ABSTRACTS FROM THE SCIENTIFIC AND TECHNICAL PRESS.

Issued by the

Directorates of Scientific Research and Technical Development, Air Ministry.

(Prepared by R.T.P.)

No. 63. JANUARY, 1939.

The Present State of Coastal Defence. (C. Rehder, W.T.M., Vol. 42, No. 8, August, 1938, pp. 356-365. Translation No. 788.) (63/1 Germany.)

In the future as in the past, properly designed coastal defences will be able to hold their own against any attack by ships. Modern defences will differ from previous installations by a much greater depth, with efficient protection on the land side.

All the heavy guns are mounted in gas-proof turrets and great care must be given to the equipment of the signals branch (warning of attack both from the sea or air). A coastal defence system should be able to hold its own without support from the home fleet. An adequate supply of small surface vessels must, however, be provided for scouting and mine sweeping. Reconnaissance aircraft must also be provided so as to reduce the possibility of surprise by an enemy aircraft attack coming from the sea. In a future war it will not be possible to build new coastal defences after hostilities have started, modern air raids rendering all work of this type impossible. It is, therefore, essential that available coastal defensive systems should be designed with an eye as to future requirements.

Success is only possible if there is complete and harmonious co-operation between all three services, fleet, air and army.

Training A.A. Searchlight Spotters. (L. E. C. M. Perowne, Coast Artillery Journal, No. 6, Nov.-Dec., 1938, pp. 430-41.) (63/2 U.S.A.)

Unlike the training of lorry-drivers and searchlight operators, we are faced in the training of spotters and listeners with making men proficient in a subject which has no counterpart in civil life. We have here the problem of developing the senses, but, whereas the sound locator provides in itself a ready means of demonstration, checking progress and registering the results of the listeners' work, the functions of the spotter furnish us at present with no such opportunities. Telescopic vision, moreover, is an art practised by few among those from which our potential spotters are drawn.

One of the principal objects of the system of training outlined above is, therefore, to furnish a scientific framework upon which to build, and to provide a basis for a series of tests to which both instructor and pupil can relate their progress.

Target Aircraft for A.A. Artillery Training. (S. L. McCroskey, Coast Artillery Journal, No. 6, Nov.-Dec., 1938, pp. 479-81.) (63/3 U.S.A.)

The general characteristics of the Denny targets are as follows:—

Ceiling: 7,000-8,000ft.
Maximum speed: 75 miles per hour (approximately).
Controls: Radio and automatic.
Wing span: 12ft.
Length of fuselage: About 8ft.
Parachute equipped, opening automatically to assist in landing without damage.
Fuel capacity: 30 minutes of flight.
Launching: Simple catapult.

These little targets do not have the characteristics required for anti-aircraft gun training, but they represent a step in the right direction. They may fill the bill for machine gun target use and also for the use of gun batteries. Many organisations, such as ROTC units, have scant opportunity to practise trackings because of lack of aeroplanes. If the Denny target will operate dependably, it may well meet the need in these cases.

In the meantime, studies looking toward the production of a target of greater capabilities continue. Such a target should not cost more than $1,500 in quantities. A list of desirable qualities is given by the author.

A Plotting Board for A.A. Target Practice. (H. W. Conklin, Coast Artillery Journal, No. 6, Nov.-Dec., 1938, pp. 482-3.) (63/4 U.S.A.)

In the analysis of an anti-aircraft target practice it is necessary to determine the speed of the target. The only method that can determine this speed accurately is a plot of the horizontal projection of the course. Since this plot has to be made and is made from the data furnished by the camera stations accurately located at the ends of a surveyed baseline, there is no reason why the horizontal ranges from the base end stations should not be read directly from this plot.

Most anti-aircraft record sections have improvised boards upon which to do this plotting, but in many cases such boards have been locally and crudely made, and have been constructed so as to be of use for one particular baseline only.

To overcome the difficulty of using several boards, and to provide one universal plotting board suitable for a baseline of any length and azimuth applicable to anti-aircraft firings was the object of the design of the board described herein.

In addition to the horizontal plot, this board, by the addition of a grid chart, will also serve as a slant range board solving the elements of the right triangle in the vertical plane, *i.e.*, slant ranges and altitudes.

Comparison of French and German Air Power. (H. Bouché, Int. Avia., No. 602, 17/12/38, pp. 1-3.) (63/5 France.)

According to the author, the following table gives a comparison between French and German air power:

	Front Line Strength. (Aircraft).	Front Reserves. %	Monthly Production. End of 1938. Aircraft.	Monthly Production. End of 1938. Engine.	Labour. Force.	Weekly Working Hours.
Germany	3,000	60-70	400	1,000	120,000	6,960,000
France	1,400	20	70	200	48,000	2,160,000

From this it can be deduced that:

(1) The French front line strength is less than half the German.
(2) The German front reserves amount to over six times the French reserve.
(3) The time taken by Germany to pass a type from design to production stage is less than half the time taken by France.
(4) Taking the whole of 1938, the French production of aircraft and engines amounted to less than one-fifth of the German production.

The Objectives of Independent Air Attack. (G. Rohrig, Verkehrsrechtliche Schriften No. 6, Ost Europa Verleg, 1938.) (63/6 Germany.)

In a modern war the distinction between combatants and non-combatants has largely disappeared and hence the scope of the attack and the number of objectives have increased enormously.

The author defines the legal aspects of aerial warfare and the various attempts to arrive at international agreement at the Hague and Geneva are reviewed.

Unfortunately all these attempts have failed, so far, and even hospitals and works of art are not immune from air attack since illumination at night would not be practicable and other buildings forming more or less legitimate targets are generally sufficiently near to render " mistakes " possible. The only hope is a fresh world conference now that the consequences of indescriminate air attack are being more fully realised.

According to the author, Germany is ready to sign a pact with the Western Nations restricting the use of aircraft and preventing sudden attacks.

The book is well documented and contains extensive quotations from English, American and French authors.

Aerial Combat. (A. Surikoff and W. Nikolsky, Na Straje, 20/7/38, Luftwehr, Vol. 5, No. 11, Nov., 1938, pp. 447-450.) (63/7 U.S.S.R.)

Whenever possible, the attack should come as a surprise to the enemy. In case of equal training and material, victory comes to the fighter displaying the greater aggressive spirit. Any slackening of the attack immediately stimulates the enemy and may prove fatal. On account of the high airspeeds, the time of attack is relatively short (5-10 seconds). The advantage of the fighter over the bomber as regards speed has also been very much reduced and whilst three to four attacks could be carried out previously in quick succession on a bomber formation it may now take the fighters 15 minutes to catch up the bombers for a second attack.

The various manœuvres for breaking off the fight have to be carefully studied since during these moments the danger of assuming an unfavourable position is very great.

Experience in Spain has shown that the pilot who turned away first was frequently shot down. For this reason it appears useful to utilise two types of fighters simultaneously. Very high speed machines for breaking up the enemy formation and lower speed machines of great manœuvrability for the subsequent " dog fight."

Protection of Buildings Against Incendiary Thermite and Electron Thermite Bombs. (F. J. Hombracht, De Ing. (Bouw en Waterbouwkunde), Vol. 53, 16/9/38, pp. 161-3. Eng. Absts., Vol. I, No. 11 (Sect. I), Nov., 1938, pp. 123-4.) (63/8 Holland.)

The author states that bombs used during recent wars have been filled with a mixture of powdered aluminium and ferric oxide. This ignites easily and produces in its combustion temperatures of 2,000-3,000°C. during three to four minutes, whilst if encased in " elektron " shells, made of a combustible alloy of magnesium and aluminium the combustion period is extended to 10-12 minutes. It is difficult to find building materials both cheap enough to be used extensively, and capable of resisting such high temperatures. The author proposes the use of cover-plates made of clay or loam containing straw, cut to lengths ranging from 20 mm. to 50 mm. and mixed in the following volumetric proportions: Three parts chopped straw; one part clay or loam; ½ part ciment fondu; ½ part milk of lime diluted to 15° Beaume; the moist mixture to weigh 1.1-1.2 kg. per litre. Such plates become firm and are very porous. They are bedded on paper or board rendered waterproof by being soaked in oil. A thickness of about 25 mm. is suitable for vertical attic walls, and 35 mm. for floors. Plates of this type have been tested by dropping on them ordinary incendiary bombs weighing 3 kg.

(6.6lb.) and " elektron-covered " bombs weighing 1 kg. (2.2lb.) from a height of 35 m. (82ft.). It was found that the burning bomb forms a thick ash on the surface of the cover-plate, and that the moisture between the surface and the oiled paper forms a cushion of air or steam which prevents the heat from penetrating through the plate. Very little damage was caused to the plates. Tests are to be made with heavier " elektron-covered " bombs. The author states that the penetration of weak attic floors can be prevented by covering them with a thin layer of concrete reinforced with wire-gauze.

Theoretical Stability and Control Characteristics of Wings with Various Amounts of Taper and Twist. (H. A. Pearson and R. T. Jones, N.A.C.A. Report No. 635, 1938.) (63/9 U.S.A.)

Stability derivatives have been computed for twisted wings of different plan forms that include variations in both the wing taper and the aspect ratio. Taper ratios of 1.0, 0.50 and 0.25 are considered for each of three aspect ratios: 6, 10, and 16. The specific derivatives for which results are given are the rolling-moment and the yawing-moment derivatives with respect to (*a*) rolling velocity (*b*) yawing velocity, and (*c*) angle of sideslip. These results are given in such a form that the effect of any initial symmetrical wing twist (such as may be produced by flaps) on the derivatives may easily be taken into account.

In addition to the stability derivatives, results are included for determining the theoretical rolling moment due to aileron deflection and a series of influence lines is given by which the loading across the span may be determined for any angle-of-attack distribution that may occur on the wing plan forms considered. The report also includes incidental references to the application of the results.

The Moment of the Fluid Pressure Acting on a Flat Plate in a Stream Between Two Parallel Walls and Some Allied Problems. (S. Tomotika, Aer. Res. Inst., Tokio, No. 170, Oct., 1938, pp. 475-551.) (63/10 Japan.)

In the present paper, the problem of the moment of the fluid pressure acting on a flat plate in a stream between parallel rigid walls is solved in an exact and general form, by using suitable conformal transformations, under the assumption that there is circulation round the plate. After detailed numerical calculations for the particular case when the mid-point of the plate is midway between the walls, the interference effect of the channel walls upon the moment on the plate is discussed and also an investigation is made on the manner in which the centre of pressure of the plate is affected by the presence of the channel walls. It is found that the moment of the plate always increases due to the influence of the walls and that when the angle of attack lies within the practically important range, the centre of pressure of the plate moves towards its mid-point as the width of the channel decreases. An expansion for the moment is also obtained for the particular case concerned.

Next, the values of the moment for the plate in the case of flow with circulation round the plate are compared with those of the moment for the case of flow with no circulation. It is found that the moment is slightly increased due to the presence of the circulating flow.

By removing either of the upper and lower boundary walls of the channel to infinity, we obtain two semi-infinite streams past a flat plate bounded respectively by a lower or upper wall. These limiting cases lead to results in agreement with previous expressions obtained by the author.

Pressure Loss in Flowing Gases. (R. Stroehlen, Archiv Warmewirtschaft, Vol. 19, Aug., 1938, pp. 209-13. Eng. Absts., Vol. 1, No. 11 (Sect. 2), Nov., 1938, p. 158.) (63/11 Germany.)

The author asserts that the usual method of ascertaining the pressure loss due to heat-interchange in flowing gases, on the basis of the equation for isothermal flow, leads to incorrect results. He demonstrates that the interrelation between

interchange of heat, pipe friction, and the resulting pressure drop can be deduced from the basic energy equation, and that close agreement between calculated and measured results can be obtained. It has been found, with the formulæ hitherto used, that in actual practice, in the case of the higher speeds of flow, the measured resistances were lower than would have been expected by the application of these formulæ. This discrepancy cannot be accounted for by the influence of the pipe diameter, but is more likely to be due to the altered flow conditions caused by the interchange of heat. The resistance to the flow is primarily influenced by the change of temperature in the direction of flow. The author presents an analysis based upon certain assumptions, and works a numerical example.

The Accurate Measurement of Static and Dynamic Pressure. (G. Kiel, L.F.F., Vol. 15, No. 12, 10/12/38, pp. 583-597.) (63/12 Germany.)

In the case of a biplane, it is relatively easy to find a region between the two planes in which the air speed corresponds with that of the undisturbed flow for the complete range of practical angles of incidence.

In the case of a monoplane, however, an accurate measurement of static and dynamic pressure would entail mounting the instrument at a considerable distance from the wing. Such an installation is clumsy, fragile and affects the drag of the complete aircraft. As an alternative, the author investigated the fitting of a small subsidiary wing above the main monoplane wing and mounting the static and dynamic pressure tubes in close proximity to the underside of the subsidiary wing. This scheme, although giving satisfactory results, is still clumsy and was finally abandoned for a novel method in which two pressure recording tubes are employed mounted respectively above and below the main wing. In this arrangement the static pressure recorders are connected together and by proper dimensioning of the pipe, the correct (undisturbed) static pressure can be tapped off at some intermediate point, whilst the total pressure can be read on either instrument. Experiments show that the new method is accurate over the full range of incidence, including flap operation and will be specially useful for determining altitude during blind landings.

The Aerodynamic Characteristics of Four Full-Scale Propellers Having Different Plan Forms. (E. P. Hartman and D. Biermann, N.A.C.A. Report No. 643, 1938.) (63/13 U.S.A.)

Tests were made of four propellers, with diameters of 10ft., having different blade plan forms. One propeller (Navy design No. 5868-R6) was of the usual present-day type and was used as a basis of comparison for the other three, which had unusual plan forms distinguished by the inward (toward the hub) location of the sections having the greatest blade width.

It was found that propellers with points of maximum blade width occurring closer to the hub than on the present-day type of blade had higher peak efficiencies but lower take-off efficiencies. This result was found true for a " clean " liquid-cooled engine installation. It appears that some modification could be made to present plan forms which would produce propellers having more satisfactory aerodynamic qualities.

The propellers with the inward location of the points of maximum blade width had lower thrust and power coefficients and stalled earlier than the present-day type.

Tests of a Contra-Propeller for Aircraft. (W. M. Benson, N.A.C.A. Tech. Note No. 677, November, 1938.) (63/14 U.S.A.)

Tests of an eight-blade contra-propeller of 32-in. diameter in combination with a four-blade, 36-in. diameter adjustable pitch, metal propeller at pitch settings of 15°. 25°. 35°, and 45° at 0.75 R were made in the wind tunnel at Stanford University.

The tests showed a significant increase in effective thrust of the combination over that of the propeller alone for values of V/nD somewhat below those for maximum efficiency and without a corresponding increase of power absorbed. From ½ per cent. to 2½ per cent. in propulsive efficiency was thus gained in this range. In all but one case, however, the peak propulsive efficiency of the combination was found to be from 1 to 2 per cent. less than that of the propeller alone.

Counter torque on the contra-propeller amounted to about 50 per cent. of the propeller torque.

Possibilities of the Jump-Off Autogyro. (R. H. Prewitt, J. Aer. Sci., Vol. 6, No. 1, Nov., 1938, pp. 10-14.) (63/15 U.S.A.)

(1) It appears that all-purpose autogyros can be built to " jump-off " up to 100ft. and that for special purposes, autogyros can be made to " jump-off " 200ft. In the former case, the gross weight of the ships will be increased less than 5 per cent. to account for the increase in blade weight and extra mechanism involved and in the latter case, the gross weight will be increased less than 15 per cent. for the same items. It is believed that the accelerations involved in the above predictions will not be excessive.

(2) The available kinetic energy in the rotor system for " jump-off " is directly proportional to the weight of the blades and to the square of the rotational speed of the rotor. Thus, with a given autogyro having the weight of the blades fixed, the height of " jump-off " is dependent upon the horsepower available for accelerating the rotor. This, in turn, is dependent upon the pitch setting of the propeller which, for relatively high jumps, would have to be of controllable type to provide adequate power for the rotor and yet hold down the engine r.p.m. at top speed.

Desirable Qualities of Transport Aeroplanes from the Pilot's Point of View. (B. O. Howard, J. Aer. Sci., Vol. 6, No. 1, Nov., 1938, pp. 15-19.) (63/16 U.S.A.)

The pilots have unqualified respect and admiration for the vision and ingenuity displayed by the designer in the development of the highly efficient present-day transport. They have conscientiously tried to improve their knowledge and ability to the end that the greatest operating efficiency could be derived from the equipment. However, the time is rapidly approaching when the " least capable " pilot will have reached the saturation point and a halt in the ever-increasing " pilot skill required " will be necessary.

For this reason the author is of the opinion that closer co-operation between pilot and designer is called for.

Static Longitudinal Stability and Longitudinal Control of Autogyro Rotors. (M. Schrenk, L.F.F., Vol. 15, No. 6, 6/6/38, pp. 283-9. Available as Translation T.M. 879.) (63/17 Germany.)

The present report discusses three different systems of elevator control and their effects on the stability and manœuvrability of autogyros: (*a*) ailerons and elevators (standard); (*b*) blade control (la Cierva); (*c*) gravity control (new).

The control sensitivity $\frac{dv}{d\beta}$, which is dependent to a great degree on the speed in system (*a*), becomes substantially more uniform in system (*b*), and practically constant through the whole range from zero to maximum speed in system (*c*). At the same time, the highest restoring moments attainable at pull-up become consistently smaller. The important characteristics of blade control and gravity control are:—

(1) Flattening out from a high-speed dive is smoother and with little stress;
(2) The aeroplane can be landed with very small control deflections;
(3) Steering is not too sensitive at high speeds;
(4) The maximum permissible speed can be easily and safely limited by control movements, a fact which constitutes a special safeguard for an autogyro rotor having a prescribed maximum co-efficient of advance.

The control force balance can be readily achieved by proper design of the rotor head with its suspension. The control forces (to be kept moderate) with blade control and gravity control also change linearly with the speed. The shifting of the equilibrium condition or balance of centre of gravity displacements, attainable by suitable structural design of the rotor head assembly, affects neither stability nor control force variation.

The Argus Variable Pitch Propeller. (O. Ursinus, Flugsport, Vol. 30, No. 25, 7/12/38, pp. 671-2.) (63/18 Germany.)

This propeller was exhibited at the 1938 Paris Salon and is of the constant speed type, the necessary adjustments being carried out automatically by means of a small subsidiary propeller placed in front of the hub of the main propeller and rotating in the opposite direction This propeller drives continuously on epicyclic gear housed inside the hub. The lateral wheels of this gear are in mesh with two spur wheels which thus rotate in opposite directions. The spur wheels embrace a control shaft placed at right angles to the main propeller axis. This shaft is under the combined action of centrifugal force and a control spring and will engage with the left or right hand spur wheel depending on the speed of rotation of the hub as a whole. A left or right hand engagement works the blades of the main propeller and thus alters its pitch so as to maintain constant speed. The control spring is adjustable by the pilot so as to give two different constant speed settings. By means of a special control lever the spring can be put out of action and zero blade incidence obtained.

It is stated that the propeller is intended for engines up to 450 h.p. No weights are given.

Glassy Landings. (Sci. Am., Vol. 160, No. 1, Jan., 1939, pp. 32.) (63/19 U.S.A.)

Judging height accurately when alighting on perfectly calm water is practically impossible. Within the last year, about 50 pilots and passengers have lost their lives in various parts of the world because of " glassy landings." Under glassy conditions, the pilot should not guess at height and follow the conventional manœuvre of gliding down and then flattening out a few feet from the surface. He may flatten out too late, and nose into the water with possibly disastrous consequences. What he should carry out is a " power stall." At about 50ft. from the surface of the water, he should open up the throttle of the engine a trifle, and pull the nose slightly above the horizon. The plane will then lose altitude slowly in an almost stalled attitude. The subsequent contact with the water will be harmless, although to land in a power stall on the much harder ground might not be so judicious.

Hydrodynamic and Aerodynamic Tests of Four Models of Outboard Floats. (N.A.C.A. Models 51-A, 51-B, 51-C and 51-D. J. R. Dawson and E. D. Hartman, N.A.C.A. Tech. Note No. 678, Dec., 1938.) (63/20 U.S.A.)

CONCLUSIONS.

1. The tank data from the present tests indicate that:—
   (*a*) For minimum spray from the float or angle of heel of the seaplane, the planing surface of the float should have a wide stern and a low dead rise.

(*b*) The inclusion of a step, or other equivalent discontinuity, with a properly formed afterbody allows the use of a wide planing surface without sacrificing performance in the drifting condition.

(*c*) The greatest structural loads will be obtained from the float with the most effective planing surface.

2. The wind-tunnel data from the present tests indicate that:—

(*a*) The float that may be set with its chines most nearly in line with the direction of flight in cruising is likely to be the best float from considerations of air drag.

(*b*) All chines or other sharp intersections in the cross section should be avoided except where they are definitely necessary for hydrodynamic reasons.

(*c*) In order to obtain low air drag, it is desirable that the angle of float setting be as small as practicable.

Some Notes on the Measurement of the Flying Qualities of Aircraft. (H. J. van der Maas, Istus Congress, Bern, 1938. Original available in R.T.P.) (63/21 Holland.)

Whilst a considerable amount of research on aircraft performance is available, full scale tests on flying qualities (stability, manœuvrability, control response) are relatively scarce. As a result the flying qualities are mainly judged subjectively by the pilot controlling the aircraft and this may lead to difference of opinion unless absolute criteria are available.

The author shows how a measure of stability (longitudinal lateral and directional) can be obtained from relatively simple flight tests by recording the control surface deflections and angle of banking and constant indicated air speed for various angles of sideslip. An aircraft is thus laterally stable, if an increase in sideslip is accompanied by an increase in the downward aileron deflection on the side facing the lateral wind. Similar simple relationship hold for longitudinal and directional stability. These so-called " static " conditions of stability are not, by themselves, sufficient to determine the motion of an aircraft after a disturbance (oscillation). For these so-called " dynamic " conditions, the flight test requires more complicated apparatus which is at present being developed.

Design and Development of Aircraft Engines. (A. Bagnulo, Riv. Aeron., Vol 14, No. 8, Aug., 1938, pp. 311-320.) (63/22 Italy.)

This is the third instalment of an article dealing with general design problems. The present instalment deals mainly with carburation and distribution. The author is of the opinion that uniform distribution on a multi-cylinder engine can only be achieved by direct metering of the fuel to each cylinder. In the case of spark ignition engines, the metering can be carried out either by means of a separate injection pump or the fuel can be atomised in a small venturi, the exit passage being governed by means of a mechanically operated inlet valve. This constitutes to all intents and purposes the provision of individual floatless carburettors. The author apparently favours the latter scheme since the accurate metering of light fuels of the petrol class by means of a mechanical pump presents difficulties.

Scavenging a Piston-Ported Two-Stroke Cylinder. (A. R. Rogowski and C. L. Bouchard, N.A.C.A. Tech. Note No. 764, November, 1938.) (63/23 U.S.A.)

An investigation was made with a specially designed engine to determine the scavenging characteristics of a large number of inlet-port shapes and arrangements and the optimum port arrangement and timing for this particular type of engine. A special cylinder construction permitted wide variations in timing as well as in shape and arrangement of both the inlet and exhaust ports.

The study of the effect of port shape combinations and timings on engine performance was made using illuminating gas as a fuel. Through variations in inlet-port arrangement and port timings, the value of the scavenging efficiency was increased from an original 44 per cent. to approximately 67 per cent. with a corresponding increase in power. With the optimum port arrangement and timing determined, a large number of performance runs were made under both spark-ignition and compression-ignition operation.

Discharge Characteristics of a Simulated Unit Injection System. (E. T. Marsh, N.A.C.A. Tech. Note No. 676, November, 1938.) (63/24 U.S.A.)

Rate-of-discharge curves that show the discharge characteristics of an injection system having a very short fuel passage are presented. The rate of discharge closely follows the rate of displacement of the injection-pump plunger for open nozzles in which the maximum calculated pressures at the orifice do not exceed a certain value, which is dependent on the particular injection pump. With small orifices and high pump speeds, the rate of discharge does not follow the rate of plunger displacement because the higher discharge pressures result in increased leakage past the pump plunger with a corresponding decrease in discharge rate and in fuel quantity. The rate of discharge is not directly related to the rate of plunger displacement with automatic injection valves having closed nozzles. The types of pump check valve tested did not control the rate of cut-off or the discharge rate but they did affect the injection lag. Increase in valve opening pressure slightly increased the injection lag. Use of the short fuel passage eliminated the formation of secondary discharges.

Automotive Two-Cycle Diesel Engines (with Discussion). (F. G. Shoemaker, J.S.A.E., Vol. 43, No. 6, December, 1938, pp. 485-96.) (63/25 U.S.A.)

The paper is chiefly concerned with the problem of producing an engine that will use the same materials, design practices, manufacturing methods, and mechanical parts as are common practice in production-type petrol engines.

Scavenging is effected in these engines by using piston-controlled inlet ports and poppet exhaust valves in the head.

The author shows how a change in design of the blower to a three-lobe helical-rotor type reduced noise and improved discharge characteristics. Piston cooling is effected by coring out the rim of the piston between the piston crown and the ring belt and cooling the crown directly by oil spray.

In the remainder of the paper the author discusses injection, engine-balance problems and the commercial problems involved in designing the engines and parts to meet a wide variety of applications.

Some Factors Controlling Part-Load Economy. (H. Rabezzana, J.S.A.E., Vol. 43, No. 6, December, 1938, pp. 511-4 and 528.) (63/26 U.S.A.)

Multi-cylinder engines have generally a low economy at light loads. The following are the main disturbing factors: Non-uniform mixture distribution among cylinders; low mixture speed in the manifold at light loads; poor turbulence in the cylinder-head; stratification of the mixture; dilution of the mixture due to the valve timing overlapping the high exhaust back pressure; poor scavenging around the spark-plug gap position; and improper mixture at the spark-plug gap.

Cylinder Cooling and Drag of Radial Engine Installations. (K. Campbell, J.S.A.E., Vol. 43, No. 6, Dec., 1938, pp. 515-528.) (63/27 U.S.A.)

The cowling of an air-cooled radial engine consists, in principle, of two systems in series: (1) The baffle (2) the exit slot. The total pressure drop across the system is approximately equal to the dynamic head of flight, *i.e.*, $\frac{1}{2}\rho v^2$. The ratio of baffle resistance to total resistance depends on the relative effective areas.

Thus, if the slot area is relatively large, the major part of the total available pressure drop occurs at the baffle. With a well-designed exit slot the pressure drop at the slot is recovered and thus the cowling h.p. is mainly due to the baffles. Since this h.p. depends on the volume of air passing, flight at constant indicated air speed is accompanied by an increase in cooling h.p. with altitude unless the exit slot opening is reduced.

On the ground, and during take-off, only the dynamic head of the propeller slip stream is available for forcing the cooling air through the baffles and the cooling may be insufficient even with fully opened exit slot. Attempts have been made to increase this pressure drop by making use of a suction effect near the cowl nose (reverse flow cowls), but experiment has shown that this effect is small and is more than made up by the extra external resistance of a cowl of this type at speed. As an alternative, guide vanes can be installed at the cowl entrance so as to render the rotary component of the slip stream effective. Finally a fan may be installed either behind the propeller and integral with it or as a separate unit (blower cooled installation).

Neither of these schemes has so far progressed beyond the experimental stage, but separate blower cooling of air-cooled engines operating at high altitudes may eventually become necessary.

The Szydlowski-Planiol Centrifugal Supercharger. (A. Métral. Original publication available in R.T.P.) (63/28 France.)

The supercharger consists essentially of a normal centrifugal wheel preceded by three wheels of the axial (propeller) type, all four wheels being keyed to one shaft. The axial blades are of aerofoil section, the first having a symmetrical profile. The diameter of the entry propellers is the same as that of the entry section of the centrifugal wheel. Movable guide vanes are installed in the air intake of the combination by means of which the incidence at the first (symmetrical) propeller can be varied. In this manner the propeller blade assembly can be made to act either as an axial blower (assisting the centrifugal wheel) or as a turbine, with the result of an efficient control of pressure ratio. For very low pressure ratios, break-away of the flow may occur at the turbine and for this reason a second inlet is provided which by-passes the propeller system and gives direct access to the centrifugal wheel.

A constant adiabatic compression efficiency of approximately 80 per cent. is claimed for pressure ratios ranging from 1.3 to 2.5.

Fuels for Aircraft Engines. (F. Seeber, Luftwissen, Vol. 5, No. 9, Sept., 1938, pp. 321-330.) (63/29 Germany.)

The general requirements which an aircraft fuel must meet are the following:—

(1) High octane number.
(2) Good lead response.
(3) Easy vapourisation together with
  (*a*) suitable vapour pressure
  (*b*) high calorific value.
(4) Very great stability when stored.
(5) Perfectly pure and neutral.
(6) No corrosion.
(7) Low freezing point.

The aircraft fuel specifications of Germany, Great Britain, France and U.S.A. are compared.

The octane rating can only be obtained by means of engine tests and the C.F.R. method is now generally used, although ratings above 87 are rather uncertain. Requirements (3) to (7) in the above list can be checked by means of laboratory tests. Seventeen references.

Rating Aviation Fuels in Full-Scale Aircraft Engines. (H. K. Cummings, J.S.A.E., Vol. 43, No. 6, December, 1938, pp. 497-503.) (63/30 U.S.A.)

Data in this report represent work carried out in accordance with assignments made in the first report of the C.F.R. Committee presented at the 1936 Annual Meeting of the Society, as follows:—

1. Establish the validity of the C.F.R. Recommended Procedure for Rating Fuels in Full-Scale Aircraft Engines for fuels above 87 octane number.
2. Conduct full-scale engine tests in the range from 87 octane number to the highest octane number available.
3. Concurrently with assignment 1, develop or revise knock-test methods leading to correlation with full-scale engine data.

The data presented are in accordance with assignments 1 and 2, and the data required for assignment 3 have been obtained in part. Further tests on olefinic fuels are reported.

The Mechanism of Flame Extinction by Means of Dry Powders. (C. Dufraisse and M. German, Compt. Rend., Vol. 207, No. 24, 12/12/37, pp. 1221/1224.) (63/31 France.)

Dry powders are commonly supposed to extinguish flames either by insulating the combustible substance, or cooling the flame or by generating inert gases (steam or CO_2).

The author has carried out experiments on flames of hydrogen, coal gas, methane and carbon monoxide, the minimum concentration of powder required for extinction being measured. The gas burner was placed in the axis of a pyrex tube, the powder being introduced at the base of the tube and carried upwards by the air currents. It appears that certain powders possess a power of extinguishing flames depending on a specific anti-oxygen quality which has nothing to do with either a mechanical or a chemical reaction in bulk (*i.e.*, liberation of inert gases).

Thus a concentration of 5 mg. of potassium chlorate per litre of air will extinguish a CO flame, whilst 50 mg. per litre will extinguish the methane flame. The same powder, however, will act as an accelerator to coal gas and hydrogen flames.

The Hydrodynamic Theory of Detonation. (H. Langweiler, Zeit. Tech. Physik, Vol. 19, Sept., 1938, pp. 271-83. Eng. Abstracts, Vol. 1 (Sect. 4), Nov., 1938, pp. 45-6.) (63/32 Germany.)

The author derives equations containing only directly measurable constants for the quantities involved in the hydrodynamic theory of detonation. The stable detonation speed, D, is revealed as having the lowest possible value in the case of positive material velocity, by finding the minimum of the Du curve (u denotes the speed of the gases of combustion). A study of the conditions of energy and impulse in suspended detonating systems leads to the disclosure of a rarefaction front travelling at a low speed behind the detonation front; its velocity is calculated. The latent energy of the explosive passes into the steadily-growing detonation zone, the region between the detonation front and the rarefaction front. The conclusions drawn from the author's study lead to a new conception of shattering power. His calculations are based upon the behaviour of trinitrotoluene.

Tests on Materials Suitable for Damping Vibrations of Engine Foundations. (K. Sotiroff, Z.V.D.I., Vol. 82, No. 38, 17/9/38, pp. 1120-1.) (63/33 Germany.)

The samples were placed on a concrete floor so as to form the angles of an equilateral triangle. A vibration test machine (Type Losenhausen) was placed on top of the specimen and the whole was surmounted by a stiff iron plate to

which was bolted a vibrograph (Geiger) and a counterweight. By means of the vibration machine the whole system could be forced to undergo either vertical, horizontal or rotary vibration of frequency varying between 0 and 40 vibrations/sec.

The amplitude of the forced vibrations (*i.e.*, resonance of the system) was obtained from the readings of the Geiger Vibrograph.

From the resonance curves both the elastic constants and the damping of the material forming the foundation can be calculated. Of special interest are the experiments with horizontal displacements, since very little was previously known concerning the damping under such conditions (shear). The samples were of uniform dimensions 80 × 80 × 60 mm. ordinary commercial materials such as cork, bonded paper, rubber and their combinations being used.

Effect of Wing Twist Upon Stresses Due to Bending. (H. W. Sibert, J. Aer. Sci., Vol. 6, No. 1, Nov., 1938, pp. 7-9.) (63/34 U.S.A.)

In present design practice no attempt is made to calculate the effect of the twisting moment on a wing upon the tensile and compressive stresses due to bending. A simple formula is derived in this article for the ratio of the tensile and compressive stresses under combined simple bending and wing twist to the corresponding simple bending stresses. This formula involves an unknown constant which must be obtained experimentally from a deflection test on the wing.

New Developments in Seamless Steel Tubing. (W. M. Murray, J. Aer. Sci., Vol. 6, No. 1, Nov., 1938, pp. 20-3.) (63/35 U.S.A.)

The use of welded tubular construction in aircraft has brought about the almost complete replacement of plain carbon steel by chrome molybdenum (S.A.E. X4130) steel tubing. It is the purpose of this research to investigate the properties of tubing made from other alloys, in particular chromium-nickel-molybdenum steel, with a view to finding something with more advantageous properties than the material now employed.

The tensile properties of two sizes of S.A.E. 4340 tube have been determined and the effect of welds has been investigated by strut compression tests. A comparison has been made between the strength of plain tube sections and those possessing straight and V welds and the effect of a right angle connection has been determined through tests on T-shaped specimens.

Approximate Stress Analysis of Multi-Stringer Beams with Shear Deformation of the Flange. (P. Kuhn, N.A.C.A. Report No. 636, 1938.) (63/36 U.S.A.)

The problem of skin-stringer combinations used as axially loaded panels or as covers for box beams is considered from the point of view of the practical stress analyst. By a simple substitution the problem is reduced to the problem of the single-stringer structure, which has been treated in N.A.C.A. Report No. 608. The method of making this substitution is essentially empirical; in order to justify it, comparisons are shown between calculations and strain-gauge tests of three beams tested by the author and of one compression panel and three beams tested and reported elsewhere.

For sheet with individual stringers, experimental studies on individual panels have usually led to the conclusion that the best efficiency is obtained by making the skin as thin as possible, consistent with practical considerations. If the shear deformation in the actual structure is taken into account, it becomes evident that this conclusion will often require serious modification. It might be worth while in some cases to investigate the effect of thickening the skin near the wing tip, where the shear deformations are largest and, therefore, easiest to decrease.

The Twisting of Thin-Walled Stiffened Circular Cylinders. (E. Schapitz, Lilienthal Gesellschaft fur Luttfahrtforschung Jahrbuch, 1936, pp. 94-132. Available as Translation T.M. 878.) (63/37 Germany.)

On the basis of the present investigation of the twisting of thin-walled, stiffened circular cylinders, the following conclusions can be reached:—

1. There is as yet no generally applicable formula for the buckling moment of the skin.

2. The mathematical treatment of the condition of the shell after buckling of the skin is based upon the tension field theory, wherein the strain condition is considered homogeneous.

3. The twisting tests in the DVL on stiffened circular cylinders were accompanied by stress measurements on the skin, the stringers, and the bulkheads. In addition, the strains on the shell surface were recorded and the angles of twist of the shells measured. The comparison of the theoretical with the experimental results disclosed that, on assuming a complete tension field, the imputed angles of twist were computed much too great, and the stresses in the stringers and bulkheads too high, while on assuming an incomplete tension field the theoretical results could be largely reconciled with the experimental results by suitable choice of the proper constants for the " stretching " of the tension field.

4. Applying the method to the range of twisting moment at failure, the latter can be predicted sufficiently exactly from buckling-bending tests on panels. For thin skin and strong stiffeners the calculation for complete tension field affords sufficiently accurate results; but if the skin is thick and the stiffeners weak, this calculation results in an underestimate of the ultimate twisting strength, hence an accurate calculation postulates an incomplete tension field.

The Effect of the Speed of Stretching and the Rate of Loading in the Yielding of Mild Steel. (E. A. Davis, J. Applied Mech., Vol. 5, No. 4, Dec., 1938, pp. 137-40.) (63/38 U.S.A.)

The phenomena occurring at the upper and lower yield point in mild steel are not yet fully understood. This paper is an attempt to study some of these phenomena and to correlate them with the facts already known about the first yielding of this unique material.

In order to investigate the rate of loading on the yielding of mild steel a machine was designed in which the amount of increase in load per unit time could be held constant regardless of the rate of strain. Results of tests are presented in which the rate of loading for separate tests was changed by a maximum ratio of 1 to 21,000. The effect of rate of loading was studied on four different shapes of test specimens.

Factors affecting the initial yielding of mild steel and their influence on the shape of the stress-strain diagram are discussed. These factors include the effect of the speed of deformation and of stress concentration upon the stress at which yielding takes place. The manner in which localised yielding affects the stress distribution in the bar and changes the actual strain rate is also described.

Fundamentals of Three-Dimensional Photo-Elasticity. (M. Hetényi, J. App. Mech., Vol. 5, No. 4, Dec., 1938, pp. 149-55.) (63/39 U.S.A.)

The method of three-dimensional photoelasticity is based on the experimental fact that samples of phenolic resins, such as Bakelite, Marblette, and Trolon, when annealed in a loaded condition show a complete preservation of (*a*) the elastic deformation and (*b*) the accompanying birefringence produced by the loading at the annealing temperature. After presenting a historical review of the method, the author discusses the current theory of the molecular structure of phenolic resins by which the phenomena observed in the annealing procedure can be explained. Test results are given which prove the elasticity of Bakelite at elevated temperatures. Applications of the method are also discussed.

Steady Oscillation of Systems with Non-Linear and Unsymmetrical Elasticity. (M. Rauscher, J. App. Mech., Vol. 5, No. 4, Dec., 1938, pp. 169-77.) (63/40 U.S.A.)

Steady forced oscillations are reduced to free undamped oscillations of the same amplitude. The reduction is accomplished by changing the excitation from a time function $F(t)$ into a space function $F(x)$ through the assumption that x and t are related as in a free motion. By combining $F(x)$ with the elastic restoring force $E(x)$, a new effective $E(x)$ is obtained, to which there corresponds a new " free " motion, which, in turn, furnishes a second approximation for the relation between x and t, and hence a new function $F(x)$. A new effective $E(x)$ and a new free motion are then found; and the cycle is repeated until the relation between x and t ceases to change. The frequency of the forced motion at the assumed amplitude is then known. In general, the process converges rapidly. The accuracy can be checked at any stage of the work. A general criterion of the stability of the motions is offered.

Calculation of Stresses and Natural Frequencies for a Rotating Propeller Blade Vibrating Flexurally. (W. Ramberg and S. Levy, J. of Res. Bureau of Standards, Vol. 21, No. 5, Nov., 1938, pp. 639-69.) (63/41 U.S.A.)

The present paper extends the method of computing the natural modes of flexural vibration of a non-rotating propeller blade which was described in RP764 to blades that rotate as in actual flight. The resulting integral equations were solved for two aluminium-alloy propeller blades of typical design vibrating with the fundamental mode and with the second harmonic mode and rotating at speeds covering the range of service speeds. The effect of rotation on the stress distributions and on the natural frequencies was obtained for the two extreme end conditions of rigid clamping at the hub and no clamping at the hub. Rotation was found to have a small effect (up to 13 per cent.) on the maximum stress per unit tip deflection and was found to shift the maximum toward the hub. For the determination of critical speeds, the natural frequencies were shown to follow conveniently from Lord Rayleigh's energy method by making use of the solutions for no rotation outlined in RP764. The effect of initial twist on the flexural frequencies of the blade was found to be small compared with the effect of changes in clamping at the hub. Changes in clamping may change the frequency up to 13 per cent. A correction to RP764 is noted in this connection. Both the stress distribution and the natural frequencies of a given propeller blade may be calculated from those obtained for a model blade by means of two model rules developed by Theodorsen.

The Testing of Welds. (R. Smallman-Tew, Weld. Ind., Dec., 1938, pp. 399-405. Metropolitan Vickers Tech. News Bulletin, No. 640, 23/12/38, p. 4.) (63/42 Great Britain.)

The author discusses tests on welds under the headings " Destructive " and Non-Destructive " tests. He describes fully the non-destructive tests such as visual examination, X-ray, magnetic, acoustic and partial pressure or loads tests. He continues by describing types of destructive tests such as chemical analysis, corrosion, microscopic examination, mechanical—tensile, compression, shear, bend and alternating tests—fatigue, impact, hardness, pressure, abrasive and hammer tests. He concludes the article by discussing testing requirements, the necessity for laboratory and shop tests, and the necessity for " planned testing."

Illustrated with 4 photographs and 3 diagrams.

Tests of Welds in Alloy Steels. (S. F. Yasines and F. C. Fair, J. Am. Welding Soc., Vol. 17, No. 9, Welding Research Suppt., Sept., 1938, pp. 28-34. Eng. Absts., Vol. 1, No. 11 (Sect. 2), Nov., 1938, p. 157.) (63/43 U.S.A.)

The authors observe that the main purposes of the research described in which tests were made on four kinds of alloy steels, butt-welded with two different types

of electrodes, were (1) to determine the relative hardness and impact strength of the deposited metal, the heat-affected zones, and the base metal; (2) to ascertain whether a definite relationship exists between hardness and impact strength; (3) to study the effect of heat treatment. The welds were 60° single-bevel welds in ½in. thick plates. Stress relieving was carried out for six hours at a temperature of 600°F. Impact tests were made in a standard Izod impact machine, and hardness was determined by a Rockwell machine. The results indicated that the welds gave the weakest sections as regards impact strength; that heat treatment effected some improvement in the impact strength of all zones; and that no definite relationship could be established between hardness and impact strength.

Fatigue Strength of "Fillet" and "Fusion Welded" Connections. (A. Thum and A. Erker, Zeit. Ver. deu. Ing., Vol. 82, 17/9/38, pp. 1101-6. Eng. Absts., Vol. 1, No. 11 (Sect. 2), Nov., 1938, pp. 157-8.) (63/44 Germany.)

The authors describe experiments carried out with specimens of T-section having a web 19⅝in. wide and 0.59in. thick, welded to the flange by means of (1) a fillet on each side of the web; (2) a fusion weld. In the latter case the flange was formed with a longitudinal projecting rib to which the web was welded. Fatigue-strength results for both types of welded seam, in the untreated state, when annealed, and when mechanically treated, are plotted in curves which indicate that under 10^7 repetitions of load, a strength equal to that of parent metal was attained when the fillets were trimmed to a smooth finish and the edges were rolled with a pair of disks, one on each side of the web, the edge of the disks being rounded to a radius of 2.5 mm. (0.1in.) and acting under a pressure of 1,650lb. The disks were held in a frame attached to a planning machine, on the table of which the welded specimen was placed and submitted to the rolling treatment during four to-and-fro movements of the table.

X-Ray Measurement of Stress in Steel Bars Subjected to Bending Stresses Exceeding the Yield Point. (F. Bollenrath and E. Schiedt, Z.V.D.I., Vol. 82, 17/9/38, pp. 1094-1098. Eng. Absts., Vol. 1, No. 11 (Sect. 1), Nov., 1938, p. 118.) (63/45 Germany.)

The authors describe experiments, in which test bars of square, trapezoidal, and triangular section were submitted to bending moments. The calculated stresses in the outer fibres were compared with the stresses deduced from the lattice spacing of the crystals, as determined by X-ray examination. The results indicate that for a bar ⅝in. square, containing 0.04 per cent. C, the yield point was attained at 15.2 tons per sq. in. Increase in the bending moment to a calculated stress of 17.6 tons per sq. in. revealed a lattice distortion corresponding with a stress of 12.9 tons per sq. in. Inherent stresses in the bar after successive unloadings ranged between $\pm$ 1.2 tons per sq. in. until the yield point was attained. Bending moments producing 16 tons and 17.5 tons per sq. in. tension, revealed inherent compressive stresses of 3.5 tons and 4.4 tons per sq. in. when the load was released. The authors state that the yield point is not higher under bending than under tension, and that bending moments from which the calculated stresses are in excess of the yield point reveal stresses under X-ray examination which are lower than the yield point, indicating that the excess portion of the stress is transferred to the neighbouring fibres of the cross section.

The D.V.L. Exhaust Gas Analyser. (H. H. Berg, A.T.Z., Vol. 41, No. 17, 10/9/38, p. 455.) (63/46 Germany.)

The proper adjustment of carburettors and injection pumps requires a knowledge of the mixture strength in the cylinder. Measurements of air and fuel supply need rather complicated installations and an accurate and continuous reading of the rate of fuel supply is not easy. Since mixture strength and composition of exhaust gas are intimately connected, a continuous exhaust gas analyser gives the required

information in a very simple manner. The apparatus evolved by the D.V.L. depends on changes in the thermal conductivity of the exhaust with change in composition and after calibration on an actual engine, the excess air coefficient can generally be obtained to within ± 1 per cent., the lag being of the order of five seconds. The D.V.L. instrument is compensated for altitude and change in temperature. An efficient water separator is incorporated in the design and it is stated that the analyser will function over long periods in aircraft without requiring any attention. The readings are taken on a pointer instrument and fuel adjustment for maximum range is thus an easy matter.

Viscous Flow Air Meters. (The Engineer, Vol. 166, No. 4,329, 30/12/38, p. 743.) (63/47 Great Britain.)

This instrument, known as the Alcock viscous flow air meter, is designed to eliminate the serious errors which arise when pulsating air flows are measured in kinetic air meters of the orifice, Venturi and other types. These errors are partly accounted for by " root-mean-square " effects and partly by the flow in and out of the manometer, set up by pressure variations.

In the viscous flow air meter, the meter element is a honeycomb of long triangular passages, 3in. long and 0.017in. in height. Within the working range, the flow through these passages is viscous, and the resistance of the element is, therefore, directly proportional to the velocity; this fact automatically eliminates the " root-mean-square " error.

Electric CO_2 Meter with Bar-Shaped Heating Elements. (G. Heidtkamp, A. E. G. Mitt, Dec., 1938, pp. 562-5. Metropolitan Vickers Technical News Bulletin, No. 641, 30/12/38, p. 9.) (63/48 Germany.)

The author describes an improvement on the platinum wire elements hitherto used in CO_2 meters, namely thin bars of sintered alumina heated by a wire inside. The advantages claimed are that current-carrying parts of the apparatus do not come into contact with the flue gas and that the test wires are protected from chemical attack. He discusses conditions relative to the operation of such bars, the temperature distribution along a bar, the lag in indication of the CO_2 transmitter, etc.

Illustrated with 5 diagrams and 1 photograph.

Icing of Aircraft Antenna Wires. (G. L. Haller, J. Aer. Sci., Vol. 6, No. 1, Nov., 1938, pp. 27-8.) (63/49 U.S.A.)

More data under conditions of higher wind velocity are needed before definite conclusion can be made regarding a critical icing angle, but due to the limitations of the test equipment these conditions cannot be obtained at the present time.

In general, the results that antenna wires on aircraft should be installed with angles from the wind stream of less than 15° to 20° in order that the ice load be reduced and the ice formation will be as unstable as possible.

Lightning Discharge to the Empire State Building. (K. B. McEachron, Electrical Engineering, Dec., 1938, pp. 493-505, 507. Metropolitan Vickers Technical News Bulletin, No. 641, 30/12/38, p. 4.) (63/50 Great Britain.)

In this article the author describes a series of investigations undertaken in New York on lightning discharges to the Empire State Building. A description of the photographic equipment—cathode ray oscillograph, electro-magnetic oscillograph, Boyes camera and two rotating lens cameras—is given and the results are discussed. By means of photographic and oscillographic records, the author shows the different types of discharge and discusses the polarity, duration, charge transferred, mechanism of the discharge leaders, de-ionisation time, branching, discharge path, upward streamers, thunder, streamer currents and maximum currents.

Illustrated with 8 photographs, 9 diagrams and 2 tables.

Heat Transfer to Boiling Liquids. (F. H. Rhodes and C. H. Bridges, Ind. and Eng. Chem. (Industrial Edition), Vol. 30, No. 12, December, 1938, pp. 1401-6.) (63/51 U.S.A.)

The results of these experiments indicate that the manner of boiling of a liquid at the surface of a solid and the observed unit rate of heat transfer are determined largely by the ease with which the liquid wets the solid. Relatively small amounts of certain substances in solution or in suspension in the liquid may have a great effect in altering the manner of boiling and in changing the unit rate of heat transfer.

Some of the large variations in the evaporative capacities of evaporators operating under apparently similar or comparable conditions may be due to the presence of small amounts of contaminating substances that change the wettability of the solid by the liquid. The observed variation in the effects of various salt solutions in the quenching of steel may be caused by variations in the ease of wetting of the metal by the solution.

The Photography of Airscrew Sound Waves. (W. F. Hilton, Proc. Roy. Soc., Series A, Vol. 169, No. 937, 22/12/38, pp. 174-90.) (63/52 Great Britain.)

An experimental technique has been developed for photographing the shock waves generated by an airscrew at all speeds above a certain critical speed. A modified form of spark photography was employed, and photographs were obtained for the first time of the airscrew sound wave system at tip speeds ranging from 0.83 to 1.2 of the velocity of sound.

The photographs also reveal a tailing vortex from the blade tip, and an eddying wake behind the blade. These vortices and eddies are more distinct at high speeds than at low, but there is no definite lower limit to the speed at which they can be photographed.

A method is given for calculating the pressure amplitude of these shock waves from measurements of the width of the image. The wave velocity has been calculated from the photographs, and is found to be slightly greater than that of small amplitude waves.

A method of calculating the shape of the waves is examined, but no theoretical indication of a wave front at tip speeds less than the speed of sound is given, whereas a very definite wave front exists down to speeds as low as 0.85 of sound velocity. The problem of noise reduction in aircraft is discussed.

The London Television Service. (T. C. Macnamara and D. C. Birkinshaw, J. Inst. Elec. Eng., Vol. 82, No. 504, Dec., 1938, pp. 729-57.) (63/53 Great Britain.)

The paper is divided into six parts:—

Part 1 touches briefly upon the history of television development in this country.

Part 2 deals with the recommendation of the television committee that a station for transmitting high-definition television should be established, and it discusses various factors upon which the subsequently appointed Television Advisory Committee based its decisions regarding the choice of the Alexandra Palace site, the operating wavelengths, and standard of definition.

Part 3 describes the arrangement of studios and apparatus rooms at the Alexandra Palace Station.

Part 4 describes the layout and arrangement of the control room and transmitter equipment installed for the vision and accompanyng sound transmissions.

Part 5 is concerned with the plant developed to enable current events and other programme items taking place at some distance from the Alexandra Palace to be televised.

Part 6 is a brief consideration of the reception results of signals from the Alexandra Palace since the beginning of the service, and embodies the result of single surveys made in the vicinity of, and at distances from, the station.

Finally, the various types of television receivers and aerials are discussed.

The Centralised Control of Public Lighting and Off-Peak Loads by Superimposed Ripples (with Discussion). (H. P. Barker, J. Inst. Elec. Eng., Vol. 82, No. 504, Dec., 1938, pp. 823-4.) (63/54 Great Britain.)

It is the author's purpose in this paper to discuss the problems of collective control on modern supply networks, to examine various alternative methods, and to explain how, by the aid of superimposed high-frequency signals, any distribution network may be used as a signalling system which will enable a supply undertaking to exercise remote control of consumer circuits from its own power station.

The special application of superimposed control in war time for the extinction of public lighting and for the dissemination of warning signals is briefly discussed.

Rectangular Hollow-Pipe Radiators. (W. L. Barlow and F. M. Greene, Proc. Inst. Rad. Eng., Vol. 26, No. 12, Dec., 1938, pp. 1498-1519.) (63/55 U.S.A.)

Two principal results of this research are the following: (1) the development of a theory for the radiation from open hollow pipes; and (2) the experimental verification of this theory. Another result is the justification of the application of Huygen's principle when used in conjunction with the Hertzian vector to radiation problems where the dimensions of the system are comparable to the wavelength. The authors believe to have shown that the open rectangular pipe is a radiating element for ultra-short waves possessing several advantages over conventional types of antennæ. The absence of insulating members, the freedom from stray radiation, and the absence of difficult amplitude and phase adjustments are examples of these features.

Electromagnetic Waves in Hollow Tubes of Rectangular Cross Section. (L. J. Chu and W. L. Barrow, Proc. Inst. Rad. Eng., Vol. 26, No. 12, Dec., 1938, pp. 1520-55.) (63/56 U.S.A.)

The theory of the transmission of electromagnetic waves in hollow conducting pipes of rectangular cross section is derived for perfectly conducting and imperfectly conducting materials. Special attention is given to the type of wave that has only one transverse and everywhere parallel component of electric intensity, and the results of experiments on this wave are reported. Expressions for the attenuation of the different types of waves allow comparisons to be made with corresponding waves in a pipe of circular cross section. In a rectangular pipe no wave has been found whose attenuation decreases indefinitely as the frequency is increased as does the H_0 wave in a circular pipe.

Production of Electricity by Direct Combustion. (The Engineer, Vol. 166, No. 4326, 9/12/38, p. 636.) (63/57 U.S.A.)

Fuel or gas cells generate E.M.F. when oxygen and a combustible gas are in contact with suitable electrodes and a suitable electrolyte in such a manner that the gases cannot mix. Such cells have been known in the laboratory for some time. According to American claims a new version of this cell appears to have commercial possibilities. According to the patent granted to H. H. Greger in 1934, the general claims are as follows:—

The process of generating electricity which comprises introducing a fuel gas into a gas cell at the gas electrode thereof, where it contacts an electrolyte comprising a fused mixture of alkali metal and alkaline earth metal carbonates and halides, and reacts chemically therewith, releasing electrical charges which are imparted to the gas electrode, and simultaneously introducing an oxygen containing gas at the oxygen electrode of the cell, where it contacts the electrolyte and reacts chemically therewith, thus releasing electrical charges which are imparted to the oxygen electrode, the cell being operated at a temperature between 700°C. and the melting point of the electrolyte. The process of generating electricity by

oxidising carbon monoxide and hydrogen at the gas electrode and simultaneously reducing oxygen by reaction with positively charged ions at the oxygen electrode of the cell.

The melting point of the mixture of salts forming the electrolyte is below 700°C., and the electrolyte is said to comprise a fused mixture of sodium carbonate, potassium carbonate, barium carbonate, sodium chloride, potassium chloride, barium chloride, sodium fluoride and potassium fluoride. Numerous mixtures and combinations of these chemicals may be made, and some of these mixtures are listed in the patent specifications as samples, the patent not being limited to any definite or specific combination.

Notes on German Popular Aviation during 1938. (Inter. Avia., No. 603, 20/12/38, p. 12.) (63/58 Germany.)

The membership is broadly divided into three classes:—

	Membership.
1. Flieger Jungvolk	63,000
2. Hitler Youth	90,000
3. N.F.S.K.	52,000

1. The F.J. comprises young boys (below 14).
2. Of the Hitler Youth, 7,500 have received gliding training.

9,000 hold " A " licence
5,000 ,, " B " ,,
1,000 ,, " C " ,,

3. The N.F.S.K. own 842 machines and have flown 2.8 million kilometres during the year. Sixty balloons are also available for training purposes.

Popular Aviation in France. (Inter. Avia., No. 603, 20/12/38, pp. 12-13.) (63/59 France.)

Three age classes are distinguished:

14-16 years (preparatory)
16-18 years (gliding)
18-21 years (power flight).

During 1938, 2,333 " I " licences were issued and 95 pupils were passed to Istres and other centres for further training. Of these seven received the military licence.

The total expenditure for the year was 80 million francs.

Large Wind Power Generating Plants. (H. Witte, E.T.Z., 22/12/38, pp. 1373-6. Metropolitan Vickers Technical News Bulletin, No. 641, 30/12/38, p. 11.) (63/60 Germany.)

On the basis of the knowledge hitherto gained on air currents, the problem of large wind power generating plants is investigated from the economic standpoint. The utilisation of the energy of the wind for the generation of power would release large quantities of coal for other purposes and would also relieve the foreign exchange situation of Germany. In a further part of his article to be published later the author will discuss the practical realisation of such generating plants, and will describe the design of a ring generator.

Illustrated with 5 diagrams.