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NOTE.—As far as possible, the country of origin quoted in the items refers to the original source.

LIST OF ABBREVIATIONS OF TITLES AND JOURNALS.

A.	Abstracts from the Scientific and Technical Press.
Aeron. Eng.	Aeronautical Engineering (U.S.S.R.)
Aer. Res. Inst. Tokyo	Aeronautical Research Institute of Tokyo.
A.C.I.C.	Air Corps Information Circular.
Ann. d. Phys.	Annalen der Physik
Army Ord.	Army Ordnance.
Autom. Eng.	Automobile Engineer
Autom. Ind.	Automotive Industries.
Autom. Tech. Zeit. ...	Automobiltechnische Zeitschrift.
Bell Tele. Pubs. ...	Bell Telephone Publications.
Bur. Stan. J. Res. ...	Bureau of Standards (U.S.A.) Journal of Research.
Chem. Absts.	Chemical Abstracts.
Chem. and Ind. ...	Chemistry and Industry.
Comp. Rend.	Comptes Rendus de L'Académie des Sciences.
Eng. Absts.	Engineering Abstracts.
E.N.S.A.	Revue Technique de l'Association des Ingénieurs de l'Ecole Nationale Supérieure de L'Aéronautique.
Forschung	Forschung auf dem Gebiete des Ingenieurwesens.
Fuel	Fuel in Science and Practice.
H.F. Technik.	Hochfrequenztechnik und Elektroakustik.
Ind. and Eng. Chem. ...	Industrial and Engineering Chemistry.
Ing.-Arch.	Ingenieur-Archiv.
Inst. Autom. Eng. ...	Institute of Automobile Engineers (Research and Standardisation Committee).
J. Aeron. Sci.	Journal of the Aeronautical Sciences.
J. App. Mech.	Journal of Applied Mechanics.
J. Am. Soc. Nav. Engs.	Journal of American Society of Naval Engineers.
J. Roy. Aero. Soc. ...	Journal of Royal Aeronautical Society.

J. Frank. Inst.	Journal of Franklin Institute.
J. Inst. Civ. Engs. ...	Journal of Institute of Civil Engineers.
J. Inst. Elec. Engs. ...	Journal of Institute of Electrical Engineers.
J. Inst. Petrol.	Journal of the Institute of Petroleum.
J. Met. Soc.	Journal of Meteorological Society.
J. Sci. Inst.	Journal of Scientific Instruments.
J. Soc. Chem. Ind. (Abstracts B)	Journal of the Society of Chemical Industry (British Chemical Abstracts B)
J.S.A.E.	Journal of Society of Automotive Engineers.
L'Aéron.	L'Aéronautique.
L.F.F.	Luftfahrt-Forschung.
Luschau.	Luftfahrt-Schrifttum des Ausiandes
Met. Mag.	Meteorological Magazine.
Met. Prog.	Metal Progress.
N.A.C.A.	National Advisory Committee for Aeronautics (U.S.A.).
Phil. Mag.	Philosophical Magazine.
Phil. Trans. Roy. Soc.	Philosophical Transactions of the Royal Society.
Phys. Berichte. ...	Physikalische Berichte.
Phys. Zeit.	Physikalische Zeitschrift.
Proc. Camb. Phil. Soc.	Proceedings of Cambridge Philosophical Society.
Proc. Inst. Rad. Engs.	Proceedings of Institute of Radio Engineers.
Proc. Roy. Soc. ...	Proceedings of Royal Society.
Pub. Sci. et Tech. ...	Publications Scientifiques et Techniques du Ministère de l'Air.
Q.J. Roy. Met. Soc. ...	Quarterly Journal of the Royal Meteorological Society.
R. and M.	Reports and Memoranda of the Aeronautical Research Committee.
Rev. de l'Arm. de l'Air	Revue de l'Armée de l'Air.
Riv. Aeron.	Rivista Aeronautica.
Sci. Absts. (A. or B.)	Science Abstracts (A or B.).
Sci. Am.	Scientific American.
Sci. Proc. Roy. Dublin Soc.	Scientific Proceedings of Royal Dublin Society.
Tech. Aéron.	La Technique Aéronautique.
Trans. A.S.M.E. ...	Transactions of the American Society of Mechanical Engineers.
Trans. C.A.H.I. ...	Transactions of the Central Aero-Hydrodynamical Institute, Moscow.
U.S. Nav. Inst. Proc.	U.S. Naval Institute Proceedings.
Veröffent (Siemens)	Veröffentlichungen aus dem Gebiete der Nachrichtentechnik (Siemens).
W.R.H.	Werft Reederei Hafen.
W.T.M.	Wehrtechnische Monatshefte.
Z.A.M.M.	Zeitschrift für Angewandte Mathematik und Mechanik.
Z.G.S.S.	Zeitschrift für das gesamte Schiess- und Sprengstoffwesen mit der Sonderabteilung Gasschutz.
Z. Instrum.	Zeitschrift für Instrumentenkunde.
Z. Mech.	Zentralblatt für Mechanik.
Z. Metallk.	Zeitschrift für Metallkunde.
Z.V.D.I.	Zeitschrift des Vereines Deutscher Ingenieure.

On the Calculation of the Impact Force of Bombs. (F. Frey, Schweiz Techn. Zeitsch, No. 24, 13/6/40, pp. 293-294.) (95/1 Switzerland.)

The author considers the special case of a bomb of mass M striking the centre of a beam of length l. The beam is assumed to be freely supported at its ends of uniform cross-section and of total mass m. If the impact is completely inelastic, the kinetic energy L of the combined system is given by

$$L = \tfrac{1}{2} M^2 V^2 / (M + M^1)$$

where M^1 = reduced mass of beam

$= (17/35)\ m$ and V = velocity of bombs at impact.

By equating this to the elastic work of deformation, it can easily be shown that the equivalent static load P is given by

$$P^2 = \frac{96\, EIL}{l^3}$$

From this the max. stress σ in the beam follows

$$\sigma = \frac{Pl}{4\, W}$$

where W = section modulus.

If the beam is short and wide a correction has to be applied for the lateral forces.

From the above, the author concludes that best protection against bomb impact is provided if the mass of the ceiling is as large and at the same time the mounting as flexible as possible. For this purpose he recommends a hinged frame construction supported on vertical pillars. It should be pointed out that the problem is considered purely from the point of view of mechanical impact and no consideration is given to explosive effects.

Reconditioning of War-Damaged Machine Tools. (Machinery, 18/9/41, pp. 673-681.) (95/2 Great Britain.)

The article describes methods employed in the Ministry of Supply Reconditioning Scheme to repair machines, damaged either by enemy action, or those worn in service. Machines damaged by high explosives are generally less difficult to deal with than those damaged by fire. Not only are the latter usually out of alignment, but they have lost their original heat-treated properties. The replacement by welding or re-casting of broken or buckled castings is described, as well as the loosening of solidly-corroded moving parts. Worn parts may be built up by metal spraying. Many details are given of checking the alignment of bedways, tables and spindles, including makeshift emergency repairs.

(Abstract supplied by Research Dept., Met. Vick.)

Military Aircraft Production in the U.S.A. during 1941. (Senator Byrd, American Aviation, Vol. 5, No. 7, Sept., 1941, pp. 1 and 15.) (95/3 U.S.A.)

	Total production by U.S. Military Aircraft Mfrs. (Official O.P.M. figures).	Military (combat plus trainer).	Combat.	Trainer.	Non-military (exclusive of combat, trainer and light planes).
January ...	1,036	957	502	455	79
February ...	972	879	415	464	93
March ...	1,216	1,056	552	504	160
April	1,389	1,357	693	664	32
May	1,334	1,258	650	608	76
June	1,489*	1,473	698	775	16
July	1,460	1,455	700†	755	5
Totals... ...	8,896	8,435	4,210	4,225	461

* OPM officially reported 1,476 for June. Above figure is correct.

† Approximate. (Of this total less than 300 were bombers of all kinds. Production of long-range bombers does not exceed 60 a month.)

Relaxation Methods Applied to Engineering Problems. VII, Percolation of Fluids Through Porous Media. (F. S. Shaw and R. V. Southwell, Procs. Roy. Soc., Vol. 178, No. 972, 9/5/41, pp. 1-17.) (95/5 Great Britain.)

The accepted theory of percolation of fluids through porous materials (which is based on Darcy's law of resistance) indicates that the velocities can be calculated from a velocity-potential which, in two-dimensional motion, is plane-harmonic within the fluid field. The associated stream function, and the fluid pressure, are also plane-harmonic, so in cases where all boundaries are known, their determination is an ordinary problem in plane-potential theory. But in cases where a free surface exists (as in the percolation of water through earth dams), its shape is not known a priori, consequently orthodox methods cannot be applied.

Here the relaxation method developed in earlier papers is shown to be applicable without special assumptions, and to yield results of more than sufficient accuracy. Three typical examples are treated, the third involving " refraction " of the lines of flow and pressure at the junction of two materials of different porosity.

Experiments at Supersonic Speed on a Biplane Arrangement of the Basemann Type. (A. Ferri, Atti di Guidonia, No. 37-38, 10/11/40.) (95/6 Italy.)

Following brief description of the experimental supersonic biplane and the experimental procedure, the author gives the results obtained by means of optical observation, the measurement of the pressures and the determination of the forces on a symmetrical biplane system for different wing-gap values. The experimental results are compared with those obtained by calculation and the causes of the discrepancies found between them are discussed.

Compressibility Effects in Aerodynamics. (Th. von Kármán, J. of Aeron. Sciences, Vol. 8, No. 9, July, 1941, pp. 337-356.) (95/7 U.S.A.)

The author reviews the various methods available for the mathematical treatment of supersonic flow in an ideal compressible fluid. Of special interest are expressions for the critical Mach number as a function of the maximum suction-pressure coefficient at low speeds applying to the case of an aerofoil (NACA 4412), and elliptic and circular cylinder respectively. The results are in fair agreement with experiment. Whilst thus the first coincidence between local velocity and local sound velocity can be predicted with fair accuracy in a number of cases, it is not by any means certain that this is necessarily associated with the appearance of a shock wave in an ideal fluid. Recently Ringleb (ZAMM Vol. 20, 1940, pp. 185/198) has found exact flow patterns of compressible gases in which the flow velocity reaches 1.6 times the value of sound and becomes subsonic again without shock losses. In the practical case of a real fluid it is scarcely likely that shock can be avoided altogether and it may be that the flow with shock is more stable than the continuous flow pattern. The mathematical analysis however indicates that the mere passage of the air at supersonic speeds does not necessarily imply energy loss by shock and that it may thus be possible to increase flying speeds considerably above present values before the wave resistance becomes important.

An extensive bibliography (52 items) concludes the article.

Temperature Effects in a Laminar Compressible Fluid Boundary Layer Along a Flat Plate. (H. W. Emmons and J. G. Brainerd, J. App. Mech., Vol. 8, No. 3, Sept., 1941, pp. 105-110.) (95/8 U.S.A.)

In this Paper the two-dimensional boundary-layer problem of the steady laminar flow of a perfect gas along a thin flat insulated plate has been solved for a wide range of gas velocities and properties by means of the differential analyser. It is found that compressibility and Prandtl number do not introduce any new phenomena, but do alter the drag on the plate, the equilibrium temperature of the plate, and the velocity and temperature distribution through the boundary layer.

The solutions of the boundary layer problem are of the same general nature for fluid velocities above and below that of sound.

In order to pass the plate, the main stream must acquire a velocity component perpendicular to the plate. At speeds below that of sound, the requisite turning angle is produced by a slight modification of the potential flow. At supersonic speeds, the turn is accomplished by a small oblique compression shock which, for practical purposes, appears as two Mach lines trailing from the leading edge of the plate.

The main conclusions reached are:

1. An increase in viscosity with temperature does not cause a proportional increase in the drag of the plate, since the velocity profile is also altered.

2. With increase in the ratio of thickness of Prandtl number velocity layer $\delta\mu$ to temperature layer δ_T increases, *i.e.*

$$\frac{\delta\mu}{\delta_T} = P_r^{\frac{1}{3}}$$

3. Increase in compressibility number leads to a large increase in the lateral flow component due to the combined effect of increase in density and temperature near the surface of the plate.

Heater for Winter Starting. (Aeroplane, U.S.S.R., Vol. 17, No. 23-24, Dec., 1940, p. 17.) (95/10 U.S.S.R.)

In the winter training of pilots it will be found useful to have a mobile starting unit consisting of a car or carriage of tramway type, accommodating about twenty men. It is heated by an iron stove and mounted on four runners of usual aircraft type, enabling it to be easily moved about the aerodrome. In winter conditions, especially prior to long-distance flights, such a heater is indispensable; the starting personnel can keep warm, and the pupils have an opportunity to change and prepare themselves for their flight.

The equipment of the car includes a small bench and tools for running repairs and a table for the time-keeper. Lockers under the seats accommodate starting equipment, pilots' and navigators' instrument bags, etc.

The entrance is in the form of a small vestibule, to keep out draught, and for the storage of fuel.

The construction of the car is of wood; interior, finish and equipment can be adapted to any particular requirements.

In conjunction with the above, a heating stove for warming up engines is described. It is made of sheet iron and heated with charcoal. When the stove has burned through and no flame appears, it is placed under a hood covering the engine. By this means, even in frost of 40°, an engine of M-11 type could be heated up to +60/70° in 20 minutes. The stove is simple in construction and safe in operation.

The devices described have been put in use by several aero-clubs in the U.S.S.R.

Winter Starting. (Aeroplane, U.S.S.R., Vol. 18, No. 2, Feb., 1941, pp. 25-27.) (95/11 U.S.S.R.)

Describing methods and appliances developed by a Moscow flying club to enable training to continue throughout the winter.

Firstly, care was taken to have the complete lubricating system of the aircraft insulated from the cold. The insulations consisted of felt cloth and aeroplane fabric or tape. This is treated in turn with two ground coats and two finishing coats of paint. By this means it was possible to keep the oil temperature at 65/70°, even in prolonged glides.

The oil/water heaters supplied have a capacity sufficient for simultaneous treatment of all the aircraft in service.

The oil is fed into the inner case through a special nozzle on the can, and not through a funnel, avoiding waste, soiling and cooling off.

The simple charcaol-fired heaters used are of the type described in the previous abstract (95/10). They have been fitted with an additional spark retainer, further decreasing the fire risk. They are extremely simple and cheap to operate. No petrol is required.

The stoves are also used to give the flying personnel and ground staff an opportunity to warm themselves before taking off.

The starting (heating) hoods used on the engines are of standard type, but additionally lined with wadded fabric. The cylindrical portion (tube) of the hood is distended by two wire rings, to prevent contact with the hot stove. The number of stoves and hoods is sufficient to serve all the aircraft stationed on the aerodrome at one time.

The stoves take 1-15 minutes to heat up and are started about one hour before the flights are to begin.

At the end of the operations for the day, a special collector receives the oil remaining in the engines. The aircraft are re-fuelled and ready for the next day.

The Pre-Flight Reflex Trainer.. (B. H. Pearse, U.S. Air Services, Vol. 26, No. 8, Aug., 1941, pp. 16-17.) (95/12 U.S.A.)

The pre-flight reflex trainer consists principally of a canvas-covered cockpit suspended in a triangular frame which is mounted on wheels and powered with a 1½ h.p. motor. Seated at the controls, the student travels at about 12 m.p.h. around a large concrete platform, making turns and banks, glides and climbs, and figure eights, trying to avoid tripping the warning horn which blares forth whenever he overbanks or makes a mistake in co-ordinating the controls.

The combination of forward motion together with the turning and banking of the cockpit gives the student the feel of a plane in a way that a stationary device cannot do. And to the student concentrating all his mental effort on trying to make his hands and feet work together instead of at cross purposes, 12 miles an hour may seem quite fast enough.

Another advantage of the device's mobility is its adaption for machine gun practice. The gun trigger operates a 22-calibre weapon mounted on the forward part of the cockpit so that control and operation of a machine gun can be practised in conjunction with operation of the usual flight controls. With installation of certain instruments and a hood, it can also be adapted to instrument flying training.

Just how much time could be saved by widespread use of such a device as the pre-flight reflex trainer, of course only a test will show. The importance of saving even an hour or two in a vast training programme affecting 10,000 and more students is obvious.

General Approach to the Flutter Problem (with Discussion). (S. J. Loring, J.S.A.E., Vol. 49, No. 2, Aug., 1941, pp. 345-356.) (95/13 U.S.A.)

A general approach to the flutter problem is outlined, which can be used to investigate any mode of flutter of any structure, provided the air forces are known.

The method can be used to investigate the possibility of flutter on such structures as aeroplane wings and tail surfaces, bomb doors, aircraft propeller blades, vehicular bridges, buildings, etc.

Starting with a well-known solution for the air forces for two-dimensional flow over an airfoil with an aileron, equations have been derived which can be used to determine the flutter speed for the wing or tail surfaces of any conventional airplane.

The use of still-air vibration tests in obtaining the structural friction of structures, and in checking a part of the flutter computations experimentally is indicated.

Finally, to suggest the possibilities in the use of this method, a standardized procedure for its general application to aircraft flutter problems is outlined briefly.

New Parachute Design Drop Tested. (Aviation, Vol. 40, No. 7, July, 1941, p. 127.) (95/14 U.S.A.)

Incorporating a new principle in construction, a parachute made by Dr. Christian A. Volf of New York, N.Y., was drop-tested recently in Glendale, Calif.

By means of an inverted cone, rate of descent is said to be decreased and greater stability obtained, thereby overcoming drift in a high wind. A further object in the new design has been to reduce the size of the present standard parachute and so cut down materials and bulk.

According to the inventor, maximum strain on the parachute exists at the outer edges where the greatest shock is absorbed upon opening. As a result of the cone, the apex, which becomes the point of attack, tends to build up an air velocity towards the centre of the canopy, about four times greater than rate of descent. The high velocity air strikes the canopy over an area where maximum tensile strength prevails.

The inventor expects to build a parachute only 15 feet in diameter having additional vents situated in the canopy to permit release of the high-velocity air moving into the canopy as a result of the cone. It is expected that this size will be sufficient to carry down a 220-lb. pilot at a speed not exceeding 18 feet per second, and that the present pilot parachutes can be eliminated because of the cone.

Boeing Strato-Chamber. (Aviation, Vol. 40, No. 7, July, 1941, p. 127.) (95/15 U.S.A.)

Group training of flight crews for extreme altitude test work is being carried out by Boeing Aircraft with a sealed tank which reproduces flying conditions at 35,000 feet.

With both Britain and Germany building planes for combat at altitudes of seven miles, pilots will require careful training and " stratosphere conditioning " will be a necessity. Boeing's strato-chamber will prepare a whole crew of trained engineers to go into the stratosphere to gather test data on the operation of turbo-superchargers in the Boeing B-17 type.

It has been found that if a man's oxygen supply is cut off at 20,000 feet, he will pass out in ten minutes. At 25,000 feet unconsciousness comes in three minutes, and at 29,000 feet the flyer passes a critical point at which loss of oxygen means unconsciousness in less than one minute.

Above 35,000 feet an oxygen mask may furnish enough pure oxygen, but the rarified atmosphere does not supply enough lung pressure, and breathing is as difficult at 40,000 feet with a mask as it would be at 18,000 feet without one. Thus 40,000 feet seems to be the limit of human endurance without pressure cabin-equipped planes or pressurized suits and helmets.

The strato-chamber can reproduce flight conditions up to 40,000 feet and can accommodate three trainees and their equipment. Vacuum pumps reduce inside pressure to the equivalent of atmosphere pressure at any altitude. To guard against " aeroembolism " (an effect similar to a diver's " bends ") pure oxygen is preathed previous to the flight to " denitrogenize " the blood. The trainees then enter the tank wearing complete flying equipment; the door is closed, pumps start, and the flyers begin their " journey " to 35,000 feet. At various altitudes they practice handling their equipment under simulated emergency conditions.

As a result of the strato-chamber tests, the Mayo Laboratory of Aviation Medicine has adopted the Boeing check-off list for stratosphere flight crews. This list is a step-by-step procedure for crews to follow in preparing for any flight above 25,000 feet.

Aircraft Electricity as the Air Line Operator Sees It. (P. C. Sandretto, J.S.A.E., Vol. 48, No. 4, April, 1941, pp. 154-159.) (95/17 U.S.A.)

The electric power consumption in the DC-3 transport aircraft on a five hours' flight is analysed. Of the total consumption, about 73 per cent. is used for navigational purposes, 19.8 for service and 7.2 for operations. Details appear in the following tables.

TABLE 1—Operation Electricity, Douglas DC-3 Plane.

	Amp.	Amp.-Min.
Warning lights	1.2	360
Landing-gear warning lights...	0.7	210
Engine starters...	260.0	520
Fuel and oil pressure warning lights	1.1	66
Booster coils	3.0	6
Total		1,162

TABLE 2—Avigation Electricity, Douglas DC-3 Plane.

	Amp.	Amp.-Min.
Windshield defroster fan	1.0	300
Argon dynamotor and/or instrument spot-light	1.5	450
Pilot heater	14.0	4,200
Running lights	2.5	750
Compass, gyro and radio panel lights	1.0	300
Instrument panel lights	1.0	300
Radio-receiving dynamotor and receiving filament	7.3	2,190
Electrical instruments	1.0	300
Wing de-icer	1.5	450
Transmitting dynamotor	60.0	900
Transmitting filaments	15.0	450
Landing lights	70.0	1,050
Baggage pits	2.0	90
278-kc. relay	0.4	2
Total		11,732

TABLE 3—Service Electricity, Douglas DC-3 Flares.

	Amp.	Amp.-Min.
Cabin side lights	6.2	1,860
Buffet lights	1.0	300
Cabin warning lights	2.5	100
Seat belt warning	1.2	360
Companionway domelight	1.0	45
Stewardess call light	1.0	5
Cabin light relay	0.5	30
Cabin dome lights	6.2	372
Entrance door light	1.7	105
Total		3,177

The source of supply consists of two 12 v. d.c. generators and two 65 amp. h.v. storage batteries. The total weight is about 190 lb., or 127 lb. per kw., on a continuous rating of 1.5 kw. (the weight of cable and conduits is of the order of 300 lb.).

On the DC-4 (55,000 lb. gross weight against 25,000 lb. of the DC-3), by stepping up to 24 volt and various other improvements, such as speeding up generators, it has been possible to obtain a continuous rating of 20 kw. for a weight of only 242 lb., *i.e.*, the specific weight has been reduced to about 20 lb. per kw., whilst the conduit system weighs about 540 lb.

The author is of the opinion that 24 v. d.c. will remain standard for some time, but that for much larger machines (gross weight ~ 100,000 lb.) a.c. current at 115 volts and frequencies ranging from 300 to 900 cycles will enable a further marked reduction in weight of the electrical power plant.

Field of View from the Pilot's Cockpit. (A. Vannucci, Atti di Guidonia, No. 42, 30/1/41.) (95/16 Italy.)

A description is given of a method for the determination of the pilot's field of view obtained by the cylindrical projection on a sheet of sensitized paper. The corrections to be made owing to the distortion of the co-ordinate grid system are calculated and applied.

The Use of Liquid Oxygen for High Altitude Flying. (J. D. Ackerman, J. Aeron. Sci., Vol. 8, No. 9, July, 1941, pp. 361-364.) (95/18 U.S.A.)

A method and apparatus is described to produce gaseous oxygen from liquid oxygen for use in high-altitude flying. The elimination of the danger of dis-

continuity of oxygen boiling and provision for securing the required volume of oxygen gas is accomplished by keeping the liquid oxygen under a pre-determined pressure and supplementing the normal evaporation by spilling a necessary amount of liquid oxygen in the gas contained. Fast evaporation takes place to maintain a constant supply of oxygen gas inside the apparatus which is connected with a second-stage reducing valve of a B-L-B oxygen mask as developed by the Mayo Foundation.

To secure the spilling of liquid oxygen into the gas container, an absolute pressure-valve is provided in the gas contained, to keep a pre-determined pressure of gas in the liquid container. The liquid container does not require the use of a vacuum bottle. Although no attempt is made to design the apparatus for any specific aeroplane, the mechanism is flexible for adaptation to meet any specific requirements of oxygen supply. Apparatus for handling and storing liquid oxygen and the possibilities of a portable liquid oxygen-producing plant are discussed.

Effect of Compass Location in Aircraft in Dynamic Errors. (W. Wrigley, J. Aeron. Sci., Vol. 8, No. 9, July, 1941, pp. 365-367.) (95/19 U.S.A.)

A compass may be located, either for convenience or necessity, at some distance from the centre of gravity of large modern aircraft. Such a location may give rise to dynamic errors in the readings of the compass due to the accelerations of roll, pitch and yaw of the aeroplane about its centre of gravity. The acceleration of yaw is probably the most serious factor in producing such dynamic errors regardless of whether the compass is located in the nose, the tail, or in a wing.

The magnitude of the dynamic errors in compass readings increases in an approximately linear fashion as the distance of the compass from the centre of gravity of the aeroplane is increased. For any particular location of the compass there will be a certain heading of the aeroplane for which the compass reading will have a maximum error. The dynamic errors may exist as magnitude effects of up to several degrees, or as phase effects of up to almost one hundred an eighty degrees.

Systematic Tank Experiments on a Twin-Float Seaplane, Type "Ġ.I.S. 6," for Different Conditions of Trim and Loading and Distance between Floats. (Cremona Cesare, Atti di Guidonia, No. 20, 20/12/39.) (95/20 Italy.)

The modern non-dimensional method is of experimentation applied to the problem of seaplane floats, both single and in pairs.

In the first part of the report, the author describes the new method and gives the results of a complete series of experiments carried out in the Guidonia tank (load, speed, drag, trim, distance between floats).

From these a general picture is presented, both of the experimental difficulties, and of the wide choice of data open to the designer and the mathematician.

M.I.T. Wright Brothers Wind Tunnel and its Operating Equipment. (J. R. Markham, J.S.A.E., Vol. 49, No. 3, Sept., 1941, pp. 380-388.) (95/25 U.S.A.)

With the M.I.T. Wright Brothers wind tunnel and balance system it is possible to obtain measurements very rapidly on a complete aeroplane model from which the coefficients for all six components can be plotted with a minimum of calculation. It is usually possible to mount the model so that the point representing the centre of gravity of the aeroplane is on the balance axis, a feature which increases the accuracy of the results and the simplicity of the calculations.

The balance system was designed to fulfil the following general specifications: It has to be compact for the pressure-type tunnel in which it operates so that the shell surrounding the test section be kept to a minimum diameter; it should be arranged so that measurements of all six components could be made remotely and that angular settings of the model in pitch and yaw could be made from

a remote station. It was required further that each component be measured independently and totally so as to simplify and shorten the numerical calculations.

The test section was made an ellipse in order to obtain as large a span-wise dimension as possible for a given test-section area. It is then possible, without requiring extra power, to test a model with a larger span in an elliptical tunnel than in a tunnel of circular cross-section of the same area at the same speed.

Icing Problems in Operation of Transport Aircraft. (R. L. McBrien, J.S.A.E., Vol. 49, No. 3, Sept., 1941, pp. 397-408.) (95/26 U.S.A.)

The information given in this Paper was obtained principally from trip icing logs and test flights conducted on a major transport system. A copy of a trip icing log is included to show the type of information obtained from normally scheduled flights.

The different types of ice formed are explained and the general effect upon the performance on the aeroplane for each type of ice is stated.

Aeroplane ice accumulations are divided into two major classes: (1) Those producing a loss of flight performance and (2) those which serve as an annoyance to the crew. The main portion of the Paper deals with these two classes, explaining when, how and why they are of importance. Numerous pictures are shown depicting the various conditions which were found to exist in scheduled airline operations and the shortcomings of the present anti-icing equipment is explained.

Consideration is given to ice accumulations on the wings, empennage, propeller, pitot mast, radio loops, windshield, and so on. It is hoped that a dissemination of these actual airline operating conditions and experiences will result in further improvements to airline and anti-icing equipment. It is also hoped that instrumentation means will be developed whereby ice accumulations can be better analyzed and reported.

Standardisation of Liquids Employed in the Hydraulic Controls and Shock Absorbers of Aircraft. (V. Ceccarini, Atti di Guidonia, No. 39-40, 10/12/40.) (95/27 Italy.)

After a reference to the absolute necessity of standardizing the liquids employed for shock absorbers and hydraulic systems on aircraft, the author gives the characteristics of the most important existing liquids and then considers the castor oil + diacetone alcohol mixture which, of the liquids in use, appears to be of the greatest interest.

The three mixtures of castor oil and diacetone alcohol prepared in the laboratory for jacks, oleo-pneumatic and oleo-elastic shock absorbers are examined. Descriptions are given of the chemical and physical tests carried out on these mixtures in order to ascertain their behaviour under service conditions, and of a method for the determination of their action on the metals and the rubber used in the fittings. The results are discussed also with respect to the possibilities of employing mineral oils, the other highly important group of liquids and perhaps the only one which may present real advantages over the castor-diacetone mixtures.

A scheme of standardization for the mixtures is suggested.

In conclusion, the relative advantages of castor oil + diacetone alcohol mixtures and of mineral oils are compared. The latter are found to be preferable provided the viscosity characteristics are suitable.

Compounding—Facts and Fallacies. (F. L. Prescott, J.S.A.E., Vol. 49, No. 2, Aug., 1941, pp. 326-331.) (95/28 U.S.A.)

The 2-Cyl. " Compound " engine with spark ignition on which the data reported in this Paper were obtained is provided with a high-pressure cylinder and a low-pressure cylinder which serves as a compressor as well as a working cylinder.

The primary consideration in this work was the extracting of additional work from the already partially expanded gases from the high-pressure cylinder; a secondary consideration was the use of the same low-pressure cylinder as a second-stage compressor to aid in supercharging the high-pressure cylinder.

In reporting test results covering the development and testing programme on the 2-Cyl. test unit, indicator diagrams showing the power developed in both high-pressure and low-pressure cylinders are presented. Some results and conclusions follow:

1. An indicated m.e.p. of 705 psi was recorded in the high-pressure cylinder but the corresponding i.m.e.p. in the low-pressure cylinder was only 63·psi.
2. Fuels are available which make possible mean effective pressures in the high-pressure cylinder, resulting in release pressures to the low-pressure cylinder of 350 to 400 psi.
3. Two-stage expansion to a final ratio of 15:1 or more is feasible.
4. Modern internally cooled valves are satisfactory even under the unusual temperature and pressure conditions encountered by the high-pressure exhaust valve.
5. Compounding the expansion results in a definite increase in thermal efficiency.
6. The brake thermal efficiency is however poor, due to friction losses in the low pressure piston compressor.

Waste Heat Recovery with Vapour-Phase Cooling. (J. H. Wallace, J.S.A.E., Vol. 48, No. 4, April, 1941, p. 159.) (Digest.) (95/30 U.S.A.)

Based on heat input, present day internal combustion engines average about 25 per cent. efficiency, the heat distribution being roughly as follows:—

Shaft h.p.	... ...	26 per cent.
Jackets	... ...	28 ,,
Exhaust	... ...	34 ,,
Friction	... ...	6 ,,
Radiation	... ...	6 ,,

Exhaust waste heat boilers can recover between $2\frac{1}{4}$ and $2\frac{1}{2}$ lb. of steam per b.h.p. hour. The apparatus is, however, excessively bulky and subject to corrosion troubles.

By use of the vapour-phase system of cooling, as much as $5\frac{1}{2}$ lb. of steam can be generated per b.h.p. hour at full load and the steam can be delivered at pressure between 5 and 20 lb. per sq. in. without any marked change in present day engine design. The main features requiring attention are the gaskets and liner packing. By using neoprene or duprene sealing rings, the temperature at the liner joints can be raised to 350°F. without difficulty.

Altitude Performance of High Output Aircraft Engines. (R. N. Du Bois, J.S.A.E., Vol. 48, No. 4, April, 1941, pp. 138-147.) (95/29 U.S.A.)

Starting off with laboratory tests covering the b.h.p. and motoring losses of a single cylinder engine over a wide range of inlet and exhaust conditions, the author calculates the altitude performance of the same engine at various degrees of boost, *i.e.*, supercharger drive ratio. The supercharger is assumed to have a compression efficiency of 66 per cent. and a 10 in. impeller. Curves connecting impeller tip speed and compression ratio at various inlet temperatures are assumed to be available as well as pressure drop at intake to blower as a function of rate of air flow. Polytropic compression with the exponent $n = 1.67$ is assumed. The final manifold pressure and temperature gives the indicated power from the engine calibration chart. This is converted into the corresponding air consumption and the blower h.p. calculated. The engine friction h.p. is defined as the power

required to overcome mechanical friction and pumping losses at the intake and exhaust pressures under consideration. (Under high degrees of boost, the friction h.p. may be negative, *i.e.*, the engine is being driven by the exhaust/inlet pressure difference.) Deducting friction and blower h.p. from the indicated h.p., the b.h.p. at altitude is finally obtained.

The author also considers the case when a two-speed single stage, a two-stage single speed, or a two-speed two-stage blower is employed respectively. Of special interest is the proposal to have the first stage driven independently by means of an auxiliary engine, whilst the second stage is coupled permanently to the main power plant.

For a given brake output to the propeller, the indicated h.p. of the main engine is less in this arrangement and this is an advantage when working near the limiting cylinder output.

American Experience with Buchi Supercharging. (J. P. Stewart and other, J.S.A.E., Vol. 49, No. 3, Sept., 1941, pp. 389-930.) (95/32 U.S.A.)

Buchi turbo-charged engines are suitable for practically any class of service where a Diesel engine is used. This system of supercharging at present has its greatest usefulness with those engine builders who do not manufacture a few standardised engines in production quantities such as the automotive type, but who have a number of available standard sizes which are adapted to specific requirements in each case. This enables them to offer for sale normally aspirated engines when suitable and turbo-charged engines when required, with a few changes from the standard engine construction. With the positive-pressure blower, a mechanical drive must be provided, requiring in the neighbourhood of 6 to 10 per cent. of the total output of the engine. In many cases the normal camshaft drives are not designed to carry such a load, nor is space available for the blower without affecting overall dimensions.

The question naturally arises as to the future possibilities or trends with respect to supercharged engines. The indications are that supercharged engines must be used increasingly in the future, and it is not inconceivable that the time will come when practically all four-cycle engines will not only be supercharged in some form, but will be designed specifically for supercharging. The most important reason for supercharging is, of course, to obtain more output per total less weight and space. At the present time, a cost saving in dollars per total horse-power due to using supercharging can be shown, but it is not of great magnitude. However, there are good reasons to believe that costs will develop to be more and more in favour of the supercharged engine as time goes on and supercharging is more universally used.

The ultimate possibilities of supercharging are still very largely unexplored. A still greater degree of supercharging is possible with the single-stage turbo-charger blower than is now being used commercially. Multi-stage blowers with higher charging pressures, coupled with advances in metallurgy to permit higher operating temperatures, are a further possibility.

One hundred and forty psi b.m.e.p. is already attainable with existing temperature limits. This is by no means the limit, but undoubtedly additional problems will remain to be solved in the development of even higher b.m.e.p. values. Also, as the degree of supercharging is increased, the greater quantity of fuel burned in the cylinder will bring new combustion problems. No doubt increasingly higher piston speeds will also be used in conjunction with higher values of b.m.e.p., and these will bring their own problems in connection with the mechanical design of the engine. To sum up, it is felt that the four-cycle supercharged Diesel engine is now on the verge of a rapid evolution toward a substantial reduction in specific weight and space, although these objectives will be accomplished only by considerable research and field operating experience.

Design Feature and Performance Characteristics of the Mercedes Benz D.B. 601A Aircraft Engine. (R. W. Young, S.A.E. Journal, Vol. 49, No. 1, July, 1941, pp. 22-23.) (Digest with Discussion.) (95/33 U.S.A.)

From a review on contemporary American, British, French and German aircraft engines, it appears that German and French liquid-cooled designs tend towards larger displacement and lower crankshaft speeds than those current in Britain and the U.S.A. At the same time the b.m.e.p. under military rating is about 6 per cent. lower. Nevertheless, the performance of the D.B. 601 with regard to sea level and altitude power, fuel consumption and weight is on a par with best existing designs.

No useless effort in man hours or finish has been expended where there is not a direct return in increased reliability or performance. The handiwork in polishing and finish of all highly stressed parts is however of the highest order.

The fuel injection system and fluid drive are of special interest. The mixture control for altitude is stated to be complicated but reliable. The workmanship is excellent and ensures smooth operation of the control. The magnetos employed weigh only about half as much as the standard American product. Servicing is rendered easy by a number of clever devices preventing loss of small parts on disassembly. All screws not necessarily to be touched have their slots covered with white paint.

(The paper has been published in full in " Aircraft Engineering," Oct., 1941, pp. 270-279.)

A New High Altitude Fuel System for Aircraft. (W. H. Curtis and R. R. Curtiss, J.S.A.E., Vol. 49, No. 1, July, 1941, pp. 260-265.) (95/34 U.S.A.)

This paper deals in a general way with a brief history of the work that has been done in the past on aircraft fuel systems to adapt them for high altitude flight, the reasons for failures that developed, some of the physical aspects of aircraft fuel at high altitude, and a brief description of the Thompson booster system.

This system was evolved as the result of the application of analytical reasoning to the fuel systems that preceded it. The booster unit is a modified centrifugal pump, attached directly to the fuel tank and driven by an electric motor. Its function is to prevent entrance of released vapour and air to the fuel line leading to the fuel pump on the engine. It also maintains sufficient pressure in this line to prevent additional release of air vapour.

Standardisation of Aircraft Engine Components. (G. Carvelli, J.S.A.E., Vol. 49, No. 1, July, 1941, pp. 294-300.) (95/35 U.S.A.)

Standardization of engine components should start in the drafting room with use of a system of sample drawings, and dimensioning of parts should be simplified through use of a two-place decimal system.

The importance of standardization of notes, clearances, tolerances, and other data listed on drawings is emphasised. In addition, threaded parts, gear tooth form, and many such items can and should be standardized, and serious consideration should be given to adoption of the metric system.

Since the Army-Navy (AN) Standards were developed primarily for aeroplanes and often do not apply to aircraft engines, a new set of standards must be developed for parts used on engines only.

The twenty odd gauging systems used to-day should be eliminated and only one system used, based on a decimal system. The number and letter drill sizes should be replaced by sizes based on a decimal system. It has been estimated by a firm using copper, brass and aluminium, that the saving for this firm alone would be over $1,000,000 a year if a uniform gauge system was used.

The money spent on standardization will pay dividends beyond imagination, so it is recommended that the management of engine and aeroplane companies encourage their men to serve on S.A.E. committees because, without the management's support, the work cannot be done satisfactorily.

Design and Construction of the Aero Engine Supercharger. (W. Von der Neall and H. Pfan, Z.V.D.I., Vol. 85, No. 37-38, 20/9/41, pp. 763-773.) (95/36 Germany.)

Amongst the features of special interest discussed by the author may be mentioned:—

(1). Relationship between tip speed and compression ratio at maximum efficiency, based on 313 measurements covering various designs of single-stage centrifugal blowers. It appears that tip speed of the order of 325 m./sec. are required for compensation at 20,000 feet.

(2). Effect of number of blades on efficiency. Experiments were carried out with 1-24 radial blades and with subsidiary short blades placed at the periphery of the semi-shrouded wheel. These subsidiary blades varied between 48 and 120 in number, the main radial blades being kept at 12 for these experiments. Whilst an increase in the number of blades generally leads to an increase in compression ratio, the compression efficiency suffers due to increased friction losses. It appears that 6-8 radial blades give the best all-round results, when other factors such as throttling at intake and ease of manufacture are taken into consideration.

(3). Effect of entry and exit vanes. Although such vanes may lead to improvements under certain operative conditions, they may have a deleterious effect if the running condition departs widely from the designed value. For this reason vaneless diffusors are recommended, since they facilitate installation and improve stability of operation.

Reference is made to the Planiol supercharger which is fitted with three sets of entry vanes. The increase in axial length and vulnerability of such a rotor, quite apart from manufacturing difficulties, is considered to outweigh any possible improved efficiency.

(4). Effect of altitude conditions on supercharger performance. The author considers it essential that supercharger tests be carried out at entry temperatures corresponding to those at operative heights. Altitude performance estimates from tests at normal temperatures may be seriously at fault. Compression ratio and efficiency may either increase or decrease compared with ground temperature performance, a decrease being most commonly observed. A satisfactory explanation of this behaviour has not yet been found.

The Elements of Pendulum Dampers. (T. S. Williams and R. W. Zdanovich, Proc. I. Mech. E., Vol. 143 (1940), No. 3, p. 182, and Vol. 144 (1941), p. 217.) (Discussion.) (95/37 Great Britain.)

The dynamics of a Rotating Pendulum Detuner has been treated in a completely general way, all principal known types being included. A new and practical method of considering the effects of a Pendulum Detuner when fixed at any point in the engine system has been developed showing that a Detuner of the type described virtually behaves as a simple fly-wheel whose moment of inertia can be varied at will to possess practically any value lying between the limits of plus and minus infinity, consequently its action results in an alteration or displacement of the critical speeds at which the harmonic orders occur. The effects of a Detuner on harmonic orders other than the design ones are also fully considered.

A convenient practical method is outlined for arriving at the best design of a Detuner, irrespectively of its location or position in the engine or engine transmission system. This method successfully overcomes the numerous

difficulties which were experienced by all the early designers and which were due to incomplete understanding of the general principles governing the behaviour of the Detuners. The method outlined also enables the designer to adopt easy machining tolerances for the various component parts thereby allowing for the effects of wear, distortion, thermal exapnsion, etc.

As a practical illustration a brief account is given of experimental work which was undertaken to test the behaviour of a well-known engine with a Detuner fitted at the fly-wheel. . This position has been chosen as being the least obvious of all for the successful application of a Detuner. A further example is given of the application of a Detuner to a six-cylinder in-line engine. Both examples clearly illustrate the very precise agreement in all cases between experimental and calculated results.

The discussion on the Paper (Proceedings, Vol. 144, pp. 217/230) is of interest, since most of the British experts on torsional vibrations contributed. Whilst there appeared general agreement with the treatment, doubt was expressed in some quarters as to the extent slipping of the rollers can be prevented in practice. Some slipping is bound to occur if the angle of swing is large and fine tuning must become impossible if the relative amounts of slipping and rolling change.

A parallel treatment dealing with the suppression of longitudinal or axial vibrations of crankshafts etc. is discussed in the author's reply to the contributions. The possibilities of adopting various curved tracks for the suspension of pendulums, *i.e.* elliptical, hyperbolic, parabolic etc., in place of the customary circular ones, are also touched upon.

A convenient method for obtaining reliable results with a Geiger torsiograph is outlined together with some reproductions of actual records of torsional vibrations.

Special forms of pendulums and a note on the estimation of angular amplitudes are discussed in Appendices. A bibliography and a short list of the most important Patent Specifications relating to Rotating Pendulum Detuners are also included.

In the bibliography, a Paper by A. Stieglitz on " The effect of Pendular Masses on Torsional Vibrations " (published in the Yearbook of German Aeronautical Research, 1938, Vol. 2, pp. 164/178) has been omitted. This Paper, available as M.A.P. Translation No. 1012, deals with the fundamental characteristics of pendular masses on shafts, and the general conclusions are in agreement with those of the present authors. Stieglitz was careful to point out that the pendular masses act as detuners and not dampers.

A.S.T.M. Knock Rating of Aircraft Fuels. (Engineering, Vol. 152, No. 3,949, 19/9/41, p. 225.) (95/38 U.S.A.)

The test for the knock characteristics of aviation fuels, for use in aircraft engines of the spark-ignition type, differs from the method of testing the knock characteristics of motor fuels (Specification D. 357) principally in the manner in which the combustion characteristics are measured. In the new method a thermal plug is employed for comparing temperatures in the cylinder, while in the motor fuel method, knock intensity is measured by a bouncing pin and knock-meter. The term, knock characteristics, however, has been retained on account of is widespread use, even though knock intensity is not actually measured. The A.S.T.M. knock value of an aviation fuel is given as the whole number nearest to the percentage, by volume, of iso-octane 2, 2, 4-trimethylpentane) in a blend of iso-octane and normal heptane which the fuel matches, in knock characteristics, when compared by the prescribed method. It is emphasised that these specifications do not constitute a definition of aviation spirit; neither do they include all types of fuel satisfactory for spark-ignition aero-engines. Certain equipment or conditions of use may require fuels having special characteristics. Three grades of aviation spirit, however, are provided for. These vary chiefly in the matter of knock value and the grades are

designated by their respective A.S.T.M. aviation-spirit knock values, namely Grade 73, Grade 91, and Grade 100.

Lubrication of Severe Duty Engines (Diesels). (J. G. McNab and others, J.S.A.E., Vol. 49, No. 2, Aug., 1941, pp. 309-325.) (95/40 U.S.A.)

This Paper points out differences in diesel and petrol engine design and operation which result in significant differences in heat flow which may, in some cases, cause emphasis to be put on such problems as ring-sticking, wear, and piston scuffing, and in others, on sludge formation, varnish, coking, and so on.

Naphthenic and paraffinic oils of 40 and 100 viscosity index, respectively, to which have been added small amounts of a detergent-dispersal-inhibitor type additive developed by the Esso Laboratories, have been subjected to extensive laboratory and field tests and have been found to meet the most severe requirements of heavy-duty diesel service in modern transportation and industry. Results of some of these tests were compared with results of similar tests on typical naphthenic and paraffinic mineral oils commonly used for diesel lubrication under moderate conditions of speed, load, and temperature, where extreme detergency and oxidation stability are not required, on another detergent-disperser-inhibitor blend in a naphthenic base oil and on a commercial inhibited oil of the paraffinic type used in diesels requiring extreme oxidation stability but only a little detergency.

The research forming the basis of this Paper was carried out principally on three of the better-known makes of diesel engines, selected because they represented three rather distinct types of engine design and because each manifested certain of the characteristic lubrication problems which, considered together, included practically all of those peculiar to the diesel engine.

The Present Status of Combustion Research. (E. F. Fiok, J.S.A.E., Vol. 49, No. 2, Aug., 1941, pp. 332-338.) (95/41 U.S.A.)

A number of the more important contributions made recently to our knowledge of the process of combustion in the engine cylinder are reviewed briefly in this Paper.

Of the possible lines of attack which promise to lead to further improvements in the control of gaseous combustion as a source of power, the following are stressed:

1. Finding new mixtures which are inherently more powerful or more economical;
2. Finding new methods of altering the mass rate of burning, the completeness of combustion and, hence also, the rate of increase in pressure;
3. Preventing pre-ignition in spark-ignition engines and facilitating ignition in compression ignition engines;
4. Suppressing detonation.

The need for an increasing amount of combustion research and the desirability for careful co-ordination are demonstrated by an examination of progress to date.

Electrolytical Method for the Determination of the Lead Tetraethyl Content of a Fuel. ((Squeo Ignazio and Cianetti Elvio, Atti di Guidonia, No. 41, 20/1/41.) (95/42 Italy.)

A description is given of an improved method for the determination of the lead tetraethyl content of "ethylated" petrols and anti-knock mixtures, based on the electrolysis of lead nitrate, obtained either by precipitating the lead from the "ethylated" petrol with a solution of bromium in carbon tetrachloride and subsequently extracting it with nitric acid, or by extracting it with hydrochloric acid and transforming the chloride into nitrate. The most suitable conditions for such electrolyses are investigated; it is shown that the electrolytic

method is quicker and quite as accurate as the methods of precipitation hitherto practised. Finally, it is shown that the more suitable application of the method is that of combining lead tetraethyl with hydrochloric acid.

An Instrument for Measuring the Ignition Quality of Diesel Fuels. (W. H. Browne, J.S.A.E., Vol. 48, No. 4, April, 1941, pp. 148-153.) (95/43 U.S.A.)

This Paper is a report of the work done on the development of the cetane valve, an instrument used for the measurement of the cetane ratings of diesel fuels by throttling the intake air of a one-cylinder test engine. The author traces the history of the valve from its conception at the time of rating diesel fuels for altitude work to the present design, which has been used very successfully on a $5\frac{3}{4}$ by 8 inch engine, a $3\frac{3}{4}$ by 5 inch engine, and is being adapted to the CFR test engine.

Ratings made with the instrument, consisting of both reference blends and commercial fuels, are compared with results obtained by the coincident flash (CFR ignition lag) method. The advantages of the cetane valve as enumerated by the author are:

1. Simplicity of instrument and method;
2. Ease and quickness of operation;
3. Reproducibility and accuracy of results; and
4. Adaptability to engines of various strokes and bores.

A 13-year Improvement in Mixture Ratios. (W. G. Lovell and others, J.S.A.E., Vol. 48, No. 4, April, 1941, pp. 160-164.) (95/44 U.S.A.)

Between 1927 and 1940 there has been a considerable improvement in the direction of leaner air-fuel mixtures used in representative cars, amounting to an average of about two ratios at road load, equivalent to a saving of about 18 per cent. in fuel consumption. These data also suggest that there is a possibility of still further gains.

The air-fuel ratios used in automobiles represent the engineering compromise that must be made between the relatively lean mixtures which are desirable from the standpoint of economy of fuel, and the richer ones which are necessary because of inherent imperfections in commercial induction systems.

Comparisons of mixtures used by the cars tested in the three years are given on graphs showing average and range of air-fuel ratios plotted against miles per hour at road load and full load, and per cent. of energy loss plotted against miles per hour at road and full load.

Crankcase Oils for Heavy Duty Service. (H. R. Wilf, J.S.A.E., Vol. 48, No. 4, April, 1941, pp. 128-137.) (95/45 U.S.A.)

This Paper presents the results of road and dynamometer tests made to evaluate crankcase oils; appraises the effect of operating conditions; and reviews the causes and cures of failure of copper-lead bearings in heavy-duty service.

During the past year attention has been focused on the failure of copper-lead bearings in heavy-duty service. These failures may be classified as loss of lead due to the corrosive effect of the lubricant, and mechanical failures due to fatigue. Corrosion and fatigue are greatly accelerated by an increase in bearing pressure; consequently, tests made in full-size multi-cylinder engines more closely approximate service conditions than miniature single-cylinder engine tests or laboratory bearing corrosion tests.

Loss of lead may be caused by the solvent action of acidic products formed on oxidation of the base oil. The oxidation of the base oil may be greatly accelerated by the catalytic effect of metallic soaps used as detergents.

Metallic compounds other than metallic soaps, which either do not break down under the conditions existing in the high-pressure bearing areas or do not form free

acids or acidic compounds on decomposition, are available as detergent compounds. This type of metallic detergent compound does not cause bearing corrosion.

Effect of Quenching Rate on Susceptibility to the Intercrystalline Corrosion of Heat Treated 24S Aluminium Alloy Sheet. (H. L. Logan, J. of Research Nat. Bureau of Stands., Vol. 26, No. 4, April, 1941, pp. 321-329.) (95/46 U.S.A.)

The effect of the quenching rate of the 24S (aircraft) aluminium alloy upon its behaviour in an accelerated corroding solution ($NaCl + H_2O_2 + H_2O$) was determined. Specimen cooled from a temperature above 400°C. at a rate in excess of 815° to 1,110°C./sec. (increasing with increasing copper content of the alloy) were susceptible only to the pitting type of corrosion. Specimen cooled at a rate less than 300° to 400°C./sec. (increasing with increasing copper content) and specimens cooled slowly to a temperature below 400°C. before quenching were subject to severe intercrystalline corrosion. For cooling rates between the above ranges there was a gradual change from one type of corrosion to the other.

Cooling rates were determined by means of a thermocouple and an Einthoven string galvanometer.

Influence of Stress on the Corrosion Pitting of Aluminium Bronze and Monel Metal in Water. (D. J. McAdam and G. W. Geil, Bur. Stan. J. Res., Vol. 26, No. 2, Feb., 1941, pp. 135-139.) (95/47 U.S.A.)

Cyclic stress tends to increase the size and sharpness of corrosion pits in aluminium bronze and monel metal and thus tends to increase the rate of lowering of the fatigue limit by corrosion. The form of corrosion pits in aluminium bronze is affected by the duplex microstructure. Pits in monel metal are not appreciably influenced by the microstructure. Curves of decrease of the fatigue limit, and constant-damage diagrams derived from these curves, are very different from those obtained with steels. These differences may be attributed to the fact that the rate of corrosion of aluminium bronze and monel metal, unlike that of steel, is anodically controlled. Steady stress tends to increase the rate of corrosion pitting of aluminium bronze but has little apparent effect on monel metal.

Phosphate Coatings Facilitate the Cold Working of Metals. (H. Faber and H. Kopp, Korrosion and Metallschutz, Vol. 17, No. 6, June, 1941, pp. 211-214.) (95/48 Germany.)

During the cold work of metal (such as the drawing of tubes and rods, and the deep drawing of containers), considerable friction is necessarily set up between the surface of the material and the die. In order to reduce wear of the die and the seizure of the material, it has been customary to use certain oils and fats as lubricants. The difficulty is to ensure adhesion of the lubricant under these arduous conditions, and although it is usual to roughen the surface of the material between the various stages of the process, the oil film will tear unless the rate of working is carefully adjusted. It has been discovered recently by Singer that the retention of the lubricant can be vastly improved if the material is coated with a phosphate layer prior to drawing. A zinc phosphate deposit by the Bonder process has been found specially suitable and is covered by the German Patent 673,405. The thickness of the deposit will depend on the degree of deformation required. In the case of tubes, one coating will generally last up to five consecutive drawings. In many cases it is thus possible to reach the final dimensions without a reheating of the material. Examples are given of electrically-welded steel tubes (S.M. Steel of 35/40 kg./mm.^{2} tensile) which were drawn in this way in five stages from an original diameter of 26 mm. and 1.2 mm. thickness to 16 mm. diameter and .6 mm. thickness. This implies

a reduction in area of cross-section of 69 per cent. Even more spectacular results were obtained with Cr.-Mo. steel (cross-section reduced by over 80 per cent. in five stages without reheating).

The process has also been applied successfully to pressure vessels, wire drawing, up-setting of screw heads, etc. and, in the author's opinion, constitutes one of the outstanding discoveries of recent times.

Phosphate Coatings as Running-in Layers for Piston Rings. (F. Bremer, Korrosion und Metallschutz, Vol. 17, No. 6, June, 1941, pp. 208-209.) (95/49 Germany.)

Modern developments in high-duty engines have necessitated the use of piston rings made of wear-resisting material. The running-in of such rings is necessarily a lengthy process and many attempts have been made to shorten the time required, either by putting up the contact pressure (stepped or chamfered rings) by the provision of soft metal inserts in the ring surface or by covering the latter with a deposit of tin, copper or cadmium. Whilst the latter process has met with a certain amount of success, its general application is not recommended by the author since it is fairly complicated and the metals required for the deposit are not produced in Germany. Recent experiments have shown that better results can be obtained in a simpler manner by applying phosphate coatings to the ring surface. The Abrament Process (I.G. Farbenindustrie) is used, the deposit consisting of a mixture of manganese and iron phosphates or zinc and iron phosphates, depending on the nature of the piston ring material. The time of treatment depends on the temperature and composition of the bath, and varies between ten minutes and one hour. Experience has shown that the deposit should consist mainly of fine crystals, uniformly distributed. A few coarse crystals inside this matrix are not harmful. If, however, the whole deposit is coarsely crystalline, the coat loses its value and may even increase the running-in time required. The great advantage of the phosphate layers lies in the fact that the final bearing surface is free from distortion or displacement of material. If the ring surface is finely machined before the coat is applied, the gas seal is almost perfect from the start so that the engine can be operated normally even before the running-in process is completed.

Phosphate coatings are oil absorbent and in an emergency will run dry for an appreciable time without seizing. The danger of local high-pressure zones leading to partial seizure during normal operation is thus much reduced.

In conclusion the author states that a further deposit of graphite on top of the phosphate coating may prove beneficial.

Metal Spraying with an Electric Arc Gun. (J. Am. Soc. Nav. Engs., Vol. 53, No. 3, Aug., 1941, pp. 688-689.) (95/50 U.S.A.)

A new method of metal spraying has been developed by Dr. M. U. Schoop of Switzerland, originator of the metal-spraying process, which makes use of a spray gun utilizing an electric arc to melt the metal to be deposited. Hitherto, the metal-spraying process has depended upon a gas flame of some kind to melt the metal before being deposited on the base surface.

The new Schoop process consists essentially of short-circuiting two conducting wires which pass through the spray gun, atomizing each drop of metal melted by the resulting arc, and projecting the atomized metal by means of a compressed air blast on the surface to be metallized. A small luminous arc is formed at the breaking point, insuring the continued melting of the wires, which are constantly being fed forward by means of a turbine. Although the compressed air blast directed through the arc may be fed into the gun at pressures ranging from 60 to 120 pounds per square inch, the arc is reported to be entirely stable.

The new process of metal spraying is claimed to be highly economical and efficient. It is said that about twenty-two pounds of carbon steel or stainless

steel wire can be sprayed during each hour of operation. In many cases, the pre-treatment of the surfaces by sand-blasting heretofore required, can be dispensed with because of the increased strength of bond secured by this method of deposition. Thus, if a glass plate is electro-metallized with aluminium or steel by this process, and an attempt is made to remove the deposited metal, a layer or " skin " of glass will also be torn off. It appears that owing to the electric arc, the temperature of the sprayed metal particles is so high that they melt into the surface against which they are propelled, rather than becoming merely a surface layer.

Arc Welding without Residual Stresses. (R. E. Spaulding, J. Am. Soc. Nav. Engs., Vol. 53, No. 3, Aug., 1941, pp. 675-679.) (95/51 U.S.A.)

The process recommended consists in pressing or light-hammering the weld area while it is cooling (vibratory pressure is best; steady pressure only if welding process is continuous). This added pressure (applied at right angles to the axis of the weld) can usually be best obtained by the use of a light pneumatic or electric hammer having a tool face adapted to the desired size and contour of the weld. If applied at the right time, that is while the yield strength of the hot weld is relatively low, only a small amount of effort is needed and all shrinkage tendency is found to have been eliminated.

The new method must not be confused with so-called " peaning " or hammering of the weld area after it has cooled to such an extent that the elastic limit or yield strength of the area has again approximated that of the original metal. Nor should it be compared to re-heating of the weld area, with or without treatment while heated, since no heat produced by a flame can even approximate the same relative heat penetration with corresponding surface intensity of that resulting from an electric arc. In both of these latter methods counter-balancing locked-in stresses may be introduced which will overcome warpage but the welded assembly is nevertheless still subject to high internal stresses, and often the physical structure of the metal is disturbed and weakened.

Method of Selecting Ball and Roller Bearings—II. (Ungar, Machinist, 20/9/41, pp. 214-215.) (95/52 Great Britain.)

In this article, the author shows the method of selection of a bearing for the spindle head of a typical plain milling machine. A minimum life expectancy of 10,000 hours is assumed and also that the motor is always operating at its maximum horse-power and speed. Results from two equations previously recorded by the author are tabulated and from these suitable bearings for a portable electric saw are chosen.

(Abstract supplied by Research Dept., Met. Vick.)

A New Chromising Process. (Rudorff, Met. Ind., 26/9/41, pp. 194-195.) (95/53 Great Britain.)

Although there are several ways in which the high corrosion resistance of chromium can be utilized for the protection of iron and steel, the most widely known, chromium plating, requires an intercoating between the steel surface and the chromium layer. The author states that much greater wear resistance and service life can be obtained by resorting to chromium impregnation, the process of which is described, in which an integral surface layer is formed by a diffusion process employing an atmosphere containing chromous chloride.

(Abstract supplied by Research Dept., Met. Vick.)

Metal Coating of Plastics. (B.I. Plastics and Moulded Product, Sept., 1941, p. 106.) (95/55 Great Britain.)

It is claimed that in the process of coating plastics with zinc, aluminium, copper or tin, the metal particles join with the synthetic resin particles and therefore

strengthen the surface of the moulded article. The process can also be applied to cast resin and to laminated and cellulose products. Results are given of test carried out to compare the electro-magnetic screening properties of the metal film with tinfoil of the same dimensions.

(Abstract supplied by Research Dept., Met. Vick.)

Avoiding Galvanic Corrosion in Light Alloy Products. (Taylor, Metallurgia, June, 1941, pp. 43-46 and 66.) (95/56 Great Britain.)

It is stated that many failures of metals and alloys in service are due to galvanic corrosion, and in this article means by which this form of corrosion proceeds are discussed. Some considerations in the design of composite components are given with the object of avoiding or reducing galvanic action and some principles are discussed, the observance of which is claimed to limit the number of failures from this cause.

(Abstract supplied by Research Dept., Met. Vick.)

The Protection of Duralumin in Aircraft Structures. (A. Iacoboni, Atti di Guidonia, Nos. 45-47, 20/3/41.) (95/57 Italy.)

In a preliminary discussion it is shown that in order to assess the real protective efficiency of a given coating and to obtain a guide in making a suitable selection, in addition to corrosion tests under conditions which approach the actual working conditions as closely as possible, further investigations and tests are necessary in order to ascertain the numerous other characteristics of the protective layer. A complete series of laboratory experiments have been carried out and from the results it has been possible to establish the system which, in each case, is the most suitable for the protection of duralumin in aircraft constructions. At the same time, with the different processes of protection under investigation, the causes of their particular behaviour are revealed and the different manner and form in which the phenomenon of corrosion takes place under the different conditions and with different protective systems are indicated.

The Circular Cylinder with a Band of Uniform Pressure on a Finite Length of the Surface. (M. V. Barton, J. App. Mech., Vol. 8, No. 3, Sept., 1941, pp. 97-104.) (95/58 U.S.A.)

The solution to the fundamental problem of a cylinder with a uniform pressure over one-half its length and a uniform tension on the other half is found by using the Papcovitch-Neuber solution to the general equations. In this Paper, the results, given analytically in terms of infinite-series expressions, are exhibited as curves giving a complete picture of the stress and deformation. The case of a cylinder with a band of uniform pressure of any length, with the exception of very small ones, is then solved by the method superposition. The stresses and displacements are evaluated for the special cases of a cylinder with a uniform pressure load of 1 diameter and $\frac{1}{2}$ diameter in length. The problem of cylinder heated over one half its length is solved by the same means.

The Effect of Foundation Stiffness on the Resonant Frequencies of Rotating Machines. (E. H. Hull, J. App. Mech., Vol. 8, No. 3, Sept., 1941, pp. 121-129.) (95/59 U.S.A.)

The work described in this Paper was carried out in an attempt to clarify the problem of determining the effects of elastic foundations under rotating machines on the resonant speeds of those machines. Non-rotating models were used as a medium for studying this problem for reasons of expediency in construction, manipulation and measurement. These models consisted of a " rotor " mounted in " bearings " from a rigid stator which in turn was supported through a foundation, the stiffness of which could be varied. The behaviour of uniform rods and models of turbo-driven alternator rotors was studied in this apparatus. Results

showed a wide variation of certain resonant frequencies of the model system with foundation stiffness, emphasizing the need for careful consideration of the effect of this factor on the resonant speeds of full-sized machines when run on their permanent foundations.

Actions of Deep Beams Under Combined Vertical, Lateral and Torsional Loads. (C. O. Dohrenwend, J. App. Mech., Vol. 8, No. 3, Sept., 1941, pp. 130-134.) (95/60 U.S.A.)

This Paper is devoted to a discussion of the behaviour of beams when the primary load acts at the same time as the secondary lateral and torsional loads. Beam loading of this type occurs in the case of shop travelling cranes, measurements indicating that the lateral and torsional loads are much smaller than the primary vertical load. The author considers the problem of the " deep beam " in which the moment of inertia of the cross-section about the horizontal axis is much greater than about the vertical axis. The solution is achieved by determining the equation of twist in the beam and the moment or load where small increases of their values cause large increases in the values of angle of twist.

Use of Hardenability Tests for Selection and Specification of Automatic Steels. (A. L. Boegehold, J.S.A.E., Vol. 49, No. 1, July, 1941, pp. 266-276.) (95/63 U.S.A.)

The fundamental relationship between cooling rate during quenching and hardness produced in steel is pointed out. The requirements for a hardenability test bar for determining this relationship for a wide variety of section sizes and steels are given. Some of the methods that have been suggested for testing hardenability are discussed briefly, pointing out that the end-quench specimen is best suited for obtaining this fundamental relationship beween hardness and cooling rate.

A method of interpreting hardenability information obtained from various hardenability tests in terms of hardness cooling rate curves is explained. This translation of hardenability information rate curve permits the use of these various test bars for the purpose of predicting hardness in complicated shaped articles. The H-CR curve is the abbreviated name taken for convenience in referring to the hardness-cooling rate curve.

Determination of Hardenability on Small Sizes. (F. E. McCleary and R. Wuerfel, J.S.A.E., Vol. 49, No. 1, July, 1941, pp. 276-278.) (95/64 U.S.A.)

Limitations of the two general methods available for determining hardenability in steel, are that the test piece may not have a sufficient cross-section in which to develop the desired series of cooling rates, and that a special test piece (known as the L-type) must be machined for steels of low hardenability. The method using the Wuerfel bomb described in this Paper is directed primarily toward removal of these two limitations.

Stated in terms of the critical diameter, the results of the method are reproducible within $\frac{1}{8}$ in.

Determination of Specific Hardenability of Shallow Hardening Steels. (O. V. Greene and C. B. Post, J.S.A.E., Vol. 49, No. 1, July, 1941, pp. 278-283.) (95/65 U.S.A.)

A taper test specimen having a taper of 1 in. in 5 in. of length, $\frac{1}{4}$ in. in diameter at one end and 1.1/4 in. in diameter at the other end, is proposed as a test for measuring the specific hardenability of shallow-hardening steels. The hardened taper test specimens are split and Rockwell hardnesses obtained along the central axis of test specimen, or the central section may be etched

lightly to bring out the relative colours of case and core. This taper test specimen has been correlated with the Jominy-Boegehold " L " bar. This enables the rate of cooling at any point along the central axis of the taper test specimen to be expressed in terms of deg. F. per sec. at 1,300 F.

The taper test specimen has also been correlated with the work of Grossmann and his associates concerning critical bar diameters and severity of quench. It is shown experimentally that this degree of taper is small enough so that the taper test specimen behaves within experimental error like a series of round bars whose diameters are given by twice the perpendicular distance from the surface of the taper test specimen to any point along the centre axis.

A correlation is shown between the Shepherd disc hardenability Nos. 10 to 16 inclusive and the critical cooling velocity in deg. F. per sec. of 1,300 F. (as determined from the cooling rates published for the Jominy-Boegehold Type " L " bar) and critical bar diameters at a severity of quench of $H=4.5$, or the " ideal critical bar diameters " for $H=\infty$.

Correlation Between Jominy Test and Quenched Round Bars. (M. Asimow and others, J.S.A.E., Vol. 49, No. 1, July, 1941, pp. 283-293.) (95/66 U.S.A.)

A number of different tests have been developed for ascertaining the hardenability of steel, that is its susceptibility to hardening by quenching. Although each of these different tests may be suited particularly to a specific problem, it would be useful to know how to interpret one test in terms of another. The present Paper suggests a manner of correlating the extent of hardening in the Jominy-Boegehold end-quench test with the extent of hardening in quenched round bars.

For any particular steel, the extent to which it hardens when quenched varies with the cooling rate (cooling time) in the quench. That is, if cooled rapidly enough it will become hard and, if cooled slowly it will be soft, so that for each steel a series of hardness may be found experimentally corresponding to a series of cooling times. Different cooling times occur along the length of a Jominy bar, and various cooling times are also found at various positions in different sizes of quenched bars, quenched with various severities of quench.

It therefore becomes possible to predict from the results of a Jominy test what the hardness distribution will be on the cross-section of a quenched round bar when quenched with a known severity of quench.

Oblique Incidence Radio Transmission and the Lorentz Polarization Term. (N. Smith, Bur. Stan. J. Res., Vol. 26, No. 2, Feb., 1941, pp. 105-116.) (95/67 U.S.A.)

The force on an electron in an ionized medium may be written $E+4\pi aP$ per unit charge, where E is the electric force, P the polarization of the medium, and a constant which is zero on the Sellmeyer theory and may have a value of $1/3$ on the Lorentz theory. A well defined distinction exists between maximum usable frequencies for ionospheric radio transmission calculated on the basis of the two theories. This Paper describes a type of experiment for measuring maximum usable frequencies and comparing them with calculated values. The results indicate that a is probably zero, at least in these experiments. There is also described a step-by-step method of solving the virtual-height integral equation, necessary in much theoretical work concerning the ionosphere.

Diffraction Theory of Electromagnetic Waves. (J. A. Stretton and L. S. Chu, Physical Review, Vol. 56, July, 1939, pp. 99-107.) (95/68 U.S.A.)

It has been shown by Larniov, Kottler and others that the classical method of calculating diffraction from the Kirchhoff formula in terms of the scalar light functions cannot be applied directly to the electro-magnetic field since neither the Vector character of the field nor the effect of charges along the contour of

the opening are taken into account. The field equations are integrated directly by the authors by means of a Vector analogue of Green's theorem. The results are applied to calculating the diffraction of electro-magnetic waves from a rectangular slit in a screen of infinite conductivity. The results are compared with an exact solution of the two-dimensional problem published in Phy. Rev. 54, 895 (1938) by Morse & Rubinstein.

The distributions given by these authors agree very satisfactorily with the equatorial solution given in the present Paper. It appears therefore that the simple equations given by Stretton & Chu can be applied to diffraction phenomena with confidence. In the case of radiations from hollow tubes and horns, an extension to take account of the internal reflected wave (by methods similar to those applied in acoustics) should not prove difficult.

The Investigation of Rapidly Changing Mechanised Stresses with the Cathode Ray Oscillograph. (S. L. de Bruin, Philips Technical Review, Vol. 5, No. 1, Jan., 1940, pp. 26-28.) (95/69 Holland.)

The method consists in attaching a resistance strip to the structural element under investigation. The strip is made of insulating material, 50 mm. long, 8 mm. wide, and .3 mm. thick. The ends are made conducting by means of a deposit of silver and a line is drawn on the strip with a drawing pen using very finely divided carbon powder suspended in a liquid binder. The binder is dried by heating and the resultant element has a resistance of about 10,000 *w*. It is next cemented to the surface under examination by means of celluloid lacquer, dried under pressure. The electrical resistance of the strip changes with its longitudinal dimension and is recorded by means of a cathode ray oscillograph, which measures the effective voltage across the strip, the latter being in series with a high resistance and battery. A valve amplifier built into the oscillograph unit gives an effective amplification of about 1,500. Direct calibration has shown that the relationshop between specific extension λ and specific resistance ρ of the strip is practically linear for extensions up to .03 per cent. Over this range, $\lambda/\rho = 15$ app.

The Laryngophone. (J. De Boer and K. De Boer, Philips Technical Review, Vol. 5, No. 1, Jan., 1940, pp. 6-14.) (95/70 Holland.)

In telephoning it is possible to use as excitation agent the mechanical vibrations of the speaker's throat instead of the air vibrations which occur in front of the mouth of the speaker. This method makes it possible to use the telephone in places where there is so much noise that the human voice is drowned. The picking up of the throat vibrations is done with a laryngophone, the principle and several structural details of which are described in this article. Two different types have been developed: a crystal microphone in which the chief aim has been the best possible quality of reproduction, and a carbon microphone whose sensitivity can be made so great that it can be used directly in a telephone apparatus instead of the usual microphone. A consideration of the sensitivity of the laryngophone for air vibrations as well as a series of intelligibility tests show to what degree the desired purpose has been realized in the laryngophones described.

It appears that with the crystal microphone, conversation can be carried out with an intelligibility of the order of 86 per cent., the noise background having a disturbance level as high as 123 phons. With an ordinary telephone intelligilibity is zero when the speaker is surrounded by a noise level of only 90 phons.

Another application of the device is in combination with gas masks. An air microphone is quite useless in this case due to resonance in the small sealed airspace inside the mask. Moreover, the microphone can in this case be passed from one speaker to another without having to open the mask.

The Effect of Silver on the Performance of Antimonial Lead Storage Batteries. (Fink, Dornblatt, Metallurgia, June, 1941, pp. 39-40.) (95/71 Great Britain.)

The results are given of an investigation into the effect of from 0.05-0.15 per cent. of silver upon the properties and performance, in storage batteries, of lead alloys containing from 4 to 12 per cent. of antimony. It is claimed that batteries with heat-treated 4 per cent. antimony, and 0.10 per cent. silver alloy grids have improved characteristics in corrosion resistance of the positive plates, ruggedness, battery life, retention of charge and low temperature rise on overcharge.

(Abstract supplied by Research Dept., Met. Vick.)

The Radiosonde. (E. T. Clark and S. A. Korff, J. Frank. Inst., Vol. 232, No. 3, Sept., 1941, pp. 217-238.) (95/72 U.S.A.)

The radiosonde, the most recently developed tool for use in the investigation of phenomena in the upper atmosphere, is described. The various merits and disadvantages of the three systems now in use for the transmission of physical data from the stratosphere are reviewed. In a discussion of present-day radiosonde technique are included descriptions of transmitters, receivers, meteorological and other observing instruments, and ballooning methods. Their application to the study of cosmic rays is given as a typical illustration of their usefulness in fields other than meteorological. A new formula for the upward velocity of the flight in terms of its free lift is developed, which shows that the observed constant rate of ascent of pilot type balloons is fortuitous, depending on a particular range of values of the Reynold's Number of the balloons.

Daytime Photo-Electric Measurement of Cloud Heights. (M. K. Laufer and L. W. Foskett, Bur. Stan. J. Res., Vol. 26, No. 4, April, 1941, pp. 331-334.) (95/73 U.S.A.)

A photo-electric detector is used in conjunction with a modulated beam of light for the measurement by triangulation of the height of clouds during the daytime. An a.c. operated mercury-arc lamp is used to obtain the modulated beam. An electronic " synchronous switch " is used to eliminate the effect of the varying background brightness of the clouds. The shot noise of the photo-tube, resulting from the relatively high brightness of clouds during the daytime, limits the detection. Dark overcast clouds at an elevation of 9,000 feet have been detected.

Methods for Determining Sound Transmission Loss in the Field. (A. London, Bur. Stan. J. Res., Vol. 26, No. 5, May, 1941, pp. 419-453.) (95/74 U.S.A.)

In the customary method of determining the transmission loss of a wall or floor partition, it is necessary to measure the difference in sound levels existing in two rooms which have the partition as a separating wall or floor. Also the ratio A_2/S, where A_2 is the total sound absorption of the receiving room and S the transmitting area of the partition, must be known. Difficulties are experienced in field measurements because of the non-uniformity of sound levels in the test rooms and an uncertain knowledge of A_2. Two new methods which eliminate these difficulties are described. In both of these methods the sound level on the quiet side is measured at the panel face, in the one method with a pressure microphone and in the other with a pressure-gradient (ribbon) microphone. In the latter method the transmission loss is independent of the value of A_2/S if the panel face has little sound-absorptive value, while in the former it is possible, in most cases, to eliminate the necessity of measuring A_2 by determining in addition the average sound level in the receiving room.

Also, the possibility of using the ribbon microphone as a radiation pick-up is indicated.

Some Factors Influencing the Performance of Diaphragm Indicators of Explosion Pressures. (F. R. Caldwell and E. F. Fiock, Bur. Stan. J. Res., Vol. 26, No. 3, March, 1941, pp. 175-196.) (95/75 U.S.A.)

Information obtained during the development and use of accurate diaphragm-type indicators of the pressures developed during explosions of gaseous mixtures in bombs is presented. Although some of the following conclusions are not original, all are supported by new experimental evidence.

It is shown that all passages and cavities on the explosion side of the diaphragm should be eliminated for highest accuracy. Although the sensitivity of the diaphragm to pressure difference must not be less than the value determined by the accuracy with which pressures are to be measured, it is important, when highest accuracy is desired, that the sensitivity shall not greatly exceed this same value so that the inertia error will not become larger than the allowable tolerance. Radial tension in the diaphragm is advantageous in reducing time lag. A blued or polished surface is preferable to one which absorbs more radiant energy. Projections around the diaphragms are without measurable effect upon the performance of the indicators.

It seems probable that, with a properly designed indicator, the measured values of explosion pressure need not deviate from the actual pressure by more than a few tenths of 1 mm. Hg.

Library—Laboratory Research. (Mech. Eng., Vol. 63, No. 5, May, 1941, pp. 381-382.) (95/76 U.S.A.)

Costly repetition of research already described completely in the literature and failure to appreciate inventions described almost verbatim in the literature; these evils will continue until the scientist gives to library research the attention it merits. Already the time has come when research programmes should provide a definite place for a new type of scientist. This scientist will devote all, or the greater part, of his time to thorough investigation of scientific literature. His research will be marked by the same thoroughness, concentration, imagination and resourcefulness exhibited by brother scientists in research laboratories. He will guide laboratory programmes from the pitfalls of prior art. He will unearth innumerable inventions now hidden in the literature, and he or his fellow scientists will check those library discoveries by laboratory tests.

A Mechanical Device for the Determination of the Differential Coefficients of a Given Curve. (P. Teofilato, Atti di Juidonia, No. 48, 10/4/41.) (95/77 Italy.)

The author reviews the practical difficulties entailed in obtaining, from a diagram, the second derivative of the function expressed by this diagram, when the latter is disturbed by oscillations. He describes a mechanical device which depends on determining the loads required to bond an elastic rod so that it lies along the curve. The required derivative (*i.e.* curvature) can be easily determined from the distribution of the bending moment.

Note on the Angular Motions of Ships. (N. Minorsky, J. App. Mech., Vol. 8, No. 3, Sept., 1941, pp. 111-120.) (95/78 U.S.A.)

The object of this Paper is to bring to the attention of mechanical engineers a number of dynamical problems encountered in the theory of the ship; to indicate briefly the form of corresponding differential equations and their solutions; to analyze the validity of underlying theoretical assumptions; and to approach in this manner a comparison of the ship's dynamics with problems commonly encountered in other fields, such as that of vibration theory.

LIST OF SELECTED TRANSLATIONS.

No. 38.

NOTE.—Applications for the loan of copies of translations mentioned below should be addressed to the Secretary (R.T.P.3), Ministry of Aircraft Production, and not to the Royal Aeronautical Society. Copies will be loaned as far as availability of stocks permits. Suggestions concerning new translations will be considered in relation to general interest and facilities available.

Lists of selected translations have appeared in this publication since September, 1938.

AERO AND HYDRODYNAMICS.

TRANSLATION NUMBER	AND AUTHOR.	TITLE AND JOURNAL.
1244	Hoff, W.	*Notes on the Ideal Efficiency of Air Screws.* (L.F.F., Vol. 18, No. 4, pp. 114-121.)
1246	Bolotnikov, V. ...	*Correction of the Speed Indicator at High Speeds of Flight.* (Air Fleet News, U.S.S.R., Vol. 23, No. 2, Feb., 1941, pp. 159-166.)
1257	Sieg, H.	*Propagation of Sound in the Free Atmosphere and its Dependence on Meteorological Conditions.* (El. Nachrichten Technik, Vol. 14, No. 9, Sept., 1940, pp. 193-208.)
1270	Wolf, K. ... ... Rumpf, H.	*On the Extractor Action of a Two Dimensional Spiral Air Flow.* (Z.V.D.I., Vol. 85, No. 27, 5/7/41, pp. 601-604.)
1287	Tollmien, W. ... Schafer, M. ...	*On the Theory of Wind Tunnel Turbulence.* (Z.A.M.M., Vol. 21, No. 1, Feb., 1941, pp. 1-17.)

AIRCRAFT AND ACCESSORIES.

1241	Kotelmikov, V. A....	*Longitudinal Dynamic Stability of an Aeroplane with an Automatic Pilot.* (Aeron. Eng., U.S.S.R., Vol. 15, No. 1, Jan., 1941, pp. 27-31.)
1249	Anders, K.	*Prevention of Ice Formation.* (Der Deutsche Sportflieger, Jan., 1941, p. 6.)
1256	Miram, P.	*The Influence of Atmospherics on Wireless Reception in Aircraft.* (Luftwissen, Vol. 8, No. 4, April, 1941, pp. 113-114.)
1277	Margerre, K. ...	*Stresses in Reinforced Cut-outs.* (L.F.F., Vol. 18, No. 7, 19/7/41, pp. 253-261.)
1278	Puishnoff, V. S. ...	*Aircraft Manœuvrability Coefficient.* (Aeron. Eng., U.S.S.R., Vol. 14, No. 12, Dec., 1940, pp. 26-30.)
1280	Stuper, J.	*The Measuring Technique of Flight Tests.* (Luftwissen, Vol. 8, No. 4, April, 1941, pp. 109-113.)
1284	Stieds, W.	*The Statics of Circular Frames Used in Aircraft Pressure Cabins.* (L.F.F., Vol. 18, No. 6, 30/6/41, pp. 214-222.)

Material and Elasticity.

Translation Number and Author.			Title and Journal.
1243	Kimm, G.	... ...	*The Stability of Thin-Walled V Sections of Constant Thickness in Elastic Region.* (L.F.F., Vol. 18, No. 5, 28/4/41, pp. 155-168.)
1251	Kuch	... ...	*Home Produced Materials for Aircraft Construction.* (Johnbuch de Deutschen Luftfahrtforechung, 1937, pp. 551-572.)
1264	Romashevsky	...	*Investigation of Thin-Walled Beams with Non-Parallel Strips.* (Trans. C.A.H.1, No. 203.)
1269	Berg, S.	... ...	*Technique of Fatigue Testing.* (Z.V.D.I., Vol. 85, No. 27, 5/7/41, pp. 605-608.)
1275	Posch, T.	... ...	*An Elementary Theory on Fatigue Strength.* (Ing. Archiv., Vol. 12, No. 2, April, 1941, pp. 71-76.)

Miscellaneous.

1250	Sakharov, K. N.	...	*A Device for Joining Short Lengths of Films.* (Air Fleet News, U.S.S.R., Vol. 23, No. 3, March, 1941, pp. 263-264.)
1252	Yieweg, R. ... Gottwald, F.	... ...	*A New Method for Determining Small Friction Couples.* (Z.V.D.I., Vol. 85, No. 18, 3/4/41, pp. 417-419.)
1276	Bulgarkov, B. Y.	...	*Accumulation of Errors on Gyro Apparatus.* (Ing. Arch., Vol. 11, No. 6, Dec., 1940, pp. 461-469.)

TITLES AND REFERENCES OF ARTICLES AND PAPERS SELECTED FROM PUBLICATIONS RECEIVED IN R.T.P.3 DURING SEPTEMBER, 1941, TOGETHER WITH LIST OF NEW TRANSLATIONS RENDERED AVAILABLE.

Notices and abstracts from the Scientific and Technical Press are prepared primarily for the information of Scientific and Technical Staffs. Particular attention is paid to the work carried out in foreign countries, on the assumption that the more accessible British work (for example, that published by the Aeronautical Research Committee) is already known to these Staffs.

Theory and Practice of Warfare.

ITEM NO.	R.T.P. REF.		TITLE AND JOURNAL.
1	28736	Germany ...	*The Air War during June, 1941 (with some reference to the Russian Campaign).* (Luftwissen, Vol. 8, No. 7, July, 1941, pp. 202-206.)
4	28744	U.S.A. ...	*Brewster SB2A-1 Dive Bomber (Photograph).* (Aero Digest, Vol. 31, No. 1, July, 1941, p. 104.)
5	28752	U.S.A. ...	*Plywood Floats.* (Aero Digest, Vol. 31, No. 1, July, 1941, p. 155.)
8	28778	U.S.A. ...	*Boeing B17E (Fortress II).* (Aeroplane, Vol. 61, No. 1,583, 26/9/41, p. 326.)
9	28779	Germany ...	*German Aeroplanes in Service (V) (Dornier Series).* (Aeroplane, Vol. 61, No. 1,583, 26/9/41, p. 333.)
10	28780	France ...	*The Defeat of the French Air Force.* (P. Cot, Aeroplane, Vol. 61, No. 1,583, 26/9/41, pp. 334-335.)
11	28782	Great Britain	*Handley Page Halifax Bomber (Photographs).* (Aeroplane, Vol. 61, No. 1,583, 26/9/41, pp. 338-339.)
12	28790	Great Britain	*Assembling the Beaufighter.* (B. Foster, Airc. Prod., Vol. 111, No. 36, Oct., 1941, pp. 347-353.)
13	28795	U.S.A. ...	*Originality in the Bell Airacobra.* (Airc. Prod., Vol. 111, No. 36, Oct, 1941, pp. 364-367.)

14	28796	Great Britain	*Wooden Wings in Manufacture for Miles Trainer Aircraft.* (Airc. Prod., Vol. 111, No. 36, Oct., 1941, pp. 373-375.)
15	28799	Great Britain	*Hawker Hurricane II.* (Aeroplane, Vol. 61, No. 1,584, 3/10/41, p. 359.)
16	28801	Germany ...	*German Aeroplanes in Service (VI) (The Dornier Series).* (Aeroplane, Vol. 61, No. 1,584, 3/10/41, p. 363.)
17	28802	France ...	*The Defeat of the French Air Force (II).* (P. Cot, Aeroplane, Vol. 61, No. 1,584, 3/10/41, pp. 372-373.)
18	28805	Great Britain	*Blackburn "Botha" (Operational Trainer).* (Flight, Vol. 40, No. 1,710, 2/10/41, pp. a-d.)
19	28806	Great Britain	*The Ideal Trainer with Special Reference to the Side-by-Side Cabin Type.* (Flight, Vol. 40, No. 1,710, 2/10/41, p. f-216.)
20	28808	Germany ...	*Focke Wulf 189 Observation Plane.* (Flight, Vol. 40, No. 1,710, 2/10/41, p. 222.)
22	28830	U.S.A. ...	*Curtiss P40D Fighter (Photograph).* (U.S. Air Services, Vol. 26, No. 8, Aug., 1941, p. 29.)
23	28831	U.S.A. ...	*Curtiss S.N.C.-1 Two Place Trainer (Photograph).* (U.S. Air Services, Vol. 26, No. 8, Aug., 1941, p. 30.)
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