introduced into, say, benzene derivatives, the velocity at which these compounds react is changed and these changes are nearly all due to changes in the activation energy. In other cases, however, superimposed on the changes in Q are variations in A , and frequently the two variations tend to compensate each other. The factor A shows marked variations due to changes of the solvent in which reaction occurs, and both A and Q have been found to vary with changes in the hydrostatic pressure. Changes in the velocity constants of a series of chemical reactions are often related to the changes in the equilibrium constants for the same or for a very similar series of reactions by $\log k = \alpha \log K + \text{const.}$ This gives an important approach to the understanding of the reactivity of organic compounds. Although a quantitative explanation cannot yet be given, it is just beginning to be possible to connect some of these relationships with changes in bond strengths, repulsion forces and chemical driving forces.

The last section of the discussion dealt with ionic and proton transfer reactions. The mechanism of both types of change has been considered in terms of 'extension' and repulsion forces. In the field of negative ion reaction, it has been possible to trace a relationship between the mechanism on one hand, and the chemical structure of the reactants and the physical conditions of reaction on the other. This study is of great value to the understanding of organic reactivity and the nature of the factors influencing it.

In the proton transfer reactions the small weight of the proton and the comparatively short distances between centres make a quantum mechanical 'tunnel effect' possible, but the experimental evidence available does not directly demonstrate the presence or absence of this effect. The comparison of reactions involving deuterons with those in which protons take part has led to valuable information about the mechanism of acid-base catalysis and proton transfer reactions in general.

Institution of Gas Engineers

AUTUMN RESEARCH MEETING

THE ninth Autumn Research Meeting of the Institution of Gas Engineers in London on November 2 and 3 had an interest above the average. The Institution research organizations have hitherto concerned themselves with current technical problems. This year the fortieth and forty-first reports of the Joint Research Committee of the Institution and the University of Leeds deal with problems of the future, and offer a glimpse of a cherished ideal of the gas industry, namely, the complete conversion of coal into a gas suitable for general distribution. Seventeen years ago, at a meeting of the Institution, gasification with oxygen and steam was visualized as an approach to this problem. Cost of oxygen and unsuitability of composition of the gas offered obstacles then unsurmountable. In the meantime, the oxygen production has been improved and cheapened. High-pressure technique has also shown the possibility of synthesizing hydrocarbons. In Germany, the Lurgi Company has built and operated a high-pressure producer whereby the town of Hirschfelde is supplied with gas made from lignite. In the forty-first report, on experiments made by Dr. F. J. Dent, it is disclosed that solid fuel can be freely hydrogenated to gaseous paraffin hydrocarbons at quite moderate pressures.

After carbonization at low temperatures, a coke contains carbon in a condition very ready to take up hydrogen under pressure, giving gaseous hydrocarbons instead of liquids, but without requiring the very high pressures necessary to 'liquefy' coal. Indeed results quoted show that hydrogenation of the coke combined with gasification of the residue would enable a coal to be converted into a rich gas without exceeding steam boiler pressure, and with an efficiency of 80 per cent. Such a gas, made and purified under pressure, would probably be practically sulphur-free and ready for distribution over considerable distances. Such results would apparently

be attainable with almost any type of coal, whereas high-class coking coal must be used in current practice.

The transference of these results to an industrial scale may take time, but there is no reason to doubt its feasibility as the engineering problems involved have already been solved. There is thus in prospect a method of fuel distribution which should be kept in mind at a time when the future of the coal, fuel and power industries is the subject of repeated inquiry and comment.

The fortieth report, prepared by Mr. J. W. Wood, on the combustion characteristics of town gas, contains a review of the literature on the combustion of gas which is probably the most comprehensive available. It presents an attempt to ascertain the characteristic of a gas most suitable for general use, and is appropriately associated with the forty-first report, which suggests that a process of complete gasification might be capable of adaptation to suit the composition of the gas produced.

A paper on the ignition of gas by 'cold catalyst' by L. W. Andrew, A. B. Densham and E. W. Voice suggests that the time is approaching when gas burners may be ignited by the use of a switch only. H. Hollings, W. K. Hutchinson and R. H. Griffith read papers on the removal of sulphur from gas, showing a way to sulphur-free gas made by current methods. Towns gas is the purest commercial fuel—so far as sulphur is concerned—but the removal of the residual traces of sulphur has eluded the ingenuity of gas chemists for generations. Now several alternatives have appeared, and catalytic oxidation of sulphur compounds at 150° holds promise of almost complete removal. When the products of combustion of coal gas are free from sulphur, considerable expansion in the uses of gas can be envisaged, and the reports at this meeting show that this time is now in sight.

H. J. HODSMAN.