ABSTRACTS FROM THE SCIENTIFIC AND TECHNICAL PRESS.

Issued by the

Directorates of Scientific Research and Technical Development, Air Ministry.

(*Prepared by R.T.P.*)

No. 55. MAY, 1938.

Munitions Manufacture. (H. Hoerschelmann, Z.V.D.I., Vol. 82, 1/1/38, pp. 3-7. Eng. Absts., Vol. 1, No. 3, Section 2, March, 1938, p. 50.) (55/1 Germany.)

The author observes that munitions manufacture is not essentially different from other branches of engineering, but that, on account of the purposes in view, quality and reliability are of unusual importance. He states that during the war functional failure of certain stores led to breakdown of important plans, and he contrasts the usual commercial considerations of price and limited market with the military view of necessity and large production in a limited time. He indicates the necessity for reserve stores and for protection against their deterioration. He cites two examples from practice in which the various tolerances are batched in groups, demonstrating that most parts do not require extreme accuracy. He considers that hand polishing methods can be largely replaced by buffing and grinding. He emphasises the importance of interchangeability of parts, and indicates how by special machines this can be readily obtained. Inspection of munitions must be quite different from that of other products, because not only are the functional importance and the interchangeability inescapable, but also the product is State property and the inspector must be governed by clear rules and specifications—never by discretion.

Portable Wireless Stations. (H. Neumann, W.T.M., Vol. 42, No. 1, Jan., 1938, pp. 23-33.) (55/2 Germany.)

The following types are described:—

Power (watt).	Wavelength (m.).	Range (km.).	Weight (kg.).
5	96—316	20— 80	90
1	60—100	12— 20	56
15	60—100	30—100	70
15	40—100	30—100	89

The shorter of the two ranges stated refers to telephonic communication.

The 1 watt station, fitted with accumulators instead of hand-operated dynamo, only weighs 37 kg. and is arranged in two separate packs which can be easily carried by two soldiers. Communication can then be maintained on the march. The operation of the hand dynamo is specially silenced so that the apparatus can be used in the front line trenches.

(Reference should also be made to Abstracts No. 51, item 62, where particulars of a light weight wireless set suitable for gliders are given. This set only weighs 4.5 kg. and has a range of 20 km.)

Aircraft Reconnaissance at Night. (F. Lohle, W.T.M., Vol. 42, No. 3, March, 1938, pp. 125-133, and No. 4, April, 1938, pp. 170-178.) (55/3 Germany.)

The author investigates the physical basis underlying the observation of ground details from great heights, assuming a clear sky and no moon (starlight and no clouds). It is well known that under these circumstances the ground illumination may vary over wide limits with no apparent reason, but exceptionally bright nights usually occur in August and December (at any rate in Germany).

The source of the illumination has not yet been satisfactorily determined, but it is certain that the starlight can only be responsible for a very small proportion of the total. It appears probable that the sunlight is indirectly responsible, the upper atmosphere being under electrical excitation (electron bombardment). One peculiarity of this light from the sky is the fact that the slight haze generally present in the lower layers of the atmosphere is also rendered luminous and, seen from above, the ground details (already rendered difficult to observe on account of the faint light) are obscured still further.

The author considers the minimum size of black objects on a white background which can be distinguished by the eye under various degrees of illumination and extends the case to the effect of differences in contrast and the presence of luminous haze.

Night glasses are only beneficial if of sufficient magnification (30 x) and this is difficult to provide for in aircraft (vibration, etc.). According to the author, the new German motor roads are completely invisible from an altitude of 6,000 m. in the absence of moonlight.

Air Attacks on Barcelona. (Les Ailes, No. 881, 5/5/38, p. 11.) (55/4 Spain.)

For the attack, bombs weighing 500, 100 and 50 kg. were employed. The aircraft operated in groups of three or six at altitudes between 4,000 and 6,000 m. The bombs were dropped at the rate of approximately 1 ton per hour, 350 hits being scored.

As the raiding aircraft approached from the sea at a speed of the order of 380 km./h., no previous warning could be given to the civilian population.

Balloon Barrages and Atmospheric Electricity. (D. Lautner, Luftwehr, Vol. 5, No. 2, Feb., 1938, pp. 66-70.) (55/5 Germany.)

The atmosphere may be considered as a partly conducting dielectric between the earth surface and the Heaviside layer. Whilst the conductivity of the earth surface and the Heaviside layer are approximately equal (6×10^{5} sec^{-1}), the conductivity of the lower atmosphere is very much less (5×10^{-4} sec.$^{-1}$).

For some as yet unknown reason, the earth surface is constantly charged with approximately -5×10^{-5} coulombs. This charge necessitates a potential difference of the order of 200,000 volts between the Heaviside layer and the surface of the earth, the gradient being steepest near the surface, *i.e.*, up to 6 km. This means that a balloon barrage has to operate (even in the absence of electric storms) under conditions of considerable electrical stress (earthed cable).

Matters are, however, made very much worse if a thunderstorm intervenes. The author briefly reviews modern theories and calculates that even a moderate stroke of lightning will completely vaporise 4 km. of iron wire 1.6 mm. diameter. The only protection is to wind up the balloon if there is any chance of a storm and the barrage must therefore rely on an efficient meteorological service. Waiting till thunder is heard is fatal, since the storm may be overhead within a few minutes whilst it takes at least half an hour to descend the balloon.

New War Gases for Old? (C. E. Brigham, Army Ordnance, Vol. 18, No. 108, May-June, 1938, pp. 334-338.) (55/6 U.S.A.)

One ton of mustard gas possesses sufficient toxicity to kill 45,000,000 people—if it could be administered without waste.

Statistics of the world war have shown that one ton of this gas had to be used to produce 20 casualties, of which one was fatal.

It is thus evident that the military scientist has more to gain by improving the efficiency in the utilisation of known gases (which are amply toxic) than from a quest of new agents of greater inherent power.

A case in point is the German Blue Cross gas (diphenyl chlorarsine) which was a failure in the war because the proper technique of dispersion was not mastered in time.

This difficulty has now been overcome and very efficient gas masks are required to withstand the action of this poison.

Masks of this type are uncomfortable to wear and affect both the mobility, fighting power and morale of the troops.

These secondary effects of chemical warfare are almost as important as the production of fatal casualties.

(See also Translations Nos. 641A to 641E, which cover various aspects of chemical warfare with special reference to dissemination by aircraft.)

On the Motion of a Fluid Heated from Below. (R. J. Schmidt and O. A. Saunders, Proc. Roy. Soc., Series A, Vol. 165, No. 921, 5/4/38, pp. 216-28.) (55/7 Great Britain.)

If a horizontal layer of fluid, initially at rest, is heated from below, instability and cellular motion set in when λ ($\equiv agc\,(\theta_1-\theta_2)\,d^3Kv$) is about 1,700. Experiments for several layer depths show that on further heating the layer becomes completely turbulent at about $\lambda=45{,}000$. Observations by an optical method indicate that in the case of water the turbulence develops suddenly, but that in air the transition is more gradual, the first signs of turbulence occurring at about $\lambda=5{,}000$. The rate of heat transfer is measured at each stage, and the increase at the change from cellular to turbulent motion is found to be less than that at the change from equilibrium to cellular motion.

$\lambda=dgc\,(\theta_1-\theta_2)\,d^3/k\gamma$.
a = expansion coefficient.
c = specific heat per unit volume.
γ = kinematic viscosity.
K = thermal conductivity.
d = distance between plates.
g = gravity acceleration.

Drag of Cylinders of Simple Shape. (W. F. Lindsey, N.A.C.A. Report No. 619, 1938.) (55/8 U.S.A.)

In order to determine the effect of shape, compressibility, and Reynolds number on the drag and critical speed for simple forms, the drag forces on models of various simple geometric cross sections were measured in the N.A.C.A. 11-inch wind tunnel.

The models were circular, semitubular, elliptical, square and triangular (isosceles) cylinders. They were tested over a speed range from 5 per cent. of the speed of sound to a value in excess of the critical speed, corresponding, for each model, approximately to a tenfold Reynolds number range, which extended from a minimum of 840 for the smallest model to a maximum of 310,000 for the largest model.

The following are the main conclusions:—

1. The compressibility effects appear to be independent of Reynolds number for ranges wherein there are no marked changes in the flow pattern caused by Reynolds number effects.
2. The critical speed of elliptical cylinders decreases with decrease in fineness ratio.
3. For bodies having sharp edges that may be expected to define the separation point, the Reynolds number effects are small. This result substantiates earlier investigations.

Effect of Change in Cross-Section on the Velocity and Pressure Distribution of Turbulent Flow in Pipes. (E. Mayer, Forschungsheft 389, March-April, 1938.) (55/9 Germany.)

In practical engineering the case often arises of the cross-section of a channel altering its shape as we proceed along the channel.

The author investigates the case of variation from circular to rectangular cross-section of equal area and vice versa, using air as the flowing medium. The circular diameter was 190 mm. and the rectangle 119 × 238 mm. The total distance during which the change in shape takes place varied between 110 and 440 mm., the change being carried out smoothly in every case, the area remaining constant throughout.

The length of inlet pipe was chosen so that fully turbulent flow was established before the change in shape took place.

Numerous velocity and pressure profiles were obtained over the section undergoing the change in shape and the resistance co-efficient of this section was determined. In no case was there any evidence of separation of flow.

Dust Separation with the Cyclone Fan (Vortex Sink). (E. Feifel, Forschung., Vol. 9, No. 2, March-April, 1938, pp. 68-81.) (55/10 Germany.)

Along with all problems of dust technique the simple and cheap method of dust separation with the cyclone is gaining increasing economic importance. The action of the cyclones and their dimensions have as yet been considered chiefly empirically. In order to establish dependable data for designing a cyclone, it is necessary to determine the flow within the cyclone, and more especially within the dust-charged whirl, by calculation and to direct it by suitable construction. By considering the flow for the first time as an ideal vortex sink, the author has succeeded in calculating the influence of the most diverse service conditions. The flow theory then furnishes the means of producing within the whirl chamber of the cyclone a gas motion approaching the ideal flow of the vortex sink. Tests on the model and on working constructions prove the appropriateness of the method of calculation and of the corresponding design measures.

The Turbulent Flow of a Fluid in a Straight Pipe of Annular Cross-Section. (In English.) (V. Mikrjukov, Tech. Physics of the U.S.S.R., Vol. 4, No. 11-12, Nov.-Dec., 1937, pp. 961-77.) (55/11 U.S.S.R.)

1. Turbulent motion of liquid was studied in a straight tube of annular cross-section.
2. In this case the distribution of velocities in the cross-section is asymmetrical.
3. Study of the friction stress on the internal and external walls of the tubes showed that it is approximately three times greater on the inner wall than on the outer one.
4. It was found that Prandtl's and Kàrmàn's theory of turbulent flow is qualitatively applicable to the case of a straight tube of annular cross-section.

Taking the universal constant in Kàrmàn's equation $x=0.24$, good qualitative agreement is obtained between the experimental points and Kàrmàn's theoretical curve.

The Influence of Wall Oscillations, Wall Rotation and Entry Eddies on the Breakdown of Laminar Flow in an Annular Pipe. (A. Fage, Proc. Roy. Soc., Series A, Vol. 165, No. 923, 27/4/38, pp. 501-28.) (55/12 Great Britain.)

1. Scope of work. Experiments have been made to determine the effects of disturbances of known character on the laminar flow of water in a long pipe of annular cross-section. The disturbances considered are those due to axial oscillations of the inner wall of the pipe, to oscillations of the inner wall about its axis, and to both weak and intense entry eddies. Experiments on the breakdown due to a uniform rotation of the inner wall (outer wall fixed) have also been made.

The breakdown of flow near a plane surface oscillating in a stationary fluid has been observed.

2. The frequency of the axial oscillation of the inner wall when a departure from laminar flow occurs depends on the axial amplitude of the wall and the viscosity of the fluid, and is independent, within the accuracy of measurement, of the velocity of axial flow.

The results with the inner wall of the pipe oscillating longitudinally suggest that the flow remains laminar up to the critical Reynolds number of disturbance measured with the inner wall oscillating axially.

When the inner wall rotates at a uniform speed (outer wall stationary), the critical rotational speed increases with the axial speed of flow; and the critical number for no axial flow, predicted by extrapolation of the curve drawn through the numbers measured with axial flow, is in close agreement with Taylor's theoretical number.

It is shown that the early breakdown of laminar flow associated with intense entry disturbances can be caused by very weak entry disturbances, provided they are in the form of discreet eddies.

Transport of Electric Ions Applied to Supersonic Speed Measurements. (V. Volkovisky, Comp. Rend., Vol. 206, No. 14, pp. 1084-1086.) (55/13 France.)

The authors carried out experiments with insulated electrodes embedded in the wall of a tube, the air current moving at speeds varying from the velocity of sound to three times the magnitude. The following results were obtained:—

1. The ionisation current is a function of the power input and the Mach number.

$$i=f(W, V/a)$$

provided $W>W_0$.

2. With $W=$constant, i is an increasing function of V/a, tending asymptotically to the saturation value which depends on W.

3. If the ionisation is confined to the boundary layer, i is increased.

The author suggests applying the method to velocity measurements in the boundary layer of a body under supersonic flow conditions.

Interference of Wing and Fuselage from Tests of 17 Combinations in the N.A.C.A. Variable Density Tunnel Combinations with Special Junctures. (A. Sherman, N.A.C.A. Tech. Note No. 641, March, 1938.) (55/14 U.S.A.)

As part of the wing fuselage interference programme in progress in the N.A.C.A. variable density tunnel, a method of eliminating the interference burble associated with critical midwing combinations was investigated. The interference

burble of the critical midwing combination was shown to respond to modifications at the nose of the juncture and to be entirely suppressed with little or no adverse effect on the high speed drag by special leading edge fillets.

Interference of Wing and Fuselage from Tests of Eight Combinations in the N.A.C.A. Variable Density Tunnel Combinations with Tapered Fillets and Straight Side Junctures. (A. Sherman, N.A.C.A. Tech. Note No. 642, March, 1938.) (55/15 U.S.A.)

The round fuselage of an unfilleted low wing combination was modified to incorporate straight-side junctures. The resulting combination, with or without horizontal tail surfaces, had practically the same aerodynamic characteristics as the corresponding round-fuselage tapered-fillet combination.

Comparative Flight and Full-Scale Wind Tunnel Measurements of the Maximum Lift of an Aeroplane. (A. Silverstein, S. Katzoff and J. A. Hootman, N.A.C.A. Report No. 619, 1938.) (55/16 U.S.A.)

Determinations of the power-off maximum lift of a Fairchild 22 aeroplane were made in the N.A.C.A. full-scale wind tunnel and in flight. The results from the two types of test were in satisfactory agreement. It was found that, when the aeroplane was rotated positively in pitch through the angle of stall at rates of the order of 0.1° per second, the maximum lift coefficient was considerably higher than that obtained in the standard tests, in which the forces are measured with the angles of attack fixed. Scale effect on the maximum lift coefficient was also investigated.

A Study of Flying Boat Take-off. (W. S. Diekl, N.A.C.A. Technical Note No. 643, April, 1938.) (55/17 U.S.A.)

The conclusions indicated by this study are as follows:—

1. The resistance curve for a flying boat may, in general, be satisfactorily approximated by two straight lines.
2. A graphical solution of the equations based on the linear approximation gives satisfactory agreement with step-by-step integration.
3. The relative distance and time required to reach hump speed depend largely on the value of the accelerating force at high speeds; the effect of variation in static thrust is small and the effect of variation in accelerating force at the hump is negligible.
4. Neglecting any effects due to variation in thrust with speed, the effect of a reasonable variation in the actual hump speed is negligible, except for very heavily loaded seaplanes.
5. Where take-off distance is a consideration, it may be advisable to accept a high hump resistance in order to obtain low planing resistance. The take-off time will depend only on the average accelerating force.
6. The take-off charts may be employed to determine the accelerating forces required to meet specified take-off performance.

The Oetiker Engine Brake. (F. Weiner, Autom. Tech. Zeit., Vol. 41, 25/1/38, pp. 31-3. Eng. Absts., Vol. 1, No. 3, Section 2, March, 1938, p. 40.) (55/18 Germany.)

The author describes the construction and action of the Oetiker brake system, which depends upon the pressure in the exhaust pipe acting on a cylinder piston system with the usual linkage. The brake system includes a hand lever operating a slide valve on the exhaust pipe and a control on the inlet pipe, which in carburettor engines opens an air valve and in diesel engines cuts out the fuel pump. The slide valve on the exhaust pipe is duplex in that a small valve is used to relieve the pressure on the main valve; both valves are sealed by the

exhaust gas pressure, and movement of a single valve would need too much effort. The pressures utilised are of the order of 2-4 atm., and the system is self-regulating since an accumulated pressure in the exhaust pipe will lift the exhaust valves against their springs and thus cut out the engine as a compressor. When the brake system is operated by the hand lever, a storage cylinder is charged with filtered exhaust gas. When the vehicle is to be braked the usual foot-pedal is depressed, and this opens a valve from the storage cylinder to a Westinghouse low pressure brake cylinder of the usual type.

Experiments on the Hesselman Engine. (W. Wilke, Autom. Tech. Zeit., Vol. 41, 25/1/38, pp. 25-30. Eng. Absts., Vol. 1, No. 3, Section 2, March, 1938, p. 40.) (55/19 Germany.)

The author divides internal combustion motors into five categories, ranging from the low compression Otto motor with spark ignition and low compression to the high compression, compression ignition, Diesel motor using heavy fuel. The Hesselman motor is in the central category, with medium compression medium fuel, and spark ignition with pump injection. A table contrasts the main characteristics of the Otto and Diesel motors in regard to knocking. Seven factors cause increase of knocking in the one and decrease of knocking in the other; for example, in the Diesel motor lead tetra ethyl and iron carbonyl cause knocking, which they inhibit in the Otto motor. The Hesselman motor represents a blend of extremes midway between the defects of both types. The author reproduces diagrams of the latest Hesselman arrangements with spark advance linked to a fuel pump for partial load operation, and curves illustrating engine performance under various conditions of injection timing, injection duration, ignition timing, and with light and heavy fuels of various cetane contents and with alcohol additions. The author asserts that the Hesselman motor can utilise light fuels unsuitable for carburettor engines, and heavy fuels unsuitable for Diesel engines, whilst on account of the spark ignition it offers considerable promise as a high speed, two-stroke engine of light weight for traction purposes.

Starting Troubles in Vehicle Diesel Motors. (R. Johannis, Autom. Tech. Zeit., Vol. 41, 25/1/38, pp. 34-9. Eng. Absts., Vol. 1, No. 3, Section 2, March, 1938, p. 45.) (55/20 Germany.)

On the basis of experience gained in a German armoured-car school, the author presents a comprehensive treatment of the starting problem, which, he states, arises every winter. Curves illustrate the temperature producible by various compression ratios when the engine is warm and when cold, and others indicate the starter h.p. required and available at various air temperatures. The causes of failure to start are classified as follows:—(1) battery exhaustion; battery too small, and other electrical defects; poor compression due to cylinder and piston wear; and unduly thick lubricating oil; (2) derangements in the Diesel engine; the author discusses fuel supply, heating coil action; injection timing; injection nozzles; injection pump; and the filter-cum-pipe system.

Within limits the author recommends the use of an enriched mixture for starting; but he utters a serious warning against excess. He also indicates emergency measures, which should be forbidden in normal circumstances, *e.g.*, towing a vehicle and throwing in the clutch or admitting petrol vapour or acetylene gas to the inlet pipe. Under careful control calcium carbide and water afford a handy adjunct for assisting a Diesel engine to start.

Fabric Gears. (E. W. Brown, Metropolitan Vickers Electrical Co., Ltd., Tech. News Bulletin, No. 608, 29/4/38, p. 2. Power Transport, April, 1938, pp. 152-8.) (55/21 Great Britain.)

This is a symposium relative to the general design and construction of fabric gears, with particular reference to the process involved in fabrication. The

article deals with the subject by discussing its leading features under the following headings:—Characteristics of the ideal gear and its construction; fabric materials now used; their physical mechanical properties; construction and the methods of fitting shrouds and bushes; types of fabric gear; gear design, gear teeth; lubrication; operation; machining, sawing, trepanning, drilling, turning, tapping and gear and screw cutting in fabric gear material.

Illustrated with six diagrams.

The Friction of Reciprocating Engines. (F. H. Dutcher, Trans. A.S.M.E., Vol. 60, No. 3, April, 1938, pp. 225-32.) (55/22 U.S.A.)

The paper contains a description of an automotive engine and cradle dynamometer set-up used in tests for ascertaining the following relations: (*a*) Pumping losses versus r.p.m. for different manifold pressures, (*b*) total friction mean pressure (pumping plus mechanical) versus r.p.m. at different manifold pressures, (*c*) total friction mean pressure versus mean pressure on the pistons at different constant speeds, (*d*) mechanical friction mean pressure versus r.p.m. at different manifold pressures, (*e*) mechanical friction mean pressure versus mean pressure on the pistons at different constant speeds. These relations are all presented graphically. It appears that the friction m.e.p. increases appreciably under load and the losses are thus greater than commonly appreciated (similar conclusions were arrived at by British Air Ministry tests in 1925).

Thrust Bearings. (F. C. Linn and R. Sheppard, Trans. A.S.M.E., Vol. 60, No. 3, April, 1938, pp. 245-52.) (55/23 U.S.A.)

From a standpoint of thrust bearing design, there are two fundamentally different types of prime movers in use, namely: (1) The vertical shaft waterwheel generators which are massive, operate from low to moderate speeds, and have the weight of the rotating parts plus or minus the hydraulic thrust carried by the thrust bearing; (2) the horizontal shaft steam turbines which operate from moderate to high speeds and where the thrust load increases from a small value at zero torque to high values at maximum torque. For the first type of machinery, the flexibly supported thrust bearing is used and for the latter, the tapered land thrust bearing. There are also a large number of steam turbines in regular service to-day operating with "marine-type thrust bearings." The authors deal more fully with the flexibly supported and tapered land thrust bearings and describe suitable test plants for these bearings.

In an appendix the classical theory of lubrication as applied to rectangular surfaces is extended to include helicoidal surfaces.

Engines and Propellers for Powered Gliders and Light Aeroplanes. (Gropp, H., Flugsport, Vol. 29, No. 24, 24/11/37, pp. 663-671. Available as Translation T.M. 850.) (55/24 Germany.)

Light aeroplane engines are conveniently designed as high-speed engines (the term "high-speed" being understood to mean speeds of 3,000 to 4,000 revolutions per minute). In those cases where a definite useful power, to be expressed conventionally by the maximum climb velocity of the aeroplane, is to be attained with the smallest engine weight, the propellor should be the direct drive type. If economical operation—that is, the best possible flight performance for a given power developed by the engine, or for a given fuel consumption is the factor of importance—then a gear-driven propeller is recommended, the reduction ratio of which is determined by the maximum allowable propeller diameter. The propeller speed will then be about 600 to 1,000 revolutions per minute.

Auto-Ignition and Combustion of Diesel Fuel in a Constant Volume Bomb. (R. F. Selden, N.A.C.A. Report No. 617, 1938.) (55/25 U.S.A.)

The following are the main conclusions:—

1. For fuel injection into a constant volume bomb containing stagnant air at a temperature and a pressure approximating those in a compression-ignition engine, the ignition lag was essentially independent of the injected fuel quantity and was of the same magnitude as in the engine.

2. For the fuel used, the possible decrease in the ignition lag for a given increase in air temperature or density became quite small at temperatures and densities in excess of those generally occurring in compression-ignition engines.

3. The combustion efficiency improved as the ignition lag was lengthened; hence it should be worth while to use those fuels in an engine whose ignition lags correspond to the higher permissible rates of pressure rise. The useless " after-burning " decreased as the ignition lag was lengthened.

4. The ignition lag tended to increase and the maximum rate of pressure rise definitely decreased upon the addition of inert gases to an air charge of fixed concentration.

Oil Sprays: An Investigation of Velocities and Penetrations. (P. H. Schweitzer, Autom. Eng., Vol. 28, February, 1938, pp. 61-4. Eng. Absts., Vol. 1, No. 3, Section 2, March, 1938, p. 41.) (55/26 Great Britain.)

The author describes experiments made by timing the interval between the opening of the spray-valve and the impingement of the spray on a sensitive electrical contact at various distances. He concludes that the spray in ordinary Diesel engines is not influenced by the injection duration, the penetration of an intermittent spray being generally similar to that of a stationary spray. Concise rules are given for calculating spray penetration and velocity.

Investigation of the Atomisation of Liquid Fuel. (In English.) (L. Strazhevski, Tech. Physics, U.S.S.R., Vol. 4, No. 11-12, Nov.-Dec., 1937, pp. 978-1003.) (55/27 U.S.S.R.)

The purpose of this investigation was to study the quality of atomisation of liquid fuel when injected at relatively low pressures from 25 to 150 kg./cm.^{2} (excess). Three series of experiments were carried out: The injection of benzine in calm air, injection of benzine in a counter-stream of air and injection of kerosene in calm air.

The injections were made in a medium having a pressure of 1 kg./cm.^{2}. The droplets of the fuel were captured on smoky glass plates, which were photographed afterwards with a magnification of 50 times. As criteria for the estimation of the quality of atomisation Sauter's average diameter and a newly introduced modulus of atomisation were used.

This investigation has established a direct relation between the quality of atomisation and the injection pressure. It was found that the effect of the injection pressure upon the quality of atomisation is more pronounced in the range of the lower pressures. At equal injection pressures benzine gives a finer atomisation than kerosene. Injection in a counter-stream of air gives better atomisation than injection in calm air.

Effect of Fuel-Air Ratio on Detonation in Petrol Engines. (L. A. Peletier, World Petroleum Congress, Paris, June, 1937. Available as Translation T.M. No. 853.) (55/28 France.)

According to the generally accepted view, detonation is equivalent to the self ignition of the unburnt charge at some period prior to complete (normal) inflammation.

It is well-known that the tendency to detonate is reduced as the mixture strength is increased and the author gives a list of factors which he considers responsible:—

1. Pressure and temperature of unburnt charge at end of compression is reduced on account of the small specific heat ratio of the rich mixture.
2. A further reduction in temperature is due to increased latent heat.
3. Flame speed is reduced and this increases the compression time.
4. Lower flame temperature decreases cylinder wall temperature (especially exhaust valve).

Direct experiment of variation of auto-ignition temperature with mixture strength (limiting compression ratio with engine motored), however, showed that the richer mixtures auto-ignite more readily and the author therefore concludes that the factors 1-4 listed above reverse this natural tendency.

Note—The author apparently neglects any possible effect due to admixture of exhaust with unburnt charge.

The Structure of Lubricating Greases. (A. S. C. Lawrence, J. Inst. Petrol. Tech., Vol. 24, No. 174, April, 1938, pp. 201-20.) (55/29 Great Britain.)

Soap oil systems exist in three forms: True solution, true gel and pseudo gel, which is a paste of micro-crystals. Commercial lubricating greases may be in stage 2 or 3. There is a well-defined temperature of transition from 2 to 3 which depends on the nature of the soap used and upon the pressure of polar substances, such as fatty acid, water or glycerine, which lower it. These greases are not emulsions. Natural greases such as butter and tallow are emulsions in which the dispersion medium is a soft solid. Dispersion of the soap in the oil can be brought about by stirring at any temperature above that of the transition and does not require raising to that of true solution. Formation of gel and pseudo gel are crystallisations and the mechanical properties of the systems are due to the peculiar crystal habit and properties of the separating soap particles. The properties are profoundly modified by small amounts of fatty acid.

Catalysts in Hydrocarbon Chemistry. (E. K. Rideal, J. Inst. Petrol. Tech., Vol. 24, No. 174, April, 1938, pp. 221-4.) (55/30 Great Britain.)

In hydrocarbon chemistry increasing attention is being paid to catalytic processes. It is shown that these can be formulated on a radical mechanism. Homogeneous reactions can be brought about by free radicals and heterogeneous reactions by chemi-absorbed radicals. The energy of activation of such heterogeneous processes is less than one-fourth of the corresponding homogeneous reactions. This permits of lower temperature operation, greater efficiency and greater control. The use of o.p. hydrogen and of deuterium as tools for the elucidation of the mechanism of hydrogenation is briefly indicated.

Effect of Carburation and Manifolding on Fuel Knock Characteristics. (E. Bartholomew, H. Chalk and B. Brewster, Oil Gas J., 13/1/38. J. Inst. Petrol. Tech., Vol. 24, No. 174, April, 1938, pp. 194A-195A.) (55/31 Great Britain.)

The relative knocking tendency of cylinders of a multi-cylinder engine varies with carburation and fuel distribution, provided spark advance and cylinder cooling are uniform. Variations in knocking among the cylinders due to differences in cooling are believed to have been minimised in recent engines. Variations in spark advance create a greater problem, but recently an instrument capable of measuring the ignition advance of each cylinder simultaneously has been devised. This is described and illustrated.

It is apparent that with all the possible variations in carburation, fuel distribution, etc., in engines of the present day, no single set of carburettor and manifold conditions for the laboratory engine should give ratings equal to the average of

ratings obtained on several cars. The development of a correction factor applicable to all types of fuel and capable of direct determination on the engine would be desirable.

Application of the Grignard Reagent to a Study of Mineral Oils. (R. G. Larsen, Ind. and Eng. Chem. (Analytical Edn.), Vol. 19, No. 4, 15/4/38, pp. 195-8.) (55/32 U.S.A.)

During a chemical and electrical study of oil oxidation, a Grignard reagent (methyl magnesium iodide) was applied as an analytical tool with some success. By using apparatus similar to the " Grignard machine " currently in use for elucidation of the structure of organic compounds, procedures have been devised which permit the determination of minute amounts of water in oil, the establishment of an oxygen balance during oil oxidation, and the approximate prediction of oxidation stability by a single test on the original oil.

Ignition Quality of Diesel Fuels. (J. Inst. Petrol. Tech., Vol. 24, No. 173, March, 1938, pp. 176-9.) (55/33 Great Britain.)

The ignition quality of a fuel is a measure of the relative time required for combustion to start after the commencement of injection; the shorter the time the higher the ignition quality.

High ignition quality indicates ease of starting and smoothness of running, but the ignition quality of a fuel is not necessarily an indication of its combustion quality in all types of compression ignition engines. Furthermore, hot-bulb engines have special requirements, as have engines which use spark ignition for heavy oils. No form of test is suitable for rating fuels for these engines except direct tests in the engines themselves.

The routine test described involves the use of reference fuels calibrated by the I.P.T. Diesel Panel, but it should be mentioned that other suitable secondary reference fuels have been employed elsewhere.

Two methods of test have been described in I.P.T. Serial Designation F.O.39 (T). The first method measures the ignition delay directly by means of an indicator. In the second method the intake of the engine is throttled till misfiring occurs. Method I is preferred for routine cetane number determinations but Method II has the special advantage of being readily applicable to a large range of Diesel-engine types and is therefore convenient for making comparisons of fuel ignition quality where special apparatus is not available.

The Problem of Detonation. (M. Serruys, Airc. Eng., Vol. 10, No. 111, May, 1938, pp. 143-151.) (55/34 France.)

Following the usual theory that detonation is essentially auto-ignition of the " rest " gas, the author attempts to draw general conclusions from single cylinder experiments of small power output. (Brake horse-powers are quoted accurate to 1 in 10,000!). The author points out that as many as 17 factors (of which 6 are of major importance) determine the behaviour of the rest gas. There appears great danger that with so many factors almost any experimental result can be explained by adjusting their relative importance. Thus the well-known anti-knock effect of rich mixture is attributed to the smaller explosion pressure reducing the effective compression ratio of the rest gas. Yet both laboratory experiments and the chain reaction theory indicate a lower ignition temperature for the richer mixture.

No details are given of the type of connection employed for the optical indicator and it appears doubtful whether the vibrations shown on the expansion line are true indications of the state of motion of the gas in the engine cylinder.

Electrical Apparatus on Aircraft. (H. Viehmann, E.T.Z., 7/4/38, pp. 361-6. Metropolitan Vickers Electrical Co., Tech. News Bulletin, No. 606, 15/4/38, p. 7.) (55/35 Germany.)

After setting forth the requirements to be satisfied by electrical apparatus to be used on aircraft, the author discusses the special features of the current sources, the aircraft network and the current consuming devices, special reference being made to automatic switches, fuses, navigation lights, ignition systems for the Otto engines and wireless interference suppression. Illustrated with six diagrams and three photographs.

Investigation on Landing Impact of Seaplanes. (A. S. Povitzky, Trans. Scientific Tech. Soc. of Shipbuilding and Engineering, Vol. 2, 1936. Eng. Absts., Vol. 1, No. 2, Section 3, March, 1938, p. 14.) (55/36 U.S.S.R.)

Particulars are given of the methods adopted by the Hydro-Experimental Department of the Central Aero-Hydro-Dynamic Institute when carrying out experiments on seaplanes. Interesting results were obtained from the tests by means of micro-recording instruments at present used by the above department, which include a dynamic tensiometer for synchronous measurement of deflection, an accelograph for overload measurements and a stress recorder for measuring the pressure on the hull skin. Illustrations are given of the various instruments employed in carrying out the experiments. The most interesting instrument is the accelograph which has a range of acceleration from 130 units per second (1 variant) to 250-300 units per second (2 variants); this high acceleration permits the overload stresses produced by outside forces as well as the vibration to be recorded with great accuracy. Overload graphs are given of a seaplane when landing.

The Bristol Metameter. (J. A. Oates, Metropolitan Vickers Electrical Company, Ltd., Tech. News Bulletin, No. 607, 22/4/38, p. 7. Electrical Engineer, 8/4/38, pp. 860-2.) (55/37 Great Britain.)

The author describes the construction and operation of the Bristol Metameter, an instrument for transmitting records of various quantities. The " Impulse " system of telemetering is employed. Contacts in an electrical circuit are repeatedly opened and closed, the opening taking place at uniform time intervals, and the period of closure being governed by the value of the measured quantity. Illustrated with two photographs and three diagrams.

Some Results from Research on Flow Nozzles. (H. S. Bean and S. R. Beitler, Trans. A.S.M.E., Vol. 60, No. 3, April, 1938, pp. 235-44.) (55/38 U.S.A.)

The circumstances which caused the A.S.M.E. special research committee on fluid meters to undertake the present research programme on flow nozzles were recounted in an earlier paper. In that paper many of the committee's arrangements and plans for conducting the research were given. In another paper,* a description was given of the method being used to measure the size and shape of the nozzles.

This present paper which is the third of the series is a progress report presenting the results from various subsidiary tests. There is given a comparison of results from tests using rough and smooth pipe, standard and extra heavy pipe, and clean and deposit coated nozzles. Based upon tests with steam, there is given a comparison of the adiabatic expansion factor ϕ and the " net " expansion factor Y. The results from several groups of pressure gradient tests are pre-

* " Determining Flow Nozzle Contours at National Bureau of Standards," by F. C. Morey, Instruments, Vol. 10, June, 1937, p. 157.

sented, and based upon these results there is given a recommendation on the location of pipe-wall taps.

Reference Tables for Iron-Constantan and Copper-Constantan Thermocouples. (W. F. Roeser and A. I. Dah, Bur. Stan. J. Res., Vol. 20, No. 3, March, 1938, pp. 337-355.) (55/39 U.S.A.)

Tables have been prepared giving corresponding values of temperature and thermal electromotive force at various temperatures from −200 to 1,000°C. for iron-constantan thermocouples. Similar tables from −200 to 400°C. for copper-constantan thermocouples, although not new, have been included for completeness. The temperature-emf relations embodied in these tables are such that (1) each can be reproduced with materials generally and readily available; (2) each is the same (within $\pm\frac{3}{4}$ per cent.) as the temperature-emf relation of a large percentage of such thermocouples of that type now in use; (3) each is near the mean of the extreme limits of the temperature-emf relations for thermocouples of that type; (4) the table for iron-constantan is near the existing table most widely used, while the one for copper-constantan is the one most widely used; and (5) the constantan used with one element to reproduce one table can be used with the other element to reproduce the other table.

This paper also gives (1) average values of the thermal-emf of copper, iron which is generally available, and constantan against platinum, as a guide in selecting materials to yield any specified relation between thermal-emf and temperature for thermocouples of these types and (2) the variations in thermal-emf that might be expected between samples of these materials from the same lot and from different lots.

The Constantin Wind Vane Stabiliser on Aircraft. (J. Mottez, Tech. Aeron., Vol. 29, No. 147, pp. 45-82.) (55/40 France.)

The author investigates mathematically the stability of a given aircraft, both when flown normally and when fitted with a wind vane stabiliser. The results are incorporated in a series of graphs from which the author concludes:—

1. The wind vane stabiliser produces qualitatively the same results as would be obtained by alteration of dihedral or changes in the tail surface. Objectionable aircraft characteristic can thus be remedied in a simple manner without entailing constructional alterations.
2. Combined with the normal wing flaps, the wind vane is very useful in controlling the elevator so as to limit variation in the position of the centre of pressure. Considering its extreme simplicity and reliability the device is thus considered to merit the close attention of aircraft designers.

On the Forces Acting Between Atoms and Ions and the Physical Properties of Matter in Bulk. (J. A. Wasastjerna, Phil. Trans. Roy. Soc., Series A, Vol. 237, No. 774, 7/3/38, pp. 105-31.) (55/41 Great Britain.)

A method is developed according to which it is possible to analyse, by the aid of accessible experimental data, the question of the dependence of the potential energy on the interatomic distance for atoms and ions with closed shells. The results of the analysis have been made the foundation for a theoretical calculation of a number of physical properties of crystals. In many instances the results of the calculations can be compared with experimental data. In other instances information is obtained concerning data, which have previously been entirely unknown or about which great uncertainty has prevailed. Finally, a theoretical interpretation is given to the empirical results.

Natural Frequencies of Uniform Cantilever Beams of Symmetrical Cross Section. (L. S. Jacobsen, J. App. Mech., Vol. 5, No. 1, March, 1938, pp. A1-6.) (55/42 U.S.A.)

(*a*) The paper contains a deduction of the general frequency equation of cantilever beams. From this general equation, which is rather complicated, a number of simpler equations have been deduced, relating to frequencies of beams in which as many as four of the six independent variables have been neglected. It is shown that *considerable simplification results if the effect due to rotatory inertia is neglected.*

(*b*) An example of the influence of an elastically yielding ground on the first six mode periods of a building shows the *gradual transformation of the second mode period of the cantilever into the fundamental mode period of the free beam,* the third of the cantilever into the second of the free beam, etc.

(*c*) A general solution of the first four mode periods of the rigidly built-in cantilever is given in tabular form. The effect of *shear increases with the order of the mode, so that for high mode frequencies a consideration of shear alone gives good results unless the beams are very slender indeed.*

(*d*) The influence of *shearing or torsional elastic yielding* of the ground on the first five mode periods of a beam subjected to translational shear or to torsional shear is given by a family of curves. The curves show *the same type of transformation of second mode of cantilever to fundamental mode of free beam,* etc., as discussed in the building example.

Engineering Radiography. (E. A. W. Mueller, Siemens Revue, Vol. 3, 1937, No. 5, pp. 161-7. Metropolitan Vickers Electrical Co., Tech. News Bulletin, No. 606, 15/4/1938, p. 6.) (55/43 Great Britain.)

A brief survey is given of the applications of radiography to welded work, forgings, castings and other products. Several types of X-Ray industrial testing are described.

Illustrated with various photographs and diagrams.

A Method of Calculating Intricate Statical Indeterminable Systems. (P. A. Minjaev, Trans. Scientific Tech. Soc. of Shipbuilding and Engineering, U.S.S.R., Vol. 2, 1936. Eng. Absts., Vol. 1, No. 2, Section 3, March, 1938, p. 14.) (55/44 U.S.S.R.)

The usual method of calculation for a statical indeterminable system is based on the assumption that the unknown elements are independent and variable. This may be considered as arriving at an informal solution of the system. A general method of solution may be developed by treating the unknown forces as functions independent of each other, and considering the potential energy as a component function of them. This permits deriving a system of equations with a gradual reduction of the numbers of the unknown by application of the principle of least work. The last equation will contain only one unknown element, thus permitting its value to be determined; the general solution may be then gradually obtained by the method of substitution. Where there are a large number of unknown elements the calculation may be simplified by dividing the system into parts and by the application of the above method to each separate part.

Fatigue Tests of Strengthened Flanges in Welded Tension Bars and Girders. (O. Graf, Z.V.D.I., Vol. 82, 12/2/38, pp. 158-60. Eng. Absts., Vol. 1, No. 3, Section 1, March, 1938, p. 33.) (55/45 Germany.)

The author describes tests of the joint in a 5½in. by ⅜in. tension-bar having welded covers, the ends of which were diminished in width and thickness; and also when provided with rectangular covers uniform in width and thickness, having the transverse end welding fillet ground off to a smooth finish. Under repetition loading with a minimum constant load ranging from 0.3 ton to 0.6 ton per sq. in.,

the former type revealed a fatigue strength of 8.8 tons per sq. in. and the latter of 10.7 tons per sq. in. A test of a 12in. by 5in. joist, having a fusion-welded joint in which the flanges were splayed at an angle of 45 degrees, revealed a fatigue strength of 11.3 tons per sq. in. An equal strength was developed when the joint was made with rectangular flange-covers, the welding fillets being machined as described above.

A New Method Based Upon the Principle of Least Work for the Calculation of Box Girders Subject to Torsion. (C. Minelli, Richerche de Ingegneria, Vol. 5, November-December, 1937, pp. 155-61. Eng. Absts., Vol. 1, No. 3, Section 1, March, 1938, p. 33.) (55/46 Italy.)

The author explains briefly a method of calculating the conditions of strain in complex elastic systems by reference to the principle of least work, enabling the conditions of stress to be induced immediately therefrom. Developing a long succession of equations, he applies this method to the design of box girders such as occur in aircraft construction, and discusses four different problems according to the conditions of end fixation, the presence or absence of internal diaphragms, and the mode of application of torsional loads.

Force Distribution in Riveted Connections of Constant Cross Sections Under Tensile Loads. (L.F.F., Vol. 15, 20/1/38, pp. 41-7. Eng. Absts., Vol. 1, No. 3, Section 1, March, 1938, pp. 33.) (55-47 Germany.)

The author develops a method for the approximate determination of the force distribution in simple butt straps of constant cross section up to the tensile breaking load. The expressions which he develops permit the determination of the displacements of the straps for both elastic and plastic deformation of the rivets. In order to simplify the calculations he replaces the rivets by an ideal connecting layer between the surfaces and formulates an equation for the total displacement at any point in the connection, which is made up by the displacement in shear within the layer and the difference of the displacements in tension, integrated up to the point under consideration, of the plates connected.

The author describes tests on the displacements taking place in double-shear connections, each consisting of ten duralumin rivets disposed in line with the pull and connecting plates of different thicknesses, and also tests made with various types of single-rivet connections. An analysis of the results indicated good agreement with those calculated, and the author concludes that at small loadings the force-distribution in the connection is markedly non-uniform. If the loads are increased up to the breaking point, however, greater uniformity is obtained, owing to the permanent deformation which is set up in the end rivets.

Detection of Electric Welding Faults by X-Rays. (J. E. de Graaf, Metropolitan Vickers Electrical Company, Ltd., Tech. News Bulletin, No. 607, 22/4/38, p. 13. Welding Industry, April, 1938, pp. 93-6.) (55/48 Great Britain.)

This is the concluding section of the article which reviews the types of fault that can be found in electrically welded steel parts by means of X-Ray examination. In this present number there are two pages of characteristic X-Ray photographs which are fully discussed. The conclusion is that, when faults have fully developed characteristics, it is generally possible to give an interpretation by the X-Ray method. Illustrated with 21 photographs and three diagrams.

Ordinary Fracture, Time Limit Fracture, and Fatigue Fracture (Appearance of Fracture Under Tension Bending and Torsion). (A. Thum, Forschung, Vol. 9, No. 2, March-April, 1938, pp. 57-67.) (55/49 Germany.)

All constructional materials give rise to a variety of fracture phenomena, both in ordinary practice and in the testing laboratory. In order to obtain from them knowledge useful for design purposes, it is necessary to recognise the typical

appearance of the different fractures, to determine which general laws apply, and to investigate the internal mechanism of the failure. At the same time, special consideration must be given to the shape of the fractured part, the nature of the surface, and the material itself. The present research is intended to provide the fundamentals. It is chiefly restricted to rolled steel and cast iron.

Optical Investigation on Three-Dimensional Stress Conditions (Convergent Light). (R. Hiltscher, Forschung, Vol 9, No. 2, March-April, 1938, pp. 91-103.) (55/50 Germany.)

The " solidification method " developed by G. Oppel for the first time offered the possibility of investigating three-dimensional stress conditions with the aid of polarised light. Oppel's analyses were confined to the special cases of symmetrical stresses, the deformed test specimen being cut up in slices perpendicular to one of the three principal normal stresses. The other two principal normal stresses lie in the plane of the slice, so that the problem is reduced to investigation of two-dimensional stress conditions. The direction of one of the principal normal stresses must therefore be known beforehand, while it is doubtful which of the three principal shear stresses are measured in the plane. An optical method was therefore evolved which above all determines the directions of the three principal normal stresses. The investigation thereby becomes independent of the direction of the cut, and any unsymmetrical three-dimensional stress problems may be handled. As an example the method is applied to a portion of a crankshaft.

The Crystalline Structure of Steel at Fracture. (H. J. Gough and W. A. Wood, Proc. Roy. Soc., Series A, Vol. 165, No. 922, 14/4/38, pp. 358-71.) (55/51 Great Britain.)

The stability of the atomic arrangement in the metal is the result of equilibrium between the positive ions and the surrounding electron distribution. Permanent deformation of the metal produces, in the first place, a process of grain dislocation and fragmentation leading to a structure consisting entirely of a mass of crystallites having a limiting size and completely random orientation. But the attainment of this condition is not the criterion of fracture; in fact, although it is doubtful if the metal is really " strengthened " by such cold-working, it can certainly withstand, without plastic deformation, a greater strain or range of strain than in its initial state. The investigation shows that the stage when fracture is imminent is approached only after the structure has become completely fragmented. The experiments have clearly demonstrated the progressive deterioration in the regularity of the atomic structure and electron distribution and, therefore, a disturbance of the equilibrium of the structure. This produces localised regions of weakness at which fracture can be initiated under the action of external forces whose magnitude would appear to be quite inadequate if the material were homogeneous and possessed the full theoretical strength.

Twisting Failure of Centrally Loaded Open-Section Columns in the Elastic Range. (Kappus, R., L.F.F., Vol. 14, No. 9, 20/9/37, pp. 444-57. Available as Translation T.M. 851.) (55/52 Germany.)

The buckling of centrally loaded columns of open section is always accompanied by a twist if the cross section discloses neither axial nor point symmetry. There are three such axes of twist and consequently three different critical compressive stresses (twisting failure stresses). With point symmetry of the cross section the three critical compressive stresses are given in two Euler stresses for (twist-free) buckling in direction of the two principal axes of inertia and one twisting failure stress for twisting about an axis of rotation passing through the centre of gravity. With simple cross-section symmetry, it finally affords one Euler stress for buckling in direction of the axis of symmetry and two twisting failure stresses for twisting about two axes of rotation in the plane of symmetry. The thicker

the wall and the greater the length of the columns the more the effect of the twist is neutralised, as the distance between centre of rotation and centre of gravity continues to increase until, finally, the observed buckling is practically free from twist.

Twisting of Thin-Walled Columns Perfectly Restrained at One End. (Lazzarino, L., L'Aerotecnica, Vol. 17, No. 10, Oct., 1937, pp. 850-61. Available as Translation T.M. 854.) (55/53 Italy.)

Proceeding from the basic assumptions of the Batho-Bredt theory on twisting failure of thin-walled columns, the discrepancies most frequently encountered are analysed. A generalised approximate method is suggested for the determination of the disturbances in the stress condition of the column, induced by the constrained wrinkling in one of the end sections.

Photoelastic Determination of Stresses Around a Circular Inclusion in Rubber. (W. E. Thibodean and L. A. Wood, Bur. Stan. J. Res., Vol. 20, No. 3, March, 1938, pp. 393-409.) (55/54 U.S.A.)

Analysis is made of the stresses around a rigid circular inclusion with cemented boundary in a rubber sheet which is under simple tension at a distance from the inclusion. The analysis is performed by the photoelastic method, in which data are obtained from observations of the changes produced in a beam of polarised light passing through the transparent model. The fundamental principles of the method and a detailed account of their application are given. The possibilities of the use of rubber as a model material are demonstrated. The stress-optical coefficient of a certain soft vulcanised rubber compound is found to be 2,030 brewsters.* This is in agreement with the results of previous work. The maximum stresses near the boundary of the disk are found to be about 50 per cent. greater than the average applied stress. The experimental results are compared with those given by a theoretical treatment of this problem, and quite satisfactory agreement is obtained.

On the Influence of Chromium on the Oxidisability of Tungsten at High Temperatures. (S. Isida and H. Asada, Aer. Res. Inst., Tokyo, Report No. 161, April, 1938.) (55/55 Japan.)

Alloys of chromium and tungsten were prepared by the thermite process and the melting point, microscopic structure, X-Ray analysis and hardness were determined over a range of compositions. It appears that the oxidisability of tungsten in air (900°C.) is markedly reduced by the addition of 13 per cent. of chromium.

A Method of Measuring the Thermal Conductivity of Fluids. (H. Pfriem, Z.V.D.I., Vol. 82, 15/1/38, pp. 71-2. Eng. Absts., Vol. 1, No. 3, Section 2, March, 1938, p. 47.) (55/56 Germany.)

The author observes that, with the known fixed methods of measuring the thermal conductivity of fluids, the heat-loss due to convection currents presents an important difficulty. Moreover, the methods are complicated by the necessity of adopting means for counteracting heat-losses. He describes a simple method in which a very thin wire, electrically heated, is stretched vertically in the fluid. The calculation of the temperature field is based upon the known equation for heat-conductivity in cylindrical temperature fields. The author discusses briefly the theory upon which this method of measurement is based and gives the principal formulæ from which the results are calculated.

* One brewster $= 10^{-13}$ cm^2/dyne.

The Heat Conductivity of a Spherical Packing in a Gas Current. (G. Kling, Forschung, Vol. 9, No. 2, March-April, 1938, pp. 82-90.) (55/57 Germany.)

The heat conductivity of ball packings increases considerably due to the convection of the contained gas. The influence of the gas flow through the interstices is investigated for the case that the heat flow is in a direction perpendicular to an enforced gas flow.

Investigation of Wave Phenomena on Models Using Ultra Sonic Waves. (S. Kretochner and S. Rshevkin, Technical Physics, U.S.S.R., Vol. 4, No. 11-12, Nov.-Dec., 1937, pp. 1004-1019.) (55/58 U.S.S.R.)

Plane waves of the order of $\lambda = 1$ mm. were generated in an oil bath and illuminated at right angles by a parallel beam of light. The resultant wave patterns were examined by the Toeppler " Schlieren " method, a Kerr cell providing an effective stroboscope. Photographs are given showing a number of simple reflection, diffraction and interference effects.

The author applied the new technique to the study of the acoustical properties of irregular wall surfaces and predict the transition frequency from regular reflection to scattering.

The work is being continued.

Magnetic Method for Measuring the Thickness of Non-Magnetic Coatings on Iron and Steel. (A. Brenner, Bur. Stan. J. Res., Vol. 20, No. 3, March, 1938, pp. 357-68.) (55/59 U.S.A.)

A non-destructive, magnetic method is described for measuring the thickness of non-magnetic coatings on steel. The instrument used is similar to that previously described for measuring nickel coatings on non-magnetic base metals. The present method depends on the decrease in the attraction of a permanent magnet for steel when the two are separated by a non-magnetic coating.

Measurements on commercial coatings of which the actual thicknesses were determined by standard methods yielded results that were accurate to ± 10 per cent. for most coatings. The results were about 25 per cent. low for hot-dipped tin coatings, which are only about 0.00011n. thick.

Because nickel is less magnetic than steel, the thickness of nickel coatings on steel can be measured by this method, using a suitable calibration curve.

A Method for the Investigation of Upper Air Phenomena and its Application to Radio Meteorography. (H. Diamond, W. S. Hinman, Jr., and F. W. Dunmore, Bur. Stan. J. Res., Vol. 20, No. 3, March, 1938, pp. 369-92.) (55/60 U.S.A.)

Experimental work conducted for the U.S. Navy Department on the development of a radio meteorograph for sending down from unmanned balloons information on upper-air pressures, temperatures and humidities has led to radio methods applicable to the study of a large class of upper-air phenomena. The miniature transmitter sent aloft on the small balloon employs an ultra high-frequency oscillator and a modulating oscillator; the frequency of the latter is controlled by resistors connected in its grid circuit. These may be ordinary resistors mechanically varied by instruments responding to the phenomena being investigated, or special devices the electrical resistances of which vary with the phenomena. The modulation frequency is thus a measure of the phenomenon studied. Several phenomena may be measured successively, the corresponding resistors being switched into circuit in sequence by an air-pressure-driven switching unit. This unit also serves for indicating the balloon altitude. At the ground receiving station, a graphic frequency recorder, connected in the receiving set output, provides an automatic chart of the variation of the phenomena with altitude. The availability of a modulated carrier wave during the complete ascent allows of

tracking the balloon for determining its azimuthal direction and distance from the receiving station—data required in measuring the direction and velocity of winds in the upper air.

Constants of Fixed Antennæ on Aircraft. (G. L. Haller, Proc. Inst. Rad. Eng., Vol. 26, No. 4, April, 1938, pp. 415-20.) (55/61 U.S.A.)

This paper presents the resistance and reactance characteristics of various fixed antennæ on two types of modern aircraft, one a two-place low-wing metal military aeroplane of the attack type and the other a large mid-wing metal military aeroplane of the bombardment type, whose dimensions are comparable to those of modern commercial transport aeroplanes. A frequency range of from three to eight megacycles is covered in all cases and in some cases this range is extended. A description of the measuring equipment and method is included.

Water Purification by Ozone. (Metropolitan Vickers Electrical Co., Ltd., Tech. News Bulletin, No. 608, 29/4/38, p. 5. Electrician, 22/4/38, p. 511.) (55/62 Great Britain.)

The desirability of water purification in various cases is discussed, and the "Ozonair" system of treatment by electrically generated ozone is described. This is compared with the chlorination process.

Illustrated with 1 diagram.

Aerial Survey in Exploration Work. (B. Scherpbier, J. Inst. Petrol Tech., Vol. 24, No. 174, April, 1938, pp. 225-32.) (55/63 Great Britain.)

Aerial photography has proved to be of great value for petroleum exploration work, especially in remote countries. Photogrammetric cameras have advantages over photographic ones, also when surveying undeveloped countries, because their use entails less ground control.

By applying aerial triangulation the ground control can be reduced to the determination of ground bases 100-200 km. apart.

Aerial survey enables the exploration geologist, before entering the area to be explored, to have already available a topographical map, which very often even contains geological information derived from the photographs.