infected roots can be ascribed in great measure to the increase of size of the cells in a radial plane, and there is, on the whole, a reduction in longitudinal elongation which more than compensates for this increase, so that cell volumes are reduced. Correlated with such changes, xylem development and endodermal thickening occur nearer the apex of mycorrhizas. He is of the opinion that the area of surface of individual mycorrhiza rootlets is less than that of uninfected rootlets. He emphasized the point that this observation does not necessarily imply a reduction in the area of surface of the whole root system. Dr. Clowes referred to the recent work of Slankis on pine roots in culture, but pointed out that colchicine tumours are as similar to mycorrhizal structures as are the growths produced by heteroauxin. A degree of caution is therefore required, for several equally attractive hypotheses could be formulated to guide future work on causal anatomy of mycorrhizal roots.

Dr. Ida Levisohn described several examples of pseudomycorrhizas found on pine and spruce roots. She uses the term 'pseudomycorrhiza' for structures superficially similar in general form to mycorrhizas but lacking sheath or Hartig net, or showing obvious evidence of parasitism. She outlined the diagnostic features of three important types, illustrating her account with photomicrographs and other slides. The ecological distribution and importance of each was particularly emphasized, and she concluded by asking for any available information upon the haustorial type of pseudomycorrhiza which is particularly prevalent in arable soil and worn-out nurseries.

Dr. John Ramsbottom opened the general discussion. He remarked that the variability of mycorrhizas in form and occurrence indicates that no single explanation of their effects upon their various hosts is likely to be found. Each particular example requires detailed study on its own. He showed slides of orchid mycorrhizas and demonstrated a specimen of the interesting saprophytic liverwort *Cryptothallus*. He believes that the Basidiomycetes associated with ectotrophic mycorrhizas possess a habitat in the soil apart from the root surface.

The discussion which followed was characterized by its friendly but very controversial spirit, and it centred particularly upon the ecology of root infection and of mycorrhizal and root-infecting fungi.

J. L. HARLEY

VELOCITY OF SECOND SOUND IN LIQUID HELIUM II

IN a letter to the *Physical Review*[1] (September 15 issue), Dr. J. R. Pellam and R. B. Scott, of the United States Bureau of Standards, give the results of their experimental observations on the qualitative behaviour of the velocity of second sound in paramagnetically cooled liquid helium II in the temperature range below 1° K. The helium was cooled by the demagnetization method using hydrated iron-ammonium-alum crystals immersed in the liquid. The remainder of the bath contained the apparatus for the generation and detection of the second sound by the pulse method, and the velocity of the second sound was determined from oscillographic observations of the transit time. Accurate determinations of the temperatures of the liquid helium corresponding to the velocity values obtained could not be made, but it was established that the second sound velocity increases markedly with decrease of temperature below 1° K. reaching nearly twice its value for 1° K. at the lowest temperature attained. As the helium bath warmed up, the velocity minimum of 18·4 m./sec., observed originally by Peshkov[2], just above 1° K., was verified.

Tisza formed a theory of helium II in 1938 which was based on F. London's interpretation of the λ-point transition of helium as an Einstein–Bose condensation, and which predicted that the velocity of second sound should decrease with decrease of temperature below 1·5° K. (Both Tisza and London have discussed this theory recently in *Nature*[3,4].) On the other hand, Landau, who denied the relevance of Einstein–Bose statistics, predicted a strong increase in the velocity below 1° K. It would appear, therefore, that Pellam and Scott's results are direct evidence in favour of Landau's assumptions, though, as is pointed out in the letter, this does not necessarily weaken the original Einstein–Bose hypothesis but only the interpretations that have been given to it. In fact, the recent experiments of D. Osborne and co-workers[5], which show non-superfluidity in helium-3, are exceedingly strong evidence in support of the condensation theory.

In the October 1 issue of the *Physical Review*, R. D. Maurer and M. A. Herlin[6] describe experiments, similar to those of Pellam and Scott, in which they have measured the second sound velocity down to 0·86° K. They also verify the rise in velocity below 1·1° K. observed by Peshkov, but their values for the velocity below 1·2° K. are slightly higher than Peshkov's most recent evaluations. Qualitative indication that the thermomechanical effect in helium II remains strong down to the lowest temperature reached was obtained. They conclude that it is likely that a more refined form of the two-fluid model should contain elements of both the Tisza and Landau theories.

[1] *Phys. Rev.*, **76**, 869 (1949).
[2] *J. Exp. Theor. Phys., U.S.S.R.*, **18**, 951 (1948).
[3] *Nature*, **163**, 102 (1949).
[4] *Nature*, **163**, 694 (1949).
[5] *Phys. Rev.*, **75**, 988 (1949).
[6] *Phys. Rev.*, **76**, 948 (1949).

TRAINING OF TRADES UNION OFFICIALS

AT one of the sectional meetings of the conference of the British Institute of Management which was held at Cliftonville in May 1948, Mr. E. P. Harries, secretary of the Organisation Department of the Trades Union Congress, introduced a discussion on whether special facilities are required for the training of trades union officials in the principles and practices of management.

Mr. Harries stated that most trades union officials who had given any thought to the subject would unhesitatingly reply that such training is necessary. The General Council of the Trades Union Congress has already deliberately undertaken the task of re-orientating the attitude of mind of trade unionists to the problem of production and, since time is short, believes that the process could be considerably speeded up if trades union officials are given some insight into the nature of management.

For many years the trades unions have been spending large sums of money on cultural and economic education; but it is only since the end of the War that the majority of unions have devoted time and money to the education and training of their members for purely industrial techniques like methods of work measurement and job evaluation. Since the unions believe that no uneducated man can benefit from specialized technical education, cultural education will continue but will be increasingly accompanied by more specialized education bound up with the problems of industry to-day. Through the activities of the Workers' Educational Association, the National Council of Labour Colleges and Ruskin College, Oxford, a great deal is already being done in subjects bearing on the structure of industry, economic and industrial policy, human relations in industry and the functions of management.

Recently the Trades Union Congress General Council has directed the attention of affiliated organisations to the importance of ensuring that adequate training is given to workshop representatives and particularly those who are called upon to deal with matters affecting production. A new development in the training of trades union officials is now coming from individual unions. The Electrical Trades Union, for example, is shortly to establish a national residential college for the training of its branch officers and shop stewards.

The trades unions have also co-operated with the universities and technical colleges in developing courses intended particularly for trades union officials. Some of these courses have already begun to introduce workpeople to the study of the problems of management and organisation in industry. Thus, Birmingham Central Technical College offers, from time to time, a special twelve weeks course for workers' representatives on works advisory councils and joint production committees, its object being to survey those aspects of industrial organisation with which workers' representatives are directly concerned in their discussions and negotiations with management. The subjects of the lectures are: the responsibility of the workers' representatives in the changing economic situation; the growth and structure of modern industry; organisation of a manufacturing company; organisation of the workshop; the work of a personnel department; importance of the Factories Acts; planning and control of factory work; the methods of work measurement; the purpose of job evaluation; the need for measurement and control of factory costs and the job of management. After the first course, a second-stage course lasting thirty weeks has been begun involving part-time day attendance for about six hours weekly at more advanced lectures in these subjects.

The Manchester College of Technology has also provided a course of lecture-discussions on industrial administration for workers' representatives on works advisory councils and joint consultative committees, designed particularly for workers in the engineering industry. It is the policy of the Trades Union Congress to stimulate these demands in order that more courses in management should be provided, and among recent developments are the proposals put forward by the cotton textile unions and by the National Union of General and Municipal Workers. The cotton textile unions have come to an arrangement with the Shirley Institute for the training of officers, both full-time and part-time, at Shirley in re-deployment, works measurement and related subjects. The executive committee of the National Union of General and Municipal Workers has recently decided that ten of its officials and ten shop stewards should be trained in the technique of time- and motion-study. Mr. Harries went on to say that these developments mean that trades unions will have at their disposal officers who can, if necessary, follow any system put into operation by a firm in which they have members and about which disputes have arisen. This will give confidence to the members of the trades unions that they are not being imposed upon by a malevolent management which conceals its true objects beneath a cloud of jargon and pseudo-scientific terms.

In the United States four of the largest trades unions have production efficiency departments, and, on behalf of the unions, these employ industrial consultants who can talk to management representatives on equal terms about particular problems in the industry. If a firm is not able to pay trades union rates and observe trades union conditions, the alternative is presented to the firm of either allowing the union's efficiency experts to go in and put the place on a proper production basis or the union will withdraw its labour. It is unlikely that a similar development will take place in Great Britain, although the unions should be prepared to encourage reputable industrial consultants to act on their behalf where difficulties arise. It is hoped that the managements concerned would offer no objection to this course.

Finally, Mr. Harries declared that one of the best ways in which the trades union movement could be trained in managerial subjects would come when the British Institute of Management pursues its policy of developing local management associations. These local associations should provide a forum at which local development and management difficulties could be discussed, at which men engaged at all levels of industry who take sufficient interest could attend and learn something of the other fellow's point of view, and would, in general, form a meeting-ground at which not only could knowledge be disseminated but also the atmosphere of industry greatly improved. These local management associations should improve the industrial atmosphere in a particular area, and they could win the goodwill and support of district trades union officers to support the courses of local technical colleges, the organisation of week-end schools to discuss managerial problems and generally imbue the rank and file of the trades union movement with a sense of responsibility towards the national economy.

Much vigorous discussion followed Mr. Harries's paper and contributions were given by delegates from firms representing all sides of industry throughout Britain. It was agreed that the idea of educating trades unionists in management so that they could better understand and discuss management problems, and the idea that trades unionists should actually take part in management, should be clearly distinguished. It was desirable to begin the education of workers in management subjects at an early age, and one delegate believed that such training could begin with apprentices. The meeting concluded with unanimous agreement that the education of trades union officials in the principles of management should be encouraged and that the British Institute of Management should, by all the means at its disposal, stimulate the demand for education and any necessary expansion of existing facilities for its provision.

T. H. HAWKINS