Institut International de Chimie Solvay.

THE second of the triennial chemical conferences under the Ernest Solvay Trust was held in Brussels, on April 16-24, at the Fondation Universitaire, a palatial new club established since the War, under the presidency of "Sir Pope de Cambridge," who filled the office with distinction at the first conference. To quote *Le Soir*: "Chacun loue la clarté précise, la pondération, la pénétration et le tact parfait de sa présidence."

The members of the Scientific Committee present were: Mm. E. Briner (Geneva), O. Dony-Henault (Brussels), J. Duclaux (Paris), F. M. Jaeger (Groningen), A. Job (Paris), J. Perrin (Paris), F. Swarts (Ghent). In addition, the following attended by invitation: H. E. Armstrong (London), E. F. Armstrong (Warrington), G. Barger (Edinburgh), W. Barlow (London), A. Berthoud (Neuchatel), J. Boeseken (Delft), W. L. Bragg (Manchester), C. S. Gibson (London), Sir W. B. Hardy (Cambridge), T. M. Lowry (Cambridge), Ch. Maugin (Paris), Ch. Moureu (Paris), E. K. Rideal (Cambridge), H. Staudinger (Zurich), H. von Euler (Stockholm). The following professors in the University of Brussels were also present: G. Chavanne, J. Timmermans, H. Wuyts, E. Saerens, E. Herzen.

Twelve sittings were held, occupying six whole days, so the meeting was no mere joy-ride, the more as it took place under continental conditions of air and light and was a severe linguistic trial, English alternating with French in several tongues; indeed, even a little Swiss-German was introduced. That our self-sacrificing devotion was not unappreciated, is clear from a notice in *L'Indépendance Belge*: "Nous l'avons dit, les Conseils de Chimie, les conseils de Physique ne sont pas des congrès. Tout le temps dont disposent les savants qu'ils réunissent est consacré au travail. Généralement, on travaille encore au cours du déjeuner quotidien: la tâche n'est jamais interrompue."

The Council was received by His Majesty the King of the Belgians, at the Royal Palace, on the afternoon of Friday, April 17. Messrs. Heger and Lefebure, Sir William Pope, Sir William Hardy, and Profs. Armstrong, Jaeger, Moureu, and Perrin had the honour of dining with the King and Queen and members of the Royal family at the Palace at Laeken on the Saturday evening. On both occasions all were much impressed by the cordiality and sincerity of our reception and by the obvious appreciation the King showed of the service the Guild of Science is rendering. The meeting was the subject of serious notice in the press, and we learnt from lady friends, who made purchases in the city, that the conference was talked of even in *lingerie* circles. Such notice in Great Britain is unthinkable. These matters are ordered differently abroad. The courtesy shown to their visitors by M. Heger and his colleagues and by Madame Solvay and other members of her family cannot be adequately acknowledged.

The following reports were presented and considered: The Mechanism of Chemical Change, T. M. Lowry; Les Relations interatomiques médiates dans les composés organiques, F. Swarts; L'Adsorption en relation avec la catalyse et les actions enzymiques, J. Duclaux; Les Réactions intermédiaires dans la catalyse, Andre Job; Lumière et réactions chimique, Jean Perrin; On the Spreading of Fluids on Water and Solids and the Thickness of a Primary Film, W. B. Hardy; Structure des matières colloidales à l'état solide, M. J. Duclaux; The X-ray Analysis of Crystal Structure and its Bearing on Chemical Constitution, W. L. Bragg; Organic Crystals, W. H. Bragg; The Configuration of the Carbon Atom and the Geometrical Relations of this Configuration to those of other Atoms as evidenced in the Chemical and Crystallographic Structures of Organic Chemistry, W. Barlow; Recent Developments in the Theory of Catalytic Processes in Heterogeneous Reactions, E. K. Rideal; Catalysis at Solid Surfaces, E. F. Armstrong and T. P. Hilditch; Considérations sur l'autoxydation et les phénomènes catalytiques qui s'y rattachent, C. Moureu et C. Dufraisse; Catalysis and Oxidation, Henry E. Armstrong; General Views on Catalysis in Enzyme Reactions, H. v. Euler.

As to the outcome. The Conference was definitely an advance on the first. The subjects considered were more fundamental and of critical importance. It cannot be pretended, however, that the reports were adequately discussed. When published, probably at an early date, they will undoubtedly serve to stimulate a far more complete consideration of the issues raised. The discussions were not reported verbatim and will be known only in the form of brief summaries. Few of the reports were circulated in time and several were obviously insufficiently thought out. At the next Conference it should be made a condition that reports are all in the hands of those who are to participate in their discussion at least three, better six, months before the meeting. Instead of reproducing discussions, except in the briefest possible manner, to indicate who speaks and to what end, it may be better to allow each reporter to supplement his contribution and give a considered opinion, if not upon the proceedings as a whole, at least on the problems with which he is specially concerned. Remarks made almost casually at such meetings may be of profound significance.

M. Ernest Solvay undoubtedly did great service to science in endowing the foundation to which his name is now permanently attached. The organisation is destined to play an important part in the future development of physical science, by focussing attention, at suitable intervals, upon fundamental theoretical issues. There has been far too little serious discussion of this kind, and, as a consequence, chemistry, in particular, is encumbered with a mass of loose speculation by workers whose outlook is far too narrow for them to discuss with advantage the problems they affect to consider. We need to put an end to the present-day tendency, particularly obvious in chemical circles at the moment, to paraphrase in terms of new fashions, without in any way getting down to fact or making any real advance in treatment.

The great advantage of such international gatherings is that different mentalities are brought into contact and opportunity given to bring out the facts. The physical school to-day, unfortunately, has little regard for facts: its main office seems to be to distort them in the service of the fashion by which it is dominated. The most recently published text-books are witness of this tendency: a great volume of pseudo-mathematical sack is provided, but the bread of fact is scarce regarded, and there is not the faintest indication of the "proportionate judgment" being brought into play the use of which was so strongly insisted upon by Faraday—which he contended, moreover, should be the great outcome of devotion to scientific inquiry.

At the Conference, two main topics were under discussion—the nature of chemical change in its various forms, and molecular structure as revealed by X-ray and geometric analysis. No particular advance was made in dealing with the former, but the issues were presented probably more clearly and definitely than they have been hitherto: the view

of the French school was certainly broadened. The tendency is growing to recognise that the phenomena are of greater complexity than has been supposed, and even to hark back to Faraday's conceptions. It is an astounding fact and a great reproach to our science, that we are in no way agreed as to the precise mechanism underlying the simplest case of chemical change. We simply have no criteria. Unfortunately, we have wandered during forty years in the wilderness, wearing teutonic blinkers. At the root of our difficulty is the lack of philosophical outlook, due to narrowness of practical experience, insufficient knowledge of materials and processes, and undue specialisation. We need a Wagner to knit our scattered themes into rhythmic form: we need also to pay far more attention to fact.

The discussion of the structure of solids was probably the most important part of the proceedings. A great difference of opinion between chemist and physicist was apparent. The able account of the results of the X-ray analysis of crystals given by Prof. Bragg was much appreciated. It is clear that it is possible to determine the orientation of atomic centres in crystals, but it is in no way proved that the partitioning of the atoms among the molecules can be ascertained: Prof. Bragg was prepared to admit this. The volume occupied or influenced by the atom was also much discussed. Here again it was agreed that the X-ray method, at present, affords no direct information and that only the distance between atomic centres can be fixed. Precision was given to this latter problem by Mr. Barlow, who gave an account of the way in which he has modified the original Barlow-Pope valency-volume hypothesis, by using a cell of unit-valency and forming models of atoms of higher valency by associating such unit-cells in the appropriate numbers. Mr. Barlow has constructed close-packed models of a considerable number of benzene derivatives which are in direct near agreement with crystallographic data: several of these were exhibited. The writer was able to point out how closely the properties of carbon were reproduced in the model of the carbon atom—a pyramid of four unit-dodecahedral cells—used by Mr. Barlow in constructing his models. Finally, the existence of atoms in the crystal—in common salt, for example, —as independent units was brought under discussion. Mr. Barlow exhibited a model of the molecule of potassium chloride, composed of two similar 13-faced cells; such *molecular* units may be close-packed in any numbers to give crystal units having all the geometric properties shown by potassium chloride. The writer expressed the opinion that it was impossible, from the chemist's point of view, on present evidence, to believe for one moment that the molecule lost its individuality in the crystal. H. E. A.

Heavy-Oil Engines.

THE James Forrest Lecture for 1925 was delivered by Capt. H. Riall Sankey before the Institution of Civil Engineers on May 5, and dealt with some outstanding questions relating to large engines of the self-ignition type. The discussion was limited to engines working either on the two- or the four-stroke cycle, and compressing air to a temperature sufficient for the self-ignition of an injected fuel of not less than 0·82 specific gravity.

There are many difficulties in connexion with fuel-injection, and much research is still required before practical perfection is reached and the best method finally established. The two methods employed are air-injection and mechanical injection (also called solid injection). The former requires an air-compressor, and introduces oxygen with the oil, producing probably a small initial explosion together with an air-blast which causes turbulence and drives the oil into all parts of the combustion chamber. The expansion of the air cools the jet by some 100° F., which has to be allowed for by a higher initial pressure of the air in the cylinder. The air injector is able to impart greater energy to the atomised oil, to which is probably due the fact that a greater indicated mean effective pressure is possible with air than with mechanical injection, as has been found by Engineer-Commander Hawkes. The cooling effect of air-injection is especially noticeable at light loads, and may cause misfires and explosion troubles; mechanical injection is much freer from these troubles. It would appear that at present the economical results per I.H.P. are better with air-injection than with mechanical.

High temperatures and pressures occurring in heavy-oil-engine cylinders cause stresses which are difficult to meet. The parts principally affected are the cylinder head, the cylinder walls, and the piston. Cast steel is generally employed for the heads, since the same strength can be obtained with much thinner walls, and the temperature-stresses are thereby substantially reduced. In large cylinders with thick walls the temperature-stresses in the walls exceed the ring-stress due to the internal pressure. Various ways of strengthening the walls have been employed and were mentioned by the lecturer. Some idea of the relative ring- and temperature-stresses may be obtained from the following figures given by Mr. A. D. Bruce for a 40-in. cylinder:

Thickness of Cylinder Wall.	Tension in lb. per sq. inch due to	
	Ring Stress.	Temperature-Stress.
2 in.	5000	10,630
3·5 in.	2800	18,600

Temperature affects the design of pistons profoundly. Hopkinson has shown that a gas-engine piston 11·5 in. in diameter, without water or oil cooling, may have a temperature-stress of tension at the outside rim amounting to 7·5 tons per sq. inch. Hence, for larger diameters, cooling arrangements have to be adopted. Such arrangements—except in experimental engines—have not been successfully applied to pistons exceeding 33 in. in diameter.

A large mean effective pressure is desirable to reduce the weight of and the space occupied by the engine, and can be obtained by increasing the weight of oil injected per stroke if arrangements are made for reasonably perfect combustion. This requires an increase of oxygen packed into the compression space, and is known as supercharging. The method has been successfully worked to obtain higher powers with aeroplanes at high altitudes. It has been estimated that about 50 per cent. more indicated power may be obtained by supercharging, but a deduction of about 10 per cent. must be made for the power required, leaving a net gain of 40 per cent. It cannot be said that supercharging has advanced very far at present, except in two-stroke engines, but it may be expected to produce great improvements in the future.

Among other matters dealt with by Capt. Riall