Measurements have also been made on the thermal conductivity in the intermediate state, which may be considerably less than in either of the pure superconducting or normal states; the effect is observed in both longitudinal and transverse fields, and indicates additional scattering processes at the phase boundaries. In the course of the discussion it was mentioned that Laredo at Cambridge has obtained by experiments on impure tin powerful support for the view that lattice conductivity is dominant at the lowest temperatures.

Finally, Prof. G. O. Jones (Queen Mary College, London) described work carried out under his direction by Mr. P. F. Chester on superconductivity at high pressures. The transition temperature is affected by volume changes, and a study of the magnitude of the effect is of interest in connexion with fundamental theories, as those of Fröhlich and Bardeen. By means of Bridgman's crossed knife-edge technique, modified for use at helium temperatures, pressures up to 40,000 atmospheres may be applied to small specimens, the transition of which to superconductivity is observed magnetically. The transition temperature of tin is reduced to about 3° K. from 3.73° K. by the application of 17,000 atmospheres; and although the transition is not very sharp at the high pressure, it is sharp enough to demonstrate that over the majority of the specimen the pressure is nearly constant. So far as the experiments go, there is no evidence for any change in slope of the critical-field curve under pressure. In thallium, contrary to a report by Russian workers, at lower pressures the transition temperature is also reduced by pressure, but only by about one-tenth of the amount found in tin. Of considerable interest is bismuth, for a long time believed to be on the verge of being a superconductor. Hilsch found that bismuth films deposited at 4° K. were superconducting, and it now turns out that massive bismuth is superconducting at pressures greater than 20,000 atmospheres, the transition temperature, 7° K., being nearly constant up to 41,000 atmospheres. Removal of the pressure destroys superconductivity. Since there is a phase-transition in bismuth at room temperature to a more close-packed structure at about 25,000 atmospheres, it seems natural to suppose that it is this modification which becomes superconducting. Other metals being studied are calcium and strontium, which according to Fröhlich's criterion might be expected to become superconducting, but this is not observed up to 40,000 atmospheres.

A. B. PIPPARD

EMPIRICAL RESEARCH IN INDUSTRY

WIDELY varying methods of research for studying the behaviour of individuals and organizations in industry were discussed at an informal week-end gathering held in York during October 2-5 under the auspices of the Acton Society Trust and the York Civic Trust. With backgrounds in the disciplines of anthropology, psychology, sociology, industrial relations, industrial and public administration, operational research, and engineering, twenty-three persons from nineteen university and other research groups met with the common bond that all are actively concerned with research studies of industry.

Two full days of informal discussion were prefaced by a reception, held in the ancient St. Anthony's Hall which now forms part of the Borthwick Institute of Historical Research. The conference was welcomed to York by the chairman of the York Civic Trust, Dr. J. B. Morrell, the chairman of the Acton Society Trust, Prof. A. W. Harvey, and the Lord Mayor of York. On behalf of the visitors, Mr. R. G. Stansfield (Department of Scientific and Industrial Research) said that many research workers in different parts of Great Britain and working in very different ways, are studying what may be called "the natural history of industry"; often these workers are not well aware of the methods, problems and interests—and sometimes even of the existence—of other workers on related problems. The object of the meeting was to bring together some of these people, so that they could get to know each other and stimulate each other's ideas, with plenty of time for free and frank discussion. York, with its tradition of social pioneering, associated with such names as Seebohm Rowntree and William Temple, was a fitting place for such a conference; and especially in view of Rowntree's pioneer empirical studies of poverty in York, and his association with the early days of the Industrial Health Research Board.

On October 3, Mr. Tom Burns (Edinburgh University Social Science Research Centre) spoke of his research into factory organization. He stated that we are largely at the stage of crude ignorance of what management does; he himself had used the Carlson technique to record how managers spend their time. His findings suggest that in some organizations it would be wrong to talk in terms of vertical communication; the flow of communication is much more 'lateral' than top management usually thinks, and vertical communication is better thought of as 'controlled leaks' up and down from the lateral system. Mr. R. Denerley (Medical Research Council Industrial Psychology Research Group) mentioned six investigations by the Group now under way. The methods used are those of general observation, analysis of factory records, and interviewing techniques; he described some of the work done on investigating and validating various interview techniques. Discussion of these papers took up the second session.

In each subsequent session discussion was prefaced by a single, short paper. Mr. H. Clegg (Fellow of Nuffield College, Oxford) described his methods, as a student of industrial relations, in the study of large-scale organizations. Mr. J. R. Gass (Department of Scientific and Industrial Research), analysing broadly research problems and methods, pointed out that the three previous papers described the use of very different interviewing methods. Each method is appropriate in its own place; his criticism was that the users are unwilling to state the limitations of their method. If between the 'human relations' and 'industrial relations' schools a conflict—a false conflict—seems to be replacing mutual indifference, it is a sign of the impact of mutual relevance of the two approaches. At present, each can be criticized for what it ignores; much American sociology on the changing of habits ignores economic forces and the effect of large-scale organizations external to the factory; the industrial relations school, which studies these large-scale organizations, is interested in the conflicts of power, but tends to ignore the informal structure and personal forces. The link between the two approaches may be found in the

study of the conflict for internal power in large-scale organizations.

In a joint contribution, Dr. Alastair Heron and Dr. P. H. Venables (Medical Research Council Unit for Research in Occupational Adaptation) described an investigation of the relation between psychological handicap and occupational adjustment. In this study, the third of a series, relatively objective techniques have been used both in the assessment of psychological handicap and in the evaluation of job-satisfaction and value to the employer. A particular feature of this inquiry was the use of various techniques within the same interview, to indicate the degree of consistency of the data obtained. Mr. Gussmann spoke of the Acton Society Trust's interest in large-scale organizations; this comes under the headings of the internal administrative problems, problems of public control, and problems of the effect on the individual in the organization. From an anthropological background, he is studying five gas-works, of very different sizes, in one particular area, to find out the effects of size of the works. Preliminary results suggest that systematic differences in indices, such as absenteeism, may be due not directly to sheer size but to 'black spots' being harder to control in a larger organization; or to apparently identical jobs in two organizations being inherently different because one organization is big and the other small.

Mr. R. N. Spann (Department of Government and Administration, University of Manchester) discussed the place of the case-study in research and teaching. Case-studies, he pointed out, are so various that the term is of little meaning; they differ enormously in detail of reporting, and whether the description is purely that of a contemporary observer or includes extensive interpretation. By contrast with the abundance of material about how politicians behave, there is a great lack of material about business administration. The most valuable narratives are by people who do not rationalize too much; some accounts of organizations, blinkered by adherence to 'principles of organization', become less and less revealing.

At the final session, Mr. R. G. Stansfield, who acted as chairman during the discussion sessions, summed up the conference. The people for such a conference could not have been found even five years ago; and another sign of the growth and integration of the social sciences in the study of what goes on in industry was the standard of the discussion and constructiveness of the criticism. Thanks were due to Dr. T. E. Chester, of the Acton Society Trust, and his staff for organizing the conference.

In retrospect, the conference seems to have met a real need in bringing together people who did not know of each other's work or—in some cases—each other's existence. It was suggested that social scientists spend much less time than do physical scientists in correspondence between research workers for the exchange of news and views; and those present expressed the future intention of mending their ways. Another live subject linked the scientific method and the problem of recording the results of research. It appeared to emerge that much of the controversy among social scientists about the scientific method (usually in terms of the believed practices of the physical sciences) is misconceived in terms of quantitative and other techniques; the real distinction is between scholars' attitudes of mind, scientific, philosophical, historical and so on. It was

suggested that the essential element in the scientific attitude is a distinctive sense of responsibility; including responsibility for seeking out all the relevant data, and for striving to take into consideration all possible alternative interpretations and theories. Especially, the researcher is responsible, in reporting his work, for ensuring that all necessary key details of situation, methods and observations are put on record to enable future workers to compare their results with his and to evaluate his conclusions. In this connexion it was recognized that in accepting this responsibility, the research worker must depend on an equally responsible attitude in the editors of scientific journals.

The interview is the research tool which, in one form or another, is used in all the researches which were described; but while some users appear to take this tool more or less for granted, others are intensely concerned with its techniques and conditions, and it would seem that a whole conference might usefully be devoted to considering knowledge about the interview and its use in the different disciplines of study. Last, but not least, was the sense which kept breaking into the discussion, that the studies which were described, of worker or management behaviour, or of industrial relations, were but stages towards the goal of study of the firm, of the organization, as a going entity; but this study remains for the future to grasp.

R. G. STANSFIELD

TEACHING OF MECHANICS IN BRITISH UNIVERSITIES

DURING September a series of informal discussions was held at the Department of Engineering of the University of Cambridge, under the auspices of Prof. J. F. Baker, to consider "the teaching of mechanics, vibrations and control". Representatives were invited from the departments of mechanical engineering of all universities and colleges of university standing in the United Kingdom; in very many cases the head of the department himself elected to attend, so that the fifty or so members of the symposium, as it was called, included a remarkably wide range of engineering teaching experience at this level. A few visitors from large industrial concerns were also invited, to represent the user's point of view.

The nine discussion-periods of an hour and a half each extended from "How much mechanics ought every engineer to know?", through the scope of courses at various levels, to the consideration of teaching techniques, laboratory work and the approach abroad. Each discussion was introduced by a speaker who suggested, as provocatively as he might wish, particular points on which he believed an exchange of views might be valuable. Prof. W. J. Duncan, for example, in opening the discussion of advanced teaching techniques, put in a plea for wider use of the concept of mechanical admittance; and Prof. W. A. Tuplin, of the postgraduate school of applied mechanics in the University of Sheffield, in introducing the subject of advanced and postgraduate courses, wittily described some experiences at this school.

A meeting such as this, which would be a mere commonplace in the United States, is something of an innovation in Britain, and it was most encouraging