

It had previously been found that for the same spacing between attachments, a sheet stiffener combination will carry most load if welded and least if bolted. Riveting is intermediate. The present paper investigates the effect of size and position of rivets. The conclusions are that the spacing of the rivets should not be too close and the rivets as large as possible.

A Method of Stress Analysis of Monocoque Fuselage Circular Rings. (E. J. A. Greenwood, J. Aer. Sci., Vol. 3, No. 12, Oct., 1936, pp. 440-443.) (3524 U.S.A.)

The purpose of this paper is to outline a method which may be used for the determination of the forces in a monocoque fuselage circular ring which is sub-

jected to concentrated external forces and moments. The balancing forces are considered to be applied by the fuselage skin, which is the usual design condition. Coefficients for determining the bending moment, shear, and axial load at any point in a ring have been derived and a method of plotting these in terms of the applied load and radius of curvature of the ring is presented. By use of these curves the stress at any ring section may be readily determined for the loading condition considered in this paper. Curves similar to those presented here may be constructed for other basic loading conditions.

METEOROLOGY AND PHYSIOLOGY.

Airplane Tracks in the Surface of Stratus Clouds. (Irving Langmuir and Alexander Forbes, J. Aer. Sci., Vol. 3, No. 11, Sept., 1936, pages 385-387.) (3515 U.S.A.)

Cloud-forms differ in stability according to their type. Cumulus clouds are characterised by turbulence, whereas stratus clouds are, by contrast, stable and relatively static. The authors describe a series of observations in which the stability of stratus clouds was shown by the persistence of tracks made in them by aeroplanes. The authors consider that the track is caused by the weight of the aeroplane giving to the air along the track a downward component of velocity which results in the warm, dry air, just above the cloud, being forced down into the cloud. Attempts were made to cut visible tracks through the tops of rounded cumulus clouds but the tracks were indistinct and quickly disappeared, agreeing with other evidence of turbulence in cumulus clouds. The authors conclude from a comparison of observations made that a sharply defined upper surface of a stratus cloud, correlated with inversion of temperature, presents a condition of great stability, and that in the case of stratus clouds the more sharply defined the surface, the greater is the stability. (Photographs of tracks are shown.)

Change of Boiling Point of Liquid Oxygen at High Altitudes. (Jean Piccard, J. Aer. Sci., Vol. 3, No. 11, Sept., 1936, page 406.) (3519 U.S.A.)

When an aeroplane is rising, the boiling point of liquid oxygen is constantly diminishing. The liquid is therefore boiling more violently and is cooling far below its normal boiling point. When the ceiling is reached and the pilot commences his return voyage to earth, the atmospheric pressure on his oxygen apparatus immediately begins to rise and the liquid stops boiling, with the result that gas production stops entirely, and, in addition, the cold liquid begins to condense nitrogen and oxygen at its surface. In this manner, air is even sucked back from the gas mask into the bottle. The author describes his experience with this phenomenon and points out the danger to aviators engaged in high altitude flights when a gas mask employing liquid oxygen is used. There is very real danger of suffocation on the descent to earth.

MISCELLANEOUS.

French Aerodynamic Research Institution's Exhibit at the Paris Show. (Les Ailes, No. 805, 19/11/36, p. 5.) (3618 France.)

Amongst items of interest are:—(1) Study of flow round propellers and wings by means of smoke jets, the flow being examined stroboscopically. (2) Boundary layer control by moving belt forming part of wing surface. (3) Dropping tests to study effect of high Reynolds numbers on resistance. The buoyant model is dropped into a lake and the retardation recorded. (4) Gunpowder engine by Riabouchinsky. Powder cartridges are fired in succession and the resultant gas operates a reaction turbine geared to a propeller. (5) Supersonic wind tunnels of the induced flow type (injector). (6) Hydrodynamic analogy of supersonic flow by study of surface waves and ripples in liquids.

SOUND, LIGHT AND HEAT.

The Modulation of a Light Source by Means of Supersonic Waves. (H. E. R. Becker, H.F. Technik., Vol. 48, No. 3, Sept., 1936, pp. 89-91.) (3048 Germany.)

The sound waves are generated piezo-electrically inside a liquid in a tank, the energy required being very small (less than 0.1w). The method depends on the Debye-Sears phenomenon of diffraction and has possible application to television.

Heat Conductivity of Gases with Free Convection. (W. Weizsäcker, Phys. Zeit., Vol. 37, No. 18, 15/9/36, pp. 641-650.) (3179 Germany.)

The free convection in an enclosure is reduced as the gas pressure is reduced and disappears at a certain critical pressure which is a characteristic of the gas examined. For hydrogen true conduction is set up at absolute pressures of the order of 80 mm. of mercury. For CO_2 and air much lower pressures are required (10-20 mm.)

A Study of the Characteristics of Noise. (V. D. Landon, Proc. Inst. Rad. Eng., Vol. 24, No. 11, Nov., 1936, pp. 1514-1521.) (3488 U.S.A.)

It is well known that when smooth noise such as hiss is passed through or generated in a radio-frequency amplifier, the root-mean-square output is proportional to the square root of the frequency band width. Experiments are described which show that the peak value of the hiss is also proportional to the square root of band width. The crest factor (defined as the ratio of the amplitudes of the highest peaks to the root-mean-square value) was found to be equal to 3.4 and independent of band width. When the noise is caused by impulse excitation with decay trains not overlapping, the result is quite different. The root-mean-square amplitude is still proportional to the square root of frequency band passed; however, the peak amplitudes are directly proportional to the first power of the frequency band. The result is verified mathematically and experimentally.

ELECTRICITY.

Ultra-High-Frequency Transmission between the R.C.A. Building and the Empire State Building in New York City. (P. S. Carter and G. S. Wickizer, Proc. Inst. Rad. Eng., Vol. 24, No. 8, Aug., 1936, pp. 1082-1094.) (2465 U.S.A.)

Propagation between these two buildings at a frequency of 177 megacycles has been studied with the object of providing a radio circuit with flat response over three megacycles. It was found that the received signal arrived over several paths, some of which were due to reflections from ground and from nearby buildings. The effects on the indirect rays of horizontal and vertical directivity, and change in angle of polarization were observed. The theoretical response curve for an assumed combination of rays was compared with the curves obtained experimentally.

Electron Optical System of Two Cylinders as Applied to Cathode-Ray Tubes. (D. W. Epstein, Proc. Inst. Rad. Eng., Vol. 24, No. 8, Aug., 1936, pp. 1095-1139.) (2466 U.S.A.)

The electron beam of a cathode-ray tube is usually focussed by means of an electron optical system of two coaxial cylinders. This paper presents a detailed treatment of such a focussing system and is divided into two parts. Geometric electron optics of axially symmetric electrostatic fields is presented in Part I.

This deals with (1) the analogy between light and electron optics, (2) motion of electrons in axially symmetric electrostatic fields, (3) definition and determination of positions of cardinal points due to axially symmetric electrostatic fields, and (4) thick and thin lenses. The lenses equivalent to the electrostatic fields of two coaxial cylinders are discussed in Part II.

This deals with (1) positions of cardinal points due to two coaxial cylinders of various diameters and at various voltages, (2) use of such cardinal points, (3) experimental determination of positions of cardinal points, and (4) spherical aberration of electrostatic field due to two cylinders. The results are applied to the cathode-ray tube.

Magnetron Oscillators for the Generation of Frequencies between 300 and 600 Megacycles. (G. R. Kilgore, Proc. Inst. Rad. Eng., Vol. 24, No. 8, Aug., 1936, pp. 1140-1157.) (2467 U.S.A.)

The need for vacuum tube generators capable of delivering appreciable power at frequencies from 300 to 600 megacycles is pointed out and the negative resistance magnetron is suggested as one of the more promising generators for this purpose. An explanation of the negative resistance characteristic in a split-anode magnetron is given by means of a special tube which makes possible the visual study of electron paths. In this manner it is demonstrated how most of the electrons starting toward the higher potential plate reach the lower potential plate. From the static characteristics it is shown how the output, efficiency, and load resistance can be calculated. Two methods are described for increasing the plate-dissipation limit. One method is that of increasing the effective heat-dissipating area by the use of an internal circuit of heavy conductors. The other method is that of a special water-cooling arrangement which also makes use of the internal circuit construction. Examples of laboratory tubes are illustrated, including a radiation-cooled tube which will deliver 50 watts at 550 megacycles and a water-cooled tube which will deliver 100 watts at 600 megacycles.

Beam Wireless Direction Finding Using Two Similar and Separately Tuned Receiving Antennæ. (Telefunken, German patent No. 628,763.) (H.F. Technik, Vol. 48, No. 3, Sept., 1936, p. 109.) (3050 Germany.)

In the case of the Adcock direction finder (freedom from night effects) the tuning of the two receiving antennæ is difficult. In the present patent tuning is achieved by utilising an auxiliary transmitter which is placed symmetrically with the antennæ and which is in tune with the beam. Correct tuning of the antennæ is checked by putting them in opposition when the E.M.F. generated should cancel out.

The Propagation of Radio Waves Over the Surface of the Earth and in the Atmosphere. (K. A. Norton, Proc. Inst. Rad. Eng., Vol. 24, No. 10, Oct., 1936, pp. 1367-1387.) (3361 U.S.A.)

Simple formulæ and graphs are given which represent the ground-wave field intensity at the surface of the earth as radiated from a short vertical antenna at the surface of the earth. The theory is compared with some experimental results reported by other investigators. The diffraction formula given is theoretically valid only at the lower frequencies; however, it was shown that sky waves are important both day and night and over land and sea at those distances where diffraction would otherwise cause a marked decrease in the received field intensity. The attenuation formula given for the short distances where diffraction may be neglected is theoretically valid for any frequency and set of ground constants; experimental data are given which show that the formula may be used at the ultra-high frequencies.

Modified Sommerfeld's Integral and its Application. (S. A. Schelkunoff, Proc. Inst. Rad. Eng., Vol. 24, No. 10, Oct., 1936, pp. 1388-1398.) (3362 U.S.A.)

The purpose of this paper is to obtain a certain integral expressing fundamental wave function and with the aid of this integral to calculate the radiation resistance of small doublets and small loops placed inside an infinite hollow cylinder. Some applications of this integral to calculation of radiation from parallel wires in free space are also discussed.

The Experimental Determination of the Velocity of Radio Waves. (R. C. Colwell and others, J. Frank. Inst., Vol. 222, No. 5, Nov., 1936, pp. 551-552.) (3559 U.S.A.)

A radio station "A" sends out sixty short pulses a second; another station " B " at a distance of twenty kilometres is also sending out sixty pulses per second. By means of a phase shifter, the operator at " B " can send his pulses back to "A" at the exact instant of reception. Hence the station " B " acts as a reflector for the pulses. The operator at " B " sets his pulses in coincidence with those from "A" with the aid of an oscilloscope having a sixty cycle sweep. The operator at "A" measures the distance between the two groups of pulses seen on the oscilloscope. Since the sweep rate of the oscilloscope is known, the velocity can be calculated. For the medium-high frequency waves used, the velocity is considerably less than the velocity of light, varying from $\frac{1}{2}$ to $2/3$ of that constant depending on meteorological conditions. The reduction appears to be largely due to conductivity and variation in the dielectric constant of the earth.

Television Exhibit at the Brussels International Exhibition. (R. Barthélemy, Revue Générale de L'Électricité, Vol. 38, No. 12, 21/9/36, pp. 405-410.) (3569 Belgium.)

Visitors were moved past the exhibit by a slowly moving platform and in this way large numbers could be dealt with. The apparatus, of French design, and similar to that installed at the Eiffel Tower, utilises a spiral Nipkow disc and a 60 line Cathode Ray picture. The definition is improved by giving each line a small oscillatory motion. In this way, the dark horizontal intervening spaces disappear and the impression of a 120 line scanning is given. The special synchronising device (short signal at end of each line) and its associated thyratron circuit is described.