method for obtaining delirium cordis in the frog-ventricle. Danielopolu (Bucharest) records observations upon the effects of various conditions—clinical and experimental—upon the human electro-cardiogram.

In a communication by Heger (Brussels) the cause of the relative hypertrophy of the right ventricle which occurs in man and animals acclimatised to residence at a high altitude is ascribed to a persistent pulmonary hyperæmia.

Anaphylaxis was the subject of communications by Kopaczewski (Paris) and Pesci (Turin).

Communications dealing with the central nervous system were few in number. Among them was one by Amantea (Rome) on the effect of application of strychnine to the sensori-motor region of the cerebral cortex on experimentally excited epilepsy; one by Camus and Roussy (Paris) on polyuria produced by lesions at the base of the brain; and one by Lafora (Madrid) on the functions of the corpus callosum.

According to Abelous (Toulouse), cholesterol is manufactured in the spleen, which organ may be stimulated to increased production in this direction by secretin. A paper by Rothlin (Zürich) was devoted to the effects of adrenalin and β -iminazoethylamine (active principle of secretin) on gastric secretion; the

former inhibits, and the latter, if injected subcutaneously or intramuscularly, stimulates. Quantitative studies on the adrenalin output of the adrenal glands was the subject of a communication by Stewart (Cleveland). Bazett (Oxford), as the result of cross-circulation experiments, finds that adrenalin is of little importance as regards pressor reflexes, but that it functions by maintaining a normal tone in the arterioles or capillaries. Negrin y Lopez finds that after "piqûre" and double vagotomy the blood-pressure always rises, but if the animal has been adrenalectomised a fall occurs. Gayda (Turin) finds that tadpoles fed with thyroid give off more heat than normal ones.

Pézarid (Paris) confirmed the experience of others that castration leads to the appearance of the opposite sex-characters in fowls. Athias (Lisbon) showed that after total castration pituitrin always contracts the uterus, while adrenalin does so only in the rabbit and hedgehog; it inhibits contraction of the uterus of the dog and cat.

There were also presented many communications dealing with problems of chemical physiology and with the action of particular drugs the contents of which do not lend themselves to a short summary.

R. K. S. LIM.

Liquid Fuel from Coal.

By PROF. JOHN W. COBB.

A PAPER entitled "Coal as a Future Source of Oil-fuel Supply," which has a very special interest at the present time, was read by Sir Arthur Duckham at a meeting of the Institution of Petroleum Technologists held at the Royal Society of Arts on October 19, 1920. It marks the recognition of a new state of affairs which is rising out of the enormous increase, actual and contemplated, in the use of liquid fuel and the by no means unlimited supply of natural petroleum. America is already concerned with the conservation of its own supplies of the latter, and there is every necessity for a careful and extended examination of any method which appears to be practicable for producing liquid fuel from solid deposits.

The demands that have to be met are of various kinds, and require products differing widely in the degree of their refinement. One extreme is encountered in providing for the delicate mechanism of the motor-car engine, and the other in meeting the grosser requirements of a steam boiler, particularly in the raising of steam for the propulsion of battleships and other sea-going vessels.

The Scottish shale industry is old-established, and an example of the practicability of obtaining oils by retorting, but the proved quantities of suitable oil-producing shale in this country are not very great. Sir Arthur Duckham has addressed himself to a discussion of what may be done by way of treating coal so as to obtain the best value in oils and tars. In reviewing possible lines of development he expresses the belief that the industrial future of this country lies in the conversion of the coal at the pit's mouth into liquid and gaseous fuels. "Liquid fuels will be recognised as the medium for providing energy for all transport by land, sea, or air with the exception of electrical transport for congested areas, while gaseous fuels will be used direct for the great majority of heating purposes and for the generation of electricity." He points out that "full experience has been gained in America of the transmission of gas over long distances," and then that "there is no question

that, starting in the big industrial districts which lie near the coalfields, gas can be supplied in sufficient quantities and can economically replace solid fuel." In this way the author emphasises the production of gas, oil, and tar together from coal as being the right direction in which to go, and proceeds to discuss the various technical and commercial considerations which should influence the choice of process and plant for the purpose.

In this Sir Arthur Duckham is completely at home, and, although primarily a gas engineer of assured reputation, he displays no reverence for traditional and accepted methods when these appear to him to be only second best. He is, however, compelled to lament at an early stage the impossibility of supplying financial or thermal balance-sheets with any degree of confidence. This difficulty is inevitable at any time with unproved processes, and at the present time there are peculiar difficulties on the financial side which are not confined to the problem he is discussing, but apply to all schemes involving extensive reconstruction.

In order to deal in turn with established methods, the author reviews the position of gasworks, coke-ovens, and gas-producers. He describes the evolution of gas-making as it is conducted for the purpose of public supply, pointing out how "it started as a low-temperature process, and gradually became, with the improvement of materials of construction and advanced knowledge, a high-temperature process." He indicates the extent to which gas undertakings have been hampered by "antiquated and restrictive legislation," based upon the conditions of the past, and indicates quite rightly that the recent removal of these restrictions should make for rapid development.

The form of gasworks plant which meets with Sir Arthur's approval is evidently the continuous vertical retort with steaming, increasing the temperature about the bottom of the retorts and highly superheating the steam before it enters. The hot waste gases from the plant are to go through waste-heat boilers, so raising the quantity of steam required for steaming

the retorts in return for a small extra capital expenditure and the cost required to drive the fan on the outlet boilers. The author points out in this connection what is so frequently ignored by the less informed advocates of low-temperature carbonisation, that in the continuous vertical retort a really fractional distillation can be attained. "The products of distillation are driven away as made, and have to pass through no higher temperature than that at which they are evolved, whilst if water-gas is made at the same time in the retort by steaming, this process protects the hydrocarbons and gives a greater quantity of a lighter quality tar." The weakness of gasworks practice, from the author's point of view, is that the coal has to be conveyed to the gasworks and the coke removed from it.

In dealing with coke-ovens it is argued that they meet a definite but limited demand for a specific article, namely, hard coke for blast-furnace work, and that on this account the erection of coke-ovens for supplying gas- and tar-oils to meet national needs is not feasible.

The author turns aside for a moment to indicate the possibility of using much more coke-oven gas for town supply, and points out that the chief difficulty in the way at present is the variation in its quality. That difficulty is not, however, insuperable.

He expresses, too, a belief that gas will in the future be used instead of coke in the smelting of iron-ore, but it is possible that in coming to that conclusion the high output and efficiency of a modern blast-furnace plant have not been taken sufficiently into account.

Sir Arthur does not regard gas-producers very favourably, though he admits their power of giving a large supply of heat-units in the form of gas at a low cost. His main criticism is that the tar-oils recovered are not valuable. "The condition in which they come from the plant makes them difficult to work up, and, according to the tar distillers, the final products do not compare at all favourably in value with the final products from other methods of destructive distillation

of coal." In justice to the gas-producer it may be pointed out, however, that most of the criticisms under this head might be applied equally well to products of other processes of low-temperature distillation, and often mean simply that the tar is very poor in aromatic constituents, different from gasworks tar, and cannot be worked conveniently along with it.

In speaking of low-temperature carbonisation the author makes the pertinent observation that its advantages are too obvious. He goes on to indicate that the difficulties it presents are very real, and, of course, it cannot attain his ideal because so much of the fuel is finally left in the solid form.

The whole of these considerations and criticisms of the shortcomings of different processes have been leading up to a proposal of something different—total gasification in some form of plant which differs from a gas-producer in that air is not used for gasification of the fixed carbon, and, therefore, nitrogen in quantity is not present in the gas. "The principle of this process is the partial carbonisation of coal in a vertical retort superimposed on a water-gas generator, the retort being heated externally by means of the products of combustion of the producer during the blow period, and internally by the passing of the water-gas made up through the charge in the retort."

This comprehensive survey ends with the formulation of an ideal system of manufacture to meet the demands for liquid and gaseous fuels. It is to gasify coal completely, preferably in one vessel, recovering in a liquid form the maximum amount of volatiles in the coal (working with any coal) and preserving the resulting ammonia. It would be of the combined vertical retort water-gas-producer type, with recuperators, waste-heat boilers, and mechanical arrangements making for labour-saving and for high thermal and chemical efficiency. It is to the treatment in some such plant as this that the author looks for increasing our home-produced oil-fuel supplies, and no doubt he is willing to take his share in the skilful design and careful experimental work involved.

Sheep Panics.

A SHEEP panic on the night of December 10-11, in which the sheep broke their folds in twenty parishes in an area extending some twenty miles in the highest part of Cambridgeshire, has been attracting attention. These panics have often occurred, for sheep are notoriously timid and nervous animals. On November 3, 1888—an intensely dark night, with occasional flashes of lightning—tens of thousands of folded sheep jumped the hurdles and were found scattered the next morning. Every large farm from Wallingford to Twyford was affected, and those on the hill country north of the Thames most so. Again, on the night of December 4, 1893, another very remarkable panic among sheep occurred in the northern and middle parts of Oxfordshire, extending into adjoining parts of the counties of Warwick, Gloucester, and Berks.

Various causes for these panics have been suggested, but only one reasonable explanation has been satisfactorily adduced. The 1893 panic was, at the time, fully investigated by Mr. O. V. Aplin, who published in the *Journal of the Royal Agricultural Society* the result of his inquiries and the conclusions he drew from the extensive evidence collected. The conclusion arrived at was that the cause of the panic was simply thick darkness. Very few people, probably, have ever been out in a really dark night, and

it is impossible for anyone who has not had this experience to imagine what it is like and the sense of helplessness it causes. That a thick darkness of this kind was experienced in the early part of the night of the recent panic (at a time agreeing with that at which, so far as was known, the sheep stampeded) was proved by abundant evidence. One report said that it was between 8 and 9 p.m. when such a thick and heavy darkness came on that a man could not see his own hand. Another witness wrote that a little before 8 o'clock there was an extraordinary black cloud travelling from north-west to south-east, which appeared to be rolling along the ground. The darkness lasted for thirty or forty minutes, and during that time it was like being shut up in a dark room. Later in the night—long after the panics—there were several flashes of lightning.

Mr. Aplin states that animals probably see perfectly well on ordinary dark nights, and we can imagine a bewilderment coming over them when they find themselves overtaken by a thick darkness in which they can see nothing. Folded sheep (and it was the small folds that the sheep broke most) in moving about would knock against their feeding-troughs and one another, and the first one that got a fright from this and made a little rush would probably come into collision with one or two others, and