Taveau (2000 francs); the Caméré prize to M. Gisclard; the Jerome Ponti prize to Georges Rouy, for his researches in systematic botany; the Leconte prize between Charles Tellier (8000 francs) and M. Forest (12,000 francs); the prize founded by Mme. la Marquise de Laplace to Jules Adolphe Menj; the prize founded by M. Felix Rivot between J. A. Menj, J F. G. Daval, R. G. R. Mabilleau, and R. E Bollack.

## *THE TIN MINES OF NEW SOUTH WALES.*[1]

THE more rapid growth of the demand for tin than of the supply, and the disappointing failure of aluminium to replace tin for many purposes for which it was hoped to prove an efficient substitute, have led to the more careful study of the tin fields of the world and to an increase in the tin production by about a third in the first decade of this century. Mr. J. E. Carne has added a monograph on the tin mines of New South Wales to the series of valuable monographs with which he has enriched the economic geology of Australia.

The monograph is careful and exhaustive, and shows the author's combined caution and insight. It consists mostly of detailed descriptions of the tin mines and mining fields, and the economic problems naturally receive greater attention than the theoretical. There is, however, an interesting discussion of the genesis of tin ores, and the account of the mines is often enriched with suggestions of general interest. Economic questions are especially important in connection with a metal which is subject to such violent fluctuations in value, for the price of tin on the London market has varied since 1905 between 120*l.* and its present price of 230*l.* per ton. The association of tin with pegmatite veins has led to its being often claimed as one of the metals most likely to be of direct igneous origin; but Mr. Carne rejects the view that the tin in some granites was a primary constituent of the granite, and has been collected into veins as a direct differentiation product. He lays stress on the evidence which points to the deposition of the tin after the complete consolidation of the granite.

The New South Wales tin deposits are, however, not of the kind for which there is most to be said for the igneous theory. Mr. Carne gives a list of seventy-seven tin veins in New South Wales, and in sixty-nine of these the tin is associated with quartz, in twenty-nine with chlorite, in wenty with felspar, and in only three with tourmaline. The rarity of the association with tourmaline suggests that tin in New South Wales is not a pneumatolytic product.

The first record of tin in Australia which Mr. Carne accepts as authentic was in 1824. Actual tin-mining in New South Wales only began in 1872. Since 1875 the largest field—Emmaville—has yielded about 52,000 tons, and the Tingha field has yielded slightly less (45,500 tons). The tin mines in New South Wales include both alluvial deposits and lodes. The lodes belong to a type in which the distribution of the tin is sporadic and the patches of ore become smaller and poorer in depth. The deepest tin mine in Australia is the Vulcan Mine in North Queensland, which has already attained the depth of 1400 ft. The deepest in New South Wales is only 360 ft., and Mr. Carne's account of the lodes renders this fact not surprising.

J. W. G.

[1] "The Tin mining Industry and the Distribution of Tin Ores in New South Wales." By J. E. Carne. (New South Wales Department of Mines, Geological Survey, Mineral Resources No. 14.) Pp. 378+xxxiii plates+8 figs.+14 maps and sections+iii maps in portfolio. (Sydney, 1911.)

## *OSMOTIC PRESSURE AND THE THEORY OF SOLUTIONS.*

ATTENTION may be directed to a paper by Prof. A. Findlay on osmotic pressure and the theory of solutions, which has recently been published in *Scientia*. It has sometimes been suggested that the problems of osmotic pressure were solved once for all by van't Hoff's discovery that the gas equation PV=RT could be applied to solutions by substituting "osmotic pressure" for "gas pressure." But the recent exact measurements of the Earl of Berkeley and Mr. Hartley in England and of Morse and his colleagues in America have shown clearly that this simple equation is so restricted that it cannot in practice be applied with any approach to accuracy in the case of any of those solutions of which the osmotic pressures have been exactly measured.

As Prof. Findlay points out, the first limitation to the equation PV=RT, when applied to solutions, is that the method used in deducing it only holds good for very dilute solutions. For stronger solutions the equation $P=\frac{RT}{V}=\frac{RT}{V_0}x$ becomes

$$P=\frac{RT}{V_0}\left\{-\log_e(1-x)\right\}=\frac{RT}{V}\left\{x+\tfrac{1}{2}x^2+\tfrac{1}{3}x^3,\ \&c.\right\}$$

where $V_0$ is the molecular volume of the solute and $x$ is the molar ratio, *i.e.* the ratio of the number of molecules of solute to the total number of molecules present.

This equation assumes that there is no formation of complex molecules, no change of energy or volume on mixing the liquid solvent and solute, and that the solution is incompressible. G. N. Lewis has shown that it holds good in a marvellous way when applied to vapour pressure measurements in mixtures of propylene bromide and ethylene bromide at 85°. But even this equation fails to represent with any approach to accuracy the measured osmotic pressures of cane-sugar solutions. Better results are obtained by assuming the formation of a hydrate of the sugar, but it is abundantly clear that van't Hoff's equation is only the beginning and not the end of the quantitative study of osmotic pressure, and that direct measurements of this property are still of the highest importance in studying the theory of solutions.

## *ENGINEERING AT THE BRITISH ASSOCIATION.*

A GLANCE at the proceedings of the Mechanical Science Section shows that a wide range of subjects was considered by the members, and, indeed, much planning was required to group the papers in such a way that all could be read and adequately discussed, and every moment of the available time was fully occupied in carrying out the longest programme of recent years.

In the course of his presidential address on the Thursday morning, Prof. Barr discussed the relation of the engineer to the public, both from a utilitarian and an æsthetic point of view, and by aid of many illustrations of modern engineering achievements he again and again enforced his main argument that the maintenance of a high ideal in all engineering work was necessary to obtain the highest good for the greatest number.

Such illustrations as the attainment of dustless roads, smokeless factories, ships, and locomotives, and the abandonment of all sham decoration of engineering structures gave point to an address which was free from technicalities and permeated by a dry, literary humour of its own.

The address was followed by an important report, the fifth of the Gaseous Explosions Committee, which dealt chiefly with the radiation effects and the turbulent motion of the gas charge in the cylinders of internal combustion engines. In this account of a large amount of new work carried out by different members, the committee shows that turbulence plays a most important part in determining the time of ignition of the charge in high-speed engines, such as are now used for motor-cars and aeroplanes, while it also has a large effect on heat loss, although at very high explosion temperatures the radiation effect is of chief importance.

In connection with this paper Prof. Harold Dixon confirmed some of the results of the committee's work in his account of the experiments on coal dust explosions at Eskmeals conducted for the Home Office.

Prof. Thornton also described his experiments on the igniton of gaseous mixtures by momentary arcs, and indicated the safe limits for operating electrical machinery in coal mines containing inflammable gases.

An important discussion with Section A on wireless telegraphy commenced the proceedings on the Friday morning. This joint meeting afforded an animated discussion in which a number of speakers representing both sections took part. A summary of the chief matters of interest has already appeared in these columns (December 12, p. 421), and it only remains to mention that this meeting was the most successful joint gathering of these sections in recent years.

A paper immediately following, by Dr. Eccles and Mr. A. J. Makower, dealt with the production of electrical oscillations with spark-gaps immersed in running liquids. Although it appears that the efficiencies are about the same as that of an ordinary spark-gap in air, yet the former have the advantage of being practically noiseless, a matter of some importance in large-powered wireless stations.

The impedance of telephone receivers was also discussed in a paper by Profs. Kennelly and Pierce, and the effect of the motion of the diaphragm was analysed in some detail.

Another electrical paper of great interest was contributed by Prof. J. T. Morris, who described a method of measuring wind velocities by the aid of a small bare wire Wheatstone bridge having arms of manganin and platinum. The cooling effect of a current of air has no influence on the resistance of the manganin, but it lowers the resistance of the platinum, and an increased current is therefore required to effect a balance. This change of current is a measure of the velocity of flow of the air, as the author demonstrated by lecture experiments.

A discussion on the gas turbine, at the commencement of the Monday meeting, was opened by Dr. Dugald Clerk, who described the attempts which have been made in recent years to construct a successful gas turbine. In particular, the performance of the large turbine recently constructed by Herr Hans Hobzwarth was analysed in some detail. Unfortunately, Herr Hobzwarth was, at the last moment, prevented from attending the discussion, and the details of his latest improvements were not available.

An interesting group of papers dealing with motor-car and aviation problems was headed by a contribution from Sir John H. A. Macdonald, K.C.B., F.R.S., on "The Road Problem," in which he described the road-making methods of Macadam and Telford, and the modern attempts to obtain a dustless and practically indestructible road suitable for motor vehicles. Various interesting experiments on the acceleration and tractive power of motor-cars were described by Mr. Wimperis, who, in the absence of the author, Prof. Chatley, also gave a summary of a paper on the control of aeroplanes. The results of experiments at the East London College on the distribution of pressure on inclined aerocurves were also described by Mr. A. P. Thurston.

A considerable portion of the sitting on the Tuesday was devoted to naval problems, and the first paper was a notable contribution on the suction between passing vessels by Prof. Gibson, of University College, Dundee, and Mr. Thompson, the engineer of the Dundee Harbour Trust. Numerous experiments were made with a fair-sized steam yacht, and a 30-foot motor-boat running on parallel courses at speeds of about six knots, and these showed that suction was considerable, and rapid in action at lateral distances of less than 100 feet.

Prof. Henderson discussed problems in propulsion by the aid of energy systems moving with the propelled body, and Mr. Mavor described some large new vessels fitted with his system of electrical transmission, and showed the advances made since his paper of last year.

Mr. Axel Welin also described his system of lifeboat lowering and raising gear, which is now being fitted to numerous passenger vessels.

Papers relating to the testing of materials were taken on the concluding morning.

Prof. Coker described some optical determinations of the distribution of stress in plate and coiled springs, and also the results of stress determinations by thermo-electric methods. These latter have an advantage in that they depend on the sum of the principal stresses at a point, while optical measurements determine the difference, and a combination of both methods was advocated in certain cases.

Mr. Haigh described an ingenious electro-magnetic machine for obtaining repetitions of stress at frequencies up to 120 per second, and Mr. Larard showed some very fine kinematograph films of the fracture of torsion specimens.

Papers by Prof. Petavel and Dr. Lander were also read during the meeting, describing experiments on heat transmission, in which attention was directed to the large convection losses of steam-pipe coverings.

Mr. R. S. Whipple described a Féry bomb calorimeter in which the rise of temperature due to combustion is measured by thermo-couples, and the heating effect is absorbed by the metal, no water being employed.

Dr. Gray and Mr. Burnside gave an interesting demonstration of their motor gyroscopes, and Prof. Wilson gave an account of some exposure tests of aluminium alloys, while Dr. Wall discussed the question of hysteresis loss in iron due to pulsating and rotating magnetic fields.

Mr. T. Reid described a new form of rescue apparatus for coal mines, and Dr. Owens contributed a paper on the weathering of Portland stone.

The section was well attended throughout, and the discussions were well sustained. During the proceedings the section heartily congratulated Sir William White, K.C.B., F.R.S., a past-president of the section, on his election to the presidency of the Association for the Birmingham meeting next year. It is interesting to recall that in the last twenty-five years two other distinguished engineers, Sir Frederick Bramwal and Sir Douglas Galton, have filled the presidential chair.

E. G. C.