PROGRAMME AND TIME TABLE

MONDAY, 10th OCTOBER.

2.15 p.m. Assembly of delegates.

2.30 p.m. Official Opening (Dr. F.W.G. White)

Summary of Major Activities during the past year by Division of Forest Products and the State Services.

Recording the Conference.

1. Building Boards.
   - A. Market Surveys.
   - B. Experimental Work of the Division of Forest Products.
   - C. General.
2. Nomenclature.
   - A. Nomenclature of Australian Timbers.
   - B. Phytochemical Register.

TUESDAY, 11th OCTOBER.

9.30 a.m.

3. Railway Sleepers.
   - A. Australian Standards.
   - B. High Pressure Preservation Treatment and Field Tests.
   - C. Mechanical Failure Investigations.
4. Marine Borer Investigations.
5. Durability Tests.
6. Laboratory Tests of Preservatives.
7. Pole Bulletin.
8. Standard Nomenclature for Timbers Imported into Australia.
9. Tasmanian Pole Tests.
10. Cross Arm Survey
11. Taxonomy of Fungi.

2.15 p.m.

12. Lyctus Conference.
    - A. Re-examination of toxicity of boric acid and borax.
    - B. Use of sodium fluoride as a Lycticide.
    - C. Australian standard specifications for boric acid treatment.
      - a. General
      - b. Review of standard minimum requirements as regards depth of penetration.

2.15 p.m. Lyctus Conference (cond.)

D. Susceptibility gradings for new commercial timbers
E. Review of S.A.A. specification with respect to inclusion of sapwood in Lyctus susceptible species.
F. Report on Lyctus legislation (Queensland)
G. Laboratory Breeding and Testing Techniques Committee.
    a. General Report.
    b. Report on Nutritional Studies.
H. Anobium.
    a. Susceptibility of Radiata pine
    b. Susceptibility of Baltic pine
    c. Attack in finished Scandinavian pre-fabricated houses.

7.30 p.m. J. Spraying of Buildings.
    a. Alternative clause in War Service Homes Specification.
K. Lyctus Publications.
    a. Trade Circular
    b. Treatment Manual.
L. Uniform Building Regulations and Building Research.
M. Treatment for Moulds and Sapstain.
N. Superficial Preservative Treatment of Lyctus Susceptible Timbers.

WEDNESDAY, 12th OCTOBER.

9.30 a.m. O. Glue-line tests.
P. Methods of Analysis for Boric Acid.
    a. Standard Procedure for Sample Selection.
    b. Analytical Methods.
Q. Toxicity testing of Wolman Salts to Lyctus.
R. Change of Name.

13. Battery Separators.

14. Standard Terms and Definitions in Forest Products Research.

15. Reports on Overseas Conferences.

1.30 p.m. EXCURSION.

THURSDAY, 13th OCTOBER

9.30 a.m. 16. Equilibrium Moisture Content.
    a. Report of the Committee.

17. Vapour Drying.

18. The Pre-drier.

19. The Composite Wood Corresponding Committee Report.

20. Growth Studies.

21. Sapwood-Heartwood.

2.15 p.m. 22. Plywood from Ash Eucalypts.
- a. Veneer Production.
- b. Drying of Veneer.

23. Utilization of Radiata Pine Veneer

24. Tannin-Formaldehyde Adhesives.

25. Bark of Radiata Pine.

26. The Suitability of Australian Timbers for the Manufacture of Spirituous Liquor Casks.

27. Synthetic Resin Adhesives and Waterproof .

28. Lactic and Acid Casein Glues. Substitutes and Extenders.
- a. Acid Casein
- b. Peanut Meal
- c. Blood.

29. Basic Aspects of Adhesion.

30. The Effect of Boric Acid and Borax Treatment on Bonding with Phenolic Resins.

FRIDAY, 14th OCTOBER.

9.30 a.m. 31. Mill Studies - Sawmill Engineering.

32. Tanning Materials.

33. Minor Forest Products from Queensland Rain Forest Trees.

34. Standardization of Test for yield of essential oils.

35. General Items.
- A. Library of Educational Films.
- B. The C.S.I.R.O. Act.
- C. Education in Wood Technology.
- D. Co-operation with Building Research Liaison Service, Department of Works and Housing.
  - a. General.
  - b. Flooring Tests.
- E. Sylviculture and Properties.
- F. Utilization of Hardwood Thinnings.
- G. Utilization of Sawdust.
- H. Publications.

35. General Items (Contd.)

J. Timber Bank For Research Purposes.
K. Collection of Material.

36. Paints and Lacquers.

37. Assumption of Applied Work by State Forest Services.

38. Standards.

a. General.
b. Grading Instruction.
c. Inclusion of Sapwood in Non-Lyctus Susceptible Species.

39. Standardization of Sizes of Case Shooks.

OFFICIAL OPENING OF THE CONFERENCE

by

DR. F.W.G. WHITE, CHIEF EXECUTIVE OFFICER, C.S.I.R.O.

Dr. White was introduced by the Chairman, Mr. S.A. Clarke, Chief of Division of Forest Products.

DR. F.W.G. White: Mr. Chairman and Gentlemen: The first thing I have to do is to apologise for Dr. Clunies Ross, our Chairman, who was invited by your Secretary to open the Conference. Dr. Clunies Ross has been unable to come today, so the duty has fallen upon me. He has sent his apologies for being absent.

It gives me great pleasure indeed to open this Conference, and in doing so I welcome, first of all, the representatives of the State Forest Services. I understand from Mr. Clarke that all the States are represented here at the Conference, with the exception of Western Australia, and unfortunately South Australia has had to withdraw at the last moment owing to the illness of one of the senior officers of the Woods and Forests Department.

In addition to officers from the Forest Services of the Australian States, we have a representative from New Guinea and from the Commonwealth Forestry and Timber Bureau. The Conference also includes officers from the Defence Research Laboratories, the Divisions of Industrial Chemistry and Entomology and the Head of the Building Research Liaison Service of the Department of Works and Housing (Mr. Banks).

I can assure you on behalf of the Executive of C.S.I.R.O. that we do indeed welcome this opportunity to discuss our research programme and matters of mutual interest with you.

Another feature of this Conference, in which it differs from previous Conferences, is that we have with us today Mr. Banks from the Department of Works and Housing. Since Mr. Banks's organization has come into being recently I thought I would like to tell you what he is doing and how he fits into the picture. His Service is something of an innovation. You may have read some time ago of the visit of Sir Reginald Stradling to Australia. Sir Reginald was at one time Director of the Building Research Station and is now Chief Scientific Officer of the Ministry of Works in England. During his visit we had lengthy conversations with him on the whole problem of building research generally and particularly in relation to the very difficult problem of bringing the results of research to the notice of those in industry who should be interested in them. As a result of these conversations it was decided to set up a Building Research Lisison Service under the auspices of the Department of Works and Housing. Mr. Banks was appointed to take charge of this Service: he is faced with a very difficult task, as it is his duty, not only to keep in touch with all those engaged in research, but to keep contact also with all those bodies which are interested in it. I have no doubt that his presence at this Conference will help him very considerably.

Mr. Clarke has suggested that I might tell you of the metamorphosis that has overtaken C.S.I.R. Besides the initials "C.S.I.R." an "O" has now been added. All I can do today is to tell you of the changes that have taken place. When these changes were in the process of occurring many of us had very grave fears that the nature of the organization might be so drastically changed as to make the conduct of scientific work difficult. All of us, I think, held very strong views about the way in which the body we are working for should be arranged, governed and run if good scientific work was to be done. Personally I feel that most of the fears we have had have proved to be unfounded· but if you will bear with me for a moment or two I would like to mention the main changes that have occurred.

The change in the initials seems insignificant, but, in the full title, we now go under the name of the Commonwealth Scientific and Industrial Research Organization instead of the Council for Scientific and Industrial Research. The name had to be changed, of course, because of an obvious change in the Act under which we now work as compared with the previous Act. Under the old Act the Council, a body of 25 men, was the governing body of the organization. The Council was a body corporate and had all the authority under the Act of Parliament. It is, as you know, difficult to get a large body of this sort together very often, and for such a body to take over effectively the day-to-day responsibility of government and administration. Under the old Act the main responsibility fell on the Executive Committee, and you will remember that Sir David Rivett was Chairman and Dr. Richardson the Chief Executive Officer of that Committee.

In our new Act the need for a similar group to take the full day-to-day responsibility of the administration has been recognized, while, at the same time, the need for a larger advisory body has been met. The responsibility for the management of the Organization as a whole now rests fairly and squarely on the shoulders of an Executive of five people, who will be advised from time to time by an Advisory Council, this Council being composed of men selected in exactly the same way as the previous Council. It will be the function of the Advisory Council to help and advise the Executive on any matter which it may think fit, or which the Executive may refer to it. That is, I think, the main change in the structure of the body itself.

One interesting feature, from the point of view of some of you perhaps, is that this new Act still provides in the same way as before for State Committees. When the C.S.I.R. was first founded provision was made for the setting up in each State of a Committee of men who would be intimately associated with C.S.I.R., but who would also be familiar with the problems and scientific difficulties in the various States. It was hoped to establish the principle that the Executive Committee and the Council would be able to obtain, by these means, advice as to the work to be done and the problems to be faced in each State. This way of doing things does not seem to work as well today as it perhaps did years ago. This may be the inevitable result of the much wider extent of our activities which probably increases the difficulty of informed discussion in a Committee of limited membership.

However, the State Committees do still exist, and if any of you can suggest a way of making effective use of them, either to bring pressure to bear on us or to relieve pressure on us in some way in connection with the problems that arise in your State, we would be pleased to know of it.

The present Executive hopes that the changes which I have described so briefly will not cause any serious difference, either in the way we ourselves work internally or in the relations which have been built up by C.S.I.R. with other bodies that have related interests. I would like to state quite specifically today that we hope that our relationship with the various State organizations will not be changed. Sir David Rivett has often told the story of how he and his colleagues of the Executive Committee arrived at a mutually satisfactory understanding with the State Departments as to the activities which should be undertaken by the new Commonwealth research organization. In those days, of course, the main problems to be considered by C.S.I.R. were those of agricultural research.

The Executive Committee very wisely asked the State Departments of Agriculture for advice as to the problems in agriculture which should be undertaken by the Commonwealth· the principle was then agreed to that the new Commonwealth body would devote its attention to the basic long range problems of interest over large areas of this continent. We are following much the same principle today, as is amply obvious from this Conference. This is the principle to which we wish to adhere in the future.

I do not think I need say more. I repeat my welcome to the delegates to this Conference. I know that you will have an energetic discussion for the next few days. I hope it will be amicable and I hope it will be successful.

<u>Mr. Clarke</u>: Before we start on the general programme itself, it might be an advantage if we were just to cover briefly any major developments which have occurred in the various States. We will then have a better idea of our combined programme of work.

So far as this Division is concerned, we have erected a vapour-drying plant and a small untrasonic generator. We have nearly completed a piece of equipment for basic studies in the sawing of wood.

Our wall-board work is progressing. We have overcome the initial difficulties of breaking down waste wood into suitable pulp in our laboratory equipment and sample boards will be shown later this afternoon.

With regard to sleepers, there have been two important developments. The design of our high pressure cylinder is now complete and we have been able to obtain a favourable quote for six months delivery. Investigations into mechanical failure of sleepers have been commenced. We have carried out some surveys on cross arm failure and more are in hand. They disclose a field of work in which considerable savings can be made.

I would now like the State delegates to speak of any developments in their own areas.

Mr. Payne: Although Tasmania has not got an independent section dealing with forest products research, that is possibly an advantage because of the advice given by the Division of Forest Products. The Forestry Commission in Tasmania has been grateful for the assistance given to the State in fieldsof work which would not otherwise be covered, and I call to mind a recent case concerning an investigation of a coal mine in Tasmania where there have been serious difficulties caused by the rotting of the timber heads and legs. The life of these timbers is measured, not in years as it should be, but in months. This propensity to perish of course means a lot of breaking down, and we were very glad to hear, just before I came over to Melbourne, that the Division of Forest Products will investigate the possibilities of finding preservatives for these timbers with the idea of adding considerably to their life. It will help not only in the operation of the mines, but in reducing the risk so far as safety of workers is concerned.

Mr. Benallack: First of all I must say that, to a certain extent, I have lost the threads of the work which has been carried on in Victoria since the last Conference. For the last two years I have been away on a rather onerous job, and have only recently returned "home". In Victoria the Commission has been roading large areas of woollybutt timber. One of these is at Licola and the other in the Delatite-King valleys, and there is no doubt that a good deal of this timber will be utilised in the near future.

One of the problems with which we are confronted in these areas is the peeling of woollybutt, and we will require a lot of information on this subject. Actually two plants are being established with that object in view· one is at Mansfield, and the other at Myrtleford. Both propose to peel woollybutt from the Delatite area. Incidentally, the Myrtleford plant proposes to peel Pinus radiata also.

Peeling woolybutt is therefore an important problem which confronts us in Victoria, and I think we will be looking to the Division of Forest Products for quite a lot of assistance.

Mr. Huddleston: Since our last Conference there have been a number of developments in New South Wales of a scientific nature and one thing which I shall call political. We have had an expansion of boric acid treatment which is still developing. We have reached a definite basis of treatment which is proving satisfactory and it is not expected to bring about improvement until such time as new methods of treatment are developed as a result of basic research. That basic research we are leaving entirely to you.

Possibly the major development during the year has been the preservation plant which we have taken over at Putney. This plant is approximately 6 feet in diameter, 30 feet in length, with a working pressure of 100 lb./sq.in. It has taken a considerable time to get it into operation, but we have since found quite a number of problems for it. One is the preservation of timber for mining in our northern field in New South Wales. The cost in connection with mining timber runs into many thousands of pounds. They get about two years life out of the timber, which is regarded as a good life. There are many parts of the mine in which timber is being held up by the mines rather than holding up the mines themselves. It is only recently that the true state of affairs has come to the notice of mine managements and something must be done about it.

We have opened up another large field in New South Wales in connection with transmission poles. Supplies of ironbark and grey gum for this purpose have been largely cut out, and operations are being held up throughout the State because they cannot get poles. The attention of the Department has been drawn to blackbutt, spotted gum etc. which are of suitable pole form but lack durability. It is thought that treatment of the natural round boles with suitable preservatives may solve the supply position and there is a possibility that one of our public departments will be installing a plant for this purpose. There has been interest shown from New Zealand, and in order to test the market we have agreed to treat 5000 30 ft. poles with a view to exporting these poles to New Zealand. This has solved the major problem in that labour cannot be found in the bush to desap durable timbers for satisfactory poles.

As the result of discussions a few years ago, we took over the box testing equipment of the Division of Forest Products and have been carrying out a limited amount of work with it. Shortly after the equipment was installed, the man trained to operate it left us and we have had some reluctance on the part of our case makers to make use of the equipment. At the present time, baltic shooks are coming in and boxmakers and users have suddenly shown a keen desire to examine the make-up of their cases in comparison with the imported shooks. There is a conference arranged for next Tuesday week in Sydney, and it appears that after that conference we are to have a very busy time testing boxes of local timbers to comparison with the imported shooks. We have also been engaged on an investigation of the field lug box for the Murrimbidgee Irrigation Area, requirements for which run into 20,000 boxes per year at 10/- per box for replacement purposes. We have had some little success, but are still not satisfied. The investigation is proceeding.

With respect to wall boards, all we have been doing is following the work you are carrying out here.

Now I refer to one other matter which I termed political. Through some argument between the Prime Minister and the Premier it is claimed that the States - at any rate New South Wales - are not getting sufficient money from the Commonwealth to carry on activities. We are therefore faced with a reduction in our estimates, although we have been further instructed that employees are not to be dismissed. The position is that the Forestry Commission had to cut its estimates by £105,000 and we still have to carry the same number of employees. I am afraid that in the coming year, work in the nature of research will suffer by reason of that reduction. We will still be able to carry on our applied work as in the past, but we are going to be more and more dependent on the Division of Forest Products for the basic research on which we depend for our applied work.

We are particularly interested in the high pressure treatment which you are undertaking because our natural durable supplies are cutting out and we are going to be forced to use our second grades for many important requirements.

Mr. McAdam: In New Guinea we are a very small department at the present time, and we are finding it very difficult to obtain staff. Unlike other States we have had to rely for applied utilization work as well as fundamental research, on C.S.I.R.O. which is in a particularly good position to support us so far as our enquiries are concerned.

We do not know the full extent of New Guinea resources yet but, especially during the war, we were able to make vast collections of botanical material, the whole of which was handled by the Section of Wood Structure of the Division of Forest Products. The staff of that Section became very proficient with our species and are the experts on New Guinea timbers. They will remain so for many years to come.

Since the end of the war we are continuing to collect but on a reduced scale. The tempo will now increase and we will be sending down more and more of our timbers for identification. As the result of work by the Division we now have for the territory an excellent card sorting key. We started off during the past year collecting bulk samples which will shortly show up in Australia. One very practical help we have had from this Division has been the design of a sawmill. Officers of the Utilization Section spent much time with Mr. Cavanagh designing a new sawmill, and we are now practically ready to go ahead with it. The officer most concerned has been away on leave, otherwise building would now be commenced. In New Guinea we are fairly well endowed with trees but not sawmills.

We are keenly interested in the Division's new work on sawmilling. New Guinea is short of durable timbers, and throughout the four conferences which I have been fortunate enough to attend, I have been following the developments of preservation work at this Division, and am particularly interested in high pressure work. It is almost certain that we are going to require supplies of heavy building and durable timbers. Preservation is going to be of extreme importance to the Territory. Being a small and impecunious Territory dependent entirely on the Commonwealth, we are looking to the Division of Forest Products to do the basic research work up to the stage where we can "sell" the ideas to the sawmillers. I understand that at the Empire Forestry Conference it was recommended that colonial services which could not afford to have scientific research institutions on forest products problems of their own should appoint utilization officers to co-operate with those who can afford to run their own scientific research divisions. The only thing stopping us at the present time from advertising for such an officer in the

Territory is a new classification for which we are waiting. We are hoping that then we will be able to advertise for a utilization officer and a forestry officer. At that stage I am expecting that our demands on the Division of Forest Products will become more intense.

Mr. Ellis: One of the most satisfactory developments in Queensland has been our acquiring a property of approximately 5 acres at Rocklea for the site of our future Forest Products Research and Fancywoods Yard. It will be a year or two before the transfer from our present ½ acre site is effected but when the transfer is completed we shall have ample space for carrying out those functions for which we have been constituted.

Probably our most pressing problem is that of developing the optimum utilisation of miscellaneous timbers, our softwood plantation thinnings and thinnings from our hardwood areas now under silvicultural management. This development is essential to make up for the steadily decreasing cut of virgin hoop pine which is now around the 70,000,000 s.ft./per annum mark and which over the next 6 years will fall to a figure of probably less than 30,000,000 s.ft./per annum. In this work on the utilisation of thinnings we shall depend very largely on the results of the fundamental research work being carried out by the Division of Forest Products.

The Division's work on sapwood-truewood relationships is of considerable importance to Queensland, particularly in the formation of brittle heart, a proper understanding of which will have a direct and important bearing on our silvicultural and management plans of these areas. As an instance of this point, if it is established that the truewood of eucalypts begins to deteriorate into "brash heart" when the tree is 12" in diameter - more or less - then our whole management programme may need to be revised to provide that 12" diameter will be the maximum to which these trees will be permitted to grow. If, on the other hand, "brash heart" does not develop until the tree is 20" in diameter, then the cutting limit would be extended to 20". We have many millions of super feet of trees already 12" and thereabouts in diameter and we are waiting now for answers to these problems of timber quality as related to growth.

The year under review has been of special interest by virtue of the introduction of the Timber Users Protection Bill - a Bill along the lines of the Timber Marketing Act of N.S.W. This Bill might have been introduced earlier but we felt that we did not previously have sufficient information as to treatment schedules for Queensland timbers. I should like to pay a tribute to the Division of Wood Technology for the great work done in N.S.W. in pioneering their Act and also to the Division of Forest Products without whose initial work on Lyctus, the present stage would not have been attainable for many years to come. Nevertheless, it is felt that the present cost of treatment (10/- to 14/- per 100 s.ft.) should be capable of substantial reduction and our combined efforts should be strenuously directed to this end.

The past twelve months have been disappointing in the matter of Timber Grading Rules. This is a subject of great importance to all Forestry Departments, sawmillers, merchants, builders and timber users generally. Admittedly the project is a major one, but its importance demands urgent attention. The lack of progress I feel, is attributable mainly to the Division of Forest Products not proceeding with necessary surveys such as were carried out in West Australia as a necessary prelude to the formulation of those now very excellent grading rules for jarrah and karri. I understand that the Division claims that its finances do not permit the undertaking of such a project at the present time, but I would suggest that the Division, with its staff of specialists in all fields of Forest Products - and in this case - particularly in the field of timber utilisation, is the appropriate authority to undertake this work. I feel therefore that this Conference might well exhort the Executive of C.S.I.R.O. to make it possible by providing necessary funds for the Division of Forest Products to discharge its urgent responsibilities to the people of the several Australian States.

RECORDING THE CONFERENCE

Dr. Dadswell Last year the proceedings were rather bulky in spite of editing, because the record was given in full. This year we propose to abridge the discussions in order to reduce the size of the Proceedings.

Mr. Ellis: It has occurred to me that it should be possible to issue a statement of the resolutions passed at the Conference within the following fortnight. If that could be done the issue of the full Proceedings would not be necessary for some time. In the last three months since I received the Proceedings of the last Conference, I have found the record quite valuable, not only for myself, but for the members of the staff who could not be present at the Conference. The full Proceedings enables the staff to get the full benefit of the discussions. I would therefore not like to see them cut down too much.

Mr. Huddleston: I would like to support that. I have found the full Proceedings very helpful so far as our officers are concerned. They have obtained a better appreciation of the problems being faced than they could have done from a considerably abridged report.

Mr. Clarke: The suggestion then is that we make the Proceedings as full as possible: and that we get out the recommendations (Appendix 2) as soon as possible after the end of the Conference, the suggested period being a fortnight.

1. BUILDING BOARDS.

A. MARKET SURVEYS.

Mr. Clarke: Queensland is interested in the manufacture of building boards from wood waste. The Division advised the Queensland Forest Service that they should carry out a market survey to find out what boards are in greatest demand in Queensland. The Forest Service wrote to us some time later, apparently under the impression that we were going to undertake a survey in Queensland. I think such a survey could be carried out much better by the State Forest Service.

A Queensland firm is interested in producing building boards from other materials and is of the opinion that the Queensland market would be better for hardboard than for insulating board. They favour a two-faced hardboard. I am not satisfied that this firm's survey was an adequate one and a more effective survey could well be carried out.

An objection which seems to have created a prejudice against insulating board is that it has been attacked by rats but this could easily be overcome by incorporating a suitable substance in the board.

At an early stage we should know what type of board it is most desired to produce. At the present time we are oscillating between hardboard and insulating board. A prospective manufacturer of hardboard on a small scale has to face a high capital expenditure for a hot press and the high boiler pressure needed to give requisite temperature in the board. We propose to investigate the temperature required in the hot press to see if it is possible to produce a satisfactory board with a lower temperature. We also propose to investigate a suggestion for drying insulating boards in kilns on trays.

There are certain important factors associated with the decision as to whether hardboard or insulating board should be produced and we should be glad of any lead from the States as far as market surveys are concerned.

Mr. Ellis: I do not agree that any State is in a better position than the Division of Forest Products to undertake a market survey. The Division has access to better statistics than the States. The decision to put up a hardboard plant in Queensland will depend not only on the Queensland market but on the markets of the whole of Australia. We have asked the Division of Secondary Industries in Queensland to make a market survey but they have had difficulty in obtaining satisfactory figures. Any figures obtained seem to have come, in the first instance, from the Division of Forest Products. The Division has told us there are no technical problems associated with the manufacture of hardboard but that problems are purely financial. They have told us in the past that there was no prospect of Queensland establishing a hardboard industry but we learn today from Mr. Huddleston that there is such a plant in Newcastle which has recently commenced operation. I cannot believe that the prospect is hopeless for the manufacture of building boards in Brisbane or other timber producing centres, either in association with sawmills or independently.

I do not think we will get far with our market survey in Queensland but nevertheless the Division of Forest Products should persist with its fundamental studies. I said two years ago that I thought our Government would be prepared to make some contribution to such studies, at least to cover research on the Queensland aspects of the problem. The position is still the same today.

Mr. Gray: It is obvious that anyone co-ordinating fundamental research on building boards from Australian species needs some knowledge of the scope of use proposed and the forms of use to ascertain whether the investigations are worthwhile. Delegates are probably aware that the Forestry & Timber Bureau has some functions on timber requirements and we would be glad to assist in any way possible in this matter. The Bureau should be doing more work of this nature and looks forward to close liaison with the Division of Forest Products in this.

Australian production of hardboard last year was 40,000,000 sq.ft. and of softboard 26,500,000 sq.ft. It was expected that the Masonite Corporation would increase production this year and they would have done so but for the coal strike. The C.S.R. Co.'s output is not large.

Import licences have been issued so far this year for 43,000,000 sq.ft. of building boards - a larger quantity than local production of hardboard over such a period. The actual quantity imported in the first six months of this year was 5,500,000 sq.ft. Imported hardboards included such brands as Royal hardboard, Elonite Board, Wood Fibre Board, Supertex hardboard, Enamelled Wallboard, Karlite insulating board etc. In addition to these, large quantities of paper boards for cartons are being imported.

These figures indicate that Australian requirements are much larger than the present supply. We should know the saturation point of the market. Even with large plants operating, there is ample scope for a large number of smaller plants which are preferable from the forest utilization point of view.

Mr. Clarke: Would the Forestry & Timber Bureau or the Division of Industrial Development be in a position to prepare an industry report on building boards? The

Division of Industrial Development assign a special investigator to a project such as this. He examines present production, future demand and saturation point of the material under review.

Mr. Gray: An official request from this Conference would be desirable and would help the Bureau to secure the staff necessary for such a survey.

Mr. Huddleston: I move

"That this Conference request the Forestry & Timber Bureau to prepare an industry report dealing with building boards".

In moving this resolution I would like to point out that the present production and demand do not give a true indication of the potential use of building boards. Import licences have been issued for very large quantities of building boards but they are priced up to three times as much as the local boards. Importation is sporadic.

Architects and potential users avoid the use of Masonite because they feel it is unobtainable. If we establish a building board industry and can assure potential users a reasonable certainty of supply the demand will be much greater than the present production plus import licences.

If we can introduce a simple plant working in association with a mill or group of mills we can produce a satisfactory building board and I feel that Australia can absorb all the building board produced by this means. Up to the present we have not exported building boards in any quantity. I feel that there is a large potential export market.

The Division of Wood Technology will be happy to give any assistance possible to the Forestry and Timber Bureau in any survey they undertake.

Mr. Payne: I second the motion. A recent development in Tasmania has been the importation of large quantities of gypsum board. There seems to be an expanding market for building boards of any kind in view of the accelerated housing programme. In Tasmania the factor mitigating against Masonite and Caneite is the uncertainty of supply. Because of this uncertain supply substitutes are sought.

Mr. Gray: The Commonwealth Government has in mind an increase of the overall building programme by 40% on the current rate of building. This will require an enormous quantity of additional timber and other materials. The present house erection figures are to be increased from 52,000 houses to over 70,000.

B. EXPERIMENTAL WORK OF DIVISION OF FOREST PRODUCTS.

Mr. Turnbull: In the past year laboratory equipment has been set up to initiate work on building boards. Investigations have commenced mainly on *Pinus radiata*, together with a few runs on *Eucalyptus regnans*, *Pinus taeda*, *Pinus caribaea* and *Eucalyptus marginata*. Conditions of preparation have been varied, experience gained in the operation of each unit of equipment and some data accumulated on the influence of some conditions on properties.

PULPING

Defiberisation has been carried out in an 18 inch attrition mill with two sets of plates. The first set comprised a coarse lugged pattern, and the second a finer pattern of lands and grooves running in a general radial direction. Neither pattern produced a well fiberised material from raw chips. The product resembled match-like fibre bundles believed to be similar to the material used in the German Bresco board described in B.I.O.S. Report No. 1526, Item 22. Boards could be pressed out of this material, but they did not compare in strength or stability with commercial hardboards. Substantial proportions of binder are needed to attain commercial properties with the match-like material; for example 13% and upwards of phenolic resins which, at current Australian prices, would cost approximately 26/- per 100 sq.ft. finished board for adhesives alone. It has been found that pre-treatment of chips is necessary for the production of pulpy material with self-binding characteristics.

Various pre-treatments have been tried ranging from soaking to pressure treatment with steam at 150 lb. per sq.in. Soaking was found to be practically ineffective, the products from the mill being still match-like. Boiling at atmospheric temperature either with water or with 3% by dry weight of caustic soda led to very little improvement. Reasonably good pulp of board quality is producible from chips steamed at pressures rising in one hour to 150 lb. per sq.in. and held for 15 minutes at this pressure. Most of the runs have been with chips subjected to the latter conditions. Chemical cooking under pressure has not yet been investigated.

The ratio of water to chips passing through the attrition mill has some bearing on the quality of pulp produced. Too little water produces coarse pulp incompletely fiberised; excess of water, while producing a better pulp, is deemed to be wasteful of power in the machine. A percentage between 7 and 8% of dry chips in water has been employed in most runs. In the case of pulp being passed through fine plates, a somewhat lower percentage of dry fibre seems desirable to prevent clogging the machine and slowing down the feed rate. Here the optimum would appear to be around 4%. The pulp produced by this treatment consists of individual fibres, fibre bundles and a percentage of shives, that is, fibre bundles of about .5 mm. thickness.

The early work revealed some inconsistencies with changes in setting of the attrition mill. Attempts were made to control the clearance between the plates to approximately .005", and a number of mechanical difficulties were encountered. Excessive vibration of the machine caused by the variation in weight and thickness of the plate segments prevented fine clearances being maintained, and it became evident that a general overhaul was necessary. The plates were re-machined to uniform thickness and then balanced, and the setting of other parts was improved. Unfortunately this work kept the mill out of operation for a long period and has reduced the work accomplished. Now it is running well and is producing finer pulp hydrated to a greater degree. The rate of draining of some recent pulps is slow enough to suggest that sawdust may be mixed with it as a filler.

With suitably prepared chips of the species tried to date, the coarse plates can produce material that can be formed and pressed into hardboards with usable qualities. Investigations are proceeding to determine the extent to which re-running of pulp through the fine plates one or more times improves the qualities, and also to compare the effect of beating in a ball mill with re-running in the attrition mill.

Results from Radiata pine indicate that -

(a) pulp from one run through the coarse plates is below commercial hardboard standard;

(b) pulp from the coarse plates re-run once through the fine plates is within the range of commercial hardboard pulps;

(c) pulp from the coarse plates re-run twice through the fine plates is superior to commercial hardboard pulp;

(d) pulp from the coarse plates re-run twice through the fine plates and beaten in a ball mill for $1\frac{1}{2}$ hours is better than (c);

(e) a third pass through the fine plates reduces the strength of (c);

(f) beating of (e) in a ball mill reduces the freeness of the pulp to an extent that precludes its draining in our laboratory forming box.

Pulp from Eucalyptus regnans from the coarse plates can be made into boards stronger than commercial hardboards.

Only exploratory work has been carried out with Pinus taeda and Pinus caribaea, and from the conditions we applied to the former we obtained strong boards, and the conditions applied to Pinus caribaea gave weak boards.

The work on Eucalyptus marginata to date has consisted of a few inconclusive runs with shavings and sawdust.

SCREENING

As a rough measure of the degree of fiberisation attained in the attrition mill, samples of the mill output are passed over a screen while the head of water is kept uniform and the suction pulsates beneath the screen. The screen has .014" slots and a determination is made of the percentage of pulp sample retained on the screen during 60 seconds.

A typical product from Pinus radiata after coarse grinding gave 50% retained on the screen, and after fine grinding 30% was retained. With Eucalyptus regnans only 25% of the product from the coarse plates was retained on the screen. The figures for a commercial insulating board pulp from soft wood were 27% retained and for commercial hardboard pulp from hardwood 36% retained.

The screening does not, however, establish the relative forming qualities of the pulp or even give adequate classification of particle sizes. Further screens are on order to improve the fractionization, but a pulp classifier would be preferable if a satisfactory one could be designed.

Boards have been produced from the coarse fraction only, and from the fine fraction only. The fine produces the better boards.

FORMING

Boards are formed in a 6" x 6" forming box. A sample of the pulp large enough to make a certain weight of board is made up to a standard volume and the consistency measured. The draining time of the water from the pulp when placed in the forming box is the basis for comparing the approximate relative freeness of different pulps and is inverselyproportional to the fineness of the pulp. Other factors, such as degree of hydration, must also be taken into account. A pulp which has been hydrated by beating in a ball or rod mill will take longer to drain. With fine pulps it has been found necessary to apply a vacuum beneath the forming wire to produce a wet board which will hold together when cold pressed. Vacuum draining has also been found desirable to obviate the formation of pockets in the board, which cause weakening.

Data have been accumulated for the design of a forming box for 3' x 3' sheets and construction will shortly be put in hand.

PRESSING

The wet mat from the forming box produces better boards if it is pressed at 200 lb./sq.in. to approximately ½" thickness at atmospheric temperature before final hot pressing. This preliminary wet pressing would be equivalent to that attained in a press section of a commercial forming machine and reduces the moisture content to about 65% wet basis. Pressing has been investigated over the range from 250 lb./sq.in. at 250°F to 400 lb./sq.in. at 400°F. The products by pressing at 250 lb./sq.in. at 250°F generally show blisters and uneven surfaces. The temperature to 400°F tends to char the boards and 400 lb/sq.in. puts a heavy load on our laboratory press, so that we prefer to reach this infrequently.

The most suitable combinations for our preliminary laboratory investigations are temperatures from 300 to 350°F with pressures from 300 to 350 lb./sq.in., and some of these are being used for various periods of pressing.

These pressing conditions have been found capable of producing hardboards from the species handled to date, and of producing samples whose mechanical properties are as good, and in some respects considerably better than those of hardboards now being marketed commercially in Australia.

TESTING

A pattern for cutting each sample board into test specimens has been adopted and pieces are subjected respectively to puncture tests, hardness tests and static bending. Data are being accumulated to relate these properties with the various conditions of preparation. Modulus of rupture shows a parabolic increase with increase in the temperature of pressing. The upper limit is in the vicinity of 400°F above which slight charring occurs, the modulus of rupture tends to fall and brittleness to appear. A similar parabolic increase is observed with increase of pressure and constant temperature. In this case the limitations of our laboratory press have prevented us from proceeding to the determination of the probable turning point of the graph. Modulus of rupture also shows an overall increase with decrease in fibre size.

Further samples are subjected to water absorption and swelling tests. It has been found that the moisture absorption in unsized boards is inversely proportional to the fineness of the fibre.

The puncture resistance of nearly all samples is higher than that of commercial hardboards, and the majority stand up to the maximum of 1360 that the testing machine can apply.

Surface hardness is measured by a ball drop test. Figures higher than those for commercial hardboards are being obtained, but calculations with the various conditions of preparation are not yet discernible.

C. GENERAL.

Mr. Huddleston: I have a board here manufactured and patented by Vencore Veneers Pty. Ltd., Newcastle Road, Wallsend. This firm has been working secretly on the board for 2 years and has just recently contacted us for information. The exact composition of the board is not known at present but we will have more information after an inspection has been made of the plant. Present production is 30 boards/day 6' x 3' x 13/16" but this is to be increased to at least 120 boards/day. The firm has stated it will be satisfied with the list price for this board but it is not known whether this is the list price for 13/16" board or for solid timber on an equivalent super foot basis.

We have an interesting development arising from work of the Division of Industrial Chemistry on tannin formaldehyde adhesives. The bark of red ironbark was taken and formaldehyde added in its ground condition. The ground bark was then pressed under pressures of 50 lb./sq.in. at temperatures as low as 85°C. Quite good boards were produced. We propose to investigate this problem further with timbers such as Murray red gum and ironbarks, the barks of which have a high tannin content. We will grind mill edgings into coarse material, react with formaldehyde and then press into building boards. If we can find out what percentage of tan is present in different timbers we may be able to mix high and low tan content timbers. In this way a relatively cheap and satisfactory board could be produced from bark and edgings.

Mr. Clarke: I am surprised at the figure of 5% urea formaldehyde quoted by Mr. Huddleston. Normal boards overseas contain 15-20% urea formaldehyde.

Mr. Ellis: One of the difficulties confronting firms prepared to install building board plants is the lack of information concerning plant design. There should be an authority in Australia who could secure plant designs, if necessary on a licence basis, from overseas firms such as the Corvallis Co. or the U.S. Machinery Company.

Mr. Turnbull: The smallest plant of the U.S. Machinery Co. is quoted at $600,000. The smallest Corvallis plant would cost £150,000 Australian plus the recent devaluation margin. When I last saw Chapman he was not interested in overseas business - there was an abundance of local business.

Mr. Huddleston: I feel that this is a matter for the States if we are to undertake applied research. We have employed a chemical engineer in N.S.W. mainly in connection with minor forest products, but who would be available for work of this nature.

Mr. Ellis: It is not feasible to expect State officers who are very seldom sent overseas to keep abreast of overseas plant design. Officers of the Division of Forest Products are in a far better position in this regard.

Mr. Clarke: There are two main Companies manufacturing building boards - a Swedish Company and an American Company. Both Companies will prepare the design of a plant and supply all the equipment necessary for erecting a plant. Cost of the plants at the present time are very high - a 10,000 ton/year plant costs £75,000. With present-day deliveries it would take 3-4 years before the plant could commence operation and it is difficult to foresee the market position in 3-4 years' time. I think it would be possible, as far as both these Companies are concerned, to arrange for the equipment to be manufactured in Australia under licence but there are certain difficulties in this connection. Equipment of this type can only be produced by the better class firms in Australia and most of these firms are quoting long delivery for equipment. Digesters can be made in Australia cheaper than in any part of the world but deliveries take at least two years. Six digesters would not be delivered for 6 or 7 years. Theoretically there is no difficulty in erecting a building board plant but delivery times make it impractical. We, as a Division, have been interested in the possibility of small plants and have been investigating the manufacture of insulating and hardboard on a small scale as an auxiliary activity of large mills or groups of small mills. If the process can be kept to a simple procedure it will be possible to establish small units.

We are particularly interested in insulating board because the press problem is obviated. If it is possible to carry out th. s process on a small scale the engineering involved is less and would be well within the bounds of a chemical engineer such as Mr. Huddleston has employed. This would be a much different proposition to engineering a 10,000 ton/year plant.

If any firm wishes to install a large plant it can obtain all the engineering necessary from the Swedish or American firm but all Mr. Turnbull's investigations have been concerned with small plants. He has been concerned mainly with breaking the material up.

2. NOMENCLATURE.

A. NOMENCLATURE OF AUSTRALIAN TIMBERS.

Mr. Turnbull: At the third Forest Products Conference this subject was discussed and the New South Wales Forestry Commission, Division of Wood Technology, tabled a list of timbers which included the names of a considerable numbe of timbers proposed for inclusion in the revised version of Australian Standard No. 0.2. Following the Conference, discussions have been held between various officers of the Division of Forest Products, C.S.I.R.O., and correspondence has passed between the Division and the New South Wales and Queensland Forest Products staffs. The Queensland Department has forwarded a list of timbers, including many that they wish standardized for the purpose of a draft of an Act on Timber Marketing.

Some consideration has been given to the preparation of lists more comprehensive than those submitted to date from New South Wales and Queensland, and officers of the Division of Forest Products have drawn attention to the problem of reducing the number of anomalies in Australian names.

It is felt that if certain principles had been applied at the time A.S. No. 0.2 was prepared, there would be fewer inconsistencies and that an effort should be made now to reduce rather than extend their number. The adoption of distinctive names for some of its genera is commended such as satinash for Eugenia, quandong for Elaeocarpus, penda for Xanthostemon etc., and the prospect of choosing suitable names for other genera is being explored. At the present time names that might be applied to a selected number of genera have been proposed, and the views of all States would be welcomed.

It is not proposed that a preferred distinctive name introduced for some of the genera should over-ride the established names that have become well known for certain species. The Acacia, for instance, might be predominantly wattle, but not to the exclusion of mulgas, myalls, salwoods, spearwoods and various aboriginal names of long standing.

There is a considerable amount of detail to be examined on these questions, and pending decisions on principle, it has been decided that lists should be prepared, genus by genus, for all timbers desired to be named. Some of them, as for example Acacia, Angophora, Cryptocarya, Elaeocarpus and Eugenia have been practically completed, and preliminary discussions held regarding the naming of the species.

The subject is difficult to deal with in open conference, but I think discussion of the main underlying principle might be beneficial to disclose whether we are thinking generally on the same lines.

Mr. Huddleston: I do not propose to discuss the proposals put forward by Mr. Turnbull in detail as I am not prepared for such a discussion. I do however, agree with the principles enunciated by him. I think Mr. Turnbull should complete the list, adopting the principles already initiated and then a sub-committee of specialist officers of the State Forest Services should consider the list, finally forwarding it to the Standards Association for the necessary action.

Mr. Irvine: The suggestion for common names will probably be received with pleasure by those States having a multiplicity of scrub timbers but as far as the southern States are concerned the abandonment of well known common names for timbers which at the moment are of very little practical importance is certainly not a question that can be debated at this Conference. The appeal to the utilization man of calling all species in one genus by the same group name is probably outweighing the forester and the trade. It is a revolutionary idea.

Mr. Clarke: Quite a number of common names, probably the ones you are most concerned about, are covered already in our Standards list. There are quite a number of timbers coming on to the market which are not covered by the Standards list and it is these we wish to cover now with standard common names.

Mr. Irvine: I realise that point but I do not think the forester or the bushman will adopt the proposal within measurable time.

Mr. Ellis: I agree with Mr. Huddleston's remarks. On 13th September we wrote agreeing with 95% of the suggestions made by Mr. Turnbull. There will be no insuperable difficulty in Queensland once a standard is adopted. We will also be able to lead the bushman. In 10 years the previous standard has been well adopted.

Mr. Huddleston: Although we have issued instructions that timbers shall be referred to in accordance with the Standard Specification we have still to contend with bushmen sending in their log sheets with a variety of names not covered in the Specification.

Mr. Turnbull: I feel that, with the views expressed, I would be in a position to proceed, at least with the preparation of a first draft, and to circulate it.

Mr. Ellis: What is the Standards Association's standing in this matter?

Mr. Clarke: There are two ways that this work could be carried out. i) the Standards Association could do the work; or ii) a Committee could do the work, finally submitting it to the Association for approval. In this case the Standards Association has noone qualified to do the work and therefore I think it is being carried out in the best way possible.

Mr. Turnbull: The question of the revision of Standard O.2 was referred, in the preparation of the programme of work for Standards Committees, to the Sectional Committee on Wood Technology. No Committee has actually met to discuss the detail of the work.

Mr. Huddleston: There was a definite reference made to the Division of Forest Products for recommendation back to the Wood Technology Committee.

Mr. Clarke: We are in order as far as the Standards Association are concerned and also as far as this Conference is concerned as we are carrying out Resolution A1 of last year's Conference regarding Nomenclature.

B. PHYTOCHEMICAL REGISTER.

Mr. Bland: Plans have been drawn up for a Register of all known compounds occurring in Australian plants. I will run briefly through the events which have led to the formulation of these plans. A Conference was held in Melbourne in 1947 on the pharmacological constituents of Australian plants. At that Conference the idea of a Register was mooted and it was suggested that C.S.I.R. Information Service should undertake the work. Some members pointed out that compounds which do not now have any pharmacological interest may prove to have some in the future and for this reason the Register should be comprehensive.

A second meeting was held in January, 1949 at which the officer in charge of the Information Service, C.S.I.R. reported that a comprehensive Register would take the full time of two officers for 10 years. This had been reported to the Executive of C.S.I.R.O. who declined to undertake responsibility for such work unless there was a very good argument in its favour. The Conference then decided that it must take independent action but modified the scheme by proposing that the C.S.I.R.O. Information Service should be responsible for the filing and indexing of returns on the chemical constituents of Australian plants sent in by voluntary workers. A Standing Committee was formed to implement this plan. Voluntary workers will be assigned certain journals to cover and reporting will be simplified by the supply of a standard return form. It is realised that it will be necessary to search journals which are now quite obscure, e.g. the W.A. Settlers' Journal and the Bankers' Journal of N.S.W. There have been cases where work of this type has been published in a Journal and then forgotten. A notable example was the work done on rutin in red stringybark.

The new scheme was communicated to the Executive of C.S.I.R.O. who gave permission for the Information Service to keep the Register. A circular has been drawn up and sent to people and institutions inviting cooperation. We are shortly to seek publicity in journals such as the Australian Chemical Institute Journal, the Australian Journal of Science and the Forest Products News Letter.

Registration of data will bring up the problem of synonomy. Mr. Morris of the Melbourne Herbarium is to draw up a list of genera which is to include synonyms and chemists will not have to worry about synonomy but can report work under the name found in a particular journal. The work of collating the data under present day generic and specific names will be undertaken later.

It is proposed that as soon as information starts to come in that the Information Service will make it available to enquirers.

Mr. Ellis: It would be a help if Mr. Bland could let us have a list of the organisations and individuals in

Queensland who have been circularised. We may be able to suggest further possibilities.

Mr. Cokely: The Queensland Forest Service does not receive many scientific publications as such. The circular letter has been received, but difficulty is being experienced in compiling a list of scientific publications owing to our limited facilities. We may come across a reference in an odd journal - will the forwarding of that reference be satisfactory? With other laboratories checking the normal scientific journals must we be confined to specific journals?

Mr. Bland: No. Volunteers may either undertake a systematic search of a given journal or may contribute from their own particular field in which they have a specialised knowledge. Considerable overlap may occur in returns coming in to the Register but the Register will be organised to deal with this. All communications will be welcomed.

3. RAILWAY SLEEPERS.

A. AUSTRALIAN STANDARDS.

Mr. Head: At the last Conference, a motion was passed "That this Conference requests the Standards Association of Australia to prepare as a matter of urgency, adequate specifications for sleepers for both wide and narrow gauge railway lines".

The Timber Industry Committee of the S.A.A. has given a high priority to this work, but before the work of drafting specifications commences, a large amount of preliminary field work and investigation will be necessary. Later speakers will no doubt expand on this aspect of the work.

Australian standards in existence at the present time cover the Western Australian species jarrah, karri and wandoo (A.S. No. O.10 Parts I - III inclusive) and Sleepers for 24 in. gauge Railway Track (Sugar Cane Industry) A.S. No. O.57. A.S. No. O.57, as the name signifies, applies to sleepers for narrow gauge railway tracks for the sugar cane industry. It was issued in early 1949 with a corrigendum in April 1949.

This specification was prepared by a Committee on which timber and forestry interests were not represented, and in its initial form bristled with inaccuracies. Through the efforts of the Queensland Forest Service, the N.S.W. Forestry Commission, this Division and the S.A.A. Secretary of the Timber Industry Committee, many of the worst features were eliminated from the draft, and the standard as issued will, I feel, not hinder in any way the preparation of further specifications dealing with sleepers for permanent way usage throughout Australia.

All of the suggested corrections could not be made, and the standard still includes a reference regarding permissible defects not reducing the strength and durability by more than 25% of that of clear timber. It was pointed out that such a limitation was unnecessary in a sleeper specification, but the drafting committee, who had already compromised to a very large extent on the permissible imperfection limits, wished to retain the strength limitation as a possible safeguard, and since the real value of the specification lay in the individual imperfection limits of the grade description, the issue was not forced.

Mr. Ellis: Two years ago this Conference discussed this matter and some action was to be taken by some Committee of the S.A.A. I gather from Mr. Head's remarks that there is no active drafting going on at present respecting Australian specifications for all States.

Mr. Head: It is on the Agenda of the Wood Technology Committee, but I think they are holding action on the drafting of specifications pending investigations that are going on.

Mr. Gray: Do these specifications include species? What are the durability specifications?

Mr. Head: They vary. For the 24 inch gauge railway track (sugar cane industry) it does not drop below durability 2.

Mr. Ellis: I feel it is undesirable to wait until the conclusions of the investigations referred to by Mr. Head. The Queensland Railway Department has a relatively high standard for railway sleepers, and is not inclined to lower the standard but now is perhaps an opportune time in Queensland to raise the question with the Railway authorities.

Mr. Turnbull: We are not conducting at the present time any field work relating to specifications for Australian sleepers. Mechanical failures are being investigated and these will be discussed under another heading on the Agenda. The railway departments have always had their own specifications in each State and I understand the position to be that the supplies of high durability class timbers are unequal to the demand and that the railway departments, instead of rewriting their specifications, have lowered the standard of inspection against them. I think the need is for field work to ascertain what they are accepting, and for current practice to be made the basis of revised specifications. I think this is an Australia-wide problem and we would value your comments.

Mr. Huddleston: We are just as anxious as anyone to have specifications. The problem is a big one in N.S.W. and we find the specification varies according to the rate of supply of the sleepers. If there is a variation in price, and a number of people in the industry hewing sleepers, the supply improves and the specification becomes harder. With the harder specification men drop out of the industry and the specification has to be lowered. Also the standard varies according to the type of timber being cut. Along the Murray River where they are cutting red gum a very much lower standard is permitted than in the north coast areas where they are cutting a better quality timber, and to tie up these a standard specification is necessary. But it would be disastrous to have a standard specification prepared, and for the railways to say they were not prepared to use them and would continue to use their own. For that reason we must have accurate information on which to base any specification prepared by the Standards Association. I feel that to rush things now and prepare a standard specification would be to invite the Railway Departments to say they were not satisfied, the information is not sufficiently accurate, and they are going to continue to use their own specifications. I feel the action should be for a working plan, covering what is necessary, to be prepared by the Division of Forest Products, and for the various State Forest Services to cooperate in obtaining the information required by the working plan. We should be very happy to work in that way. If that is done the investigations carried out by the various States will be coordinated in your Division acting as the directing organization.

<u>Mr. Clarke</u>: That is a very valuable suggestion.

<u>Mr. Turnbull</u>: There is no short cut to this matter. It resolves itself to one of going out into the field and actually observing the defects, etc. in current supplies. If it were done the Utilization Section would require help from each of the Forest Services.

<u>Mr. Huddleston</u>: That is what I have in mind, but

I would like the working plan to be prepared by your Division. In the terms of that working plan we should arrange to collect information in our own States.

Mr. Ellis: I think it is very desirable that a standard procedure and a standard form of recording should be adopted. How much time we could give to the work in Queensland is doubtful, but I think it is the right start.

Mr. Clarke: The Western Australian specification is a good one and that is the result of a large amount of field work. It is the result also of investigations Mr. Tamblyn carried out on wood rots in Western Australian timbers. He found out that certain rots present in sleepers did not develop afterwards and as a result it was possible to widen the specification without detriment to the life of the sleeper. The work was incorporated in the specifications.

Mr. Ellis: It may be desirable to get the Railway Department staffs to undertake recording and field work. I think we would get their support in Queensland at the present time, but such observations might not be satisfactory to timber technologists.

Mr. Huddleston: I have thought of Mr. Ellis's suggestion and discarded it. An inspector inspecting sleepers for acceptance by his Department gives the sleeper a superficial look, and if it appears to be all right he passes it. If you are going to ask him to look for defects, he will start probing them, and psychologically you will have the effect of varying the standard to be applied. What we want to investigate is the standard of sleepers being inspected, and we must watch the personal element.

Mr. Turnbull: We have had some experience in starting work in this field, and we found it rather difficult. We attended inspections to make records to a pattern we had laid down. The inspectors work quickly and all we could do was to note the defects causing rejection, and go back to the rejects later for details of the defects. The inspectors were rather suspicious of our activities. I hope their attitude has changed, because we do need their sympathy in the work we have to undertake, which is after all to their advantage. I feel that the railway inspectors would be unable to gather information in the form we need.

Mr. Huddleston: The best way would be to follow the inspector. He would have piles of first class, second class and rejects, and at that stage you could have a talk as to why they were so graded. While doing the inspection you have no chance to get the inspector to say why he is grading it in any grade. If you try you will only have the effect of altering his normal method.

Mr. Gray: I indicated at the last conference what a very important question this is, because as most of you know the demand for sleepers in Australia is far greater than the available supplies of timber of the kind we have been using. It does seem extraordinary that the State of N.S.W., which has some of the most durable species has a 15 year life for sleepers, according to our records, and all the other States have far longer. Apart from the question of specification, there is a good deal in the interpretation of these specifications, and therefore a much higher standard of rejection must be used in N.S.W. It seems they must throw out a lot of sleepers which would not be thrown out in other States. 15 years, as against 25 to 35 years in other States.

Mr. Tamblyn: I think much depends on the type of ballast used. In Western Australia sleeper life is also short and may be due to greater use of dirt ballast. We have better ballast in Victoria. One also has to take other conditions of service into consideration.

Mr. Gray: After taking into account all aspects as far as they can be gathered it is very hard to see why there should be a 15 year life in N.S.W. and a 30 year life in Victoria.

Mr. Huddleston: For a lot of sleepers in N.S.W. the total life is something like 30 or 40 years. The average life of a sleeper is shown at quite a low figure because of a number of factors. In main lines, for example, when the track is relaid or new rails are put down, it is the usual practice to re-sleeper at the same time. The sleepers are then taken into sidings or branch lines, and to get a true indication of the life of sleepers you have to go to branch lines where sleepers have been transferred from main lines. There is one line in the western district where the sleepers have been taken up and put into sidings, and the line was laid about 1912 or 1914. The rails being taken up carry the date 1912.

Mr. Gray: Are you suggesting, Mr. Huddleston, that this shorter life is accounted for by the fact that there is more new construction?

Mr. Huddleston: By the practice of re-sleepering.

Mr. Gray: They give us a figure for normal maintenance and another figure for extra sleepers required to make up arrears of maintenance, and both together result in a figure which gives a 15 year life.

Mr. Clarke: The latest figures from Victoria show that from 50 per cent. of the sleepers they are installing now they expect a 10 or 15 year life. We know from the species they are using under present conditions they cannot expect more than that.

Mr. Benallack: I think that is very true. For years in Victoria the Railway Department demanded a very high grade sleeper. Whilst we had a life of 40 to 45 years, we cannot expect anything like that today because of the species they are using, and because they have lowered the specification very considerably. They are now prepared to take considerable quantities of sawn sleepers, and that will diminish the life as compared with hewn species. The expectation of life of sleepers in Victoria is going to be much lower than it has been over the last 25 years.

Mr. Clarke: In Victoria they have not yet felt the impact of low durability species put in 10 or 15 years ago. They have used messmate, and a whole range of similar species.

Mr. Bensllack: They are extneding into stringybarks, what you might call medium class timbers. They are almost going into some lower grade. I agree that they have not yet felt the impact of the use of these low grade timbers for sleepers. I would not like to say what might be the life of some of the sawn sleepers.

Mr. Gray: You would think the railway engineers responsible for giving us these estimates would have taken these things into account.

Mr. Huddleston: A big factor in N.S.W. has been the need for using heavier rails after the introduction of heavier locomotives. They found they had to restrict the speed of goods trains on curves,and when the rails were replaced the sleepers were replaced. That wassbout 10 or 15 years ago.

Mr. Clarke: Mr. Huddleston put up a suggestion that we should prepare a general plan for a uniform study of standardisation of sleepers in all States. Is it the general feeling that the time is ripe for us to do that, and if we do, will the States be able to do their share?

Mr. Ellis: I do not think any harm could result from the present adoption of a standard form for reporting. I think it should be done.

Mr. Clarke (to Mr. Turnbull): Would you be in a position to do that in the coming year?

Mr. Turnbull: If this Conference does not over-burden us with other work, I should say that we could.

Mr. Gray: Do I understand that the idea is to have a standard specification for all States, or that there should be a standard which is applicable to the different States? Some States must be different because of different species, and I cannot see that one general specification would be suitable for all States.

Mr. Clarke: The suggestion is that there should be a uniform working plan, which would lead to the preparation of specifications on a uniform basis. The specification for one timber will not necessarily be the same as for another timber. Timbers naturally will be grouped. That will have to be left to a later stage. We already have the position of a group in Western Australia covered by a specification.

Mr. Gray: Might I suggest at the same time some attempt should be made to arrive at a comparison of the standard of rejections in the different States? I am taking account of this question of life because I still feel there is something very queer in the requirements of the different States, as they have been given to us.

Mr. Turnbull: I imagine that the working plan will be cast to arrive at that information.

Mr. Gray: I understand the specification is on the basis of acceptability. This is a different thing from the standard at which sleepers are thrown out after use.

Mr. Turnbull: We want information as to why pieces are rejected, and a comparison of standards of acceptance in different States.

Mr. Gray: You are speaking of standards of acceptance. I do not think that is quite what I mean. What I have in mind is that in N.S.W. these sleepers are rejected, not by the inspectors, but at the stage where they have no further use. In another State these sleepers would be considered to have a different life.

Mr. Cooper: I think Mr. Gray is referring to rejection of sleepers at the end of their life, whereas Mr. Turnbull is talking of rejection of new sleepers. If these figures are accurate - a 15 year life and a 35 year life in different States - it does seem to need investigation. The reason may be the impact of standardization of gauges. If the Victorians are looking to that happening and not counting those sleepers they will obviously want a very much smaller number.

Mr. Gray: The figures exclude standardization.

Mr. Cooper: In that case the requirements per annum will be very much smaller and if spread over the whole system the apparent average life of sleepers replaced would be very much higher than is, in fact, the case.

Mr. Gray: The life as given is the deduced life from the number of sleepers in the track divided by the number required for renewals, which is the best approximation you can get to the life.

Mr. Clarke: If the railways had been on the present mileage for the last 100 years and had reached a steady stage, then renewals would be a fair indication. They have not reached that stage. The railways have been extending, with new sleepers and new lines, and have not yet reached a stage where renewals are taking place in an orderly fashion. That is why the figures are misleading.

Mr. Tamblyn: Perhaps it would be pertinent to remember that we are trying to introduce a high pressure creosote treatment of sleepers which, if it does become effective in the next five years, should quite considerably alter the outlook of the railways with regard to defects in new sleepers. For example presence of sapwood and heart, pockets of rot, etc. will be automatically acceptable because the sleeper will be treated. We should consider whether or not a wide survey is worth doing, when we are on the eve of very considerable developments which may change the whole position.

Mr. Clarke: There is a fact to be remembered there, and that is that even though high pressure treatment is accepted there will still be durable species cut.

Mr. Tamblyn: In decreasing numbers, and some durable species such as jarrah, for example, will be improved by treatment.

Mr. Huddleston: We are going to have a great deal of trouble in N.S.W. Most rejects are due to mechanical failure, either to loss of spike-holding capacity or to brooming. Sleepers going out after many years of service are still quite sound. The railways then use them for all sorts of things after they finish with them in the tracks. It is difficult to compare the life of sleepers between different railway services. On the Sydney-Melbourne line there is a very heavy traffic all the time, and the life of sleepers can be quite small because of mechanical failures. On a north-west line where there are very few trains your mechanical failures would be very light, and it would be possible that sleepers would remain until you got failure by decay in 40 or 50 years.

I move

"That the Division of Forest Products be asked to prepare a working plan with a view to

> assembling information as to the standard of sleepers accepted by various States, which will lead eventually to the preparation of an Australian standard specification for railway sleepers for use in Australia and New Zealand".

Mr. Ellis. I second the motion. Carried.

B. HIGH PRESSURE PRESERVATION TREATMENT AND FIELD TESTS.

Mr. Tack: Work on the high pressure treatment of Eucalypt truewood has now reached the stage where we may confidently undertake the treatment of timber in sleeper and other commercial sizes.

For this purpose, a pilot plant, capable of treating 5 sleepers per charge (9' x 10 x 5) at 1000 lb./sq.in. has been designed and tendered for. The cylinder is 10 ft. 6 in. in length and about 2 ft. in diameter, and initial tenders have been surprisingly reasonable in price. It is expected that the cylinder will be ready for installation in about 6 months' time, and, allowing for a few months for installation, we should be ready to treat timber in about a year.

Our tests to date have been restricted to Victorian eucalypts and three W.A. species, and all tests have been on an experimental scale. It is now proposed to consider service tests of treated timber, and initially, these will be restricted to sleepers and probably crossarms. In Victoria, the Railways and Forestry Department have been approached regarding their cooperation in a large scale service test of less durable eucalypt sleepers in Victoria, and initial discussions have been held on the species to be treated.

A Central Australian test with the Commonwealth Railways and W.A. Forests Department does not now include high pressure treatment, but treated sleepers may be put in if the cylinder is ready in time.

In Western Australia, it is later hoped to treat marri, karri and jarrah sleepers at high pressure.

We have previously discussed extending experimental treatment to timbers from other States - notably from Queensland and Tasmania, and expect to be ready for this work in the very near future.

It would, however, be some help in planning future work if we could have some idea of what service tests of pressure treated sleepers are required in other States. This is particularly so because with the large cylinder soon available, preliminary tests on small specimens can be done very quickly. If we are going to establish tests in other States it would be desirable to do so as soon as possible, and we should be able to treat sufficient sleepers for 1 service test/year.

<u>Mr. Ellis</u>: You have a list of Queensland species we have sent - about eight of them. We do not wish to add to that list. With respect to field tests required, it is rather difficult to fix on anything that would cover all aspects of the case, but I would suggest a test on a main line, both straight and curved - possibly 100 to 200 would be adequate. If a greater number is desired I would be quite happy to discuss the matter with Mr. Tack and Mr. Tamblyn later.

<u>Mr. Payne</u>: I am not at all informed on this question. Presumably Mr. Tamblyn has cooperated with the Tasmanian Government Railways and knows the position there, but I have no information about it at all.

<u>Mr. Tamblyn</u>: When we first considered methods of increasing sleeper life we approached all the railway departments, and the problem was stated in correspondence and discussion. They were all very enthusiastic that we develop a method of treatment, but at that stage we could not promise anything and no concrete schemes for test were put up. However, we will soon be ready for tests and feel that the State Forest Services will want to cooperate

in these tests rather than have us deal directly with the railway systems in each State. Hence Mr. Tack and I are seeking the opinion of the State services as to how quickly we should attempt to put the tests in, and which States should have priority. Personally I think Tasmania should have early priority because species of low durability are largely used. Also probably Western Australia should have early priority because Mr. Stoate is most enthusiastic to install the tests.

I think Mr. Ellis's suggestions are rather too modest. If we are going to introduce high pressure treatment in Queensland then we must look upon the railways as a customer who has to be convinced that the spending of a relatively large sum in installing high pressure equipment is warranted. When it comes to the question of large capital expenditure on plant, railway engineers will obviously want to see concrete evidence in support of it, and only by putting in extensive tests in several localities, can we be sure that a development which must be of the utmost importance will be accepted as early as possible. They will want to see not only the experimental plant, but also a test in service which is giving the results claimed for the treatment. I think we should test in all States as soon as possible and make each test as extensive as possible. There is no doubt whatever that the ultimate saving from pressure treatment will involve a colossal sum. It is a matter of showing clearly to the Railway Departments that this is the solution to one of their problems.

Mr. Payne: The Tasmanian Commission will cooperate. We shall be looking for a lead from the Division of Forest Products as to the lines that cooperation should take. Presumably there has been some traffic between the Division of Forest Products and Tasmania about this subject, but I am not aware of it.

I do not know that Tasmania will be looking to the use of inferior species as you have suggested, Mr. Chairman, because after all Euc. obliqua is probably the timber we would best like to see used for the purpose. Regnans is a diminishing species. Gigantea might have some application, but our lower grade forests tend to be mainly obliqua. It ranges from fourth class to first class forest, using ultimate height as the standard of quality of stand.

Mr. Ellis: I do not think there is any insuperable difficulty in extending the Queensland test sample to 2000 sleepers. I kept the figure low because I thought it would be more or less the limit of your capacity. I have some doubts whether preservative treatment will be satisfactory since 90 per cent. of failures are probably due to mechanical wear and tear. Mr. Tamblyn, I gather, thinks that high pressure treatment will reduce such failures?

Mr. Tamblyn: It will help because we are going to treat with an oil preservative that will retard weathering.

Mr. Clarke: We want you to think of the impact of the high pressure treatment on your forestry position as a whole. It will need careful thought because it may be a means of using perhaps thinnings of some of your young hardwood forests.

C. MECHANICAL FAILURE INVESTIGATIONS.

Mr. Gottstein: As you are all aware, the supply position in regard to suitable railway sleeper timbers in the Commonwealth is serious, replacement requirements are large, and with the possibility of gauge changes, the position is likely to deteriorate. We are faced with the low availability of high class sleeper species such as ironbark, tallowwood, grey box, red gum and jarrah, and as species of low service life are used in replacement, we are confronted with the fact that the replacement rate in the Railways must become higher as the average life is lowered.

Field observations carried out in Victoria and other States have made it quite clear that the failure of the sleeper, in many cases, is not due to fungal, bacterial or insect attack, so that the general aspects of preservation against organic breakdown are obviously confused by other factors.

Work of the Preservation Section in Victoria and elsewhere has shown that a very large proportion of sleepers are removed from the track through loss of spike holding capacity (spike kill) and allied troubles. The failures are often associated with end splitting and surface weathering and general disintegration of the sleeper through severe through checking.

The relative importance of these defects in replacement naturally varies with a number of factors, including species, locality, severity of service, track maintenance, ballast conditions, etc. Since the primary causes of failure seem to be considerable different from those overseas, where rail cut is often serious with soft species and arduous service conditions (higher axle loadings, etc.), it becomes obvious that a special study of the physical causes of sleeper failure with Australian sleeper species under local conditions is of prime importance. This is emphasised when it is considered that some 70,000,000 sleepers are in use in Australia, so that essential replacements are several millions annually.

Any improvement that can be effected in regard to prevention of physical failure must be integrated closely with preservation work, since, particularly in the low durability species, any improvement attained will make normal preservation more important.

The basic factors, which in their effect on the physical properties of the sleeper are likely to effect the mechanical life are -

(i) the history of the sleeper
(ii) conditions of the track
(iii) the type of rail fastening.

There is no doubt that very serious splitting associated with moisture movement occurs between the moisture content of the green state and that representing track conditions· further deterioration occurs with moisture changes in the track.

The history of the sleeper from the time of cutting can obviously have a very marked effect on its behaviour, and observations have shown that many sleepers reach the track seriously split.

We propose to investigate this aspect in the field and the laboratory. Observations on sleeper getting practice and methods of storage and seasoning, particularly with reference to moisture content changes and development of side and end checks, are being made at present.

Laboratory work and exposure tests are also being carried out with the object of rendering the sleeper surface more plastic by mechanical methods in order that it will be better able to absorb the movement caused by moisture changes.

Following initial laboratory work we also propose to test a number of end coatings applied as soon as possible after cutting to reduce moisture loss and end checking. This will be carried out this summer to take advantage of the more severe drying conditions.

Conditions in the track cover a very wide field including temperature and moisture relations, wheel loads, curves and speeds, traffic density, ballast and drainage.

A small test set-up will be installed on the track behind the Division to measure rail and sleeper temperatures and sleeper moisture contents. Vertical and lateral loads and movements between rails and sleepers will be examined later. These tests will enable us to perfect our equipment for field tests under various service conditions.

Environmental conditions are most important, the behaviour of most species differing widely between arid and high rainfall areas. The correlation between weather, track, time of service and mode of failure will need further investigation.

This brings up the question of the mechanism of weathering breakdown which we hope to investigate fundamentally. One of the promising approaches to increase the service life of the sleepers appears to be the use of surface coatings designed to prevent weathering breakdown of the upper surface, but many problems are involved and the work is closely linked with that of normal wood preservation.

The incidence of splitting in sleepers cannot be dissociated from the type of rail fastening commonly used in Australia, i.e. the cut spike. The use of plates appears to reduce the cutting of the sleeper by the rail, but the rail is still fastened by spikes which depend for their grip on the highly stressed timber around them.

The relation, if any, between this stress and the development of end splits if not yet known, so that we propose to determine whether splitting can be initiated or aggravated by normal spike driving, particularly with rapid changes in temperature and moisture content. The effect of chemical action or water in the spike hole is also to be examined.

The method of hewing or sawing sleepers also warrants more special investigation and this brings up the question of quartersawing versus backsawing which we hope to study later.

On the point Mr. Gray raised on the standards. I think he was trying to stress the possible value of a study of the actual sleeper rejections in service, and their impact on the preparation of initial standard specifications. I think that factor is of considerable importance in respect to mechanical or physical failure investigations and should be considered in respect of the initial standard specification if possible.

Mr. Ellis: I would like to pay tribute to the searching nature of the investigation. I feel you are tackling the problem very soundly, but cannot add anything to your approach to the problem.

4. MARINE BORER INVESTIGATIONS.

Mr. Amos: The last Conference resolved that the investigation of the possible relation between silica content and resistance to teredo attack was an important project and that there was need for carrying out a survey of the silica contents of various species and its distribution in the tree.

In accord with this resolution the survey has been completed, and a list of siliceous species has just been published as an internal report of the Division of Forest Products. Some 400 species have been found to have silica contents of 0.05% or greater, and it is considered that 0.5% imparts marked resistance to teredo.

The distribution in the various species has been recorded,and shows a marked variation as between species. It usually occurs as aggregates with distinct optical properties under the microscope. The aggregates have been shown to be completely amorphous by x-ray studies, and occur in the following typical arrangements:

a. In the rays only.
b. In the ray and vertical parenchyma elements.
c. In the vertical parenchyma only.
d. In the fibres only.
e. In vertical parenchyma and fibres.

Within any one category, the distribution shows marked variation between genera or species; for example, consider the first category. In Evoida silica bodies occur in horizontal series in the rays - in other species they may occur generally throughout the ray tissue, in the central ray cells only (Melaleuca), in the marginal cells only, in those ray cells which also contain other deposits, or in those which do not contain other deposits.

The distribution is so various that we are now engaged in preparing a key to separate and identify siliceous timbers. It has been ascertained that a distribution is specifically constant, and the large number of new timbers continually coming on to the market obliges us to seek new criteria for identification purposes. In this respect, occurrence of silica has already proved a valuable criterion.

Before proceeding further I would like to make a correction to last year's Proceedings. There it was stated that an unidentified species of the Combretaceae appeared promising from the point of view of high silica content. It is now known that this timber does not belong to the Combretaceae - in fact no members of this family contain silica in appreciable amounts. During the Conference, Mr. Ellis stated that, since I was interested in timbers of high silica content, I might include Stenocarpus sinuatus and Cryptocarya obovata in future work on siliceous species. I am pleased to be able to report that the range of silica found in Stenocarpus sinuatus is 0.14 - 0.55% with an average of 0.35% (7 specimens). The more highly siliceous specimens should be resistant to teredo attack, but I do not think the timbers at the lower end of the silica range would be. Cryptocarya obovata is non-siliceous so there is no point in including this species in future tests.

As for additional work, we have impregnated small test pieces of coachwood and radiata pine (both susceptible, non-siliceous species) with sodium silicate to see if it is possible to distribute silicate evenly through susceptible timber. The results of analyses are not yet to hand.

Mr. Frank Johnson of the Maritime Services Board also reports that the turpentine he receives for marine piling may be classified in two types - red and black - the former of which is resistant to teredo but not the latter. We are also investigating this problem.

We are also interested in the silica content of wood in relation to sawing properties. It has been reported previously that silica in timbers has a blunting effect on tools. Whether this is so or not we are not prepared to say, but reports are to hand that many non-siliceous timbers are difficult to saw, and also no complaints have been received about the sawing of some timbers which are known to be siliceous. Perhaps the Conference can give some information in connection with woods which do blunt saws - for example I have not heard any complaints about Evodia elleryana - a highly siliceous timber. Is this timber difficult to saw?

Mr. Ellis: Evodia occurs only as a small tree in Queensland and is rarely sawn.

Mr. McAdam: It occurs in New Guinea.

Mr. Head: I think it was sawn by the Forestry Companies and other sawmilling units during the war. I am almost prepared to say it was difficult to saw. At that time every species of mill size was sawn, and I think

Evodia was rather difficult.

Mr. Amos: It has been suggested that the gritty particles of silica in timbers abrade the teeth of teredos. There are alternative mechanisms of resistance. Silica may dissolve in the alimentary canals of teredos and upset the digestive system, or it may be absorbed and precipitated in acidic organs of the shipworms. Silica particles are very absorptive and they may absorb enzymes in the alimentary tract.

On the relation of silica content and sawing, the Utilization Section report that *Eucalyptus obliqua* attacked by termites has a marked blunting effect on saws, and scrapings of termite galleries have been obtained to determine silica content. Granular silica is not visible microscopically.

Mr. Ellis: *Stenocarpus sinuatus* is possibly the worst timber for sawing we have in Queensland. Have you any comparative figures on its silica content?

Mr. Amos: Timbers may contain from nil to over 3 per cent. 0.35 per cent. is a relatively low silica percentage as far as siliceous timbers go.

Mr. Ellis: It is particularly difficult to saw - more so than *Cryptocarya*.

Mr. Amos: Eight specimens of *Cryptocarya obovata* analysed averaged only 0.03 per cent. silica (range 0.00 - 0.13 per cent.). This amount could not account for sawing difficulties. Tension wood is a more likely cause.

Dr. Dadswell: In all rain forest species where you have tension wood there is difficulty in sawing. In the *Lauraceae* tension wood is very abundant.

Mr. McAdam: I did not gather whether you said silica was deposited in sapwood.

Mr. Amos: Analyses we have on sapwood and truewood show that the truewood usually contains a little more. It varies with species. We intend to follow up the distribution of silica in a tree.

Dr. Dadswell: Mr. McAdam has a point there, because Mr. Johnson in Sydney showed me two piles exposed in Sydney Harbour, in which the sapwood showed effects of borer and the heartwood did not.

Mr. Gray: I gathered from Mr. Amos that there is variability of distribution between species. Is there within a species?

Mr. Amos: No. The distribution, that is, the tissues in which silica deposition occurs, is constant for a species. There is variation in quantity, but it is not very great for a species growing in its natural habitat. Marked variation occurs in exotic plantations.

Mr. Gray: Is that the explanation of the susceptibility of turpentine in Hawaii?

Mr. Amos: Hawaiin turpentine contains less than 0.1 per cent. whereas Australian turpentine averages 0.6 per cent. silica. I would say that this explains its susceptibility.

Mr. Cooper: When I was in France last year it was reported by sawmillers that oak from sandy soils was much harder on saws than that from chalky soils. The laboratory had not been able to distinguish between the timbers. Silica was not evident in the walls in crystalline form.

Mr. Benallack: New Guinea kwila is very hard to saw. As far as I know, there is no tension wood in kwila. It is very dense timber but it cuts cleanly. I suppose that of all the timbers in New Guinea, apart from those with tension wood, kwila would take the points off a saw quicker than any other timber.

Mr. Amos: There is no silica in kwila.

Mr. Head Melaleucas?

Mr. Amos: Yes, all species except one, Melaleuca squarrosa, a Victorian species, contain silica deposits in the central ray cells.

Mr. Head: Melaleuca was recognized in the Northern Territory as being particularly difficult to saw.

Mr. Cokely: Are you basing the silica determination on microscopic or chemical analyses? Secondly, what would be the total number of species examined and how many would fall into line with the silica problem and how many would not?

Mr. Amos: On both microscopical and chemical investigations. Timbers containing 0.05 per cent. and more amount to about 400 species. About 85 contain more than 0.5 per cent. The number of species examined total some thousands.

5. DURABILITY TESTS.

Mr. Tamblyn: This subject was discussed at length at the 1948 Conference in Sydney, and it was decided that the Division of Wood Technology should proceed with field tests, the Division of Forest Products with laboratory tests, the position to be reviewed in 2 - 3 years. It has been placed on the agenda this time to enable some decisions to be made on collection for laboratory tests.

In the past 12 months, we have carried out further work on technique and have completed a comprehensive working plan on a long-term programme, in which is included a list of species to be tested, the order of testing, and the amount of material required.

Before approaching the State Forest Services for collection, we had to decide whether to ask for collection of all material together, or to ask for a preliminary collection of material to enable us to start testing. We decided to leave this to the State Forest Services, i.e. to forward to each a list of all the material, the collection of which was desired, but to indicate especially the material essential before the first test starts. As our test is comparative, the first group must all be collected (every tree of it) before any test can start, so the slowest state will set the pace.

We have not specified the locality of collection or the method of collection,leaving that to the States. We have allotted so many trees of each species to each State: they can decide where to collect so as to make a representative sample. We also leave it to the States to decide when botanical material is necessary. We want to be certain of botanical species involved for each specimen, but realize that in most cases, a forester can pick this, even at the mill landing. Also, we would like as complete data on the tree as possible, as this will enable a correlation of decay resistance with locality, topography, age of tree, size of tree, soil, etc., but if the State Forest Services find this impracticable, we will waive it in those cases. Our essential requirements are to know the botanical species and to get a representative sample of the merchantable timber. (We have asked for 10 trees in most cases, but if any State feels that the number of trees stated is too few for a representative sample for that State we are prepared to test more).

The other point is that we want to get material in green and unchecked. Will States agree to end-coat, bag and ship quickly to this Division? What other measures can we adopt?

Another point is that we want to correlate laboratory and field results, and one of the best ways to do this is to do ancillary laboratory tests on any field tests which any State may be putting in. We only need small amounts of material and, say, 4-6 ins. from the end of a stake or pole would give us good information, e.g. can we get end-matched material of Division of Wood Technology field tests?

This applies also to any field tests of preservatives, where material can be got without injuring the specimen, as we will eventually have to check our wood-block tests of toxicity and permanence with field results.

We still have to show that the majority of results we are getting are in line with field tests. More laboratory tests are to be made so that we can get as many checks as possible. It may be remembered also that at the last Conference we mentioned very briefly our intention to arrange cooperative durability tests with overseas Forest Products Laboratories. At that stage, there seemed to be two possibilities worth considering -

(i) The establishment of international field tests based on a standard set of specimens (say 20 or so species drawn from various countries) and extended by addition of as many local species as each country might want to test.

(ii) The laboratory durability testing of the standard set of specimens used in the previously mentioned field test, by as many laboratories as possible, for comparison of laboratory results with field test results.

Since the last Conference, I have been in touch with Dr. Findlay of Princes Risborough, and as an outcome, we seem to have reached agreement that the first international test should be of fairly limited scope, including perhaps a dozen timbers which will be distributed to laboratories interested in laboratory durability tests. Each laboratory will test according to its own laboratory method and will check its results by a local field test.

In his last letter, Dr. Findlay indicated that he would write to other laboratories and endeavour to arrange a suitable comparative test. Such a test should decide fairly quickly which methods of laboratory test give the greatest rapidity and reproducibility of result with the minimum of equipment and skill, and also the degree to which field test results are reproduced. If the test can be arranged, Dr. Findlay will be willing to act as the coordinator.

Mr. Fogl: We should do everything possible to assist in this work. I cannot add anything to Mr. Tamblyn's remarks.

Mr. Tamblyn: A very considerable collection of material is required to go forward slowly over the next 10 years. To start our tests we would want something like 30 species, selected so as to distribute the burden over all the States. We would then have some data to show how good or how bad the results are going to be. If at the end of the first test it does appear worth while continuing testing, we would ask for the second and third collections.

Mr. Huddleston: I agree that the work is worthwhile and would undertake to make a collection. I have had several requests for material from the Division and am endeavouring to have that material obtained and forwarded but unfortunately, power restrictions, etc. have caused setbacks in these activities.

Mr. Ellis: Mr. Tamblyn is not concerned with testing timbers like ironbark. Ironbark has a high reputation for durability, but I feel that the durability of fast grown trees has yet to be established. Mr. Tamblyn was not interested in that aspect at the moment. I would like to urge that early work be done on that aspect of it.

Mr. Tamblyn: We have not given it a great deal of thought as yet. However, if Mr. Ellis feels that it is important I do not see why both fast and slow growing ironbark should not be among the first of the timbers to be tested.

6. LABORATORY TESTS OF PRESERVATIVES.

Mr. Tamblyn: This topic has not been discussed at previous Conferences and is placed on the present agenda to inform the States of our current work and future plans, and to seek any suggestions they may care to make. The item may be discussed conveniently under three headings.

(i) Tests with copper naphthenate - Pole tests in New South Wales and Victoria have shown that green "Cuprinol" applied by a cold dipping process is giving protection which ranges from very good to very fair - dependent apparently on the penetration obtained. However, small specimen tests at Canberra have not been so promising, and have caused us to consider possible reasons for the variable results obtained. Because a cold soak treatment for round timbers is very attractive, we have therefore commenced a laboratory study of copper naphthenate as a wood preservative with the ultimate object of producing a quality specification, as well as recommending the vehicle which will give the best penetration.

We are at present fractionating crude naphthenic acids obtained from different oil fields and testing the toxicity to fungi of the various fractions before and after reaction with copper. We hope later to do some tests on permanence and also to extend toxicity tests to borers and termites.

(ii) Tests with brown coal tar creosote - It is expected that Victoria will be gasifying brown coal within the next few years, and that brown coal tar creosotes will thus be available commercially. We therefore propose to undertake a routine study of the preservative properties of brown coal creosote as soon as material is available from the pilot plant. This should assist in specifying its use as a preservative when it is commercially available. Initial tests will be entirely laboratory ones, but at a later stage, field tests will probably be installed.

(iii) Other preservatives - It seems essential that both laboratory and field tests be made of other preservatives. Although we have virtually no wood preserving industry in Australia as yet, the time is rapidly approaching when such an industry must be established for the treatment of sleepers, poles, crossarms, mine timbers, fence posts, etc. Where possible our standard recommendation, based on past field tests, is to use creosote oil, as most other preservatives tested have not shown up so favourably. However, we must recognize that the supply of creosote oil would not be sufficient to meet all purposes if a large scale industry developed. The testing of other preservatives for special purposes should thus be an important part of our future programme. In particular, we need a good water soluble preservative and an alternative oil preservative to creosote. Whether this work is first tackled in the laboratory or whether field tests are considered the first essential is probably a matter for discussion.

Laboratory tests on relative toxicity would have been helpful. I feel that in future, our tests should not so much be on small specimens as actually special tests on mining timbers or some other definite purpose.

Mr. Huddleston: There is no doubt in my mind that laboratory tests of preservatives are of the utmost importance, particularly with the state of development that we have reached in timber preservation in this country. It is of particular interest to New South Wales, and I think to Queensland when they have their

Bill confirmed to an Act, to be able quickly to assess the permanence and relative toxicity of all preservatives which are submitted for approval. For these purposes, I feel that laboratory tests are going to be of importance and I would like, if possible, to obtain some laboratory technique which would give some indication of the effectiveness and relative permanence of any particular preservative in any given application as soon as possible.

Mr. Tamblyn: We should recognize that our future needs will include one or more good water soluble preservatives and an alternative oil preservative to creosote. In many cases, future needs will be for special purposes which are not necessarily covered by a field test at Belgrave or some other site. Thus zinc chloride may not be ideal in the field but it may be an ideal preservative for mining timbers. Also boric acid treated timber may be quite resistant to decay if used in a building though field tests have shown it to be ineffective because it is liable to leaching. I feel that, in general, we should give more thought to where we are going to need our new preservatives in the future, and design tests, both laboratory and field, to supply the answers.

Mr. Huddleston: Although there does appear to be a difference between Mr. Tamblyn's outlook and my own, I think the view that I expressed will meet both. I think that if Mr. Tamblyn is going to get preservatives that he is looking for, he has to find some laboratory technique which will allow him to test the potential of preservatives before making his recommendation. It is not going to be good enough to wait 20 years before we make a recommendation.

7. POLE BULLETIN.

Mr. Tamblyn: At the last Conference, there was considerable discussion on the need for a publication to supersede the old pole bulletin and to give interim results of the various pole tests. It was agreed that a comprehensive publication should be prepared by the Division.

My purpose in bringing the matter up again is merely to explain that with all preservation Trade Circulars requiring revision, it has not been possible so far to start the pole bulletin. However, the Trade Circulars are now almost all revised and we hope to be able to begin work on the bulletin this coming year. It is quite a big task, and if completed by the next Conference, will probably take another 12 months to be printed. It would therefore seem premature to raise the question of the pole symposium yet as, if I remember correctly, the issue of the bulletin was to be the signal for the symposium.

Mr. Huddleston: The only comment I have to make is that since our last Conference, the need for the pole bulletin has become more urgent. A great deal of interest has been created in New Zealand by poles sent across from Australia. Many people are experiencing difficulty in getting supplies of durable species in long poles.

You will agree that although we may express an opinion, it would be very helpful if we had a bulletin to back up the opinions that are expressed.

Mr. Tamblyn: I think we will be able to meet the obligation this year.

8. STANDARD NOMENCLATURE FOR TIMBERS IMPORTED INTO AUSTRALIA.

Mr. Gray: I was not present at the opening session of the Conference in Sydney last year. During that session, I belive, the Bureau was asked to prepare a preliminary list of timbers imported into Australia. Mr. Cromer did some preliminary work and passed the list on to me. I did further work on it and as verification of botanical names is rather a specialised job, I referred the list to Dr. Dadswell. Mr. Turnbull and other officers of the Forest Products Division made some amendments and additions which were most helpful and which are included in the list. A copy of this list was sent to the Queensland Forest Service and to Mr. Huddleston in New South Wales. Mr. Huddleston was away and his reply was delayed. His and Mr. Ellis' suggestions are not incorporated in the list but their letters have been copied for circulation.

The list is drawn up somewhat on the lines of that of the British Standards 881 and 589 : 1946. For practical use in the trade the important thing is to have an alphabetical list based on common names. This Bureau has a special interest in this list because if would be of great service to, for example, the Department of Trade and Customs, who have to rely on details of timber imports from import entries. Frequently details on these are incomplete and when an unusual name occurs it is often wrongly classified. One of the chief troubles from our point of view is that hardwood species are frequently listed as softwoods and vice versa. The fact that softwoods = non pored woods and hardwoods = pored woods is officially recognised by the Department, but a coding officer has no guide to tell him whether, for example, a species such as ramin is a pored wood or not, and almost invariably Borneo cedar and allied species are coded as "other softwoods" while, on the other hand, frequently coniferous species are coded as "other hardwoods". For this reason it might be a good thing to have a separate list for softwoods and a separate list for hardwoods.

The list aims to cover timbers imported into Australia. An attempt has been made to sort out the confusion of names, especially that of the Borneo cedar group. It is suggested that the name Borneo cedar should be dropped. Timbers imported under this name are covered by lauan, red and white, seraya, red and white and meranti.

I notice Mr. Huddleston has included in his suggestions some common names which were included in our original list but which were omitted by the Forest Products Division. It is very hard to know where to draw the line with some of these names which often have only local use. There is one suggestion which Mr. Huddleston made, taken I think from the British Standards list, with which I do not agree. He suggested redwood as one of the common names for Pinus sylvestris. This alternative common name was deliberately omitted because of the trouble its use in Australia caused some years ago.

There are quite a number of points of interest but I think only for a few of those present, and for this reason perhaps a sub-committee could deal with the matter.

(Copies of the Preliminary List "Standard Nomenclature of Commercial Timbers Imported into Australia" were distributed at the meeting).

Mr. Huddleston: With regard to the list forwarded by us, the additional names we have included are names which are applied to timber coming on the Sydney market at the present time. It was not intended that these names remain on the list in its final form but they have been included in order that consideration will be given to them. In any case, it will need considerable editing before being issued in the form of a standard. With regard to the original, we have adopted the principle in our comments of keeping to the British

Standard List where timbers have been listed in the British list. It is desirable that if the British Standards Institute puts out a list of names and Australia puts out a list, we should bring these lists closely in line with one another, so that where a name of a timber has been listed in the British list, we would suggest that that name be used here.

<u>Mr. Benallack</u>: As far as Victoria is concerned, I query the number of kauris that are shown. It seems to me that all these different types would cause a lot of confusion here. I agree with Mr. Gray that "redwood" should not be used for "Red Baltic". These are very distinct timbers in Victoria. If I remember rightly, the importation of red baltic as redwood resulted in legal proceedings some years ago.

<u>Mr. McAdam</u>: What is the principle used in determining standard names? Is it the first name under which it comes into AustraliA? Is it the name used in the place where it is obtained? Has any consideration been given to its internationally accepted name?

<u>Mr. Gray</u>: I think all of the common names of timbers which are internationally known agree with those adopted by the British Standards. On our list, however, some additional timbers, especially from the Islands, have been included because of their particular interest to Australia. The principle has been followed of giving the common name or the commonest name used for a timber in the country from which it is imported. We have particularly kept in mind the need for records of imports to be a good deal more accurate than in the past.

In regard to kauri, Mr. Benallack is right. Vanikoro kauri and New Caledonian kauri are probably the only ones imported to Victoria but in Queensland and New South Wales several other species of kauri are also imported. Incidentally, kauri has a specific name in the

Trade & Customs' list, and no confusion should arise in its classification.

Many other timbers, as mentioned before, are constantly being wrongly classified. Coding officers would definitely be helped if, for example a separate list was given for softwoods and one for hardwoods.

Mr. Clarke: Could the hardwoods be marked with an asterisk? Perhaps the best solution with redwood would be to add a footnote, e.g. "Not to be used in Australia for Pinus sylvestris."

Mr. Huddleston: I think that we should adopt the principle adopted in the present Australian standard of giving alternative tables, one with the common names arranged in alphabetical order and the other with the botanical names arranged in alphabetical order so that we can use either. It is most essential that we keep to the name adopted by the Standards Association of Australia. The next point is that as the list affects a number of countries, the countries concerned should have the opportunity of commenting on the list that we are going to publish in Australia covering their timbers. This is going to take some time, but I think it is well worthwhile.

The need for the standard is fairly pressing and I would suggest that we could meet the position by asking the Australian Standards Association to issue this in the form of an interim standard and then to forward the interim standard to the interested parties with a view to having it incorporated in the normal standard as an Australian Standard.

Mr. Turnbull: I would like to know if any of the people here consider it would be desirable to break up the list into broad areas of origin. Would any good purpose be served by having, say, the Pacific area separated from the European area? When we started this, we did not know where the task was going to lead us. We started out to cover all timbers imported into Australia and I believe we have done it. I would like an opinion as to whether it is too much of a mixed bag.

Mr. Gray: With regard to Mr. Turnbull's suggestion that he would like to see a list of timbers from New Zealand, etc., the only thing is that it is rather repetitive. The number of species is rather limited but if you have two lists, one alphabetical of common names and one alphabetical of botanical names and then these subdivided according to country of origin, the handiness of the reference would be reduced.

Mr. Turnbull: I personally feel it is not unwieldy in its present form.

Mr. Clarke: With regard to common names, would it be possible to put in the standard trade names in large type and the other common names in small type?

Mr. Gray: I would like to see a softwood and hardwood list using asterisks. As far as we are concerned, it is a softwood and hardwood list that would get us the information on which all our suggestions are based.

Mr. Huddleston: I suggest that the modifications suggested to the preliminary list be forwarded to the States after the list has been placed in order by Mr. Gray, and, on agreement by the States, be forwarded for issue as an interim standard and that this be circulated to the countries concerned for their comments with the idea of getting out ultimately a complete Australian standard. This motion was seconded by Mr. Ellis.

Motion carried.

Mr. Ellis: How are we going to deal with this before it goes to S.A.A.?

Mr. Clarke: Mr. Gray might take the necessary action on it and forward it to the S.A.A. Is it necessary to go round all States first?

Mr. Huddleston: This can be done through S.A.A. It could go to the States at the same time as the other countries. A letter should be forwarded by this Conference to the S.A.A. drawing attention to the resolution which has been passed.

9. TASMANIAN POLE TESTS.

Mr. Tack: This item arises from a visit by Mr. Bond, formerly of the Preservation Section, to Tasmania to advise on the preservation of hop poles. While there, he contacted the Forests Commission and discussed with them the installation of pole tests in two localities - one wet and one dry. The poles were to be treated with an open tank butt treatment, using creosote oil, plus a top dip, but other preservatives and processes will probably be incorporated in the test.

As you know our current pole tests are in Victoria, New South Wales and South Australia and all are from 10-13 years old. It now seems time to think of setting up new pole tests with new preservatives, and to extend the locations of these tests to States, such as Tasmania and Queensland, at present not covered.

Some of the preservatives which have come into modern usage, such as pentachlorphenol, copper naphthenate, copperized C.Z.C., green salt K, may warrant extensive field testing, and certainly brown coal tar creosote should be tested in Victoria. It is proposed that some of these initial pole tests be set up in Tasmania, and although as yet we have only general details of this test, we hope to get opinions of the other States on the desirability of further pole tests. The question of State cooperation is very important in this regard as owing to our shortage of staff, we must depend a great deal on the assistance of the States in the supply of labour, timber, clearing sites, and the actual treating process. We might also consider whether, at some later date, pole tests should be set up in tropical areas such as New Guinea or northern Queensland where results would be obtained very rapidly.

Mr. Payne: I would like to express gratification that the Division has got round to testing poles in Tasmania. The State badly needs it. I hope the suggestion that tests be begun is adopted and I hope that they will not be restricted to new preservatives. We are also likely to be interested in Victoria's brown coal creosote and there is a need to impress upon Tasmanian users that there is something in pole preservation. Tasmania does seem to be a field of work where effective cooperation could be given by the Forestry Commission. We have plenty of field officers in suitable localities. We have no difficulty in getting suitable materials and have adequate supervision. Given advice, we should be able to successfully handle the treatments. We look forward to an extension of this preservation work, not only for hop poles but also to cover fence posts, etc. where there is a growing need for some sort of work.

Mr. Huddleston: My recollection of the last Conference was that we passed a resolution emphasizing the need for pole tests and recommending that they be deferred until some of the new plants have been placed in operation. I have in mind the Australian Wood Pipe Co.

Mr. Clarke: Our recommendation, in connection with pole tests, was that a working plan for a new series of pole tests be put in hand.

Mr. Huddleston: I think that the reason for having the resolution in that form was that a working plan would be best put in hand, but in view of the projected installation of new plants, it would be undesirable to commence a new set of pole tests until we could obtain samples treated by those plants. I think that the position still applies but we should not wait for the new plants to be put in operation in N.S.W. Arrangements could be made to go ahead with further tests. We hope to have plants installed as soon as possible. We will give whatever assistance we can in N.S.W.

Mr. Clarke: Our position would be clearly strengthened by the fact that you have the plant.

Mr. Huddleston: In that case, if you desire to use the Putney plant, we will be only too pleased for you to use it.

Mr. Ellis: I would like to see pole tests extended to Queensland, but I should like to have details of the proposals before committing myself.

Mr. Clarke: I think that our method of carrying out these pole tests might be of interest. In cooperation with the Forestry Department and certain other bodies, such as some of the pole users, we have in the past prepared a working plan of the particular project and we have supplied the technical assistance associated with it, or some of the technical assistance, but the States and some of the cooperating bodies have provided poles, labour, etc. and it would be on that basis that we would propose to carry out further tests in the various States.

Mr. McAdam: With regard to Mr. Tack's reference to accelerated tests of preservatives in tropical areas, we would be very glad to cooperate as far as we can in that matter. I have mentioned before in these talks that I think New Guinea is an exceptionally well-favoured place for accelerated tests of preservatives. Decay goes on every day of the year all the time. Our administration would be willing to cooperate as far as possible.

Mr. Tack: We would have to be careful in interpreting results. I see no reason why we should not install tests both in Sydney and New Guinea and incidentally have them in localities where the process of decay is very rapid. In New Guinea there would be plenty of labour and I think a lot of valuable data could be got from tests there. Tests at present being carried out do not give you the extreme conditions at the top end of the decay scale. I would be keen on putting in these tests.

<u>Mr. Clarke:</u> We would want to use Mr. McAdam's territory as a means of giving us rapid results. We would need to treat some of the timbers that he wants treated up there. Would his telephone problem be sufficiently important to justify telephone pole tests.

<u>Mr. McAdam</u>: It will be important later on, but it is better not to wait till the problem comes upon us. The two objects can be obtained from the same tests. I would suggest that a standard series be sent to New Guinea and that those New Guinea species likely to be in demand for durable uses could be established in the same tests and compared with the Australian standards.

<u>Mr. Tamblyn</u>: We would like as much information as the States can give us, as the tests will have to answer the special problems in each State. It would be easier if Mr. Ellis could state his problem to us. The same applies to a lesser extent to the other States. The object of this discussion is to learn how interested the States are and how ready to give us some preliminary data to work on, e.g. main hazards, suitable testing sites etc.

<u>Mr. Ellis</u>: Mr. Tamblyn's suggestion is quite a good one. A working plan could be arranged. I can see Mr. Tamblyn's difficulty.

<u>Mr. Tack</u>: I think it would be best if we sent a questionnaire to the States regarding their pole position.

<u>Mr. Ellis:</u> You will send your questionnaire

to us with your comments.

10. CROSS ARM SURVEY.

Mr. Tamblyn: Our survey of causes of failure of crossarms was mentioned at the last Conference, but no details were given of the results being obtained. It is thought that a brief indication of the position would now be of interest to delegates.

The Western Australian and Victorian surveys have been completed and reports which have been prepared should be issued shortly. Both surveys have given much the same results, which may be summarized by saying that species of relatively low durability fail primarily from decay and termite attack, and secondarily from end splitting, while with more durable species, the result is reversed, i.e. splitting is the prime cause of failure. We have considered preservative treatment carefully for both States and feel convinced that pressure treatment with an oil preservative is an economic necessity. Such treatment should almost eliminate decay and termite attack and greatly reduce end splitting in service.

As purchase of new cross arms by the P.M.G. for the next 18 months is expected to exceed 1,300,000 and the estimated cost in place is about 22/6, good preservative treatment of all arms could effect an economy of perhaps £200,000 per annum. This, of course, assumes that the pattern of failure will be much the same in the other States which have not yet been surveyed. The reason for delay in the other States has been failure on the part of the P.M.G. to collect the necessary number of arms. We have recently taken the matter up of increased collection, and expect to be able to complete the survey next year. This brings up the question of what assistance the State Services will be able to give us - particularly in N.S.W. and Queensland, where the collecting depots are scattered fairly widely. We will need all the help possible to complete the survey and feel that it might best be done by asking the States to cooperate by making available an officer and transport at least in some places. For example, in N.S.W. there are collections at about 22 depots scattered from Coffs Harbour to the far south, as well as inland, while Queensland collections go as far north as Cairns.

Since P.M.G. crossarms alone probably cost Australia a million pounds a year to purchase, bore and install, there is no question but that the survey is worth doing.

<u>Mr. Cokely</u>: We might find some difficulty in the matter of staff, but we will do all we can. I would like to leave it in abeyance until we see what we can get.

<u>Mr. Huddleston</u>: Mr. Tamblyn has more or less put us on the spot. I could provide two officers, I think I could provide the transport but I do not know whether I could provide the money to pay for transport or travelling expenditure. But we will give all the assistance we can.

<u>Mr. Clarke</u>: Would it be possible to use some of your district liaison men?

<u>Mr. Huddleston</u>: We have only one but are still trying to get two others.

<u>Mr. Clarke</u>: It might be possible for our officers to start off in one centre so that the district officer may know what is required.

<u>Mr. Huddleston</u>: We could probably do that from the Clarence River district and going as far west as Dubbo, but south of the Clarence River would not be possible at the present time.

<u>Mr. Tamblyn</u>: Inspection is a very real problem to us. It seems obvious that local state officers would be able to help immeasurably and to cooperate in the cross

arm investigation. It should be very well worth while for the States to help as the amount of money involved in cross arm replacements in Australia is almost £1,000,000 per year. It will probably cost 1/6 to 2/- to treat an arm and the saving will be very considerable. The main difficulty at present is how to arrange inspections in Queensland and N.S.W.

Mr. Gray: Does Mr. Tamblyn consider covering the question of supply and the rigidity of standards and specifications at all.

Mr. Tamblyn: To some extent, but largely only as quality affects cause of failure. Observations, for example, have been made on the effect of direction of cutting, whether quarter cut or backsawn with reference to the top surface and on the effect of gum veins and sloping grain. Primarily, however, the survey was to study causes of failure and then supply the treatment required.

Mr. Gray: I ask this because the P.M.G. Department has had considerable difficulty in getting supplies of cross arms. The question of cross arm cutting is not very popular with the mills. They say the P.M.G.'s specification is far too high. New Zealand gets quite considerable supplies. I will allow it has lower specifications. The P.M.G.'s Department does not seem to be very keen on this. I feel that in all States there is the question of durability with the question of supply which the durability tests would not cover. It may mean a matter of some investigation as to reducing standards, for example.

Mr. Tamblyn: I believe, myself, that we will not be able to reduce the quality standard of cross arms very much. It is a too specialized use.

Mr. Gray: It makes more important the question of treatment.

Mr. Huddleston: We took the question of quality requirements up with the P.M.G.'s Department in N.S.W. and considering the application to which the cross arms are to be put, their specification and their inspectors are quite reasonable. The main reason why they do not get supplies is that the sawmills are not prepared to cut to fit the specification. The second thing is that cross arms must be cut to 6'8 and 9' lengths and if an inspector rejects these, there is no market for them. The mills prefer to run material in scantling and sell it as a mill run without inspection.

Mr. Turnbull: The position of specification seems to be the same as with sleepers. Revised specifications for W.A. timbers included standards for cross arms, but work has not been undertaken in other States. It will be undertaken when Mr. Tamblyn has completed the cross arm surveys.

Mr. Cooper: Perhaps there could be an alteration of design, using a strap and not a hole.

11. TAXONOMY OF FUNGI.

Mr. Tamblyn: This Division has recently started intensive collecting in Victoria to build up a herbarium of wood-destroying fungi, but we feel that steps should be taken to set up now a central herbarium in Australia to assist in the identification of wood-destroying fungi. We are anxious to push on with this, as in order to select suitable fungi for our laboratory testing of durability, we must know what fungi are likely to attack each timber in service. At present, our knowledge in this respect is very limited. We would therefore like some discussion on whether some system of collection can be arranged by the States. Most Forestry officials must see a fair number of fruiting bodies, both on living trees and on logs, and if some definite arrangement existed whereby they could despatch these direct to D.F.P. we would be in a position not only to build up a reference collection of fruiting bodies, but also to add to our collection of cultures of wood-destroying fungi for test purposes. We would also be able to add to our data on the "host range" of various fungi, since foresters would be able to note the timber species and type of rot associated with each fruiting body, whereas most previous collections of Australian fungi have been made by mycologists who were interested only in the fungi, not in the rot caused by it.

We would like some system to be arranged whereby fruiting bodies can be properly packed, e.g. in grease-proof paper in cardboard boxes, and forwarded to D.F.P. by air mail, so that they will arrive sufficiently fresh to enable us to make fungus cultures from them and to preserve them properly.

We would more or less restrict ourselves to fungi which are definitely associated with a fairly severe rot, as there are some hundreds of bark-dwelling and soil-dwelling fungi which are not concerned with decay and which would overcrowd our culture collection. We would be particularly interested in any fruiting bodies appearing on timber in service or on test stakes.

Apart from collection of fresh fruiting bodies, we would like to know what specimens are being held in other collections of wood-destroying fungi throughout Australia, and to arrange for an interchange of duplicate specimens with other collections.

Actually, unless other collections are in constant use, it would be better to house them in a central reference herbarium here, as they would then be adequately maintained and described and would be of considerable help to us in identifying fruiting bodies.

We are now collating all the information available in our records as to the occurrence of wood-destroying fungi in Australia, with regard to (a) locality and season of collection, (b) timber species attacked, (c) form of timber attacked (trees, logs, posts, mine timber, floors, etc.), and (d) type of rot caused. This type of information is of considerable value firstly for selecting test fungi for our durability tests, and also for laboratory testing of preservatives, and secondly for identifying the various rots occurring in timber in service.

This information will be collated on a punched card system in our laboratory, but it is hoped to extract and issue the parts which are of general interest in the form of "check lists" showing the various types of rot occurring in each timber.

There must be a lot of information of this type available in the State Forest Services, even if only in the minds of the Forest Officers. Many foresters would have noticed what type of fruiting bodies occur in their locality and what type of timbers they occur on, and there is probably a fair amount of information on record (e.g. in the Division of Wood Technology and Queensland Forest Service). We would like to get as much information of this type as possible to supplement our own records.

Mr. Payne: Our experience in Tasmania has been that we leave the collection of this material to our Divisional Foresters, who are administrative officers. As they are busy people, the results are rarely satisfactory. If Tasmania is to cooperate in the collection of fungi, I think we would need to do it by deputing an officer specially to that task, now and then going out into the bush. I do not know what the taxonomic position is in regard to fungi. We have always had difficulty in getting any authoritative data for identification. It has been a matter for concern and we are becoming more interested in this particular problem in Tasmania. Recent evidence of this was a box of specimens sent to Mr. Tamblyn. Presumably, if material was sent in, it could be identified and as much information as is available could be directed back to the State Service and to the officer who makes the original collection.

Mr. Huddleston: I agree with the objective set out by Mr. Tamblyn, but as I listened to him, I was hoping that he would give us some means of ensuring that this collection was carried out. We have been trying to do something ourselves in N.S.W. I agree with Mr. Payne that we must put a man on whose main job is collecting material regularly. There is no prospect within the next twelve months.

Mr. Ellis: Queensland's position is that we have no officer available at present but I think the collecting might be attended to by officers of the Department of Agriculture. When Dr. H.E. Young was an officer of the Department of Agriculture and Stock, I understand that he was making a collection. I agree with Mr. Huddleston that it would be difficult to appoint a collector. It seems beyond the bounds of practical politics. Perhaps we can arrange for collection without the appointment of a special officer.

Mr. McAdam: We have been very busy. Our botanist has been fully occupied. However, we can contribute quite a lot from time to time over a long period now that we see some signs of getting more staff.

Mr. Clarke: It seems that some of the field officers are interested in fungi. This is probably associated in Victoria with the fact that some of them have taken Botany at the University. It is still quite possible in some other States that there are officers who have a definite interest in fungi and if they could be sought out and their interest revived and directed into the right channels, they might be able to get good collections in some districts.

Mr. McAdam: In forestry, there are very few officers who have taken any detailed interest in fungi due to lack of interest in the subject generally.

Mr. Amos: Would it be possible to get people from the Universities?

Mr. Payne: We are a small Department, with few personnel. We considered getting the help of University students during the long vacation. We are wondering if anybody has used University students.

Mr. Tamblyn: I think the only way to ensure a collection is to select one or two officers in each State Service who would be enthusiastic collectors. They could be in direct touch with the herbarium in identifying the fungi, so that there would be direct personal contact. There is one other point. The position in Queensland was that Dr. H. Young began a collection but that since he has left the Department of Agriculture and Stock, no one seems responsible for its safe keeping and maintenance and we have no record of the species collected or of the notes made by Dr. Young.

12. LYCTUS CONFERENCE.

A. RE-EXAMINATION OF TOXICITY OF BORIC ACID AND BORAX.

Mr. Fogl: The commercial treatment of Lyctus susceptible timbers with borax and boric acid has been established in N.S.W. and has proved eminently successful. Recommendations made by Forest Products that 0.2% boric acid should be contained in the core have, in the main been observed, and have proved effective. The toxicity of boric acid and borax to Anobium has been examined in New Zealand and it has been established that Anobium can be killed by the same concentration as used for Lyctus. Work on termites has been carried out by Mr. Gay.

As far as Lyctus is concerned, the only reason for re-examination would be to complete the work started by J.E. Cummins of the Division of Forest Products and reported in 1939 in the C.S.I.R. Journal. He reported results on one species only - Sloanea woolsii. As far as Lyctus is concerned I do not think that re-examination of the two chemicals is of urgent practical importance. There may be fundamental reasons for re-examination on the grounds that only one species has been tested but the difference in the actual quantity of preservative content which would occur between the various species due to variation in density would be so small as not to affect present commercial practice. We are working on a 30% safety factor and we cannot reduce this because of treatment conditions.

Mr. Cokely: I agree with Mr. Fogl in some aspects. 0.2% concentration is satisfactory but I cannot agree that the matter should be dropped. Firstly Cummins worked on one species only. Secondly he carried out work on a limited number of samples and did not include possibilities such as locality variation. Variation of species does not matter commercially but actually two timbers, one of 30 lb./cu.ft. and one of 60 lb./cu.ft. will have widely different amounts of chemical present. We should ascertain the ultimate figure.

Mr. Tamblyn: The point we have to determine is whether or not Cummins' figure is too high. Obviously 0.2% is quite satisfactory - it is giving control. However, we are blindly accepting this figure and not questioning whether 0.1% might not be equally effective.

In New Zealand, Harrow and Spiller have shown that 0.5% boric acid prevents Anobium attack. If Cummins tested his specimen complete then his figures are presumably not too high, but if he cut the specimen down the middle it is possible that the core concentration was only 0.1%. From the New Zealand figure one would expect that our figure is too high. Also with a number of timbers of varying densities we have no data to show whether we should accept the one figure for all species or whether it should be lower for lower density timbers.

Mr. Huddleston: Mr. Fogl was pointing out that for practical application the exact concentration does not matter. We can treat 1" timber on an 8 hour cycle in plants in N.S.W. but it is difficult to organise an 8 hour cycle to fit in with the 40 hour week. Most plants prefer to use a 22 hour cycle and make one treatment/day. This is done by reducing concentration of preservative. From the practical aspect it does not atter whether we adhere to 0.2% as a minimum concentration or whether we drop this figure to 0.19%. If, on the other hand, in your work of a basic nature you want to determine the exact concentration as a research tool for further investigations, I agree that a more accurate method would be worth while. If it is a matter of determining lethal concentration for present methods of preservative treatment you would be wasting your time. Nothing could be saved on chemical cost.

Mr. Fogl: N.S.W. practice is to treat mixed scrub woods together. In one charge sampled we found 10 different species. If high and low density species occur in the one charge then that charge must be treated as for high density species.

Mr. Clarke: If the minimum concentration can be reduced, consumption can be reduced accordingly.

Mr. Tamblyn: We are importing boric acid from dollar sources and expect that supplies will be short. A great saving in boric acid could be effected by reducing the required concentration by 100%. We will be doing routine testing of other toxics and I feel we should re-test the toxicity of both borax and boric acid, if only to ensure that Cummins' figures are reasonably reliable, and especially as we suspect that movement of salt in the block has a pronounced effect.

Mr. Gordon: If in the furniture industry more intensive use is likely to be made of urea glues in future, the presence of borax may result in unsatisfactory gluing. I have not heard any adverse comments yet but this point might arise. A reduction in concentration might overcome some of the difficulties which might eventually arise.

Mr. Clarke: Could States make some estimate of their yearly requirements of boric acid and borax?

Mr. Cokely: We estimated 190 tons last year but this figure will probably rise to 250 tons with the introduction of the Act. Could Mr. Parker tell us the effect of devaluation on our supplies, most of which are from American sources.

Mr. Parker: I have very little detailed knowledge of devaluation but imports must be reduced all round. Imports of borax would have to be reduced unless special consideration can be received.

Mr. Fogl: N.S.W. requirements would be about 100-150 tons/year.

Mr. Clarke: Australian consumption would appear to be about 400 tons/year. At £60/ton this would cost £25,000. If we could save 25% (which is within the bounds of possibility if we use a weaker solution) this would mean a saving of £6000/year. Comparative cost of the experiment would be small.

Mr. Fogl: I favour a change in schedule rather than a change in lethal minima.

Mr. Ellis: I feel there is full justification for toxicity re-examination of borax and boric acid. There is not much work involved and possible savings would seem to justify it.

B. USE OF SODIUM FLUORIDE AS A LYCTICIDE.

Mr. Cokely: This item is intended more for the information of the Conference than to report any positive work done. At the last Conference the use of fluosilicate was discussed and we raised objections against its use. Dr. Gordon, the Queensland Industrial Hygiene Officer, initiated an experiment to find out what health hazards were involved. We have treated one charge using the cold soak treatment and the second charge is waiting to go in. At the end of the treatment the material will be machined and health tests carried out. We have had a lot of difficulty in dissolving fluoride. We asked the Division of Forest Products for comment but eventually overcame the trouble. We dissolved the first run as a concentrate.

There is a health hazard as far as sodium fluoride is concerned. It is delivered in a wooden barrel as a very fine dust. Precautions are simple - gloves, goggles and nose mask. If these precautions had to be taken in commercial practice they would mitigate against its use.

We have not done very much on the analytical side. The Division of Wood Technology is concentrating on this. We tried methods of analysing our solution. Following Mr. Christensen's method we found this satisfactory on pure solutions but was not practical for treatment solutions, as pointed out by him.

Final results on this matter should be available at the end of January, 1950.

Mr. Christensen: Mr. Cokely sent us down some insoluble material from his treatment vats, on which we did some tests. We had a similar difficulty in the laboratory here. Commercial sodium fluoride was thought to be insoluble but we found it to be contaminated with a large percentage of sodium silico fluoride, which is capable of producing copious silicic acid precipitates.

I have not done any further work on fluoride analysis; the method is only applicable to relatively pure solutions.

Mr. Huddleston: I have a draft progress report giving the results carried out to date on analytical methods. There is a method developed and reported but we are still not happy with the method for plant control purposes. It is satisfactory for laboratory work but too complicated for general purpose use. For this reason we propose to investigate further methods of analysis.

I have recently had correspondence with Hickson & Welch, the producers of Wolman salts, a preservative which contains sodium fluoride plus other chemicals. They state, and have given extensive figures to prove, that there is no health hazard associated with the use of Wolman salts. They have stated that health authorities throughout the world are prepared to accept Wolman salts. For this reason I am wondering if the question of health hazards is not being over-rated.

Mr. Cokely: Dr. Gordon's attitude to any of these chemicals is

i) What are the advantages to be gained from it?

ii) If any hazard exists is any non-hazardous alternative available?

iii) Assuming no alternative is available do the advantages outweigh the hazards?

If there is any suggestion of hazard Dr. Gordon not only examines the chemical himself but also refers it to overseas authorities. He is the Industrial Hygiene Officer and, as such, is responsible under our Compensation Laws.

Mr. Amos: One of the best reference libraries for health hazards in this State is at the Defence Research Laboratories, and I suggest that the D.R.L. representative obtain a statement on this matter to be forwarded to State delegates.

Mr. West: I will see that this is done.

Mr. Clarke: The position seems to be that the attitude of Medical Officers on health hazards will vary from State to State. A report is coming forward from New South Wales on methods of analysis of sodium fluoride and a report will be available early next year from Queensland on treatments.

C. AUSTRALIAN STANDARD SPECIFICATIONS FOR BORIC ACID TREATMENT.

a. General.

Mr. Huddleston: At our last Conference it was agreed that it was desirable that an Australian standard specification for preservative treatment should be prepared and I feel that it was left to the Division of Forest Products to prepare an initial draft specification. N.S.W. would very much like to have an Australian standard specification for preservative treatment of timber, particularly with regard to our Timber Marketing Act.

Mr. Tamblyn: I think Mr. Huddleston was to arrange the passage of this specification on boric acid treatment with the Standards Committee. As far as I know, we did not undertake to prepare a draft specification.

Mr. Huddleston: The specification is on the programme of the Timber Industry Committee and has been referred to the Wood Technology Committee. The Division of Wood Technology will offer to prepare an initial draft for a standard specification and forward it to the Queensland Forest Service, Division of Forest Products and the Victorian Forestry Commission for comment before forwarding it on to the Standards Association.

b. Review of standard minimum requirements as regards depth of penetration.

Mr. Cokley: This item has been raised in anticipation of the introduction of our new legislation. To date we have followed the practice of complete impregnation using 0.2% as the core minimum and allowed no tolerance. I would like the views of delegates on the following points:

i) The rigidity of 0.2%. When this figure was fixed at the 1946 Conference there was a proposal for a tolerance of ± 0.02% in any one sample. Although this proposal was not accepted at the time I feel this tolerance should be allowed in commercial practice especially as there is some question of the accuracy of our analytical methods.

ii) Whether 0.2% is to be taken as the figure immediately after treatment or after allowing for seasoning.

iii) Whether the Conference approves of preventative treatments such as a spray treatment of sterilized timber having a penetration of 3/16". A commercial advantage of such a treatment is that it can be applied to finished articles where no further machining is necessary at a low treatment cost. It is anticipated that treatment cost could be reduced from 13/- per 100 sp.ft. to 7/- or 8/- per 100 sp. ft. I would like consideration of this question, not only as regards boric acid and borax but as regards pentachlorphenol and See Kay wax.

Mr. Huddleston: Mr. Cokley has made special reference to the Queensland Act. This is a matter of policy to be determined by the Queensland Forest Service. The question of minimum concentration was discussed by this Conference two or three years ago and it was decided to accept 0.2% boric acid as the absolute minimum without tolerance. We have granted all our approvals on this basis. It may be possible for preservative treated timber to be placed on the market at a lower concentration, say 0.19%, but we could not prosecute such firms because under the terms of our Act we would have to prove that 0.19% is not toxic to Lyctus and we cannot do this. Cummins has published that 0.12% or 0.13% could be toxic to Lyctus.

We have discussed surface treatments thoroughly at past Forest Products Conferences and decided unanimously that we could not afford to have any failures in preservative treated timber. We have received a number of requests in N.S.W. for approval for surface treatments and have refused every request except one. This was from a manufacturer of laminated furniture with phenol formaldehyde glue. The furniture is made from 1/16" or 1/8" veneers laminated and glued together to give the finished article. The heating in the press is sufficient to sterilize the timber.

Approval for a dip of the completed article in See Kay wax within 7 days of pressing has been given. We do not like surface treatments and are not happy with the one approval we have given. Any treatment for protection against borer should be on the basis of 0.2% boric acid at the core of the piece.

Mr. Cokely: South Africa has found it impractical using pentachlorphenol go analyse individual samples. They work on a certain pick-up per charge with a minimum penetration of 75%. With See Kay wax should we adopt Cummins' figure or should we add a tolerance to it?

Mr. Tamblyn: If more information is required on these other chemicals tests will have to be made on them.

Mr. Ellis: South Africa has been getting satisfactory service from surface treatment for quite a number of years. We should follow South Africa's example. The cost of boric acid treatment with 0.2% borax is 13/- per 100 sp.ft. I believe that with spray treatment of pentachlorphenol on the finished article, or even of a water solution of borax, the treatment could be reduced as low as 3/- per 100 sp.ft. without getting a core concentration that would be lethal. I think the risk of infection would be so small that for all practical purposes it could be ignored.

Mr. Clarke: There is a danger in adopting recommendations that have given satisfaction in other countries unless we have complete knowledge of conditions in those countries. South Africa has not the problem we have in Australia of marketing scrub timbers with a wide sapwood. They do not have the problem that if their treatments are unsatisfactory they destroy confidence in quite an important group of timbers, thus seriously affecting the market. In the case of Tasmanian hardwood shipped to Adelaide, pentachlorphenol treatment of the sapwood might be sufficient to overcome the Lyctus problem. But this is a different problem to that obtaining in New South Wales and Queensland, both of which have considerable reserves of Lyctus sysceptible timber in their scrub forests.

Mr. Gay: I have made observations on egg laying in six species of timber. In each case I have recorded the depth at which 50 or more eggs were laid.

Eucalyptus obliqua	depth of	3-5 mm.
Alstonia scholaris	"	3-5½ mm.
Sterculia acerifolia	"	1½-5½ mm.
Sloanea woolsii	"	1-5½ mm.
Tarristia argyodendron	"	1¾-5½ mm.
Eucalyptus maculata	"	1 -6½ mm.

Mr. Huddleston: A N.S.W. firm tried treatment prior to our legislation by introducing a dip treatment for Tego bonded plywood. That treatment has since been approved on the basis that everything inside the first glue line will be non-susceptible timber and this is giving satisfaction. Prior to the introduction of the legislation this manufacturer was using borer susceptible timber right through the plywood, dipping it the same as he is doing now and pasting a notice on each sheet to the effect that if the sheets were cut the edges needed to be coated with certain preservatives. A lot of this plywood went into caravans and, without exception, the plywood was attacked and destroyed by Lyctus.

Mr. Cokley: We guarantee an immunisation treatment completely against Lyctus attack but we have had a number of enquiries for preventative treatments which we cannot guarantee 100% against Lyctus attack.

Mr. Clarke: The feeling of the Conference is that Mr. Cokley should aim at immunisation.

Mr. Huddleston: In N.S.W. we throw the onus back on to the firm making application. Where we have no knowledge of their preservative they have to arrange to have tests carried out before we are prepared to grant approval.

Mr. Cokley: I would like to ascertain whether such a project as spraying of War Service Homes should be approved.

Mr. Ellis: Mr. Clarke suggested that a spray treatment might be considered satisfactory for eucalypts but not for scrubwoods which have a high percentage sapwood. I would point out that most of our eucalypts have a narrow band of sapwood although in spotted gum sapwood may be up to 1" wide.

Mr. Clarke: I quoted the case of Tasmania shipping eucalypts with comparatively narrow sapwood to South Australia. The only timbers under discussion were eucalypts with narrow sapwood. Tasmania does not have scrubwoods with a wide sapwood and if some treatment were adopted and failure occurred this would not reflect back on the sale of Tasmanian secondary species. The N.S.W. and Queensland problem is different. If spray treatment was adopted and failed this would affect the status of immunisation generally in those States.

Mr. Ellis: If limited approval for spray treatment of spotted gum were given a statement would be required that this timber had been given a surface treatment only and in this respect might not be entirely satisfactory.

I would ask Mr. Gay if it has been found that a female beetle will not lay eggs on a surface which would not prove satisfactory to the larvae.

Mr. Gay: Original work carried out by Parkin in England on this subject related merely to the starch content of the wood. The female presumably detects the presence or absence of starch in wood and the starch level by taste. The correlation was high to show that the female did not oviposit in wood which was likely to be unsuitable for larvae. Whether the presence of a chemical in the wood would have the same effect I do not know.

Mr. Tamblyn: Some work was done in U.S.A. by Christian on boric acid dipped timber which was ultimately attacked because depth of penetration was not as great as depth of oviposition. I feel disturbed at the suggestions from Queensland that they permit under their Act all the practices we have been uneasy about in the past. Enactment of legislation is a very serious matter and only processes which can be guaranteed thoroughly effective should be admitted in the first instance. Other treatments should first be investigated because if treatments approved under the Act prove unsatisfactory the whole structure of the legislation may be endangered. The Queensland Act should follow closely on the N.S.W. Act - should be conservative at first, adopting gradually other treatments as they prove effective.

<u>Mr. Clarke</u>: It may take several years to prove a treatment, especially a surface treatment, satisfactory. Hazards arise in the practical use of the timber which are very hard to reproduce in the laboratory.

<u>Mr. Irvine</u>: I would like to ask Mr. Ellis if approval is given for surface treatments, particularly of the highly susceptible spotted gum, what effect this approval will have on timber for export to other States. Will the approval cover use only within Queensland or for export to other States?

<u>Mr. Ellis</u>: I cannot answer that question - Mr. Huddleston could probably give accurate information on this point as far as it would affect N.S.W. I would like to quote an extract from an article by Christian entitled "Lyctus Beetle Damage Prevention - Second Report on Chemical Dip Tests Against Powder Post Beetles" which appeared on page 47 of "Southern Lumberman", June 15/1940.

"The only material which has been thoroughly tested on a commercial scale is borax. One million board feet of green ash lumber was dipped 10 seconds in a 5 per cent. borax solution at 130°F. during the spring and summer months of 1939 and the lumber was piled on the open mill yard for drying. A large quantity of this lumber was on the yard approximately one year later, at which time close inspections revealed no indication of Lyctus attack or any other signs of insect activity.

A great deal of Lyctus and bostrichid damage was found in some of the non-treated ash lumber cut during the same period."

Mr. Tamblyn: I think there was a second article by Christian which reported considerable damage in the second year.

Mr. Huddleston: Replying to Mr. Irvine's query, if I felt that the Queensland Department was going to approve of spray treatments I would feel obliged to recommend to my Minister that we do not enter into a reciprocal agreement with Queensland. The Act places on us a duty to the timber trade and timber users.

Mr. Clarke: Members of the Conference have given Mr. Cokley their opinions, we can go no further than this. Queensland must shoulder the responsibility of interpreting its own Act.

D. SUSCEPTIBILITY GRADINGS FOR NEW COMMERCIAL TIMBERS.

Mr. Cokley: In Queensland we have a number of commercial species which little or nothing is known as to susceptibility to Lyctus. As a result we feel that something should be done about it. In Queensland we depend mostly on Mr. Brimblecombe, of the Department of Agriculture and Stock who has a busy time with his own works and consequently there are no facilities to carry out investigations. Accordingly we refer to your Division to know what is to be done about it, and that is where the position rests at the moment. We require information as to the grading of these new timbers - about 80 of them - and what can be done to determine the relative grading in connection with the susceptibility to Lyctus. We are asking your Division to test these species and to say whether they are susceptible or not.

Mr. Clarke: Have you a range of samples of each of these species?

Mr. Cokley: No. We can arrange to obtain them as required.

Mr. Tamblyn: The matter is in the preliminary stage at present. A short time ago Queensland asked us to test the 80 or so species and also specimens. Naturally we would be very pleased to do the susceptibility testing and our techniques are now fairly satisfactory. At the same time one might suggest that Queensland set up a natural Lyctus susceptibility test, as well as our proposed laboratory one.

Mr. Huddleston: If it would help, we have a list of species marked for susceptibility determined from our own experience and other information which can be collated. We have also made some tests to confirm the gradings. This is available for any who would like it.

Dr. Dadswell: I feel we should take on this work as it will help to build up our collection of specimens. We have to learn how to identify all the brush timbers and for this would need heartwood in addition to the sapwood.

Mr. Clarke: You could arrange that Mr. Ellis?

Mr. Ellis: It is not clear as to what material you require, the size of sample and where from, etc. Could you tell us as many details as possible.

Mr. Clarke: Yes, we shall supply this information.

Mr. Fogl: I think that several contentious native species might be included. One which readily comes to mind and which I have mentioned to Mr. Tamblyn is Silver Sycamore. This species fulfills all requirements for Lyctus attack, such as starch content and pore size. I have never heard of Silve Sycamore being attacked. This species is regarded as a susceptible timber in Queensland however, although in New South Wales it is not included as such. I feel that this species should be subjected to further examination.

Mr. Clarke: Is it suggested that we should have the samples of silver sycamore from Queensland?

Mr. Ellis: Susceptibility might be a geographical characteristic. I prefer to leave it at that. In some cases a timber may be regarded as non-susceptible in New South Wales which in Queensland has been found to be susceptible. Lists should be prepared of such timbers so that further investigation can be made.

Mr. Huddleston: We cannot accept it with regard to silver sycamore.

Mr. Ellis: It was the case also in regard to coachwood until a month ago. I understand that coachwood was not regarded as susceptible but that attack has recently been recorded.

Mr. Clarke: Could that be said of any timber?

Dr. Chattaway: I think that some timbers never store starch. If a timber ever does store starch, it might store enough to be susceptible, but some timbers can have oils and fats as reserves, and I think these would always be immune from Lyctus attack, even in the sapwood.

Mr. Clarke: I think the first thing to do here is to prepare a list of species in dispute between New South Wales and Queensland· and the next thing is to decide what further tests are necessary. In the case of silver sycamore, New South Wales finds it non-susceptible, but in Queensland there is some doubt. It should be tested therefore in Queensland but not necessarily in New South Wales.

Mr. Huddleston: If any treated silver sycamore was sent into N.S.W. for manufacturing purposes the retailer or manufacturer could not be expected to know if the timber was liable to attack by Lyctus. There is no restriction to the use of it in manufacture.

Mr. Ellis: I would like to refer to Mr. Tamblyn those timbers on which we are not unanimous, particularly the native species. Those timbers on which we are in toubt should be subjected to fairly comprehensive tests.

Mr. Clarke: We would agree to that, but I do not think there is any point to be gained in the case of silver sycamore if Mr. Huddleston can say that the specimens have been collected over a fairly wide range.

Mr. Fogl: There is every criterion by which Lyctus should attack silver sycamore and the theory is that there is a chemical explanation for its freedom from Lyctus attack.

Mr. Clarke: It seems to me that silver sycamore might be included under nutritional studies.

Mr. Huddleston: It is a timber which shows all the characteristics for Lyctus attack· yet for a period of years it has been used extensively and there has been no evidence of Lyctus attack in it.

Mr. Clarke: All right, Queensland and New South Wales will prepare lists of timbers on which they are not unanimous, and later forward samples to Mr. Tamblyn for testing.

E. REVIEW OF S.A.A. SPECIFICATION WITH RESPECT TO INCLUSION OF SAPWOOD IN LYCTUS SUSCEPTIBLE SPECIES.

Mr. Ellis: It seems to me that unsatisfactory provisions exist in the S.A.A. specifications for hardwoods. The present Acts in New South Wales and Queensland are probably more up-to-date. The S.A.A. publication (E)0.54 (1942) contains no restrictions regarding Lyctus susceptible sapwood. Nevertheless we find in the Acts now before us that sapwood is definitely prohibited.

Mr. Clarke: Is it your recommendation that in reviewing the S.A.A. specification Lyctus susceptible species should not be permitted at all?

Mr. Huddleston: I am not sure that Mr. Ellis is right there.

Mr. Turnbull: Sapwood was allowed in standardised grades up to certain definite limits, knowing that if it was susceptible it would be destroyed.

Mr. Head: So far as sapwood is concerned, it is permitted in structural timbers within certain limits but it is excluded from finishing lines such as flooring. Even now susceptible sapwood is debarred from select grade finishing lines.

Mr. Ellis: In checking this I find there is no limit to susceptible sapwood in the scantling grades.

Mr. Turnbull: Our point was that in structural grades you have to consider the strength of the material. As far as sapwood is concerned, it was recognized that it might disappear from susceptible species, but the limits allowed in the original grade would ensure that the residual section would satisfy final strength requirements.

Mr. Ellis: There is no serious conflict then, apparently. I would like to say, however, that there has been a recent move in Queensland to introduce an S.A.A. scantling specification in which susceptible sapwood is rejected. It has been decided by majority vote of the Queensland Standards Timber Committee that Lyctus susceptible species in scantlings shall not be permitted.

Mr. Clarke: What is the reason?

Mr. Ellis: Objection to the borers themselves.

Mr. Clarke: That is a different matter.

Mr. Turnbull: I think it is unnecessarily restrictive in the utilization of the timbers affected.

Mr. Ellis: Would New South Wales agree to a suggestion to alter S.A.A.54 to reject Lyctus susceptible timber?

Mr. Huddleston: We would not agree to an alteration as suggested by Mr. Ellis. There is no conflict with regard to the legislation concerning scantling.

Mr. Clarke: That is virtually the position in Victoria where Lyctus susceptible sapwood is allowed. This means a tightening up in Queensland, and it seems that the tightening up is affecting you in that people are asking for a lower key market price in connection with the species concerned.

Mr. Ellis: I meant to convey that Queensland had already tightened up on (E)O.54. It is something which is coming before the Standards Association. I personally did not agree with it, but I want to draw attention to it here.

F. REPORT ON LYCTUS LEGISLATION (QUEENSLAND)

Mr. Ellis: Mr. Chairman, I understand there have been a number of amendments to the Bill but the main part of it remains substantially as it is in the Bill. I am sorry that copies are not available for all members. There are some differences between the N.S.W. and Queensland Acts. I am relying on Mr. Cokley to explain these to you.

Mr. Cokley: Briefly, there are 19 sections of the Act and I will just mention the major differences. One is for approved preservative treatment. In the Queensland Act this is limited specifically to treatments against Lyctus. The N.S.W. Act is general. That is the major difference in our definitions. The body of the Act is fairly similar. The next major difference deals with the powers and functions of the forest officer. Here we have gone much further than N.S.W. We have, for example, the right to demand for inspection all books, and to take copies of them if necessary. There are specific clauses of instruction as to what can or cannot be done, and a variation in relation to moisture content. In our Act we can specify whether we require complicance with Australian standards or whether for certain conditions, that there shall be some other minimum moisture content.

The Act provides for actual power in the State to define the conditions of a test. We vary in the time of taking samples and have quite a few other variations, one or two of which are major ones. Moisture content in itself is not covered by any specific clause dealing with faults or inaccurate moisture content specification. With regard to penalties, instead of £50 as in N.S.W. we go up to £200.

There is a big variation in schedule lists, mostly due to inclusion of other timber species including a number of eucalypts. The reason for including eucalypts is to prevent the use of sapwood in certain building practices where no Lyctus susceptible sapwood should be used - for example, in wall battens and tiling battens, both of which have caused and are causing considerable trouble to us.

Those are, very briefly, the variations between the Acts. I have not covered the lot, but I have a full list here, which is available for inspection of the members of the Conference, if desired. In general, I think it should turn out to be a good Act.

Mr. Huddleston: I have only had the opportunity of a quick look through the Queensland Bill, which I understand is now an Act. There is one very disturbing feature in that Bill. It comes about in the definition of "approved preservative treatment", which is a variation of the N.S.W. definition. Then they define "preservative treatment" in exactly the same way as in N.S.W. In the Act, you find that in the case of any person treating timber for any other purpose than against Lyctus, all he has to do is to mark the invoice stating the purpose for which the timber has been treated. For instance, they can treat it for white ants with treacle, and sell it, providing the invoice states that it has been treated. I think this is a very disturbing feature in the Act and it is something which must react against any agreement between N.S.W. and Queensland for reciprocal treatment.

Mr. Irvine: If I understand Mr. Huddleston correctly, preservative treatment is automatically approved - that is, there is no provision for approval by an authority - the treatment automatically becomes the approved treatment if a person who treates the timber marks his invoice that the timber has been treated.

Mr. Ellis: Approval must be given in the case of Lyctus treatment, but with respect to any other treatment, a man may claim that he is treating for white ants and he has only to state on his invoice that he has treated it for white ants. I do not think it is necessary for him to have the treatment approved.

G. LABORATORY BREEDING AND TESTING TECHNIQUES COMMITTEE.

(a) General Report.

Mr. Tamblyn: At the Conference in Sydney, I reported on some of our difficulties in obtaining uniformly good results in breeding Lyctus. For this reason we had suspended temporarily our further work on testing toxicity of preservatives. After considerable discussion it was decided that a corresponding committee be formed to follow up the matter of laboratory breeding and testing techniques. This Committee has not actually begun to function yet, mainly because, with the matter fully discussed at the last Conference, there has been nothing to report until recently. The matter can, I think, be covered adequately by a brief statement of the present position.

Since the last Conference, we have built a new Lyctus breeding room with good temperature and humidity control, which is clean and free from mites. In addition, we have located one source of our previous troubles in the sand used as a foothold in the bottom of the breeding jars. The sand which was being used last year proved, on comparison with other footholds, to be almost lethal - due apparently to fine particles which had not been sifted out.

We have made a number of tests with different footholds and selected one which is giving good results.

Also, we have been able to control the mite problem which was one of the previous causes of trouble. For example, when a very occasional breeding jar becomes infested with mites we find most of the beetles die within a few hours of emergence and usually before we can collect.

The main problem is now to be able to select timber which is highly susceptible to attack - that is, to forecast its degree of susceptibility. To this end, we are cooperating with Mr. Gay in some studies of the nutritional requirements of Lyctus. Mr. Gay may have some preliminary results by now and may care to comment on the matter.

(b) Report on Nutritional Studies.

Mr. Gay: You will remember that at the last Conference it was decided to carry out some work on the nutritional requirements of Lyctus, and after some discussion in which it was pointed out that there were difficulties in the way of handling normal nutritional techniques, it was suggested that we should attempt to study their requirements by using small samples of wood which had been subjected to various extracting processes to remove everything but the wood structure itself, and to put back the materials in which we were interested. There was a lot of delay before we managed to get the samples prepared. It was not until May of this year that we actually received the samples for the first test. Those samples have been under test for about five months and we have a brief preliminary statement of what has happened. We had two boards, one of which had a high natural starch content, the other was one in which natural starch was absent. Each board was split up into a number of small sub-samples of about $1\frac{1}{2} \times 1 \times \frac{1}{4}$", they were then subdivided into groups of threes and subjected to various treatments: first of all, no treatment at all: then with the natural starch removed by hydrolysis with dilute hydrochloric, followed by Soxhlet extraction with alcohol-benzene, alcohol and ether. Three more samples were given this extractive process and soluble starch put back at various levels. Four groups to which starch was added were loaded to 0.5%, 1%, 2% and 4% starch level, using soluble starch. The 7th group was subjected to the extractive process and then loaded with 1% starch, 0.5% McCollums mixture, 0.5% peptone and 0.5% sucrose. And the final group after extraction was loaded with 4% starch, 0.5% McCollums mixture, 1% peptone and 1% sucrose. Each of those samples was then subjected to the activities of five females in association with five males: they were allowed to oviposit for a period of 24 hours and were then removed. We have then 16 sets of 3 blocks and of those 48 blocks we have so far only had emergence from three blocks, the group of three in which there was a high natural starch content. None of the treated blocks have produced any adult beetles, although quite a number of them show signs of activity. There is no point to be gained by going through all the details, but the interesting feature which has come out of the work so far is that there has been no great tunnelling activity on the part of the larvae in the groups loaded with less than 4% soluble starch. Below that level there is practically no tunnelling at all, except in some cases where the tunnels are very narrow and short. Only in very rare instances has there been found any live larvae, and these were very small, less than 1 mm. long and the general appearance was such as to indicate that the general nutritional matter was unsuitable.

I have since learned a little more about the nutrition of insects in general and can see what further experiments are required to be done. For instance, there is one obvious lack in this synthetic diet and that is that it does not include any sterol. Whether or not these insects require vitamin added to the diet, I do not know. They do possess in their body structures referred to as mycetomes and possibly containing symbiotes. Some workers feel that these bodies are a source of the vitamins necessary. It may very well be that Lyctus gets its supply of vitamins from these mycetomes in the body cavity. But it seems to me that we will have to investigate the effect of adding small quantities of sterol. I should imagine that the next series of experiments would be better planned in conference between Mr. Tamblyn and myself.

<u>Mr. Clarke</u>: At our previous Conference we proposed to set up a Committee on this. Mr. Tamblyn has explained that there has been no Committee up to the present. Are you quite happy that the work should proceed on an informal basis without a Committee and that the States should be notified of developments? If a State gets into any difficulty it can get in touch.

<u>Mr. Gay</u>: If any of the States have any bright ideas, they might be passed along.

<u>Mr. Clarke</u>: The first one which is passed on is this matter of silver sycamore.

<u>Mr. Huddleston</u>: And <u>Melicope australasica</u>. This species has shown no evidence of attack. These timbers may provide some lead.

<u>Mr. Christensen</u>: I would like to ask Mr. Gay if there is any evidence that Lyctus is able to live on any of the hydrolytic products of starch rather than the starch itself. In obtaining these specimens for him the starch was removed by acid hydrolysis. It would be interesting to know if any work has been done where Lyctus has been known to live on hydrolytic products of

starch.

Mr. Gay: There is some evidence in work by Parker that glucose or soluble starch improved the nutritional value of starch.

Mr. Clarke: Have any starch estimations been done to find the threshold of Lyctus activity?

Mr. Gay: If we would get the complete nutritional data we could decide this.

Mr. Clarke: One of the difficulties is that with your diet you may have to have a higher percentage of starch than the Lyctus needs to live in a natural piece of timber. Has any work been done in the direction of making artificial bores in timbers of a small pore diameter?

Mr. Gay: We have tried to do this. We were doing it by putting small diameter wire in between layers of moist filter paper, pressing the whole thing at very high pressure and pulling out the wires. That left bores in the paper and we exposed it to a number of suitable females, but we could not get any results.

Mr. Clarke: You may still not be supplying a suitable diet.

Mr. Gay: We loaded the filter paper with starch, but they did not respond at all.

Mr. Irvine: Does the same position arise in all your samples?

Mr. Gay: I might give you an idea. In the high natural starch samples which had the starch removed by hydrolysis there was one short narrow tunnel. In the second,third and fourth groups the same treatment was provided subsequently loaded with 1 per cent. starch, and there was no evidence of tunnelling at all. I might say that so far we have cut up only one of the three blocks in each group and there are still two more blocks set up. It is a very laborious job. At 2% starch there were three or four short narrow tunnels. Without any natural starch at all, there was no tunnelling: a couple of tunnels at ½ per cent. level, 20 or more tunnels at 1 per cent. level and two or more at 4% level. So there is evidence of tunnelling at the ½ per cent. level but not to any great extent. It was not a 100% correlation but a very high correlation.

Mr. Clarke: Dr. Dadswell has put up the question as to whether the eggs could be placed in artificial pores in the timber.

Mr. Gay: I don't know if Dr. Dadswell has tried to handle the eggs. We tried to photograph the eggs. We had to do a little doctoring to get them in the right position. We had great difficulty, and in handling it the egg was ruptured: it was difficult to remove and replace. You can get them out by a long tail-like process. They are very fragile.

Dr. Dadswell: If the artificial pores are large enough the process might be possible. Can you transplant the larva itself?

Mr. Gay: You could within a day or so of hatching. You could put them in an enlarged pore.

Dr. Dadswell: I remember in 1931 or 1932 when we first started our Lyctus work we tried to take the larvae and plant them in borings in Pinus radiata.

Mr. Gay: It would be easier to transplant the larvae than the eggs.

Mr. Tamblyn: Would it not be easier to test silver sycamore by gluing or clamping on to each end a small piece of a highly susceptible timber?

Mr. Huddleston: It could be done by drilling a small hole in the silver sycamore and putting in a small block of Lyctus complete with eggs.

H. ANOBIUM.

(a) Susceptibility of radiata pine.

Mr. Tamblyn: This matter was raised at the last Conference when it was agreed that an investigation of the susceptibility of radiata pine to Anobium attack should be started as soon as possible.

I have been in touch with Harrow and Spiller in New Zealand and we have tentatively planned a test which should give a fairly definite answer within a few years. All details have not yet been finalized, but the proposal at present is as follows:-

Cages containing separate panels of P. radiata and N.Z. white pine will be infested with Anobium at D.S.I.R. in Auckland. The P. radiata used will be of both Australian and New Zealand origin and panels may be fabricated so that several different trees are represented. Egg counts will be made by D.S.I.R. so that there will be no doubt of the intensity of the infestation. Some cages will be hung in New Zealand and the remainder despatched to Australia, where we propose installing them in three localities in each State. There will be three cages in each locality to represent a dry, medium and damp site - for example, above the ceiling, inside a room and below the floor.

The susceptibility of P. radiata will be compared with that of New Zealand white pine and the degree of hazard in Australia compared with the results for cages in New Zealand. The final criterion of susceptibility will depend on the ability of the beetles hatching in the cages to re-infest and increase the population under what will amount to natural conditions. If the test is proceeded with we will need the assistance of the State Services in installing and inspecting the cages in their respective States.

Mr. Huddleston: I think the work should be proceeded with.

Mr. Ellis: The inspection would, I take it, be normally carried out by Mr. Tamblyn. We would be glad to handle it by correspondence.

Mr. Tamblyn: Would it be acceptable to everybody if we wait until the details of the test are finalized and then submit the working plans to say Messrs. Gay, Taylor and Brimblecombe for comment.

Mr. Clarke: I should think that would be sufficient. The work in the States is quite small. I think this work is very important in view of the plantings of Pinus radiata in Australia and the possible importations of radiata pine from New Zealand.

(b) Susceptibility of Baltic pine.

Mr. Huddleston: We discussed this subject at length at the last Conference. Since that time no fresh information has been received to my knowledge, though quite a lot of activities and enquiries have been made by Commonwealth Departments and others interested in the possibility of getting timber for pre-fabricated houses. Correspondence has been entered into by the various Forest Services and your Division with the Commonwealth Departments, with regard to the same matter. The position is that Baltic pine is moderately susceptible in certain parts of Sydney, I believe the same applies to Brisbane, but not so much in Victoria. The main thing concerning us at the present time is that there is a move by the more enterprising firms to capitalize on the susceptibility of Baltic pine. Prices are being quoted for treatment of houses, and these prices are exceptionally high. This Conference may feel disposed to undertake some publicity to track down the present scare which seems to be developing.

Mr. Ellis: Have we any information that the scare is not warranted? The situation has not arisen in

Brisbane so far as Baltic pine is concerned. The doubt is as to whether there is sufficient grounds for the scare.

Mr. Clarke: You think it might be used generally to scare people who have Baltic pine in their houses?

Mr. Huddleston: It is being used in that way in Sydney where people are being induced to have their houses sprayed.

Mr. Tamblyn: I would reiterate what I said at the last Conference that the position in Victoria from our experience is that Baltic pine is not worth treating. We have any amount of Baltic pine here and the evidence that we have gathered is most positively against treatment. Mr. Ellis suggests that practically the same position obtains in Queensland. I feel inclined to question whether perhaps Mr. Huddleston has over-estimated the attack in Sydney.

Mr. Huddleston: I cannot agree with that, but we are not in a position to say the extent of the attack in the houses which have Baltic pine boards. It is very difficult to make any accurate estimation of the extent of attack, but we do know that the borer firms are making quite a good living out of the treated houses.

Mr. Clarke: I just wonder if the A.B.C. could help us in putting over a warning. The Conference could say that

> We view with alarm the fear that is being built up in the community that houses containing Baltic timber are likely to be subjected to very serious borer attack and that householders, before involving themselves in spray treatments should get in touch with technical authorities.

Mr. Huddleston: Yes, Mr. Chairman, I agree.

Mr. Clarke: Do you think we might go further and get a paragraph in the Australian Timber Journal? I think we should write up a brief note from the Conference for the Australian Timber Journal, and it might include a reference to this position.

(c) Attack in finished Scandinavian pre-fabricated houses.

Mr. Huddleston: Mr. Chairman, I do not know what led to my opening this discussion and to a large extent I have already covered it. The scare has been built up that these houses are likely to be severely attacked and there seems to be a number of people willing to capitalize on that scare. I cannot see any reason to be concerned about Anobium attack because the attack is several years in coming, and when it does come, I think reasonable precautions by the householder will prevent it in the early stages. There does not seem to be any justification for spraying of houses to prevent a possible attack in 10 or 15 years. First of all, I doubt the efficiency of spraying treatment to prevent such attacks, and secondly I think the buildings can have natural protection from the paint on the houses, and it is not likely that any serious effect will occur.

Mr. Tamblyn: I support Mr. Huddleston and have no further comment to make.

Mr. Clarke: We were asked by the Department of Works and Housing for our opinion on this matter and we suggested that the Anobium position was being overstressed. Our opinion was that if they had a choice where to put these houses it would be better to put them in the dry areas. Then we had a further enquiry by one of the importers of the houses who seemed to have a feeling that that recommendation was being taken as an indication that the houses should not be put in the coastal areas of Brisbane and Sydney. So we pointed out that so far as we were concerned if there were reasons for putting pre-fabricated houses in Sydney and Brisbane, we would not regard the fear of Anobium attack as sufficiently important not to do so. A further enquiry has come with regard to the desirability of treating all the timber in these houses in England before it comes out here. There is no indication of the probable cost in such an event. I should think it would be somehwere between £50 and £100.

Mr. Huddleston: If we are going to carry out any treatment it would be desirable to treat timber with a proper pressure treatment before erection rather than to have the spray treatment. You have made an estimation of the cost of £50 to £100 per house for pressure treatment, and I think you will find that some of the local firms would quote a somewhat similar or greater cost. If any treatment is going to be carried out I very much prefer the pressure treatment to spraying.

Mr. Clarke: That is a comparison of pressure treatment versus spraying and I think everybody will agree with it. It does not answer the question of whether they should be pressure treated in England.

Mr. Huddleston: I think we have already expressed the view that the expenditure should not be incurred.

Mr. Clarke: That the cost does not justify the expense. All agreed? (General assent).

J. SPRAYING OF BUILDINGS.

(a) Alternative clause in War Service Homes Specifications.

Mr. Tamblyn: During March of this year, we received a letter from the Queensland Forest Service, which enclosed a letter they had written in December to the Director, Department of Works and Housing, Brisbane. This letter raised objection to the requirement that War Service Homes in Queensland be sprayed with a solution sold by a local firm of pest exterminators. In the letter from the Department of Forestry, addressed to us, it was asked if we would take the matter up with the Commonwealth Housing authorities as no reply had been received from the

Brisbane Department of Works and Housing.

Following this request, we wrote to the Department of Works and Housing, Melbourne, mentioning the Brisbane correspondence and generally drawing attention to the undesirability of spray treatments as a preventative measure. This finally brought action, and the letter in reply (7th July) stated that spraying for the eradication of borer had been discontinued in War Service Homes. It was, however, proposed to provide for the treatment of finishing timbers and small cross-sectional areas against borer attack by boric acid immersion or other approved treatment. To cover this the following clause was to be included in the specification -

"Any timber proposed to be used for joinery mouldings, and finishings, and for battening, nogging, or backing to ceilings and internal sheeting to walls and partitions, which is susceptible to Lyctus or other borer attack, must be immunized by boric acid immersion or other approved method and certified as having been immunized."

It was stated that the paragraph was framed to meet Queensland conditions, and that our advice on its practicability in Victoria would be welcome. Copy of this letter was sent to N.S.W. and Queensland for comment. Mr. Huddleston suggested an amendment by inserting the requirement that treated timber contain 0.2% boric acid at the core. Queensland replied (18th July) in favour of the clause. Mr. Bond had carried on this correspondence and when he left, the matter of finally replying to the Department of Works and Housing, Melbourne, had not been attended to. I therefore wrote on 24th August to the Deputy Director, Department of Works and Housing, Melbourne, as follows:-

"Spray treatment of building timbers to prevent borer attack

I regret the delay in replying fully to your letter (Ref. G.37/175) of 7th July on the above subject, following my brief acknowledgement of the 13th ult. As the matter is still under discussion with the Queensland and New South Wales Forest Services, I am restricting present comments to the position in Victoria, Tasmania, South Australia and Western Australia.

I am very pleased to learn that your Department has decided to discontinue the spray treatment of framing timbers as a whole for the prevention and eradication of borer attack. This action is fully endorsed by this Division and applies equally to Victoria, Tasmania, and South Australia, where eucalypt timbers with a relatively narrow sapwood are predominently used. There is no problem in Western Australia as both jarrah and karri are naturally immune from Lyctus attack.

It is agreed that elimination of Lyctus attack in finishing timbers and scantlings of small cross section is desirable, provided the cost does not exceed the benefit obtained. Under present conditions in the timber industry it is difficult to suggest an effective and economical means of achieving this in the abovementioned States.

Treatment of finishing timbers would be economically possible if the sawmiller could be persuaded to segregate the sapwood of susceptible timbers for subsequent boric acid (or other approved) treatment. Under present conditions however, interior trim is run from mixed stock which contains a variable, but usually small, percentage of susceptible wood. Treatment of such mixed timber would be wasteful as probably over 90 per cent. of it would be naturally immune and could not readily be sorted out.

The alternative to treatment is to place the onus on the builder to use non-susceptible timber for trim, etc., or to eradicate borer attack when it occurs by spot treatment or by replacement of damaged timber. As in our experience the amount of attack is usually small, this alternative is economically quite sound. Also it is by such methods that pressure will ultimately be brought to bear on the sawmiller to segregate susceptible from non-susceptible timber. On a seller's market he will not do so without considerable pressure from builders etc., or unless forced by legislation, as in New South Wales and (in the near future) Queensland.

If and when treatment is adopted, it must give complete and permanent control and be effectively policed. This means a few commercial treating plants under good technical supervision, rather than many small installations treating by dubiously satisfactory methods.

In so far as your proposed clause relates to finishing timbers, I am in complete agreement with its principle, though for the above reasons, do not believe treatment is at present practicable.

With regard to eucalypt timbers of small cross section, such as tiling battens, I am doubtful whether treatment is economically desirable. Over the years we have had thousands of enquiries from householders with Lyctus attack in various scantling timbers but have very rarely found cases where structural repairs were necessary. We have no record of roof failure, although some attack in tiling battens has often been observed. As such attack involves no decorative effect we have judged it serious only where there is danger of the attacked members failing. On this basis, and because I cannot recommend any cheap effective treatment, I would suggest deletion of reference to "battening, nogging, or backing ....." in your proposed paragraph. Emergence holes in plaster sheet are hardly sufficient justification for treatment costing 10/- or more per 100 super feet.

In summary, my opinion is that for Victoria, South Australia, and Tasmania, no standard treatment should be given to any eucalypt scantling timber whether of large or small cross section, to prevent borer attack. Attention however, should be given to the elimination of attack in finishing timbers where even slight attack may mar a decorative effect and necessitate replacement. There is no problem in Western Australia."

Mr. Irvine: Mr. Tamblyn's statement seems a fair one although the opinion is new to me. I agree that spraying is futile and gives a false sense of security.

Mr. Tamblyn in a Divisional letter to the Department of Works & Housing stated that treatment of sorted sapwood containing eucalypts would be economically possible. Is this an estimate or is it supported by figures? Would it be possible for the Victorian Forests Commission to receive a copy of the Division's letter to the Department of Works & Housing.

Mr. Clarke: I am not certain that the question of tiling battens has been adequately covered. I am worried that the letter might encourage the use of Lyctus susceptible material in tiling battens. To reduce the tendency to cut the outside of the log into tiling battens there should still be some clause in the specification stating that susceptible material must not be used in tiling battens.

Mr. Huddleston: I am surprised you have not had more trouble with tiling battens in view of the fact that you use obliqua and viminalis. We have had failure due to Lyctus attack in battens for both tiles and plaster.

Mr. Tamblyn: I contacted Houghton & Byrnes who said that over a period of 17 years they could not remember one case of roof failure although some had been severely attacked. Several thousand houses must have been included in that recollection. We have many reasons to discourage spray treatment: as an alternative we could only recommend immersion treatment which is not very practicable.

Mr. Huddleston: It would seem that a clause is needed similar to that in the N.S.W. Timber Marketing Act which limits borer susceptible sapwood to 25% of the perimeter of the piece. If a builder disregards this provision action can be taken in N.S.W. under civil law for breach of contract up to seven years after completion of the contract.

Mr. Irvine: I agree with the proposal because in Victoria we are tending towards the milling of smaller diameter trees. The geographical centre of utilization is moving east into Gippsland where the available logs are smaller, sapwood is wider and the species generally are more susceptible than regnans.

Mr. Huddleston: A few emergence holes in plaster are not serious but we have seen cases where the plaster has been placed on battens containing Lyctus susceptible sapwood and emergence holes have appeared over two or three seasons. This causes considerable inconvenience to the housewife and our comments have been prepared on this score.

I recommend a general clause in the contract that borer susceptible sapwood shall be limited to 25% of the perimeter of the piece. With regard to finishing timbers, the only recommendation I can make is that the buildings shall be regarded in the same way as buildings being erected for sale. The provisions of the Act will shortly be made to apply to all buildings except where the owner signifies in writing that he is prepared to accept Lyctus susceptible sapwood.

Mr. Ellis: Mr. Tamblyn in his letter to C.T. Bell dated 24th August states

> "In my opinion for Victoria, South Australia and Tasmania no standard treatment should be given to any eucalypt scantling timber whether of large or small cross section to prevent borer attack."

How would Mr. Tamblyn deal with red tulip oak, and with the scrub timbers being sent from Queensland to Melbourne?

Mr. Irvine: Victoria will be forced to pass a Timber Marketing Act which will control the import into Victoria of Lyctus susceptible timber, either from other States or from overseas. Island and interstate imports to Victoria are only 50,000 sp.ft./month at present.

Mr. Ellis: Some Unions object to the risk of life in repairing attacked roofs.

Mr. Clarke: The position seems to be as follows: (i) Queensland prefers the original Clause suggested by the War Service Homes authority: (ii) N.S.W. prefer that the N.S.W. provisions should comply with the provisions of the N.S.W. Timber Marketing Act: (iii) As far as southern States are concerned it will be necessary to make reference to probable imports from other States.

Mr. Tamblyn: Almost all the North Queensland timber imported in to Victoria is used for furniture or other high grade use. Therefore the problem of its use for battens seems non-existent.

Mr. Irvine: I recommend that in the event of Queensland or New South Wales timbers being used for War Service Homes in Victoria the provisions applying within those States should apply to the use of the timber in Victoria.

Mr. Clarke: The problem of susceptible sapwood in hardwood scantling is likely to persist for some time. Its deleterious effects can be minimized if we gradually train carpenters to place the sapwood to the outside, not against the plaster sheets. This could be done by personal contact and by articles in our Forest Products News Letter.

Mr. Huddleston: I think carpenters automatically put the sapwood to the outside in the case of studs because of the natural direction of spring.

Mr. Clarke: Not in the case of nogging. Nogging commonly contains large quantities of sapwood. If we can train carpenters to keep sapwood to the outside and not to use it at all for interior walls the problem of emergence holes in plaster sheeting will be overcome. We need a concerted campaign of education. The Building Research and Liaison Service and the Master Builders' Associations in all States might assist us here.

K. LYCTUS PUBLICATIONS.

(a) Trade Circular.

Mr. Beesley: Two drafts of this Trade Circular have been prepared by Mr. Bond, previously of the Preservation Section of this Division. The last draft drew from Mr. Brimblecombe19 pages of comments which were much to the point and indicated he had read through the Circular very carefully. We also received comments from the Division of Wood Technology and Mr. Gay. It seemed evident an extensive revision of the Trade Circular was necessary, particularly the first three or four sections which set out the Lyctus problem as it existed in Australia, the biology of the pest and the philosophical section 'The Need for Treatment'. The revision is now well under way and this will be finalised by the end of this month. It is then to be re-circulated to the States for comment. This Trade

Circular was written more as a journalistic effort than a scientific one. We have tried to write it in terms the layman will readily understand e.g. we have not mentioned the size of the pore in which the Lyctus is capable of depositing an egg. In the Trade Circular we have tried to indicate at what level of susceptibility treatment is desirable and necessary.

Mr. Fogl: We agree in general with Mr. Brimblecombe's comments but we have a few other comments. On page 11 a resume is given of the life cycle of the beetle. It states 'the life cycle varies according to climate'. We would add 'and according to species and the amount of starch present'.

Chapter 5 should be deleted.

Mr. Beesley: On page 11 the statement quoted by Mr. Fogl now reads 'The life cycle varies according to climate andavailable food supply". It has not yet been decided whether Chapter 5 will be deleted.

Mr. Tamblyn: I hope the States will accept our apologies for having already forwarded two drafts but we think that the production of a good document is worth the effort involved and will thus be forwarding the final revision for comment to the States.

(b) Treatment Manual.

Mr. Fogl: This has now been circulated to the Division of Forest Products and Queensland Forest Service for comment.

Mr. Cokely: In view of the Trade Circular that is being issued I think several items of this Manual could be deleted. There are several minor items with which I cannot agree. The first deals with cold soak treatment of timber. The Manual states that cold soak treatment is not desirable. Our experience with the cold soak treatment does not bear this out. Our temperature gradients, winter and summer, are not as bad as those occurring in the southern States but we find that 1" diameter material given a 7 days' immunisation treatment is quite satisfactory. I made a rough calculation using Mr. Chrisensen's figures on the rate of diffusion and I cannot see how that 7 days can be increased to 13 days with a temperature change of 60°. On page 34 of the Manual the following statement is made

> "Steel is not used in the construction of treatment tanks because of an interaction between iron and tannic acid leached from the timber which causes the treatment solution to turn a blue-black colour which in turn will leave a stain on the treated timber".

This is the case of boric acid but it should have been stated that steel tanks are useful under general conditions where borax is used. These are minor factors and, omitting Section I on Lyctus which is covered in the Trade Circular, I think it a very good publication.

Mr. Fogl: I think we have discussed the cold soak treatment. We say it can be done but it is harder to control than the other methods mentioned. With regard to the difference between 7 and 13 days treatment time for winter and summer respectively we have had an officer stationed at a treatment plant for some time. It is on his figures that we have based this 7-13 days treating time. With regard to steel tanks we are still cautious in recommending their use if the steaming and cold soak method is to be employed, due to the possible effect of acetic acid extracted from the timber upon the ironwork.

Mr. Christensen: Regarding the relative merits of the cold soak treatment and the effect of changes in temperature from one season to another, I have made some rough calculations which indicate that on the basis of the temperature coefficient of 1.3 per 20°F. rise in temperature, a 60° increase in temperature would result in 1.9 increase in penetration. On this basis the results obtained are fully justified.

Mr. Cokely: We have had a steel tank operating for over a year in Queensland treating on the average two charges per day and there is absolutely no effect of acetic acid corrosion. So satisfied have this firm been with the results that they have purchased a 20,000 gallon petrol cylinder which they propose to install at another of their mills.

Confirmatory evidence of lack of corrosion was obtained from a firm who have a small electrically operated steel vat, of 300 gallon capacity, for treating dowels. This was installed last October and runs an average of one charge per day. The vat is painted internally with aluminium paint. There is no corrosion and in the solution itself we can find no trace of iron or aluminium. We do advise the use of a protective paint.

To overcome the mould hazard in Queensland we advise a solution of mininum concentration 0.1% but chemical control of this is impractical. In practise we advise the addition of a gallon of chemical to 2,000 gallons of solution. We have adopted the principle "treat as necessary".

Mr. Tamblyn: I have a number of comments on this Manual but I do not think it desirable to discuss them now. The final form the Manual will take is a matter for discussion between N.S.W. and Queensland Forest Services: our comments should be restricted to relatively minor points. I will return the Manual to Mr. Fogl with pencilled comments.

Mr. Ellis: Queensland and New South Wales will cooperate on the matter. Mr. Cokely has prepared an article for a thesis and some information may be available from this.

Mr. Huddleston: We are looking to C.S.I.R.O. for publication of the Manual.

Mr. Clarke: This would have to go forward in our Bulletin series and in the normal couse would take 2 - 3 years. How many copies of the Manual will be required?

Mr. Huddleston: N.S.W. would require approximately 1,000 copies.

Mr. Ellis: Queensland would need from 500 - 1,000 copies. A total of 2,500 copies would seem to be indicated.

Mr. Huddleston: We could get the Manual printed by our Government Printer but it would have to be issued as a publiation of the Division of Wood Technology. The idea was to make it a joint publication of D.W.T., the Queensland Forest Service and the Division of Forest Products.

Mr. Clarke: The onus is with us. I will contact our Executive re the possibility of getting say 500 copies. If this is impossible we will have to duplicate the minimum number of copies possible.

L. UNIFORM BUILDING REGULATIONS AND BUILDING RESEARCH.

Mr. Tack: At the last Forest Products Conference there was considerable discussion under the general heading of "Uniform Building Regulations". Most of this was not directly concerned with wood preservation and Mr. Hartigan drew attention to the fact that N.S.W. was making a statistical survey of pest damage in buildings, from their own data and from data collected through the Works & Housing Department. As a result of this discussion it was decided that the Division of Wood Technology would send reports on its survey to the Division of Forest Products for forwarding to the Building Research Committee.

The purpose in bringing this item up for discussion is not so much to remark that we have not yet seen these reports from N.S.W., as to suggest that it is most desirable for data to be collected from all States. In Victoria, we have a reasonable idea of the extent of pest damage, but have no statistical figures and could not get them ourselves without a great deal of work. We have considered the possibility of getting data from Works & Housing, banks, and insurance inspectors, who no doubt would be willing to cooperate in the collection of information and specimens if asked to do so. Unfortunately, Works & Housing inspectors, while quite willing to help, are restricted mostly to relatively new houses, but it should be possible to slowly collect data from all the available sources. We would, however, like to know to what extent the other States would be prepared to assist in making such a survey Australia-wide to cover borers, termites, and decay. Such a survey would be extremely useful in forming future building regulations. For example, we have recently collected some data on the life of wooden house stumps in the Melbourne area, and have been impressed by the fact that jarrah or red gum stumps often begin to fail after 20-30 years' service, necessitating costly re-stumping. One may question whether untreated wooden house stumps should be used for buildings in the Melbourne area.

The information collected by the Division of Wood Technology is probably the most complete and reliable information on insect damage to houses available at the moment and we should be interested to hear of the progress of their survey.

Mr. Huddleston: Arrangements were in hand at the time of last year's Conference for a survey to be made. Unfortunately this only commenced two or three months ago. Quite a lot of data has been received but there is not enough to warrant the preparation of a report. Progress reports will be prepared in the near future. The information is particularly valuable and shows a concentration of pest damage and white ant damage in some of the older areas. As yet it is too early to say how comprehensive the survey will be.

In Sydney the Department of Works & Housing has a Survey Branch which collects data for housing schemes. Old as well as new houses are being inspected and interesting information is being obtained. We hope later to enlist the aid of exterminator firms and anyone else who may be able to help. The Department of Works & Housing is the only body cooperating with us at the present time. I will send the Division of Forest Products a copy of the questionnaire for their information.

Mr. Clarke: Mr. Banks' Liaison Service may be able to assist on this matter.

Mr. Tamblyn: South Australia and West Australia are not represented at this Conference. To make this survey really successful it must be extended to all States.

Mr. Banks: The State Housing Commissions might also assist on this matter. The Victorian Housing Commission has the responsibility of condemning buildings and they would probably have a mine of information on decay in buildings.

Mr. Huddleston: The Commonwealth Government has established within the Department of Works & Housing a Building Research Branch and they are apparently willing to make funds available for work of this nature. The Department might be able to employ a full time inspector for the purpose of making such a survey, whereas other Departments would have great difficulty in obtaining staff for this purpose.

Mr. Banks: If the survey is put up as a research project it will have to go to the Building Research Committee and then to the Building Research and Development Advisory Committee. A resolution from this Conference would be of assistance in this regard.

Mr. Tamblyn: I move

"THAT this Conference is impressed with the need for a statistical survey in all Australian States to determine the extent of borer, termite and decay damage to buildings, the object of this survey being to indicate the extent to which preservative treatment of building timbers and/or changes in building practice may be necessary to reduce pest damage.

IT IS FURTHER MOVED that the Department of Works & Housing and the Division of Forest Products be requested to institute, and to collaborate in, this survey along the lines already being undertaken in N.S.W. by the Division of Wood Technology of the N.S.W. Forestry Commission and the Department of Works & Housing working in collaboration."

Mr. Huddleston: Seconded. Carried.

M. TREATMENT FOR MOULDS AND SAPSTAIN.

Mr. Cokley: The major problem facing this Department in the treatment of moulds and sapstains may be divided into the following:

1. Incorporation of fungicidal treatment with anti-Lyctus treatment with particular reference to North Queensland area.

2. Fungicidal treatment of exotic Pinus spp. for general purpose.

3. Specialized fungicidal treatment of scrub timbers for butter boxes and other food cases.

Results are as follows:

1. Previous recommendations e.g. the use of alkaline borate solutions either by use of borax or the incorporation of soda ash to a pH 8.0 and the addition of chlorinated phenols to a concentration of approximately 0.1% in the treatment have been carried out with successful results. It can now be stated that provided these precautions are taken the risk of fungal attack is reduced to a very low degree. Samples of tulip oak treated by Lawson & Sons, Tully have been successfully carried through the wet seasons without degrade. Other mills have had equally satisfactory results.

The introduction of the momentary dip process for veneer treatment has increased this problem in so far as the wet veneer is bulk piled for some hours and in general the fungicidal hazard is great. Use of sodium pentachlorphenate in conjunction with borax is proving satisfactory.

2. The main item raised at the last Conference referred to satisfactory methods to prevent blue stain attack upon Pinus spp. (taeda and carribaea) being milled as plantation thinnings at the Glasshouse, Beerwah areas on the North Coast. This problem may be itself divided up into two sections (a) the treatment of logs (b) treatment of sawn timber from untreated logs. Preliminary investigation was made by Dr. H.E. Young, late of the Department of Agriculture & Stock, Queensland who advised that the problem was mainly one of economics and that experimental research should be delayed until November of this year, i.e. during the period of hazard. The latter section e.g. the treatment of sawn timber has been successfully carried out both experimentally and under commercial conditions. Under operating conditions the position was made more severe by the fact that the mill concerned was transferred and caused the building up of approximately half a million feet of thinnings. Other mills in this area were not faced with this difficulty and by following a reasonable procedure such as immediate cutting and railing to Brisbane, where they were kiln dried, no economic problem arose.

Fungicidal tests were carried out on 1" boards sawn from two logs of each of the species, namely P. taeda and P. carribaea and treatment was carried out at the Experimental Yard, Ipswich Road. Conditions at this time at the mill at Glasshouse were such that clean cut boards were badly infected within a period of 48 hours after cutting. In the first test carried out during the period February to March, 1949, samples were dipped for a standard period of five seconds in the fungicide and stacked under varying conditions. Bait pieces were exposed to ensure that attack would take place. All samples were under forced conditions of high humidity by coverage with wet bags and storage in a warm position. The results obtained under this test are shown in Table 1.

TABLE 1.

Fungicide Tests upon Pinus species - February - March 1949. Stored under Forced Humidity Conditions.

Treatment	No. of Days before attack appeared			
	Pinus taeda		Pinus carribaea	
	Block Stacked	Stripped	Block Stack-ed	Stripped
1% Sodium Trichlor-phenate	23+ (13 -26+)	8.5 (7-10)	8 (7-9)	6 (4-7)
1% Sodium Tcp. + 1% Borax	17 (8 -26+)	10.5 (7-14)	7 (7-8)	7 (7-7)
1% Borax	8 (7-10)	5.5 (4-7)	8 (7-9)	7 (7-7)
0.5% Na P.C.P.	22 (14-26+)	23.5 (21-26+)	17.5 (9-26+)	14 (11-21)
Untreated Controls	7 (4-12)	4.5 (4-5)	4 (4-4)	4 (4-4)

(Immunity period = additional life of preservative treated test pieces)

It will be noted that Sodium Pentachlorphenate (.5%) gave an average immunity in Pinus taeda of 15 day days in the case of block stacking and 19 days in the case of strip stacking; for Carribaea periods of 13 and 10 days respectively. This factor, together with economic ones in that lower concentrations were required when compared with the other mixtures, resulted in the firm being advised to use this concentration and chemical. A longitudinal type of vat was installed at the mill on 29.3.49 and treatment carried out.

Confirmatory tests were set up at the mill where the normal practice is for the treated timber to be bulk stacked upon pallets before seasoning and disposal to consumers. Under operating conditions no treated sample was attacked. Neglecting the costs of the plant itself, labour of only one man per week is required and chemical consumption is approximately 25 gallons per 900 super feet i.e. an average cost of 5d. - 6d. per 100 super feet. This figure, although high, is due to the fact that the vat is experimental and a percentage of this consumption is due to wastage such as overflow. During the winter months it was decided to carry out tests to reduce this concentration and further laboratory trials were put under way.

Conditions similar to that outlined on page 2 were carried out with one variation viz. one set of samples were allowed to season as at a mill i.e. block stacked under cover with natural draft. Alternative fungicides were used for the purpose of ascertaining their efficiency for general use. No differentiation was made between species and the results are as shown in Table 2.

TABLE 2.

Fungicidal Tests Upon Pinus spp. May - June, 1949.
(Species not segregated)

Treatment	No. of days before attack commenced	
	Forced Humidity	Normal Stacking
0.5% D.D.M. (Solution in soda ash)	18 (18 - 32+)	18 (18 - 32+)
0.5% Sodium Salicyl-anilide	18 (18 - 32+)	23 (17 - 32+)
0.1% Sodium PC.P.	16 (15 - 16)	15 (13 - 32+)
0.05% Lignasan	25 (18 - 32+)	32+
Controls	7 days	7 days

It will be noted there that although Lignasan proved the most efficient sodium pentachlorphenate is as reasonable as the D.D.M. and Salicylanilide when consideration is given to the difference in concentration. Lignasan, however, is regarded as a poison and its use as a fungicide is not recommended by the Queensland Department of Health who controls this matter in this State. Accordingly recommendations were made to C.W. Lutton to reduce the concentration to 0.1% NaP.C.P. and since that date treatment has been carried out satisfactorily. It is not considered that this concentration may be carried through the hazard season from November to March during which period it will possibly be necessary for the operator to return to the original concentration. This is being conducted by the principle of the observation i.e. when attack is observed upon samples treated with lower concentrations of preservative then increase in concentration is made accordingly. At the same solution concentration and assuming the same consumption a chemical cost of approximately 1d. per 100 super feet is being achieved.

In this connection as the chlorinated phenols are associated with a dermatitic hazard and factors such as working awards and compensations for injury are involved, an inspection was carried out by Dr. D. Gordon, Industrial Hygiene Officer of the Queensland Department of Health, who gave certain recommendations.

Briefly they involve the use of nose mask, goggles, and gloves together with aprons and boots as required. Later information supplied by Dr. Gordon has shown that in practice the use of Innoxa barrier cream is satisfactory but the precautions of masks, etc. are advisable.

3. Specialized fungicidal treatment of scrub timbers for butter boxes and other food cases.

A specialized problem which has developed is the treatment of wooden cleats for use in butter box construction. The firm concerned consisted of composite sawmill, plymill and case factory, and at present it is utilizing Swedish fibre board as the main body of the case with plywood sides and wooden cleats. The cleats are obtained from offcuts of the sawmill and are comprised chiefly of South Queensland scrub species of which brown tulip oak forms the major portion. This timber in particular was found to be unsatisfactory when used in the seasoned condition for mechanical reasons in that the nailing machines and wire binders would break or jam, a situation that did not occur when green or semi-green materials were used. Advice given to this firm was tentatively fixed at a 0.5% sodium salicylanilide and a number of treatments were carried out to ascertain its efficiency. Under the conditions of operation the formed cleat is passed through a shallow bath of one gallon capacity formed of curved bondwood and an overhead curved guide.

Movement is simply obtained by impetus of following cleats coming from the machine. This is disadvantageous in so far as movement is irregular, immersion time uneven and in the latter stages incomplete wetting of all faces occurs. After treatment the cleats are bulk stacked in boxes until ready for use. After assembly of the boxes, the latter are bound in bundles and stacked in a neighbouring area. Original trials, although satisfactory under laboratory conditions, were not found suitable in plant operation. Investigation indicated this was due to the following conditions:-

(i) Excessive dipping. As pointed out above the vat is of one gallon capacity and a treatment rate of 1,600 cleats (12 x 1 x 1) had been dipped with a result that incomplete wetting had taken place. Examination showed that a maximum of 1,100 cleats was possible with a recommended maximum of 800.

(ii) Change in pH. Sodium salicylanilide is a sodium salt of the very weakly acidic salicylanilide. Although comparatively weak in themselves acids such as tannic and acetic are strong enough to displace it from its salts with a consequent reduction in efficiency as the insoluble salicylanilide precipitates from the solution. Tests carried out using a Jones' pH meter showed that the pH remained constant at approximately 9.4 until 800 cleats had been treated, with a rapid drop to 8.9 in the vicinity of 1,200 cleats.

To overcome these factors the firm has been advised to increase the volume capacity of the dip to 5 gallons with incorporation of an overhead pre-mixer such that after consumption of one gallon, refill solution may be added. Mechanical movement independent of the cleat machine and a draining stage were also recommended. Health precautions necessary for its use were examined by Dr. Gordon who advised as follows:

Shirlan (sodium salicylanilide) is a mild dermatitic hazard and would be injurious if splashed in the eye. The use of gloves, goggles etc. is recommended.

Food tests.

To enable the firm as quoted above to incorporate fungicides in the butter boxes approval was required by the Department of Health, Queensland such that its use would not cause taint in the food. This Department intimated that no data was held upon the possibilities of taint and desired tests should be carried out. The opportunity was taken in such tests to examine the taint problem for pentachlorphenate and D.D.M. in addition to the salicylanilide.

Advice had been received from Australian manufacturers of D.D.M. viz. Timbrols that this particular chemical had been designed specifically for food containers. Reference was made through the courtesy of the Division of

Forest Products to the Division of Food Preservation and Transport, Sydney for any information they had on these particular chemicals. This Division was very helpful, but was unable to supply any specific data upon D.D.M. Accordingly under direction by the Government Analyst, Queensland, there was made up a series of small cases representing treatments as follows (5 seconds dip).

1. Sodium pentachlorphenate 0.5%
2. D.D.M. 0.5%
3. Sodium salicylanilide 0.5%
4. Controls.

After drying and manufacture cases were fitted with a close fitting lid and were filled with the following for each treatment.

Case 1. Eggs
Case 2. Apples
Case 3. Butter and processed cheese (Kraft)

These were stored under atmospheric conditions, being laid down 16.6.49 and sampled upon 24.6.49 and 1.7.49 with final sampling 21.7.49. In the latter butter and cheese only were incorporated with eggs and apples eliminated after the second sampling. Duplicates were taken by officers of the Department of Public Health (Government Analyst) and officers of the Queensland Forestry Department. Average 'testers' were obtained from these two Departments and tests upon taste, colour and odour were made. A sample report upon these tests is as shown below:

		Colour	Odour	Taste	Total
EGGS :	1	10	10	10	30
	2	10		10	
	3	10	10	10	30
	4	10	6	10	26
BUTTER:	1	10	10	10	30
	2	10	9	10	29
	3	10	10	10	30
	4	10	10	10	30

APPLES:		Colour	Odour	Taste	Total
	1	6	10	10	26
	2	9	10		
	3	7	10	10	27
	4	9	10	10	29
CHEESE:	1	10	10	10	30
	2	9	10	10	29
	3	10	10	10	30
	4	10	8	8	26

Final results were conclusive in that in no case was any effect attributable to the chemical. As a result the approval of the Queensland Department of Public Health has been given for the use of a 0.5% solution of pentachlorphenol, sodium salicylanilide and D.D.M. for an immersion period of 5 seconds for use with food packages. Due to the doubtful reputation of the chlorinated phenols it is the policy of this Department to recommend them for food packages only when other chemicals are inefficient.

Mr. Ellis: *Pinus taeda* and *Pinus caribeae* are generally easily distringuished by the blue stain which develops very readily in caribea.

N. SUPERFICIAL PRESERVATIVE TREATMENT OF LYCTUS SUSCEPTIBLE TIMBERS.

Mr. Cokley: In Queensland we have recently carried out tests upon a spray treatment using a proprietary mixture "Pestblite" which is a mixture of boric acid, Borax etc. Briefly the treatment consists of passing the timber through a spray followed by block stacking. The initial results looked promising although several apparent anomalies appear in the results. Further tests are being carried out and the results to date are not confirming the early figures.

It has been pointed out to me by Mr. Huddleston that some discrepancies occur between reported analyses and pick up. Before examining these figures I feel that I would need to have all laboratory data present.

O. <u>GLUE LINE TESTS</u>.

<u>Mr. Tack</u>: These tests were commenced in 1946 and you may be interested to hear a recapitulation of the experimental details.

Three Lyctus susceptible timbers were used at 2 veneer thicknesses, with 2 adhesives (casein and urea-formaldehyde), and 5 toxic chemicals at 3 levels of concentration were added to each of the glues. The panels were put into 40 insect proof cages, and in the first inoculation made in 1947, approximately 4,500 beetles were used. The second inoculation with approximately the same number of beetles was made during 1948. Results to date of the test indicate that "Gammexane" and D.D.T. will be effective in preventing Lyctus attack when added to the glue line at concentrations of 1 - 2 percent.

However, the permanence of these toxic agents must be established before the extent of commercial application can be considered. Colloidal sulphur did not prevent attack, nor did sodium fluosilicate, pentachlorphenol, or sodium pentachlorphenate. Borax and boric acid were not effective in preventing all attack even at high concentrations. The test must be continued for several years before results with "Gammexane" and D.D.T. can be considered conclusive.

In the interim, however, commercial application may be justified where temporary protection only is required.

<u>Mr. Gordon</u>: I quite agree with Mr. Tack that it is necessary to continue tests on the continued effectiveness of incorporating Lyctus preventative materials in glue lines and we propose that the laboratory tests be continued for some time but in view of the results with "Gammexane" and D.D.T., it is felt that we should implement in the near future some commercial runs of

plywood manufactured with "Gammexane" and D.D.T. incorporated in the glue lines and that we should arrange for some of the plywood made to be put into service in uses where the possible occurrence of subsequent Lyctus attack would not be a serious problem. Of the current usage, I would say that case plywood is possibly the best for such trials but the major problem would be the virtual impossibility of keeping track of the boxes that are made up. The addition of such chemicals to glue used in otherwise Lyctus susceptible case plywood should assist considerably in export cases, of which some comments have been received that the plywood has already been damaged by Lyctus before its primary function of packaging export goods has been completed. Up till now there has been no specific Government attention directed to them, but I think it is only a matter of time and possibly the incorporation of D.D.T. and "Gammexane" in glues for case plywood may be beneficial in the event of marketing difficulties being increased. As regards progress information on the tests, I discussed this with Mr. Huddleston and Mr. Ellis on a visit to N.S.W. and Queensland earlier this year and they agreed to my releasing this information to the Plywood Board in Brisbane. As the work was instituted on a suggestion from the Plywood Board it is not surprising that 2 members expressed considerable interest and wanted to seize upon it right away for commercial application. I was careful to point out that we were not by any means satisfied that "Gammexane" or D.D.T. added to the glue could be regarded as a substitute for boric treatment of veneers, but that the results were interesting and to date promising. I have not taken any action to inform them as yet of details of mixing but I feel the time is now ripe for arrangements to be made for one firm in N.S.W. and one in Queensland to make a trial batch under supervision. I think it would be necessary to call on the N.S.W. and Queensland Forestry Departments to ensure that, firstly, the veneers which are used are Lyctus susceptible and, secondly, just to check on the fact that the proper amount of chemical was added and that the manufacture was satisfactory. Subsequent to the manufacture of the plywood, it would be necessary to arrange for a certain number of sheets to be stored in block stacks as in normal storage and marketing operations, although the shortage of plywood at present is so great that little time is spent in storage. The second series of service tests should be based on the use of plywood, preferably in operations of a semi-permanent nature. At Newmarket Plywoods in Brisbane they are about to erect some more buildings and the Manager there said he would be quite happy to use for internal walls Lyctus susceptible plywood treated with a glue line preservative. This would serve as a part of the type of service test desired.

That, I think, would constitute the best method of arranging for some service tests representative of the potential usage. I have given some consideration to the feasibility of using plywood in furniture, but again, furniture being movable, it would be quite easy to lose track of it. I think the matter of producing the test plywood and arranging for its actual placing in service tests could satisfactorily be arranged by personal negotiation with selected manufacturers.

<u>Mr. Huddleston</u>: Early this year, I discussed with Mr. Gordon the problem with regard to service tests. We have a major difficulty in N.S.W. in that plywood cannot be used for permanent structures unless free of Lyctus susceptible sapwood or immunised with an approved preservative treatment. I have given the matter very careful consideration and I think that possibly the best

way of overcoming Mr. Gordon's difficulties and also keeping track of the plywood is for the Forestry Commission to issue to one selected plywood manufacturer a restricted approval. Under our regulations, we can issue such an approval and we can require the manufacturer to attach a statement in the terms that we require, to his invoice. I feel that a furniture manufacturer would agree to the terms of an approval which would require a statement reading to this effect: "This timber has been treated by the addition of toxic chemicals to the glue line, the permanence of which is doubtful and in the event of attack by Lyctus in this timber, will be replaced by the manufacturer.". It involves the giving of a guarantee which many furniture manufacturers would be prepared to give and it would automatically draw attention to the possibility of attack and in the event of attack the purchaser of the furniture would want to get the trouble rectified.

Mr. Gordon: If, Mr. Chairman, we could arrange that, I do not think we could get a more satisfactory method of arranging a service test. It is more optimistic than I had hoped for.

Mr. Tamblyn: Though we are fairly satisfied with the results of the tests to date, it must be remembered that they are not as widely representative nor have they continued for as long as we would like before recommending commercial use. I, personally, would prefer to see some further tests in the laboratory or on a semi-commercial basis before a plywood firm is invited to use the process with the possibility of having to replace the timber. On the face of it, it does look as if the treatment would be reasonably effective but one must remember that both "Gammexane" and D.D.T. are volatile and the use of them in furniture plywood for permanent use was never contemplated.

It might be going too far to do this at present.

Mr. Ellis: I agree with Mr. Tamblyn. Even if these service tests are successful over a period of two years, it will prove nothing that is not already known from laboratory tests. However, if you desire to continue with service tests, I would definitely favour a limited test by Newmarket Plywood rather than that the plywood be manufactured by firms ad lib. I do not think Newmarket Plywood would be prepared to make replacement in the event of failure. How far has Mr. Gordon gone regarding costs. I would be very surprised if the Plywood Board in Queensland would stand the whole lot.

Mr. Gordon: On the point of finance, I did have in mind the fact that probably other plywood plants would, at various times, have building and partition constructions to make similar to those of Newmarket. If we could get them to install plywood with toxic gluelines these would provide test panels for periodical examination. Further, they would be on the premises of interested parties. In plywood being used for furniture, the sort of thing I had in mind, would be a sheet of plywood on the back of a wardrobe, which in the event of damage could be replaced at little cost or inconvenience.

Mr. Huddleston: I may be under a misapprehension here, but I did believe that you had reached a stage where you wanted a service test to be run for a considerable time. As far as the cost is concerned, plywood is so short in supply, that some of our manufacturers are prepared to take a risk and are installing case plywood in draw bottoms. At the present time manufacturers are prepared to give a guarantee of replacement, with Lyctus susceptible plywood. They would be prepared to use the treated timber and accept the responsibility of having to make replacements. They would not be running the risk of being fined.

Mr. Tamblyn: The position is quite clear. The test has been in operation for two years only and in that period there has been no attack in any of the timbers treated with either "Gammexane" or D.D.T. All other preservatives have been attacked. The test thus indicates that D.D.T. and "Gammexane" give protection for two years. So far as application to case plywood is concerned, I would say two to three years protection would be adequate but could not in any circumstances recommend it where permanency for more than three years is guaranteed. Plywood firms in N.S.W. would accept it on the recommendation of the Division of Forest Products. In this case, we do not feel sure at all. If attack is going to occur, somebody's reputation will be damaged and it might be ours. We should continue the tests for another three years, thus giving a total test period of 5 years. If there is still no attack, it would be reasonable to adopt Mr. Huddleston's suggestion.

Mr. Clarke: Your suggestion is that the tests should be continued for 3 years.

Mr. Tamblyn: Yes, for the present series of tests. It should also be possible to make 100 sheets of treated plywood and arange for their distribution between the Forestry Department, ourselves and others, so that we can keep a check on them.

Mr. Gordon: I see one major objection to being so cautions. Should we have to wait for 5 years for laboratory results then do semi-commercial service tests for a further 5 years we would find that in 10 years time the Lyctus susceptible scrubwoods are relatively unimportant, and we will be using large quantities of plantation grown pine plywood. We will have missed the boat. The possibility of using this method is wanted now. I think we have to be somewhat cautious but I think that Mr. Huddleston's suggestion is within the bounds of reasonable caution. He can limit the amount of material which is treated by such firms as he licenses or he can give it on an unlimited basis. In any case we would still have to wait several years. Mr. Huddleston's suggestion should certainly bring to light any attack which might occur in treated plywood. As people are already taking this risk with no protection whatsoever, it surely is reasonable to expect them to take a limited risk with glue line treated panels. I think that we should support Mr. Huddleston's suggestion.

Mr. McAdam: The trouble with putting these tests out on a commercial basis is that you are going to popularize this new treatment. Firms may see that this treatment is cheaper than standard borax treatment and will seize upon it. If you are going to popularize this new treatment, the people who are using it are going to be in a favourable position competing with those who are supplying proved borax treated material, which will force manufacturers from their own proven processes to get a cheaper method conferred by this glue line method. I think there are two approaches, the experimental and the commercial approach. Under the new legislation that is in hand, I think we have to be very certain about the process we recommend to the industry. It has been constantly argued at this Conference that it would be very disastrous to give support to any new incompletely proven process and I think the same thing applies here. I feel that any State that brings in this legislation will require the treatment to be proved before it can allow it to be used. I think the solution to the present problem is not to put this treated plywood into tests where it will be scattered all round the countryside. It should be somewhere where you know where it is and with people who are willing to take the risk of deterioration in their structures, people who are interested in proving that it is a satisfactory process.

Mr. Tamblyn: Would you be happy, Mr. Payne, if limited approval in N.S.W. resulted in all Tasmanian plywood firms adopting the treatment.

Mr. Payne: If the material used in the tests was confined to unsanded plywood in common grades which are not going to be used for the better purposes, so that if the test breaks down and the cost would be less, it would be alright. But I would not like to see it used in everything.

Mr. Irvine: I may be under a misapprehension, but I understood Mr. Huddleston's proposal was to approve the use of chemicals in the glue line by one or two manufacturers. Under these circumstances, if a portion of the plywood was treated, it could be traced and examined. It would be used probably by a limited number of manufacturers or perhaps under conditions of approval, it could be limited to one manufacturer.

Mr. Huddleston: All we can do is to attach a statement to his invoice setting out the conditions of his approval.

Mr. Irvine: You would not be able legally to limit its use, but if the manufacturer is prepared to co-operate, fully realizing the disadvantages, I feel that the intention of small service tests should be carried out. I think it is just a matter of getting the machinery and perhaps limiting the amount of plywood that is made.

Mr. Tamblyn: After all, only two States have legislation. We might find that in a very few years there are a large number of plants in other States turning out this plywood, but it might not be till after 7 years that the attack occurs.

Mr. McAdam: Why not limit the amount?

Mr. Huddleston: You could not limit except by watering down their approval. We could not give an approval for 6 months only.

Mr. Turnbull: I would like to hear comment on the suggestion of guaranteeing a product of this description up to a certain date. Would it not be practical to print on sheets something like "not guaranteed beyond 1952, etc."

Mr. Banks: A limited guarantee has a particular application in the commercial world, e.g. it is largely to cover the purchase against inherent defects. So the implication of giving such a guarantee on plywood might be that if it is all right for two years, it is all right.

Mr. Cokley: I would like to ask Mr. Tamblyn how many cycles he has covered during the two years. Has he found any of these chemicals falling off. What would be the position, if, after two years, the treatment failed and the buyer wanted to get his money back? Could Mr. Huddleston, under his Act, ensure that that would occur.

Mr. Tamblyn: The material was placed in the cages and inoculation started somewhere in 1947. At first, about 100 or so beetles were put in the cages in small lots over a period of 6 or 8 months. The inoculation was repeated again for several months the next year so that probably 250 beetles in perhaps 20 separate lots have been put in over 2 years.

Mr. Gay: The stability of "Gammexane" and D.D.T. is still receiving consideration by the Division of Entomology in relation to the effect of various substrates. They did not break down under certain physical conditions and we have no knowledge at all of what the effect might be after incorporation in building materials. That is still in doubt.

Mr. Huddleston: Under our Act we do not help anyone to get their money back. We make the buyer aware of what he buys. Any action for recovery is a matter for the "Sale of Goods" Act and civil proceedings. In N.S.W. several people have instituted proceedings and have been successful.

Mr. Ellis: No good purpose is really going to be served by these service tests at the present time. Even after 5 years, we are not sure whether we will need to go on another 20 years. I would suggest that as far as Queensland is concerned, we might have 100 sheets made up and tested in various parts of the State, so that we would at least have 100 sheets scattered throughout Queensland and know where they were.

Mr. Christensen: With regard to the possibility of continuing these tests in the laboratory, could some consideration be given to maintaining them at a higher temperature? In this way, could it be speeded up?

Mr. Tamblyn: One has to be cautious in interpreting that sort of thing. We should not claim that the treatment is permanent until normal service tests have proved it so. In this case conclusions based on accelerated tests would involve a considerable risk, because over a period of 10 years or so millions of sheets of plywood might go into service. I do not think any research worker would be prepared to recommend accelerated tests.

Mr. Clarke: The discussion seems to indicate that we should proceed with service tests as indicated by Mr. Ellis. I suggest that we defer the proposal for testing in furniture for perhaps 12 months and review the matter then.

P. METHODS OF ANALYSIS FOR BORIC ACID.

(a) Standard Procedure for Sample Selection.

Mr. Cokley: I will give results of the work we have been doing. In the past we have had some difficulty in setting up a standard system for selecting our samples. As a result, we put forward a suggestion in 1947 that a standard procedure be adopted. At that time, we were selecting samples 3 ft. distance from the end of the board and an average number of 12 samples per charge. I discussed with Mr. Tamblyn the possibilities of sampling and eventually decided to select one sample from each board 3 feet from the end, as previously and measuring $1\frac{3}{4}$ in. in width and 11 in. in length as opposed to the original procedure of 1/5 the width of the board. We carried out an experiment on white cheesewood by subjecting a large number of 2 in. and 1 in. samples to standard treatment. As a result of that experiment, we have found no penetration occurred to a depth of over 2 in. Our suggestion is that the 3 ft. length be increased to about 18 in. from the end of the board in view of the fact that it was only done on one species and this distance may vary.

The second aspect of this problem is to decide the maximum number of samples which are taken from various charges. That will be tied up with the move for the Australian specification.

Mr. Fogl: As far as penetration of more than 2 in. goes, it does not entirely agree with our experience. I am certain that 8 or 9 in. would more likely be the maximum depth to which end penetration will be observed in most species.

I agree with Mr. Cokley's recommendation to take samples 18 in. from the end of the boards.

With regard to a maximum and minimum number of samples required, that will come under the standard specification and might well be left for the moment.

Mr. Tamblyn: We will be guided by N.S.W. and Queensland recommendations.

(b) Analytical Methods.

Mr. Cokley: There is a variation in the analytical methods used by Queensland and N.S.W. and your own Division. In Queensland, we use the Double Indicator Method and in N.S.W., the Division of Wood Technology uses the Single Indicator Method.

The background to it lies in that we are doing experimental work on tulip oak and our results do not agree with those of the N.S.W. Division of Wood Technology. There is the possibility of variation between the analytical methods. Quite a large amount of work was done some years ago in N.S.W. and the original method of Mr. Cummins was amended. This was followed by the introduction of the single indicator method by Mr. McKenzie at the Division of Wood Technology. We have prepared a summary giving various points on which we were not happy with either methods. This was shown by a check on standard samples. According to our figures -

Standard	Double Indicator	Single Indicator
0.20%	0.22%	0.19%
0.60%	0.62%	0.58%
0.81%	0.83%	0.73%

That particular batch of samples we repeated with fairly similar results. For example, at 1.5% Standard, we obtained 1.48 and 1.51, at 0.1%, 0.10 and 0.15 and in general a locus of .82, showing ± .2 variation was obtained.

With the double indicator method we had a number of unsatisfactory results, e.g. the factors of 1.08 for absorption. In addition, there is an effect from calcium and a further effect of extraneous materials such as phosphates. With the single indicator method we have, on the information supplied to us, a variation in what the maximum boron concentration should be and, in general, the method appears to be doubtful. Although we have fixed a rigid figure of 0.20%, yet we have a discrepancy in methods. Our attitude is that we would like to see another examination carried out not only with these methods, but I, personally, would like to see attention given to the use of colorimetric methods, e.g. the quinalizarin method. Under our present system, a dozen samples per day is about the maximum. That is all right under normal conditions, but it means you can never get ahead of your analytical work. There are some technical points I would like to discuss with Mr. Huddleston, Mr. Tamblyn and Mr. Christensen.

Mr. Huddleston: I find myself in violent disagreement with Queensland. I cast my mind back to 1945 when we started to report results from very low concentrations of solution in boric acid treatment. At that time, there was a suggestion from Queensland that our analytical methods were wrong. Queensland sent samples down to see if our analysis agreed with theirs. We did get some variation using the method as set out by Mr. Cokley. There was quite a lot of difficulty associated with the use of glycerol in that analysis. The Forestry Commission of N.S.W. used an officer on the job for quite some considerable time, not in developing a method, but in building up a method used by our Health Department authorities. Following that work, it was reported by Mr. McKenzie: it was discussed at a Lyctus Conference between Queensland, N.S.W. and D.F.P. and we made an arrangement for Mr. McKenzie to go down to this Division to perfect a method of analysis. As a result of the combined efforts of Sterling and McKenzie, a report was prepared in which the single indicator method was recommended and I think the analysis and subsequently the report, was discussed at a conference and it was agreed that the method of analysis set out in that report be adopted by the 3 organizations.

After Mr. Cokley took up duty in Queensland, he came down to the N.S.W. Division of Wood Technology and to D.F.P. to check up on methods of analysis and quite recently, we had a request that he should spend further time with the Division. My officers have plenty to do, and we do not feel like wasting time going over the same ground time and time again. Apparently, he is looking for a refinement in analysis which I do not think is justified.

With this in mind, I rang my preservation laboratory and asked the officer-in-charge to send me one of his laboratory books and I went through the first 20 analyses. These are commercial analyses without extreme accuracy. The first 5 or 6 will do:-

Readings	Mean	% Boric Acid	Calculated boric acid from individual readings
.380) .390)	0.385	0.41	0.404 0.415
.814) .820)	0.817	0.88	0.876 0.883
.723) .729)	0.726	0.78	0.777 0.782
1.250) 1.260)	1.255	1.36	1.355 1.363
.910) .890)	0.900	0.97	0.981 0.959
.123) .130)	0.127	0.14	.136 .143

The same thing applies throughout the book. I think that for all practical purposes, that accuracy is good enough. I do not feel that we should be asked to spend more time and money on further methods of analysis on the score of accuracy. If you can get a quick method, well and good.

Mr. Christensen: This problem of boric acid analysis has been a knotty one. Briefly, I would just like to cover certain aspects of the development of the method and more recently, what has happened over the last few years. Following the original method of Gregory, some work was carried out by Sterling of this Division and some of the errors present in the method were eliminated. Subsequently Sterling and McKenzie put forward a suggestion which is virtually the method of analysis that is being employed by N.S.W. at the present time. At the last Conference, the matter was discussed to some extent and it appeared that the single indicator, the brom-thymol blue, method at present being applied would be satisfactory as a normal laboratory test method. Since that time I have come to doubt the accuracy of the results obtained by the method, and I have carried out one or two tests to try to clear up these doubts. One aspect is the accuracy desired. We have not any problem of the nature of Queensland and N.S.W. of depending on analytical methods to back up the legislation covering effectiveness of treatment. However, from a fundamental point of view, I feel that it is desirable for a high degree of accuracy to be obtained and I think it is important that we should have some reference method to which we can refer as an absolute standard.

Considering this matter in some detail, the principles involved in the two methods are slightly different. In the first place, the double indicator method makes use of the fact that the end points of the two titrations which occur during each boric acid analysis, occur at different pH's and these are theoretically correct. The present method of application (the single indicator method) is to continue both titrations to the same end point. I feel that, as a fundamental method, the brom-thymol blue method as it stands at present is not likely to be completely satisfactory for the object I have in mind, namely, a completely accurate reference method to adopt as a standard for boric acid analysis. The second feature of the brom-thymol blue method is that it depends on the use of micro methods in the determination. In order that the two methods have an equal value, it is necessary that any experimental errors introduced during analysis must be reduced in proportion to the size of the titres. For that reason, also, providing there is no major advantage in applying brom-thymol blue, I feel that the standard method should be based on a macroscopic rather than a microscopic method. I do feel, on the basis of these two considerations, that a re-examination of the position is imperative, if we are to establish anything in the nature of a completely satisfactory method.

There is another point to be considered. That is the fact that I am not completely aware from the comments of Mr. Oakley and Mr. Huddleston of the degree of discrepancy that has been encountered as between N.S.W. and Queensland. From the point of view of practical analysis of samples from treatment plants, it seems to me that providing the actual degree of accuracy achieved in these methods is adequate, there is no great need for a uniformity of method of analysis to be applied. Another point is that a given method in the hands of one group of workers is likely to be more accurate than the same method in the hands of another group of workers. It depends on the degree of efficiency that has been acquired. As far as this Division is concerned, since the incident of the set of analyses mentioned before, we have reverted to the double indicator method with some modifications. However, in order to be completely satisfactory, a little further work should be done on the double indicator method to introduce the maximum degree of refinement so that we can have a reliable method with which all other methods can be compared. It seems to me that there are two problems; first, to arrive at some satisfactory agreement as to methods and accuracies of methods that are required for laboratory tests of samples supplied from treatment plants, and secondly, we have the necessity of having some standard method, i.e. something on which we can base all our future work.

<u>Mr. Clarke</u>: Has not a satisfactory method been agreed on by this Conference?

<u>Mr. Ellis</u>: Mr. Young was our representative at

the 1947 Conference. Mr. Huddleston states that, at this Conference, agreement was reached to adopt the single indicator method, but I would like this Conference to understand that Mr. Young is no longer an officer of the Department, that I have no recollection of any such agreement, and that no reference was made to that agreement in the minutes. Thus, when Mr. Cokley took over the work of Mr. Young, I feel that he was free to adopt either method. We decided to use the Double Indicator method. Mr. Huddleston said that we went back on the Conference. There is no record of agreement in the Conference.

Mr. Tamblyn: We have been more or less in agreement that the method developed by McKenzie and Sterling is quite satisfactory, but from time to time, there have been some questions raised by ourselves and others as to the complete accuracy of the method. I do agree with Mr. Huddleston that an earlier Conference inferred that the present method used by N.S.W. would be the standard, but I do not think we ever discussed the need for an accurate check method that might be used for special purposes. There probably is room for a method of the highest accuracy to be adopted when we are doing tests of considerable significance, such as the development of schedules or perhaps check analyses or if a disagreement arises on results. Otherwise we should continue to accept the McKenzie-Sterling method.

Mr. Clarke: It seems to me that we could continue to accept that, but someone in this Division should work on the development of a more accurate method.

Mr. Tamblyn: I think there is room for another method which is as far beyond suspicion as it can be made.

Mr. Clarke: Would the Conference agree to D.F.P. working on a method as outlined by Mr. Christensen and Mr. Tamblyn?

Mr. Huddleston: I do not know whether it is a question for the Conference. For all our purposes, the single indicator method of analysis is satisfactory. I do not visualize any work that is going to require this extreme accuracy of getting down to a fraction of a per cent. If this accuracy were needed, I would agree.

Mr. Christensen: In certain instances this accuracy may not be needed. We have done such experiments here - quite recently the experiment on the momentary dipping of veneer. In that particular experiment, the amount of boric acid taken up by the treatment was so large that the matter of analytical accuracy was not particularly important. On the other hand, it is, in certain instances, desirable to have a high degree of accuracy. If you have a large variation, your actual results do limit the interpretation which you can place on the results you obtain. We have a whole series of toxicity tests coming up for consideration and that particular experiment is one that is likely to require a high degree of accuracy. I am not optimistic that a very accurate method can be found. Some of the refinements suggested by Mr. Cokley do seem to me to be very good ones. As far as the brom-thymol blue method is concerned, there is another point that should be cleared up. The selection of the indicator itself does not make a great deal of difference to the accuracy of the method as carried out by the Division of Wood Technology. That is on the basis of the tests I have done recently. It is the method of interpretation and using of the indicator that is important. If, in using the brom-thymol blue method, the first titration is taken to the point at which the first colour change occurs, the end point corresponds very closely with the methyl red end point in the double indicator method. If the second titration is taken to the step where with the single indicator the final blue colour is obtained, the end point is very similar to that in the double indicator method. So that by using the brom-thymol blue in this manner, we have virtually the same system in operation as for the double indicator method.

Mr. Ellis: With regard to a point indicated earlier, Queensland is quite prepared to adopt the method agreed upon by D.F.P. and D.W.T. I take it that the single indicator method is quite satisfactory to the Division, and that you preferit to the double indicator method?

Mr. Christensen: In view of the nature of our work, we have ceased to use the single indicator method for the reasons given previously. We have had one or two sample boards coming in from treatments that have been going on in Melbourne, and in view of our familiarity with the double indicator method, we have continued to use the souble indicator method for these samples.

Mr. Fogl: With regard to the problem of which of the two methods of analysis is the more satisfactory, there are two minor points. Firstly, one of the main advantages to us in the use of the single indicator method was the use of mannitol in place of glycerol and the doing away with methyl orange as an indicator. The latest information from Queensland is to the effect that both these contentious features have been omitted. I do not think the order of accuracy between the two methods is different. I would be very interested to hear from Mr. Christensen about this. We have done considerable work on methods of boric acid analysis and have found no great difference.

Mr. Christensen: I cannot give figures on that point. One point was raised by Mr. Huddleston. He quoted a series of figures to illustrate the accuracy of the brom-thymol blue method. Good agreement between duplicates is not a proof of the accuracy of the method itself. It is a proof of the reproducibility of the particular method. The point is that we want to be sure that the figure obtained is the correct one. There is still the possibility of the method being slightly out, in spite of the fact that you get agreement between determinations.

Mr. Huddleston: These figures were given as an answer to Mr. Cokley's suggestion that the reproducibility of the method was questionable.

Q. TOXICITY TESTING OF WOLMAN SALTS TO LYCTUS.

Mr. Tamblyn: At the second Conference the question of the toxicity of Wolman salts to Lyctus was raised. There was also some correspondence between ourselves and Mr. Taylor and we finally undertook to set up the necessary tests. This projected work was part of the programme which was temporarily deferred when we began to experience trouble in the breeding of Lyctus. At that time it did not seem desirable to attempt to determine a toxicity threshold figure until our technique was improved.

However, we now feel able to begin this work and have done some tentative planning. We have also obtained from Hickson and Welch a standard sample of "Tanalith U" in case samples from the often caked material in drums after shipping might not be completely uniform.

There are some difficulties in this type of test which Cummins apparently did not give thought to when the original toxicity tests were made with boric acid and other chemicals. The main difficulty is to ensure that the average loading of preservative in a treated specimen is uniformly the same from case to core. Such a distribution can be obtained approximately immediately after impregnation, but it seems certain that there is some shift of salts during drying, probably towards the surface. At present, we are investigating this with the object of ensuring that the concentration determined as the toxicity threshold is not just the mean in a specimen with a sharp case to core gradient. As soon as this preliminary work is completed we will be ready to go ahead with the actual test. At present we have only white cheesewood available for testing and would like to get at least one and possibly two heavier timbers for confirmatory tests.

Mr. Fogl: I would very much like to be informed on the methods to be adopted to ensure a uniform basis for these tests and what the technique would be.

Mr. Tamblyn: Wolman salts is difficult to analyse satisfactorily. At present we are working on the assumption that if we completely saturate the specimen distribution will be uniform just after impregnation. To determine whether or not this distribution remains uniform we are treating specimens with sodium chloride and drying by different methods before analysis for uniformity of distribution. If this proves to be satisfactory we will go ahead with the testing of Wolman salts. If not uniform, larger samples will have to be treated, and, when dry, cut so as to expose the surfaces at varying depths.

Mr. Fogl: What would the size of the sample be?

Mr. Tamblyn: That has not been decided.

Mr. Clarke: Does the N.S.W. Act permit the use of Wolman salts?

Mr. Huddleston: Wolman salts is approved under the Timber Marketing Act.

R. CHANGE OF NAME.

Mr. Clarke: The Conference in the past has been called the Lyctus Conference. We now suggest that the name be changed, and as a number of other insects are under discussion concerning attacks on timber, it has been suggested that the Conference be renamed. The name "Wood

Borer Conference" is submitted.

Mr. Gay: I think that is still restrictive; I suggest "Timber Insect Conference".

Mr. Clarke: Do we require any separate name? The Conference has always run together with the Forest Products Conference.

Mr. Ellis: I agree that there is no necessity whatever to name it apart from the Forest Products Conference.

Mr. Clarke: You suggest that we delete any reference to a separate Conference?

RESOLUTION: THAT the name "Lyctus Conference" be discontinued and the business carried out under this heading be incorporated under the Forest Products Research Conference.

Moved by Mr. Irvine, seconded Mr. Bayne. Carried.

13. BATTERY SEPARATORS.

Mr. Kingston: The timber originally used for battery separators was Port Orford cedar. During the last war, this species became scarce, not only on account of difficulties here, but due to actual shortages in the U.S.A. and Canada. A certain amount was obtained for use in this country, but this was insufficient to meet the demand. The commonest substitute timber used in America was and still is Douglas fir. Other timbers such as yellow cedar have been used but only Douglas fir has come into use to any extent in this country, and this is now difficult to obtain on account of the dollar shortage. Work was commenced during the war to find suitable Australian timbers for substitute purposes and as a result of the tests, a number of softwoods hoop pine, bunya pine and Queensland kauri were found to be suitable for separator manufacture.

Postwar Shortages - In 1945 hoop and bunya pine had become scarce, supplies of kauri were insufficient to meet demands and the testing of further timbers became necessary. This was not so much due to an absolute shortage of kauri but to the difficulty of diverting quantities of this timber, which was in great demand for other purposes, to the manufacture of battery separators. This difficulty was due to a large extent to the very careful selection required for this purpose.

Tests on Queensland Species - Firstly, a number of Queensland species were tested (about a dozen in all), mostly hardwoods, of which one, sassafras, proved quite promising, and another (rose alder) still requires further testing but may be a possibility. Hardwoods have a bad name for softening in acid, but this may not be merited in all cases.

Tests on Klinki Pine - Initial tests showed that klinki pine from New Guinea was probably suitable for separators and four additional logs of this species were obtained for test. Mechanical and resistance tests and observations on handling properties were first carried out. The standard treatment was found to be suitable, the resistance was found to be satisfactory and the mechanical and handling properties good, providing the material was sliced. The handling properties proved unsatisfactory with peeled material. Next, life tests were carried out on a number of batteries containing separators of klinki pine, kauri separators being used as controls. These were done with and without vibration and the species was found to be satisfactory in all respects. Unfortunately, this species is not yet available on the Australian market.

Tests on Sassafras and Yellow Carabeen - Arrangements were also made to test sassafras and yellow carabeen. Although pored timbers are generally considered to soften more readily in acid than non-pored timbers, they have been used to some light extent overseas and it was felt that tests on certain pored timbers were desirable. It was reported by a firm of battery manufacturers that they had at one stage used sassafras for separators and found it satisfactory. The New South Wales Forestry Commission has made available material from a number of logs of yellow carabeen and these have now been tested for treatment, resistance and mechanical properties and found to be satisfactory with one possible reservation, namely that the handling properties are not quite as good as those of kauri. This point will be cleared up when life tests, which are at present being inaugurated, are carried out.

Tests on Radiata Pine - Radiata pine is a timber which is obviously worth testing. We have written to the Victorian Forests Commission to see if they have material in suitable grades for testing but the reply has not yet come to hand. We are also in touch with New Zealand Forest Products and test material from that country is due in Sydney very shortly. We have had preliminary discussions with the South Australian Woods and Forests Department regarding tests, which it is hoped will be put in hand at an early date.

Tests on Miscellaneous Species - Borneo cedar did not prove satisfactory. Ramin from Sarawak is not satisfactory as it breaks very easily in handling and has a high resistance.

There are two principal species of North Queensland kauri. Some manufacturers consider kauri is an ideal timber and yet others won't have it at any price - they prefer Douglas fir which they consider superior to kauri. I have been unable to discover the reason for this difference of opinion. Some may have been getting A. microstachya and some A. palmerstoni. I do not know; but to ensure that the point will be cleared up, we have made arrangements to test both species to determine whether or not they are equally satisfactory for separators as there is a considerable quantity of A. microstachya being cut on the Atherton tableland at present. We have obtained veneer of Vanikoro kauri. These may be satisfactory for test purposes but if not, as soon as better material is available, we will obtain further supplies.

Standard Specifications - There are two standard specifications existing at the moment, one for automobile and one for aircraft battery separators. It is felt that these need bringing up to date and combining as a permanent standard. As a comment on existing specifications we submitted a new specification in draft form covering both aircraft and automobile battery separators in one specification, and extending it to other types to make it as general as possible. The new specification has now passed the draft stage in which it was submitted to various authorities for comment. Discussions have been completed and the specification will come out in its final form at any moment. Klinki pine has not been included among approved species but if desired it could be added at any time. It is considered inadvisable to proceed further until it is available on the Australian market.

Mr. Gray: That was a very admirable summing up of the position by Mr. Kingston. The matter of the supply of battery separators is rather a chronic headache to us. I need hardly tell you that battery manufacture is a key industry to transport, so that the requirements of battery manufacturers are essential and battery separator supply should be available at all times, and for this reason local production is very desirable, especially at present, as there is a shortage of dollars. I do not quite know what the position was before the war although Mr. Kingston has given an intimation that our supplies are imported. During the war a considerable quantity was obtained under Lease-Lend. At the same time during the war the local industry was encouraged and it reached quite a fair stage of technique and quite useful veneer was being cut. After the war some of the battery manufacturers started importing on a fairly large scale and the local industry became disorganized to some extent. It was difficult to get regular oversea supplies and later on they began to say "We must get some local veneer."

As Mr. Kingston has said, some local timbers, such as kauri are satisfactory but the quantities available to meet the demand, owing to adverse conditions such as weather, strikes and all sorts of things, have been somewhat erratic. At the same time, some of the manufacturers spoke disparagingly of kauri and they would not buy it if they could get the imported timber. Many of the alleged inferiorities with regard to kauri have now been ironed out and it became clear that if some guarantee of local supplies could be assured forward arrangements would have to be made. For that reason some assurance was required from manufacturers that they would take production. With some of these doubtful factors eliminated, things looked brighter last year for obtaining more or less complete requirements in Australia. Production was good, at a higher rate than ever before, and it was hoped that a reserve might be built up, but unfortunately, at the end of the year weather conditions and other hold-ups, including the coal strike, interrupted, and the net result was that we had to import about half of our requirements.

From experience over the last few years, kauri is suitable for major requirements, and reliability of supply is of the first importance. I have suggested at different times to Mr. Kingston that the question of available quantities of timber from the southern States might be investigated. If Pinus radiata, for example, was satisfactory, the supply problem would largely disappear. Tests are being carried out with Vanikoro kauri; this may be satisfactory, but the possible supply is not large nor very reliable and we would prefer to see locally grown timber if it is at all possible. Vanikoro kauri may prove to be useful as a supplementary supply for the time being. In round figures the demand is approximately 1 million super feet of flitches, which corresponds, considering the high recovery of flitch from cylindrical kauri trees, to about 1¼ million super feet of selected logs. I would be very interested indeed to hear from Mr. McAdam concerning the available supplies of klinki pine.

I would like to raise one point. Mr. Kingston referred to klinki pine as being satisfactory in all respects, but I did note some reference to rotary klinki not being entirely satisfactory.

Mr. Kingston: Rotary cut klinki pine tends to break easily in handling. Rotary cut separators are used for central station batteries but sliced material is preferred for automobile batteries, etc.

Mr. McAdam: The position with regard to klinki pine is a bit obscure at the moment. At the present time we have under discussion the possibility of getting industries established in the Valley within a reasonable period. No finality has been reached yet so I cannot give the Conference any definite idea. So far as tying up supplies of flitches is concerned, I should say that this is out of the question at the moment, but I do not doubt that if battery veneer is such a good thing from the manufacturer's point of view whatever organization is established to develop the utilization of these klinki pine stands will look into the matter of such utilization.

Mr. Gray: I gather Mr. McAdam is not agreeable to the supply of flitches coming from New Guinea.

Mr. Kingston: Mr. McAdam remarks that battery veneer is a good proposition. The price is high but selection is so stringent that I doubt if a private firm handling veneers would bother with it.

Mr. McAdam: It is the price which induces people to produce these things. The price should be such as to offer a profit inducement to convert the timber into battery separators and sufficient to offset the waste occasioned by such high selection. If the supply of battery separators is of sufficiently vital importance to Australia, some result may eventuate by pressing the supply of klinki pine on the political level.

Mr. Gray: The Queensland Forest Service mark any kauri logs felled which are considered suitable for producing battery separator veneer and they are set on one side for that purpose alone. Selection is made in the bush.

Mr. McAdam: You take only a selection of the particular logs?

Mr. Kingston: Normally logs are cut into 6" or 6½" flitches.

Mr. McAdam: You would not regard that as altogether satisfactory. I presume Queensland gets a higher price for such logs.

Mr. Gray: The cutting of flitches by sawmillers is considered to be very remunerative. Logs which would go to a firm peeling and slicing may, however, be preferred for plywood.

Mr. Ellis: I doubt whether firms with a combined sawmill-plymill set up would saw kauri logs in preference to veneering.

Mr. Gray: Very few firms have suitable equipment which can do a proper job of slicing battery separators.

Mr. McAdam: The supply could probably be satisfied by the price adjustment. In other words, if there is an inducement to produce flitches for battery separators the ply people would be prepared to cut their logs accordingly.

Mr. Ellis: I do not know the figures, but I do know of one instance where kauri logs were sent in for cutting into flitches and were converted into peeled veneers.

Mr. McAdam: The point is that logs of the quality required for 6' boards for these flitches will ordinarily cut into 18" board. This is even more remunerative at the present time. It is largely a matter of having the market adjusted to give the necessary inducement.

Mr. Clarke: If we cannot expect to get klinki pine in sufficient quantities for some years, can any other species be suggested?

Mr. Kingston: I have not tried southern sassafras. The question of using this was raised and I was wondering whether it could be diverted from specialty uses.

Mr. Payne: I should say it would be available, but whether in the quantities needed for battery separators I do not know. As a long-term source of supply, I do not think it would be very reliable. It might, however, have possibilities.

Mr. Clarke: Any other species in N.S.W.?

Mr. Huddleston: No, I do not think so.

Mr. Ellis: There is a small amount of Ackama quadrivalvis.

Mr. Clarke: Do you want more of rose alder?

Mr. Kingston: I have enough material for the moment.

Mr. Clarke: Have you tried jarrah?

Mr. Kingston: Jarrah is all right for resistance, but it may give trouble in handling owing to the large pores.

Mr. Clarke: Jarrah chemically is more like softwoods than any other timber. It might be worth a trial.

Mr. West: But there are quantities of spruce available here in Australia and they are being tested for aircraft purposes; quite a lot of it is unsuitable, and this rejected supply might be available.

Mr. Huddleston: It is doubtful whether anything rejected for aircraft use would be suitable as battery separators because of the low Izod figures.

Mr. Kingston: Spruce may be worth testing.

Mr. West: It is very seldom we get spruce over 34 pounds per cubic foot. Samples have been sent to us for testing for aircraft purposes but there is always a percentage below the standard required, and this may be a likely market for battery separators. The flitches are always very big; the sizes which come in are approximately 8" x 8" to 12" x 6".

14. STANDARD TERMS AND DEFINITIONS IN FOREST PRODUCTS RESEARCH.

Mr. Head: At the Forest Products Conference in 1948, reference was made to the principles that were followed in preparing the draft list of terms to be used, and it was pointed out that the object was to prepare a list that would facilitate the understanding of a large percentage of any research officer's scientific contributions by other workers.

The necessity for keeping the list within reasonable limits was appreciated, but there developed considerable difficulties in deciding the justifications for including certain terms, for example, electrical engineering terms.

A tentative list of terms was circulated to the various States for comment, and as a result of their views, the list was consolidated and the preparation of suitable definitions was commenced. It was hoped that these would have been available for distribution to the States in time for discussion at this Conference, but unfortunately this was not possible. The lists should be ready for circulation amongst the States in the very near future.

The most controversial terms and definitions remaining in the list will be, I imagine, those electrical and electronic engineering terms which are used in their generally accepted scientific meaning. This departs in some measure from the principles enunciated at the last Conference, but it was felt that these terms, which are being increasingly used in both the seasoning and veneer and gluing fields should be included in order that the research worker in other branches of forest products might have ready access to them.

During the preparation of this list of terms and definitions it has become increasingly apparent that no hard and fast rules can be laid down. The individual terms have to be considered on their merits as to whether or not they should be included. For example, various types of figure such as fiddle back, mottle and birdseye have not been specifically described, as it was considered that they were more or less self-explanatory.

Definitions have been kept as brief as possible, without sacrificing clarity, and where they have different meanings in different fields, all have been covered. Some terms which occurred in the 1935 Canadian list and which are used in other overseas publications, but which are not in common usage in Australia, have been retained because the final list will be on an Empire basis. The Australian equivalent terms have been added.

Mr. McElhanney, as Chairman of the Committee preparing the Empire list, has advised that the work is proceeding, and he is awaiting the Australian comment. He will be given an outline of our progress, and his comment on the suggested terms will no doubt clarify many of the points that have aroused discussion.

We were very happy to have the views of the States, but I would stress again that it is extremely difficult to lay down any hard and fast principles. I have tried to cover the terms which are generally accepted in a scientific manner. It has been advanced by members both here and in the States that those terms should not be in the list. Some of us have felt that it should be a ready list for the workers and that there is justification for including those terms in the glossary.

Mr. Ellis: As such terms as mottle, fiddleback etc. are included in the Oxford dictionary it does not seem necessary to load the list up unduly by their inclusion.

Mr. Clarke: You suggest that they be omitted?

Mr. Ellis: Yes. With respect to the inclusion of terms in other scientific fields, I feel that there is no need to be hard and fast about this point, but that individual cases may be examined on their merits.

Mr. Huddleston: I agree with Mr. Ellis that in considering terms such as mottle etc. which are well understood, there is no need to include them. But I do feel that in a glossary or whatever you might call it, giving scientific terms used in a particular branch of science, all terms likely to be in common use in that Branch should be included - both engineering and electrical terms. If you strike a term in a piece of literature, you look up a glossary which is supposed to cover that branch of the work. If the list is to serve the purpose for which it is intended, some effort should be made to make it as comprehensive as possible without including terms which are of very little use in Forest Products research.

Mr. Head: I am particularly happy to have that endorsement of our action to date. There is another point on which I would like the guidance of the States and that is that Mr. McElhanney has now indicated that he is waiting on Australia. There is some urgency now associated with the confirmation of our ideas on definitions. Typed copies will shortly be ready for distribution to the States, and we would like to know whether the States would like these in small doses, or in one complete lot.

Mr. Payne: Is there not a possibility that if the Forest Products glossary takes in terms used in the other sciences, constant revision will be necessary.

Concepts are continually changing and there is a good deal of difficulty in keeping up to date in all the fields of science.

Mr. Clarke: I do not think we were expecting to put in any other than standard terms.

Mr. Huddleston: But I think I understand what Mr. Payne is driving at. It will be necessary to revise our glossary from time to time and we are only concerned with the interpretation adopted by Forest Products research workers and not that of the more commonly accepted meaning of the engineering term. That is another justification for including these terms, because the position may arise at some time in the future where we would use an engineering term in one sense, and an electrical engineer would use it in another.

Mr. Kingston: Definitions should be as general as possible, but should be couched in such terms that they would be intelligible to research workers other than engineers and physicists.

Mr. Huddleston: Could Mr. Head indicate whether he would prefer to send out the list in one lot or in small instalments?

Mr. Head: We could take the first half dozen letters of the alphabet and send them straight away.

Mr. Huddleston: So far as I am concerned in New South Wales it is going to be easier for us if you send it in one lot.

Mr. Ellis: I agree with that.

PROCEEDINGS

FOURTH ANNUAL

FOREST PRODUCTS RESEARCH CONFERENCE

HELD AT

THE DIVISION OF FOREST PRODUCTS,

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION,

MELBOURNE

OCTOBER 10-14, 1949

VOLUME 2

DIVISION OF FOREST PRODUCTS
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION
MELBOURNE

TABLE OF CONTENTS

VOLUME I.

	Page
Representation	(iv)
Programme and Time Table	(v)
Opening of Conference by Chief Executive Officer, C.S.I.R.O.	1
Recording the Conference	13
Building Boards	14
A. Market Surveys.	14
B. Experimental Work of Division of Forest Products	18
C. General	24
Nomenclature	27
A. Nomenclature of Australian Timbers	27
B. Phytochemical Register	30
Railway Sleepers	32
A. Australian Standards	32
B. High Pressure Preservation Treatment and Field Tests.	43
C. Mechanical Failure Investigations	46
Marine Borer Investigations	50
Durability Tests	55
Laboratory Tests of Preservatives	59
(i) Tests with copper naphthenate	59
(ii) Tests with brown coal tar creosote	59
(iii) Other preservatives	60
Pole Bulletin	62
Standard Nomenclature for Timbers Imported into Australia.	62
Tasmanian Pole Tests	68
Cross Arm Survey	72
Taxonomy of Fungi	75
Lyctus Conference	79
A. Re-Examination of Toxicity of Boric Acid and Borax	79
B. Use of Sodium Fluoride as a Lycticide	83
C. Australian Standard Specifications for Boric Acid Treatment.	85
(a) General	85
(b) Review of standard minimum requirements as regards depth of penetration	86
D. Susceptibility Gradings for New Commercial Timbers.	92
E. Review of S.A.A. Specification with Respect to Inclusion of Sapwood in Lyctus Susceptible Species	95
F. Report on Lyctus Legislation (Queensland)	97
G. Laboratory Breeding and Testing Techniques Committee.	99
(a) General report	99
(b) Report on nutritional studies	100

H.	Anobium	Page
	(a) Susceptibility of radiata pine	105
	(b) Susceptibility of Baltic pine	106
	(c) Attack in finished Scandinavian pre-fabricated houses	108
J.	Spraying of Buildings	109
	(a) Alternative clause in War Service Homes specifications	109
K.	Lyctus Publications	115
	(a) Trade Circular	115
	(b) Treatment Manual	116
L.	Uniform Building Regulations and Building Research	119
M.	Treatment for Moulds and Sapstain	122
N.	Superficial Preservative Treatment of Lyctus Susceptible Timbers	130
O.	Glue Line Tests	131
P.	Methods of Analysis for Boric Acid	140
	(a) Standard Procedure for Sample Selection	140
	(b) Analytical Methods	141
Q.	Toxicity Testing of Wolman Salts to Lyctus	150
R.	Change of Name	151
Battery Separators		152
Standard Terms and Definitions in Forest Products Research		160

VOLUME II.

Reports on Oversea Conferences	163A
Equilibrium Moisture Content	170
Vapour Drying	172
The Predrier	184
Composite Wood Corresponding Committee Report	187
Growth Studies	189
Sapwood-Heartwood	197
Plywood from Ash Eucalypts	208
(a) Veneer Production	208
(b) Drying of the Veneer	211
Utilization of 'adiata Pine Veneer	216
Tannin Formaldehyde Adhesives	217
The Bark of Radiata Pine	224
The Suitability of Australian Timbers for the Manufacture of Spirituous Liquor Casks	226
Waterproof Plywood and Synthetic Resin Adhesives	228
Lactic and Acid Casein Glues, Substitutes and Extenders	228
(a) Acid Casein	228
(b) Peanut Meal	233
(c) Blood	234

Page

Basic Aspects of Adhesion 236

The Effect of Boric Acid and Borax Treatment on Bonding with Phenolic Resins 244

Mill Studies and Sawmill Engineering 249

Tanning Materials 254

The Minor Chemical Products of Queensland Rain Forests 263

Standardization of Test for Yield of Essential Oils from Leaves and Methods of Wood Ash Analysis 276

General Items 278

A. Library of Educational Films for Forest Products. 278

B. The C.S.I.R.O.A. Act 279

C. Education on Wood Technology 281

D. Co-operation with Building Research Liaison Service, Department of Works and Housing 283

(a) General 283

(b) Flooring Tests 291

E. Sylviculture and Properties 294

F. Utilization of Hardwood Thinnings 298

G. Utilization of Sawdust 300

H. Publications 301

J. Timber Bank for Research Purposes 302

K. Collection of Material 303

Paints and Lacquers 308

Assumption of Applied Work by State Forest Services 317

Standards 322

(a) General 322

(b) Grading Instruction 325

(c) Inclusion of Sapwood in Non-Lyctus Susceptible Species 326

Standardization of Size of Case Shooks 327

Next Conference 327

Resolutions and Suggestions from the Fourth Forest Products Research Conference 328

PROCEEDINGS OF THE FOURTH FOREST PRODUCTS RESEARCH CONFERENCE

VOLUME II.

Note: As the record of the discussion of this, the Fourth Forest Products Research Conference, is of such length, it has been considered advisable for convenient handling to split the Proceedings into two Volumes.

15. REPORTS ON OVERSEA CONFERENCES.

Mr. Cooper: As a background to my report on the Conferences which I attended overseas in 1949 it is desirable to say some introductory words - which could indeed be much better given by Mr. Clarke, who was largely instrumental in having the British Empire Conference on

Timber Mechanics called, and by Mr. Gordon, who not only worked at F.A.O. Headquarters in Washington and attended a previous meeting held there, but has been invited to become a permanent member of the F.A.O. sub-committee on Mechanical Wood Technology. As the members of this sub-committee are defined as "experts capable of considering technical problems from an international viewpoint," F.A.O. chose wisely in honouring Mr. Gordon.

The Food and Agriculture Organization of the United Nations has a Standing Advisory Committee on Forestry and Forest Products which, being agreed on the value of technical sub-committees, recommended that the following committees should be set up:-

1. Silviculture and Forest Management
2. Technology of Forest Products (a) Mechanical
   (b) Chemical
3. Economics and Statistics
4. Education
5. Special (a) Unexploited Forests.

In adopting the recommendation and setting up a sub-committee on Mechanical Wood Technology an F.A.O. Conference in 1946 directed that the working programme of the sub-committee should give particular consideration to the world shortages of sawn timber and houses. The following items were listed for attention:-

1. Standardization of grading rules for lumber and a technological classification of woods in relation to their uses.
2. Elaboration of standards for mechanical testing of wood.
3. Elaboration of building codes for the use of architects and contractors; improvement of building codes and use of modern equipment and methods of assembly.

4. Methods of improving properties of wood by chemicals.

The first two meetings of the sub-committee were held at Zurich in January 1947, and at Washington D.C., in July 1947. These meetings, which were attended by the European and American members respectively, considered the working plan and made decisions as to the procedure to be adopted. At Zurich, probably because different procedures are used in different European countries, emphasis was on the standardization of specification tests, both physical and mechanical, of wood and wood products, and a rapporteur was appointed. On the other hand at Washington, where the American group had a common testing technique, emphasis was on other aspects of the programme. A request was made for the exchange of information on lumber dimensions so that an examination of the possibility of international standardization might be made. The best method of utilizing wood in construction was discussed, not only for economy, but also so that technically it might compare with other materials. It was decided to study construction methods and building codes, a complete study of new construction methods in Europe and in America, particularly the use of wood in dwellings and in pre-fabrication, to be undertaken. As a study of construction would be incomplete without a consideration of timber preservation, it was decided that information concerning preservatives and methods should be collected and disseminated. Other items considered were the utilization of waste, particularly as building boards, and an international terminology for wood technology.

The third meeting of the sub-committee, which is the meeting I attended, was held at Geneva in June 1948, and was attended by representatives of the United States, the Argentine and Australia as well as a number of European countries. The items for discussion including grading and sizes of lumber, integration of forest industries, and standardization of test methods, but lack of sufficient time meant that the attentions of the sub-committee were restricted to the question of test methods. In April 1939 a meeting at Princes Risborough in England had considered the international standardization of timber tests. Utilizing the findings of that meeting, M. Campredon, the Chairman of the sub-committee, had prepared a paper which dealt with five principal tests, and this was used as a basis for discussion by the meeting. The first, and greatest, difficulty which faced the meeting was that of size of specimen, but when this was resolved progress was made in the details of the test methods for compression, tension and shear all parallel with the grain, and for static and impact bending. The other timber tests and the testing of fibre boards and plywood were discussed but were left for more information to be obtained. Study assignments were made to various delegates and I accepted the important one on "General Conditions of Test" which was to include the relations of moisture content and temperature to strength, the accuracy of machines and instruments and the precision of readings, and the questions involved in the presentation of results.

This paper was prepared and sent to Geneva to be presented to a Conference in late August of this year by Mr. G.W. Wright. This Conference on Mechanical Wood Technology, called by F.A.O., differed from the preceding meetings in that the delegates were regarded as representing and speaking for their respective governments. Details of timber testing agreed on at the previous sub-committee meeting were accepted; reports which had been prepared were dealt with and in large degree accepted; further matters were discussed and assigned for more work to be done before the next meeting. Many of the conclusions of my own report were accepted by the Conference and written into the Resolutions, which will now be submitted to the various Governments for ratification or amendment.

An appeal was made by Mr. Glesinger of F.A.O. for delegates to be seized with the importance of grading and uniformity of sizes. He suggested that this subject might cover:-

1. a terminology of wood names to give uniformity
2. uniformity of standard sizes for each species or group of species.
3. a standard grading procedure for, at any rate, structural timbers
4. unification of commercial grades.

These matters were discussed and sub-committees were set up to try to deal with the matters by correspondence. It was suggested by a Swedish delegate, and accepted by the Conference, that the possibility of a limited number of universal stress grades should be investigated. The similarity between the problems facing the F.A.O. Conference in the world sphere and those facing this Conference in the Australian sphere is very striking.

Another statement by Mr. Glesinger may be of some interest to you. It was on "The Role of F.A.O.'s Committee on Mechanical Wood Technology in the Technical Aid Programme." Mr. Glesinger said that it was well known that Mr. Truman had suggested that the more advanced nations should give technical assistance to the less advanced nations, a suggestion which had been approved by the Economic and Social Council provided it was not financed by one nation only but by all advanced nations. It has been suggested that U.N. should spend 20to 25 million dollars per annum, of which 29 per cent would be reserved for F.A.O. If this assistance materializes, F.A.O. should be in a position to respond to requests for help perhaps in organizing forest services or modern forest industries, in developing timber seasoning and helping in the work of standardization. This technical programme would mean that F.A.O. would be expected to give practical advice to member governments and to do something to promote technical progress, but as the staff of F.A.O. itself is too small and incompetent, Mr. Glesinger said, they would have to depend on the advice of such bodies as the Conference on Mechanical Wood Technology and also on individual technicians.

The second meeting which I attended last year was one called as a result of the British Empire Forestry Conference in London in 1947 where it was suggested that meetings of specialists in forest products research would be of advantage. Subsequently it was decided to hold a meeting in Canada in the latter part of last year of timber mechanics specialists. The United States had been invited to be present at the British Empire Forestry Conference and they were further invited to be present at this meeting in Ottawa. When they accepted and offered hospitality to the delegates it was decided to meet for two weeks in Ottawa and then move to Madison for the two remaining weeks. The delegates, other than those from the United States and Canada, were from Great Britain, South Africa, New Zealand, Malaya and Australia.

We discussed in detail the procedures of testing small clear specimens with the ancillary items of calibration of testing machines, adjustments for variations in moisture and temperature, and presentation of results. Consideration was given to the testing of specimens smaller than 2" x 2", to the testing of structural timbers, to the testing of timber joints, and to the testing of poles and laminated constructions. At Madison the testing of fibre board and plywood, and special tests such as abrasion and hardness, were discussed. Some time was also spent in the Madison laboratory on demonstrations of apparatus and procedures. It was very interesting to discover that although nominally different laboratories were following the same testing procedures in some things they had diverged. The procedure of the Conference was that where the evidence was available agreement was reached, but otherwise study assignments were made. We set up a corresponding committee on Timber Mechanics and hope to be able to discuss by correspondence matters on which agreement was not reached at the Conference.

My attendance at both Conferences was very well worth while. I gained a great deal in information and experience, and the Division was able to contribute very substantially in return, and we should certainly be represented at similar Conferences in the future.

Mr. Clarke: I would like to mention that I had a letter from Mr. Rodger forwarded with a circular from F.A.O. asking how many technicians or how many officers this Division was prepared to make available per year in about 3 or 4 fields of work. I take it that similar letters have been received by the State Forest Services. My reply was that it was impossible for us to make an indication of that type, but we would be prepared to consider any request that they might make for a specialist officer on its merits at a particular time. It would depend on our programme of work and our staff position whether we would be able to meet that request.

We had a request from Dr. Huberman, F.A.O., Bangkok for a bibliography of Australian publications under standard headings and we drew his attention to the fact that the headings were unsatisfactory, particularly the wood technology one. I mentioned the Division of Wood Technology which had very much wider functions. We did not trouble to circulate this general F.A.O. material through the States because it comes through the Australian F.A.O. Committee and I think there is provision on that Committee for circulating them through the Australian Forestry Departments.

Mr. Huddleston: We get them, Mr. Chairman.

16. EQUILIBRIUM MOISTURE CONTENT.

Mr. Ellwood: At the last Conference Mr. Wright outlined the desirability of obtaining more information about moisture contents of seasoned wood to be expected for Australian localities and the factors which influenced these moisture contents. He also pointed out that work was being carried out at this Division on the relation between wood moisture content and meteorological data and a suggested working plan on Australian wide survey of seasoned wood moisture content was advanced - this survey to be carried out on a cooperative basis with the various State Forest Services. A Committee was then set up with a representative from each State, with myself as convenor to put a working plan into action.

Since the Conference a report on the relation between meteorological data and seasoned wood moisture content for sheltered outdoor localities, Expt. S.17-6 has been issued. During the year further work has been carried out on this subject in an endeavour to refine the method to be used, to determine the meteorological data necessary and to determine the optimum frequencies of wood moisture content measurement for the survey. To this end we have been supplied with data from the Q.F.S., and we hope to put out a report on this investigation in the coming year. Data has also been promised from the N.S.W. Division of Wood Technology.

From the work carried out it appears desirable that, at least weekly measurements of wood moisture contents should be taken and that daily 9 a.m. relative humidity and temperature together with monthly rainfall be taken at each station.

Unfortunately, we have not been in a position to carry out projected laboratory studies on E.M.C. owing to staff and equipment difficulties. Due to this position and the fact that it is desirable to make the field work as efficient as possible, initiation of the project may be delayed until next year.

A circular letter has been **sent** to the State representatives on this committee setting out the position and requesting advice on possible sites within their respective States where the experimental conditions could be fulfilled. To date, three States have offered their full cooperation and have suggested possible sites, we are awaiting advice from the two other States concerned before sending out a detailed working plan for comment by interested parties.

Mr. McAdam: What about New Guinea?

Mr. Ellwood: New Guinea will be asked to co-operate in this project at a later date.

Mr. Ellis: We nominated 7 Stations in Queensland, 6 of which are to be manned by Forestry Department officers. Could a Division of C.S.I.R.O. man the seventh station at Cunnamulla? Alternatively we would like as much notice as possible if we have to man the station.

Mr. Clarke: It is expected that the Division of Animal Health & Production in Queensland will man this station.

Mr. Ellis: Has the application of moisture meters to boric treated timbers been investigated? This point is of interest to Queensland and New South Wales in view of the anticipated necessity for a speedy field determination of moisture content under the Timber Users' Act.

Mr. Huddleston: We appreciate that the meter gives a wrong reading and we have to rely on the oven test.

Mr. Kingston: We have done no work on timber containing boric acid but perhaps we should.

Mr. Huddleston: Other chemicals coming on to the market should also be investigated.

Mr. Fogl: Correction figures seem to vary also with different concentrations of boric acid in the timber.

Mr. Clarke: We should investigate the capacity method.

Mr. Kingston: The capacity method is dependent on the density of the timber and the difficulty due to this might be hard to overcome.

Mr. Fogl: There are a lot of island timbers being imported with a high salt content due to long immersion in sea water. The moisture meter is proving troublesome with these timbers. High salt concentration would also have a bearing on the density of the timber.

Mr. Clarke: There is a definite need for investigation here and perhaps also for a general survey. We will look into the matter.

Mr. Huddleston: If the moisture reading shows below 15% we accept the reading as correct. If the reading is over 15% we submit the material to oven tests.

17. VAPOUR DRYING.

Mr. Clarke: When it was known that vapour drying was to be advocated in Australia by a commercial firm we thought it advisable that a body associated with this Conference should know something about vapour drying. By borrowing equipment from various Sections of the Division we erected an experimental vapour drying plant. We were particularly interested in this project because results in America had been satisfactory in the rapid seasoning of timber prior to pressure preservation. This, in conjunction with our high pressure treatment would be an important factor if it were possible in Australia. We were just about to try our experimental plant when we had a visit from Mr. Mason of Boracure (New Zealand) and Mr. Monie Hudson of Taylor-Colquitt Co. in America who have developed vapour drying to a commercial stage, at present only for the drying of timber prior to preservation treatment. It has been suggested that its application is wider than that and for this reason we decided to proceed with our experiments. A few weeks ago we had a visit from Mr. Crowe of Boracure (N.Z.) who is putting in a vapour drying plant at McKenzies in Sydney. He offered to subsidize our work to the extent of £100 a month and to send two of his technical men over from New Zealand for a period of 6 weeks so that we could have the benefit of work carried out in New Zealand and to help speed up our investigations.

Mr. Crowe said he did not propose to sell vapour drying plants in Australia but to advocate the installation of preservation plants in such a way that a vapour drying plant can be added at a later stage.

He was also interested in a Tasmanian organization who had a drying problem and had expressed interest in vapour drying. We agreed to modify our programme of work to test the two Tasmanian timbers concerned - alpine ash and myrtle - first.

The main reason why I entered into this arrangement was that I felt that the work would proceed more rapidly. We have reserved absolutely the right to publish our results in any way we wish and Mr. Crowe has agreed to this in writing.

Mr. Gottstein: The extremely rapid drying rates obtained with the wood seasoning method known as vapour drying have received publicity in Australia recently, and the Chairman referred to our installation of a pilot plant in his opening remarks.

Seasoning of wood in large sections, such as railway sleepers and poles, to a moisture content suitable for pressure preservation has been a problem for many years. Air drying is extremely slow, and often accompanied by decay in non-durable species together with other degrade. On the other hand the sizes, generally, are not adaptable to normal kiln drying and it was this problem which caused the Taylor-Colquitt Co. of Spartanburg, Illinois, U.S.A. to develop and patent the vapour drying process. A feature of the process is that it can be undertaken with slightly modified pressure preservation equipment.

The degree of success attained by the method in connection with preservative treatments has led to the suggestion that vapour drying might be a suitable and cheap method for the drying of timber for flooring, cabinet work and general joinery.

In vapour drying the heat for the evaporation of water is supplied by a vapour, which, in condensing on the timber, liberates its latent heat. Continual replacement with fresh vapour ensures a steady supply of heat and also a means for removal of water vapour.

Vapour drying consists essentially of subjecting the stock to be dried to the vapour produced by an organic liquid which usually has the boiling point above that of water. The liquid is commonly a hydrocarbon and the process is generally carried out at atmospheric pressure. Claims made for the process are that the absence of air and rapid removal of water vapour prevent oxidation and hydrolysis which would otherwise be serious at the high temperatures used.

In considering the objectives of timber seasoning in general, the following are usually considered important. (a) Production of a moisture content and distribution suited to the final use; (b) shortening of the necessary time; (c) quality of drying appropriate to end usage with as little degrade as possible in respect of that usage; (d) reduction in drying costs involving such factors as capital outlay of equipment, depreciation, handling, thermal efficiency operation and maintenance.

In order to investigate some of these factors, the Division of Forest Products has installed experimental vapour drying equipment which, in its present form, is designed to test the suitability of the basic vapour drying process for the drying of Australian timber species.

The equipment at present consists of (i) drying agent reservoirs, (ii) evaporator, (iii) drying cylinder, (iv) condenser and (v) handling and control equipment.

The hydrocarbon drying agent is fed from a working reservoir tank through a hand operated pump to an electrically heated evaporator working at atmospheric pressure. Vapour is then passed to the drying cylinder and provides the heat for both the evaporation of water from the timber sections within the cylinder and for maintaining the cylinder at the working temperature. The excess of hydrocarbon vapour containing all evaporated water is exhausted from the cylinder to a water cooled condenser and condensate is collected continuously in containers. The volume of the oil and water fractions is measured at intervals to determine the drying progress. The hydrocarbon vapour condensed on the cylinder walls in maintaining the cylinder temperature is returned directly to a working reservoir. The equipment has a drying cylinder, 15" diameter and 7 ft. 6 in. long internally, and can handle a maximum size of wood sample of 10 in. x 6 in. x 6 ft. The maximum power input is 8 kw. at present, and the drying agent in current use is mineral turpentine with an average boiling point of 330°F.

Provision has been made in the design for application of vacuum to the cylinder but so far this has not been connected. The equipment is not designed to give high thermal efficiency but rather to analyse the process in regard to seasoning degrade in Australian species. The highest thermal efficiency attainable at present is not likely to exceed 25 per cent, but this figure can have little bearing on the thermal efficiencies attainable commercially.

The programme of work for the equipment is divided into two parts, (a) a general series covering a wide range of typical species to be carried out under the standard technique of vapour drying at atmospheric pressure and (b) an intensive study of a very limited number of species to see just what improvement can be effected by variation of schedule conditions. These variations will, in general, consist of, (i) control of proportion of oil and water vapour in the drying chamber: (ii) control of temperature in inlet vapour: (iii) control of pressure within the cylinder.

The control of these factors together with a variation of the drying fluid should enable us to attain a range of conditions down to those approximating normal kiln operation and by this means we hope to determine drying time limitations and analyse the specific qualities and economic possibilities of the process compared with normal seasoning practice.

I propose now to give you an outline of findings in respect of early operation of the equipment but, I might mention as a start some of the safety precautions which were considered necessary for the installation because of the highly inflammable nature of the drying fluid.

Firstly, care is taken to remove air from the system before commencing drying. This is done by heating up the equipment initially with saturated steam. Furthermore, the system is sealed against vapour leaks but if any develop rapidly, open ventilation ensures quick dispersion. A concrete moat surrounds the floor area and prevents possible spread of inflammable liquid. Lastly, overhead fog sprays are fitted and a remote power control switch is available in case a fire occurs.

In regard to results of the runs to date, it must be appreciated that these have been directed primarily at evolving a satisfactory operational technique, and results are generally little more than indications, but they may be of some interest.

As previously indicated the dominant feature of this method of drying is the extremely rapid drying rates that can be achieved. In normal kiln drying of say 2 in. stock under conditions of 30°F. wet bulb depression, and a normal air circulation rate of say, 300 ft. per minute, a reasonably permeable timber species may lose approx. 6 grms. per square foot of surface area per hour of operation. In the case of vapour drying, however, over periods of 4 hours or so, the avera e moisture loss with initially green hardwoods has been in the vicinity of 120 gms. per square foot per hour. This means, of course, that the vapour drier in one hour of operation can achieve nearly as much as 24 hours drying in the normal kiln. The question arises as to just what species can tolerate these rapid drying conditions at elevated temperatures.

In runs to date some samples of radiata pine, stringybark, mountain ash, ramin, myrtle beech, silver wattle, alpine ash, red gum, blackbutt, brush box grey ironbark and spotted gum have been dried. Thicknesses of both 1 in. and 2 in. have been used. In general, drying runs have been continued for a set period of time rather than until the samples have reached a thoroughly dry state, but even so, it is apparent that of those species mentioned, radiata pine, ramin and silver wattle samples were in a reasonably satisfactory condition at the end of the drying period. All the other species, however, showed internal checking, generally severe, but varying between species.

On runs to date no serious attempt has been made to vary the drying conditions. The present so called schedule makes use of mineral turpentine with an average boiling point of 330°F. as the drying agent operating at atmospheric pressure and the heat input to the evaporator is controlled so that the temperature of the exhaust vapours from the drying cylinder are held at between 250 - 300°F. At the end of the drying period, samples are steamed for one hour in order to reduce temperature and the severe moisture gradient which has been found to exist through the thickness. It is probable that a certain amount of absorbed drying agent is removed during this period.

In overseas practice as much of the drying agent as possible is recovered by applying a vacuum treatment to the cylinder for this purpose at the end of drying. It will be seen that our schedule is a relatively simple one but it is representative of Taylor-Colquitt practice as far as we are aware, and is useful for purposes of comparing species behaviour generally. Very little reliable information from other workers is available on the effects of variation of drying conditions, and covering this ground will entail considerable laboratory work.

Returning to the experimental results where degrade occurs it usually takes the form of a general checking or honeycombing along the medullary rays rather than at the surface. Warping occurs to some extent but it is not assessable on results to date, since no restraint of board movement has been attempted. Surface checking sometimes occurs in backsawn material.

The internal checking may be extremely severe and indicates that high internal pressures have developed. In such cases local bulges can appear on the surfaces. This internal checking has been worst in the case of mountain ash but has occurred to some extent in all the eucalypts examined to date. At this stage the extent of checking would seem to be more or less independent of thickness between the range of ½ in. to 2 in. stock.

In many instances, the material used has not been truly green and, therefore, it is difficult to be precise in regard to the extent of checking with these species.

However, within the eucalypt group the internal checking appears to diminish with decrease in collapse susceptibility, spotted gum for example, being much more satisfactory than, say, alpine ash or river red gum. A sample of myrtle beech which showed collapse and dried relatively slowly also developed extensive internal checks. Those species which are prone to collapse do so to a greater extent than is usual in those species for normal kiln drying, but the collapse is shown by widely distributed internal checking rather than by gross distortion of the external surfaces. Little work has been done on the treatment of this collapse although there are indications that normal reconditioning treatments will give only very partial recovery. There is some evidence that better results may be attainable with high pressure saturated steam. The samples which gave these indications were checked severely internally, however, and the reconditioning problem will probably have to wait until better quality drying is achieved in these collapse susceptible species. Surface checking has so far been confined to backsawn faces only. Further, these checks seem to centre on the fully backsawn areas and the portions to each side remain quite free of checking. The surface checking so far observed has not been severe.

In the partially dried condition at least moisture gradients are severe but it has been interesting to note that stress prongs are quite neutral immediately after cutting, although the usual severe nip is attained on standing for 24 hours. While drying rates are not being measured with extreme accuracy at present it is intended in future experiments to estimate moisture by withdrawal of samples at definite intervals and at the same time to record wood temperature.

End coatings have also presented severe problems because of the nature of the drying medium and so far a cold setting phenolic such as Ellifilm is the only one that has given good results.

The extent of drying agent absorption has not been examined to date nor have operating economics of the units but I think it must be accepted that such estimates of economics cannot be made until definite drying schedules are established for particular timber species.

<u>Mr. Huddleston</u>: I would suggest that provision be made in the Working Plan to compare the effects of high temperature drying as against vapour drying. Some years ago I succeeded in drying 4 x 1 brush box at 102°C. overnight. The appearance of that brush box was similar to the samples exhibited here by Mr. Gottstein. It may be possible to obtain faster rates of drying merely by the use of elevated temperatures.

<u>Mr. Gottstein</u>: There is a recent reference by Tiemann to work with super heated coils in kilns. We will cover this point when we bring vapour drying conditions down to approximate those of normal kiln schedules. Vapour drying equipment is almost identical with normal pressure preservation equipment and once the preservation equipment is installed the addition of vapour drying equipment would be far less costly than a normal kiln installation.

<u>Mr. Huddleston</u>: I have no complaint with Mr. Gottstein's remarks if vapour drying is to be carried out by a firm who are also carrying out preservation. The publicity given in Australia has led to the belief that vapour drying is going to be the cure-all of all drying

problems. N.S.W. firms are delaying installation of drying kilns because of the favourable publicity being given to vapour drying. This is having an adverse affect on the general housing situation. My feeling is that for straight out drying of 1", 1½" and 2" timber vapour drying does not appear to offer any advantages.

Mr. Clarke: This is one of the reasons we erected our plant as quickly as possible. The only counter to the feeling in the community that conventional kilns may be out of date is some reliable information on vapour drying. I made it clear to Mr. Crowe that we were not very optimistic for the process. I told him we may, from our work, become convinced that there is no future in vapour drying in a certain direction but he may still not be convinced. As he proposes to retain ownership of the plants and to rent them, his objective and ours in this direction would seem to be identical.

Mr. Cokley: What would be the average loss of vapour over a normal run?

Mr. Gottstein: I cannot give an answer to the question yet but vapour losses are comparatively small. It is not regarded as commercially significant in U.S.A.

Mr. Ellis: What is the final moisture content of these samples If 2" radiata could be dried satisfactorily in 4 hours this might be a good commercial proposition.

Mr. Clarke: We think it has definite possibilities in South Australia for the drying of radiata prior to preservation treatment.

Mr. Gottstein: In this particular sample of radiata the moisture movement was 43% - 14" in a four hour drying period. Mineral turpentine has been the only drying agent used so far, but others will be used in the near future.

Mr. Clarke: We are worried that if we start to modify our schedules the drying time is likely to increase and some of the advantages of vapour drying will disappear.

Mr. Fogl: Mr. Hudson said he could vapour dry any timber we give him. He said he alters schedules mainly by changing the drying medium. He has used quite a range of hydrocarbons and claims to have been able to dry satisfactorily all species submitted to him.

Mr. Turnbull: Has Mr. Hudson claimed success in vapour drying without checks any American timber comparable with our Eucalypts?

Mr. Clarke: Mr. Hudson's work has been on vapour drying to a satisfactory standard for sleepers.

Mr. Turnbull: It appears to me that he is trying to gloss over the disadvantages which would be very real to us in general purpose timbers by emphasizing the advantages in a special case.

Mr. Clarke: That statement is not quite fair to Mr. Hudson. He makes his claim for the process as an auxiliary to pressure preservation. He states that it may have applications for normal seasoning but makes no claim in that direction. Mr. Crowe is prepared to invest some money to see if this is so.

Mr. Huddleston: Mr. Hudson told me he did not consider possible the drying of our refractory timbers for flooring, joinery, etc. He said that any timber inclined to check in kiln drying would check internally in vapour drying. He did not make any claim that he could eliminate checking and said he could not see any claim for vapour drying in Australia unless in conjunction with a preservation plant.

Mr. Fogl: Mr. Hudson claims good recovery with normal reconditioning treatment. Mr. Gottstein said reconditioning had not been very satisfactory but that good results had been obtained with high pressure steaming. At what pressure?

Mr. Gottstein: 40-100 lb. for 4 hours using an autoclave.

Mr. Tamblyn: (i) From the wood preservation aspect we are interested in the vapour drying process for the drying of sleepers. From discussion with Mr. Hudson it appears that the ideal condition of a railway sleeper is when the case is quite sound and unchecked and the core has many fine internal checks to allow movement of the case over it. With timbers such as jarrah and karri we may achieve this result. We should not condemn the process from the preservation angle until we have extended the work to other eucalypt timbers.

(ii) The process would appear to be more suitable for scrubwood timbers than for eucalypts. In North Queensland there may be some future use for building timbers treated with a general purpose preservative rather than with boric acid, for example in Cairns and Townsville where the dry wood termite is troublesome. Where air drying conditions are not good, vapour drying of scrubwoods, coupled with preservative treatment may have some future application.

(iii) There seems to be some possibility that incorporation of a chemical such as pentachlorphenol in the evaporator might give sufficient absorption for good Lyctus control. This would be a very attractive treatment in which the drying and the preservative treatment would be simultaneous. We should give some thought to this in our future work.

Mr. Huddleston: Latest advertisements still leave the impression that vapour drying may replace conventional kiln drying and anything Forest Products can do to dispel this impression would be appreciated. I have stated to enquirers that the process is as yet unproven and that it is my personal opinion that the economics of the two methods of drying will be much the same. It is possible that we may be able to find a solvent which is also a preservative against Lyctus and this possibility should be kept in mind.

Mr. Clarke: Mr. Crowe said it would be necessary to dry down to 6 - 8% to recover the solvent. This might mean that after vapour drying it would be necessary to humidify the timber to bring it to e.m.c. again.

Mr. Huddleston: I would like to support the need for urgency on this project at least until it is at the stage where an opinion can be expressed as to whether there is likely to be any advantage over the ordinary drying process in this country.

Mr. Clarke: We are giving priority to this project in our Seasoning programme and hope, with the help of the two New Zealand officers, to speed up the work even further.

18. THE PREDRIER.

Mr. Gottstein: I believe that Mr. Wright made a fairly comprehensive statement on the pre-drier at last year's Conference and these remarks are merely intended to cover development since that time. Under conditions where air drying is poor or space limited, initial air drying becomes difficult and we become faced with the problem of a costly kiln installation to handle drying from the green condition. Such costs become especially evident when we are dealing with species that are dried slowly in the early stages. This leads to designs of units of a progressive type since such units can show lower installation costs and high thermal efficiencies.

The existing pre-drier at Stanley represents an attempt to overcome some of the most difficult features of progressive drying units by using ducting and movable baffles to apply progressive movement of the air circulation, rather than progressive movement of the timber stacks. This arrangement was developed from proposals made by Hugh Fenton who was Manager of Circular Head Timber Company at that time.

The performance of this unit has been reported by Mr. Wright under S.9-49 in March of this year. This report is an indication of the degree of success attained, and also emphasises the circulation limitations imposed by the rather complex baffling and ducting system.

Because of these limitations a proposal has been made to return to a single overhead duct by introducing a portable heater unit which can be handled with the usual Christensen type lift truck in the same manner as a stack of timber. This portable unit may incorporate the air circulating mechanism if desired, and can also provide for ventilation. A unit of this type, incorporating the movable heater is being installed at Stanley by Mr. Fenton at present but unfortunately delays in supply of steelwork are retarding completion.

We are at present developing this design for two other Tasmanian plants. It should be noted that in the new design, for every stack dried and removed, a complete movement of the heater is also necessary.

The question of ducting for external air circulation in this new design presents some rather difficult problems which are being investigated at present.

The proposed units are of very much larger capacity than the existing one at Stanley, and in one installation the design output is about 40,000 super feet per week on a 21 day drying schedule.

A rough cost analysis has been made comparing kiln, air and kiln and pre-drier and kiln costs in Tasmania. The results favour the pre-drier as compared with complete kiln drying, but it is considered at this stage that the differences in costs could not warrant pre-drier installation where air drying conditions are favourable.

It must be appreciated that in a design of this nature, very considerable modifications are possible and it is likely that further development will occur.

Mr. Payne: Mr. Gottstein spoke of the relative costs between the pre-drier and the combined method of air and kiln drying. The comparison was between the pre-drier in Tasmania and the combined method in Victoria. It was not a comparison within Tasmania itself?

Mr. Gottstein: No.

Mr. Ellis: On what basis have the details of cost been taken out? Has consideration been given to all items of cost - overhead, insurance etc.?

Mr. Gottstein: As far as could be estimated on our limited knowledge of the life of the pre-drier unit.

Mr. Clarke: Would anyone like a copy of the figures? They are for comparison only, and are not for publication.

Mr. Ellis: I propose to speak on the matter of cost of sawmilling at a later stage.

(Representatives of all States and New Guinea, and Mr. West asked for copies of the figures.)

Mr. Huddleston: I would like to say that I saw these pre-driers in Tasmania earlier this year. Discussing their operation in Tasmania, I formed the opinion that the unit has solved a major difficulty on the island. I would like to record here that I gained the impression that the sawmillers were very much appreciative of the activities you have undertaken in that direction, and I might say that I can see applications for it in some parts of N.S.W. We are particularly interested.

Mr. Payne: I would like to compliment the Division on the quality of the publication on the pre-drier. We appreciate it very much.

19. COMPOSITE WOOD CORRESPONDING COMMITTEE REPORT.

Mr. Gordon: In April, 1948 Dr. F.Y. Henderson as executive officer of the Main Committee on forest products of the Empire Forestry Conference wrote to Empire and United States establishments having interests in composite wood materials asking them to nominate representatives on the Composite Wood Corresponding Committee.

In December, 1948 Collation No. 1 of the Composite Wood Corresponding Committee was circulated to members and associates to bring to attention of the representatives some of the opinions expressed relative to how composite wood should work and matters with which it should be concerned. In the main, arrangements were made for:-

(a) Exchange of research programmes.

(b) Consideration of methods for testing glue durability and the possibility of standardizing their interpretation.

(c) Examination of plywood specifications so far as timbers employed were concerned with a view to assessing the value of unused species for similar purposes.

The collation included programmes of work from Dehra Dun, India and Princes Risborough whilst Madison and Ottawa agreed in general that the proposed lines of work were acceptable. Comments on the collation were receivable by the Secretary by the end of May, 1949, but the second collation has not yet been received, this having been delayed pending completion of several travel arrangements by the Secretary. It was interesting to note from the programmes of work the variation in certain details and allocation of research work associated with gluing in different laboratories, but these are matters of detail.

On the subject of specification for adhesives to which attention is being directed initially it was interesting to note that urea glues are universally regarded by the various laboratories to be highly water resistant but by no means waterproof.

Answering an express enquiry for information on opinions for the suitability of adhesives for a number of purposes your Australian representative provided the following data -

USE	Type of plywood adhesive considered to be		
	Satisfactory	Doubtful	Unsatisfactory
Marine craft (external & internal)	P.F. Film	U.F. hot & cold	Casein Animal
Caravans external	P.F. Film	U.F.	Casein Animal
internal	P.F. U.F. Casein Animal		
House construction and furniture external	P.F. Film	U.F.	Casein Animal
internal	Any glue except in special cases.		

Plywood for boxes and cases should be made with glues appropriate to conditions of service and service life and requirements.

It is interesting to note that the United Kingdom, Canada and U.S.A. are specially interested in investigating hitherto unused species as potential sources of veneer and plywood supplies.

Mr. Clarke: As the Australian representative on the Composite Wood Corresponding Committee I think there is an obligation on you to keep all the States informed of the activities of that Committee. Has any action been taken on that?

Mr. Gordon: No.

Mr. Clarke: I think all States should have a copy of what is done. We were probably at fault on that because Mr. Gordon was away at the time of the other Conferences.

Mr. Huddleston: When Mr. Gordon visited Sydney recently he gave us a fairly full resume of activities of the Composite Wood Committee. We have been more or less kept informed by Mr. Gordon.

20. GROWTH STUDIES.

Mr. Amos: This is the first time that Growth Studies has been given item status on the Agenda of the Forest Products Research Conference. It is felt desirable this year to report on some work carried out over the past two years on the growth of two species of Australian trees. I understand that this is the first time Australian forest trees have been submitted to this type of study, the object of which is to correlate the structure of the timber with growing conditions. A brief summary of the points of interest about each species studied i.e. *Eucalyptus gigantea* and *Beilschmiedia bancrofti*, will be given here. Full details will be published in one of the scientific journals, and reprints will be forwarded to delegates in due course.

(i) *Eucalyptus gigantea*.

A. Rate of Growth at Various Times during the Year. Access was obtained to a regrowth area near Canberra. Three trees were felled monthly and discs removed at ground level, half height and breast height. By determining the numbers of cells cut off by the cambium from month to month, an assessment of the growth rate over the entire year was obtained. Growth commences in the crown of the tree and gradually progresses down the bole - growth at ground level being initiated about a month later at ground level than at half height. The growth rate varies at different levels in the tree, but, in general, rises to a maximum in late Spring and Summer, gradually falling off from January to about early August, when a cessation of growth occurs.

B. Dormant Period. The period of dormancy is very short, about three or four weeks, with some variation at different levels in the tree. In Tasmania, the structure of the timber suggests that no dormant period occurs.

C. Ecological Distribution. The normal ecological condition is for E. gigantea to inhabit the higher altitudes and to give way to E. regnans at lower levels. Now the growth rate of E. regnans in the early years of its life is much greater than that of E. gigantea, so it is of interest to consider why E. regnans does not displace E. gigantea at the higher levels. Since both are intolerant of shade it might be expected that the one with the more rapid growth rate would have the advantage. The evidence suggests that E. regnans is not able to stand the more intense frost conditions at the higher altitudes - it is unable to withstand temperatures lower than 15 - 20°F., whereas E. gigantea is not killed until the temperature falls to about 10°F.

D. Latewood. Latewood is laid down in July and August, preceding growth cessation.

E. Structure in Relation to Dormancy. After the dormant period, resurgence of growth is accompanied by the production of a number of fibres - sometimes as many as 30 or 40 - before a vessel is formed. This produces a band of earlywood without vessels in each annual ring and gives rise to a structure quite different from northern hemisphere species.

F. Relation to Proximity of the Crown. If the width of the vesselless band is studied from pith to cambium, the band becomes wider as the ring studied becomes further removed from the pith. Thus in the first ring resurgence of growth is immediately accompanied by the production of vessels, in the second ring one or two fibres are first formed and further out many fibres are first formed. In other words, as the crown becomes further removed from where the wood is being laid down, the number of fibres produced before vessel formation increases. It almost appears as though dormancy inactivates two factors - the stimulus for growth and the stimulus for vessel production both of which are generated by the crown, operate independently and progress at different rates down the bole of the tree when the crown again becomes active.

G. Fibre Length. In any one annual ring the fibre length is universely proportional to the growth rate. The longest fibres - 50% longer than the shortest - are formed in the latewood when growth is slow. The shortest fibres occur in the earlywood. This has some bearing on use for pulp and paper manufacture.

H. Drought Tissue. When conditions become favourable for growth, but there is insufficient soil moisture available, the tissues formed are very disorganized and are accompanied by the destruction of some of the cambium cells.

(ii) Beilschmiedia bancrofti.

Our sampling method for this study was different to that for E. gigantea. Small blocks of wood were taken monthly from mature trees. No growth rings of the nature found in E. gigantea occur, so it was not possible to obtain a reference point which was common to any two samples.

We were able to establish that the growth of the wood bore an intimate relationship to the state of the crown, but just what that relationship is cannot be determined from the material we have. The carbohydrate flux within the tree appears to have major significance. Thus, in a tree with a heavy crown the number of parenchyma bands per inch is fewer than in a tree with a light crown. In a tree with a one-sided crown the wood laid down has few parenchyma bands on one side of the tree and many on the other.

Parenchyma formation is not seasonal - it does not take place at a particular time of the year.

I have requested more material which might throw some further light on the growth of this species.

Mr. Huddleston: We have recently been watching a tree that has been ringbarked. It was done with the object of killing it, with a fairly wide barking. It has healed over completely twice, the actual growth being from the top section. It has made new wood and new bark from the top, which has moved down to the bottom. At no time at all has there been any growth upwards from the bottom. That may have some relation to the fact that you get growth from the top.

Mr. Irvine: Our present belief that there is a continuous channel of pores from the crown to the ground is perhaps not true.

Mr. Amos: The tree may still be using its previous annual ring for taking water from the roots to the crown. The sequence of pore development in a ring requires further study.

Dr. Wardrop: There is an additional point. Vessel elements are formed during a wave of growth which progresses downwards in the tree. These elements then connect to form vessels.

Mr. Clarke: You would expect it at the bottom because development at the bottom is so much later than at the top. You would think that the tree would produce vessels immediately at the bottom but it does not.

Dr. Wardrop: While new vessel elements are being differentiated there is still an adequate transpiration stream in the wood already formed.

Mr. Ellwood: I would like to bring up one point, the influence of growth on subsequent drying properties. Recently in this Division it was determined with at least one tree of regnans studied that there was a very regular difference in zonal collapse in a growth ring. The early wood zone collapsed three times as much as the latewood zone. Also with gigantea collapse appeared to be most marked at the initial stage of growth where no vessels were present and it tapered off towards the end of growth of the early wood where the vessels were plentiful. I suggest this differential collapse is one of the major causes of trouble in drying this class of timber.

Mr. Gordon: Since there is a marked difference between gigantea grown in N.S.W. and in Tasmania, N.S.W. seed should be planted in Tasmania, and similarly some Tasmanian seed planted in N.S.W. Growth studies should be made on these trees.

Mr. Amos: I have already asked for that to be put in hand.

Mr. Payne: I believe an exchange of seed between N.S.W. and Tasmania has already taken place in connection with some work being carried out by R.G. Brett, and I propose to make enquiries and if I can get any definite information I shall let you know. I believe the work was carried out some years ago. I believe there is some Canberra gigantea growing in Tasmania, and some Tasmanian growing in Canberra.

Mr. Amos: I should be very pleased to have some samples of the two woods.

Dr. Dadswell: These growth studies are fundamental studies which do have definite practical value. One fact that has come out of the studies is the variation of fibre length within the growth ring. For many years it has been recorded that the fibre length varies from the centre of the tree outwards until it reaches a maximum. We found a variation within a growth ring of E. gigantea. The study was extended to other species with distinct growth rings and a very great variation within a growth ring in many ring-porous woods e.g. oak, ash, etc. was observed. Where there is even growth throughout the season, as in tropical species, the variation of fibre length is very slight. We have also examined the conifers in this connection. We have found that with conifers the tracheids of latewood are roughly 10 per cent. longer than the tracheids of the earlywood. In E. gigantea the difference is 50 per cent. and in some ring-porous species the difference is much greater, from 0.5 mm. in the earlywood to over 1½ mm. in the latewood. This is an important contribution which may have a practical bearing in the pulp and paper field. We are going further in this work, studying the variation in fibre length throughout one tree of E. regnans. In some of the growth rings in this tree it appears that you get the longest fibres in the early part of the growth ring where the growth rate is apparently slow. The length of fibre is related to growth rate very closely.

Dr. Wardrop: In conifers a similar state of affairs seems to exist; i.e. with slower growth rate there are longer tracheids differentiated. In some preliminary work we are doing now it seems that there will be a close correlation between the properties of wood in any one annual ring and the length of the tracheids. This arises from the fact that we have established, following earlier work by Preston, that the organization of the cell wall is dependent on the length of the tracheid. The next stage of relating cell wall organization to properties has now been commenced.

Mr. Ellis: We are very keen to see this work proceed, but the last request for material will be rather difficult for us to supply. Material from some ten trees was requested, requiring a good deal of detail on the part of our collecting officer. We have forwarded your request to the District Officer concerned asking that he do as much as possible, but I have suggested to him that if he cannot spare staff for this work it might be satisfactory to send you down the full log. That again might not be satisfactory because Mr. Amos desires samples of limbs, etc. The work in Northern Queensland is being done by one of our foresters, and the time available to him for this work is limited. I was wondering whether or not some other arrangement could be made for the collection. Possibly Mr. Amos could make some observations on the spot. He says also that he would like to receive samples from plantations. We have plantations in North Queensland and various other parts. I would like him to be more specific as to just what he requires.

Mr. Clarke: It is practically impossible for us to carry on growth studies here unless we are prepared to send an officer to North Queensland at intervals or unless somebody there or in some other part of Queensland can co-operate with us in this work. There are two sides to the work, the forestry side, and the structure of timber. We are interested particularly in the structure of the timber. There seems need for a co-operative investigation between yourselves and ourselves whereby you have some officer particularly interested in these investigations keeping an eye on the forestry and silvicultural side, and we look after them from the wood structure side. Mr. Amos has a number of questions he cannot answer, and he will not be able to answer them unless there is someone on the spot who is making observations also. Will it be possible to arrange a co-operative investigation of that type? If not I am afraid we cannot go far with these investigations.

Mr. Ellis: The position in Queensland is that we are short of trained foresters. Our work as a department in developing and instituting forest management is not being attended to as we would like it. At the present time such development is limited by manpower factors. Mr. Hanson in North Queensland has spent a lot of time on this work and his services are still available to a limited extent. The request from Mr. Amos for this clean-up material is quite a big job, and I am more concerned at the moment about clean-up of this work than a continuation of the work.

Mr. Clarke: If we had a man on the spot who was kept informed of the investigation, when it came to a matter of clean-up material he would be able to make decisions as to the material required and the quantity to be sent down.

Mr. Ellis: It might be possible for our officer to do this but I have strong doubts on the matter. I feel that it would be much more satisfactory for D.F.P. to send a man to North Queensland to secure samples as required.

Mr. Clarke: We cannot afford to send a man to North Queensland. The demands on our funds are such that we just cannot do it. We have already had two requests for work to be done in North Queensland and they had to be refused. Is there a possibility of obtaining suitable species nearer Brisbane?

Mr. Ellis: Without doubt. We could give you a whole range of species. I had better discuss the matter with our silviculturalists.

Mr. Gordon: There is a big variation in the time of the year when eucalypts come into new leaf. It is popularly believed that, from the point of view of honey production, if the eucalypts blossom at the time new leaves are on the trees, the development of nectar is limited, but if blossoming takes place at some other time, the nectar is relatively prolific. Mr. Amos might take up such aspects with any forester who is co-operating with him as regards the laying down of new wood.

Mr. Amos: I think that point is very important in growth studies. Features such as high honey flow, period of flowering, size of fruit, etc., should all be recorded for this type of study. Big demands on carbohydrates have a marked influence on growth. According to this demand depends the amount available for wood formation.

Mr. Irvine: Mr. Amos has been dealing with regnans and gigantea. We are informed that the growth pattern as far as wood elements are concerned is different. It has been stated that the result of work here on the seasoning of veneers from ash eucalypts shows that gigantea is much more amenable than regnans. Is that due to the growth pattern as outlined by Mr. Amos?

Mr. Gordon: This will be answered by Mr. Ellwood under Item 22.

Mr. Irvine: As far as honey flow is concerned, I think C.S.I.R.O. has someone now working at Rothamstead, and she has been working on the correlation of starch content, sapwood, honey flow, etc. Mr. Amos should be able to get some information of interest, if not of value.

Mr. Clarke: Dr. Patton would be interested in that work.

21. SAPWOOD-HEARTWOOD.

Dr. Chattaway: Results of work on the development of gum and tyloses in the heartwood of timber have convinced me that these two phenomena are both the result of some stimulus which acts on the ray cells, causing increased activity, and, usually, resulting in their death. Whether gum or tyloses result depends, I am sure, not on any difference in the stimulus, but from the differences in the anatomy of the different woods. If the pits between the ray cells and the contiguous vessels are large and more or less simple, a tylosis is formed, if they are small and bordered and there is resistance to actual growth then the stimulus to increased activity results in secretion into the vessel.

I found that this increased activity always occurred in the ray cells, and that in thousands of cases examined both tyloses and gum were produced by the ray cells and not by any of the other tissues which bordered the vessels. I was therefore led to believe that it is the ray cells that are of fundamental importance in heartwood formation.

From this the next stage was an investigation of the state of the ray cells in the sapwood and at the time of heartwood formation in different woods. This called for perfection of a technique for fixing the ray cells of green living timber as quickly as possible after felling so as to preserve the ray cells as nearly as possible in the state in which they were in the living tree.

I have been able by this means to show that ray cells live much longer than I, at least, had anticipated. Myrtle beech from the Cumberland Valley, 30 odd years old, had living ray and parenchyma cells and even some living septate fibres at the centre of the tree. No heartwood had formed in this tree, though we know that many full grown trees of myrtle beech do make heartwood. Some very slow grown myrtle beech was sent me from Tasmania. It was 7" in diameter and about 120 years old. Ray cells in a living condition, containing nuclei and starch grains were found in wood 110 years old. At this age the cells were seen to have been killed by fungus and there was about ½" of pathological heartwood, covering about 10 years growth, at the centre of the tree.

Some sassafras from Tasmania had nine inches of sapwood with large, easily seen nuclei in all the ray cells. The central 2" of this block was formed of pathological heartwood and the line between this and the sapwood was clearly marked. At this point fungal hyphae were observed: on the outside of this line all the cells were alive, on the inner they were dead. It seems probable that, in the absence of fungal infection this sassafras would have been a sapwood tree.

This longevity of the ray cells has important implications for the timber user, for as long as there are living cells in a tree, so long can that tree store starch and other conditions being right, produce timber which may be susceptible to Lyctus attack. Wood 110 years old in myrtle beech contained starch grains, and so did wood 10" in from the bark in sassafras.

Another point of interest has appeared quite by accident, during the investigation. Formalin-acetic-alcohol has been used to kill and fix the living cells, preserving the nuclear structure almost as it was when the cells were living. The excellence of this fixation can be seen from some photos of the sassafras which show the large nuclei surrounded by starch grains, and of nuclei in young fibres of _Acacia_.

When this formalin fixative was used on samples of _Eucalyptus_, _Acacia_ or _Nothofagus_, the ray cells of the sapwood were found to contain a solid resinous mass indistinguishable except in colour from the solid tannins with which the heartwood was filled. As the result of further tests I was led to conclude that in the sapwood of these genera the ray cells and these alone are filled with a solution of tannin which is lost when sections are cut green or are boiled and cut in the normal laboratory procedure, but which had been preserved by the formalin fixative in a solid form, easily visible and very similar to the synthetic formalin plastics now being manufactured from tannin and formaldehyde.

This work has led me to formulate a hypothesis which I think explains the difference in penetration between the sapwood and heartwood of many trees.

While the tree is all sapwood the ray cells are alive and contain a solution of tannin which is held within the cell by the semipermeable membrane of protoplasm with which the cell is lined. After some time there are indications that a change is taking place in the ray cells, a stimulus which at first causes increased activity as shown by the formation of tyloses, the secretion of gum and which ultimately results in the death of the cell and the complete destruction of the semipermeable membrane. At this stage the soluble tannin can escape and permeate all the tissues of the wood, even getting between the micelles of the fibre walls. On contact with the air - for dead wood tends to dry out - oxidation takes place to give the solid coloured kinos and resins which are such a familiar feature of heartwood.

It is through impregnation with this solid material that heartwood acquires both its colour and its resistance to the penetration of preservatives. A split block of jarrah which runs from sapwood to heartwood has shown the truth of this supposition. On application of ferric chloride to this wood the rays immediately blacken throughout the sapwood, though the rest of the sapwood is merely yellowed by the colour of the ferric chloride solution. Just outside the sapwood/heartwood line, where the first signs of the heartwood change appear, budding tyloses occur in the vessels. These are continuous with the ray cells from which they arise and are still lined with protoplasm. Consequently the tannin is still held within them and they appear as glistening black globules against the yellowish vessel wall. The actual change to heartwood occurs when the death of the ray cells causes alterations in the permeability of the protoplasm and the escape of the tannin from the cells. This is shown on the jarrah block by the blackening of the whole surface of the wood, the actual walls of the fibres and vessels taking the colour as well as the cell lumina.

I am certain in my own mind that this is what happens in a tree at the time of heartwood formation but I am not yet near the solution of the problem. We have a hypothesis to explain what happens at heartwood formation and why heartwood is more difficult to penetrate than sapwood but we still haven't even a hypothesis to explain what causes the death of the ray cells. Nor, moreover, can we exolain why they should die after about 4 years in nice healthy trees of mountain ash at Toolangi, live for 110 years in much suppressed myrtle beech from Tasmania and apparently never die in some sapwood trees such as white cheesewood and kurrajong.

My work has led me to suspect that the answer to this is in someway tied up with these soluble tannins that occur in the ray cells, for I have observed that white cheesewood and kurrajong and several other of the so-called "sapwood" trees do not seem to have any tannin in the ray cells. It is possible that these trees remain alive throughout their whole lives; or it may be that the cells in the centre of the tree die and that, owing to the absence of tannins, no colouration or other change takes place in the wood. But each timber may prove to be quite individual in its behaviour, and we can only turn these hypotheses into tested theories by examining many different species.

What I need now is more material, freshly felled and pickled on the spot or sent by air. I should like to have a few weeks in a forest that grows something that isn't an _Acacia_ or a _Eucalyptus_ to collect what I need, and make observations on the state of the timber within a few hours of felling. Failing that, I want you people to send me material of any trees you are particularly interested in, especially trees that have a very wide sapwood, or that you suspect of being all sapwood.

But one thing is imperative: the material must be collected within a few hours of the tree being felled, and either fixed on the spot, or sealed with wax or grease and sent here by air freight so that it arrives in as nearly as possible the fresh condition.

We have devised a method which has proved very satisfactory for material sent from W.A. and from Tasmania, but it is dependent on the availability of an air service for despatch.

Mr. Huddleston: I have listened with a great deal of pleasure to Dr. Chattaway's paper and was most interested to hear of the accident. I only hope she experiences more similar accidents as the work proceeds.

With regard to sending material, we are only too happy to cooperate, but I feel you should adopt Dr. Chattaway's suggestion and let her "go gathering" for about three weeks. In that regard we could provide various timbers other than eucalypts and acacias in the far north coast. I am sure our Research Officer and his wife would look after Dr. Chattaway, and she would have the opportunity of collecting for this work. One advantage would be to get them together and to let Mr. Cannaway know exactly what is required and the information which is wanted. It is very difficult to explain unless the two officers can get together. If you feel inclined to let Dr. Chattaway make such a trip I am sure we can look after her very well.

Dr. Chattaway: I have had a certain amount of material by courtesy of Mr. Jessep of the Botanical Gardens, but the trouble is that they do not like you to chop trees down in Botanical Gardens. All I have had is a little twig, and it does not follow that it is the same as the rest of the tree. It has given me a lead and now

I want more material.

<u>Mr. Ellis</u>: I very strongly support Mr. Huddleston's remarks. I feel you are making a mistake if you do not let Dr. Chattaway go gathering. You have some difficulties in the matter of finance, but I would be so bold as to say that I feel this is something that should be pursued with no restrictions.

<u>Mr. McAdam</u>: I listened with interest to Dr. Chattaway's work, and I compliment her upon it. I feel that we could supply any material that you might require from us, but there is a breakdown of air services between Sydney and Victoria. We can get material from Lae to Sydney in one day, but there is often a delay in getting it on from Sydney to Victoria.

<u>Mr. Huddleston</u>: The work to my mind is of the utmost importance. With regard to the discoveries Dr. Chattaway has told us of, I feel that she may get worth while information from a study of timbers like yellow carabeen and white birch. Yellow carabeen will show starch right to the pith, and yet that timber is prone to develop dark heart associated with fungal activity. Dark heart can extend to within one or two inches of the cambium. You can take two logs of identical size, one clear and yellow right into the pith, and in many cases you find starch extending into the pith in that log. The other log will show extensive dark heart, which has different mechanical properties - it is brittle, difficult to season, slow drying and has a number of characteristics which appear to be connected with some of the discoveries Dr. Chattaway has told us about. I feel she may gain information from a tree of that species. The same thing applies to white birch, and also some of the weed trees, giant nettle and other trees of that nature, where we get extensive starch in some trees, while other trees have practically none. In view of what we have been told today,

I think there is a possible explanation relatively near at hand for the different behaviour of different trees in the species. I feel that in order that we can provide the material required, it would be better for the two officers, the collecting officer and Dr. Chattaway to see the material. I say that advisedly, because some of the yellow carabeen trees we would like to send down may be as much as three feet in diameter, and furthermore that three feet is at the top of a buttress which may be ten or twelve feet high, and it is possible that a study lower down may provide further information. These are things which Dr. Chattaway may not be aware of, and she would get possible help if she saw the tree in the forest.

Dr. Chattaway: I had some yellow carabeen from Mr. Teague, which he had fixed on the spot with formalin acetic alcohol. When I came to examine it I found this plastic-like material, and I could not see the nuclear structure. When I compared it with our collection material I found these cells clear of any contents and that put me on the possibility of this plastic forming under the influence of the formalin. I had some more material from Mr. Teague which I wanted to fix myself, but unfortunately when it arrived it smelled very bad and I found it had been ten days on the way. It was particularly interesting because it was fungus ridden. The other material fixed on the spot showed a gradation from living to dead cells. There were no cells dead at the cambium, and going to the centre of the tree the number of dead cells increased. This gradual dying of the ray cells is related to another theory that I should like to work on. It may explain some trees which have a very wide sapwood but which do ultimately form some heartwood.

Mr. Hillis: I do not think there is anything new I can add except to point out that this change in tannin composition can take place very quickly in the presence of enzymes. The sample from the tree must be adequately protected against any such enzyme action, otherwise the estimated tannin content may be much lower than the original.

Mr. Ellwood: Following Dr. Chattaway's postulation that gums, tannins, etc. are introduced between the micelles and in the amorphous portions of the cell wall during the change from sapwood to heartwood we would expect different E.M.C. values for sapwood and truewood, and there is some evidence to suggest that sapwood has a higher E.M.C. than truewood.

Another aspect, apart from any consideration of the effect of starch on the susceptibility of wood to certain insect and borer attack, is that tannin working through may add to the resistance to invasion.

Dr. Chattaway: There is the possibility that the tannin is keeping the water out, but I have been thinking on different lines, that it was the fact that the water was out which made it drier, and the dryness allowed the extension of the tannins.

Mr. Clarke: I think Mr. Ellwood means after the timber has been dried he would get differences in E.M.C. between sapwood and truewood. If you have a certain sort of wood, as in sapwood, when that changes to heartwood you add a certain quantity of extraneous material. Some of that extraneous material has a lower E.M.C. than wood. You measure E.M.C. on the total weight of the substance.

Mr. Ellwood: The effect of the extractives in wood only affects the E.M.C. in a very high relative humidity. Under normal conditions, the weight of extractives would not influence the moisture content very much.

Mr. Clarke: I think it would in jarrah. Your extractives there are fairly high.

Mr. Hillis: 25 per cent. extraneous materials. Dr. Chattaway and I are developing a micro method of examining extractives and tannins from the timber. We have not progressed very far as yet, but we have noted extractives from jarrah sapwood do contain one, or perhaps two, different compounds that are not found in heartwood, so evidently at the boundary line this compound changes into something different. This method is able to make use of small quantities of 10 mg. or so, and we hope to be able to apply it to the contents of various cells with the aid of micro manipulation.

Mr. Clarke: Can you account for the very large amount of extraneous material in the heartwood in some species? How does it get there?

Dr. Chattaway: I can only think it is the result of this extreme increase in activity which takes place when the tree is dying. There is the same thing in an injured area. Damage to the cell itself produces increased activity, and I can only suppose that in some trees the increased activity takes the form of the production of gum. If you consider tyloses, when a dying ray cell produces a big tylosis growth takes place which must be fifty or sixty times the quantity of material in the ray cell. If injury can stimulate a ray cell to produce all that, I see no reason why the increased activity when the tree is dying should not produce extraneous material. Regarding the difference in tannins in sapwood and heartwood of jarrah. We brought down some sap from Euc. regnans from Toolangi, and could not find any tannin in the sap at all, which supports my theory that tannins are held in the sapwood in the ray cells. I was very surprised, as I expected to find the sap full of tannin. It was not, not of tannin we could indentify. The work is becoming increasingly complicated by the fact that not all tannins make this plastic substance with formalin. From the Botanical Gardens material of Elaeocarpus I could not get any plastic in the cells. We have come to the conclusion there are a good many tannins we know very little about.

Mr. Hillis: The test is based on the Stiasny method of estimating tannins. When a tannin mixture containing pyrogallol and catechol types - as from oak and E. redunca - is heated with formalin and hydrochloric acid the catechol tannins are precipitated. These are filtered and the filtrate heated with urea to precipitate the pyrogallol tannins.

Dr. Chattaway: We must try some other fixative to show other forms of tannin.

Mr. Irvine: Mr. Tamblyn has reported the results of high pressure treatment of some of our lighter coloured eucalypts. I think brown stringybark was refractory at high pressures - one of the stringybarks anyway. Is that something to do with the type of tyloses formed, or not?

Dr. Chattaway: I do not think that tyloses are the whole answer to lack of penetration. Red oak is always taken as the example. If you look at any pictures of red oak penetration you find it has not gone into the fibre wall. If you have a lot of vessels which are open you can get preservative into the wood, enough to preserve it, but I do not think you are getting penetration of the fibre walls. I think there is a difference in the penetration.

Mr. Ellis: Take an extreme case of timber difficult to dry. Has Dr. Chattaway made an examination on Gmelina leichhardtii?

Mr. Huddleston: Our experience is that Litsea reticulata gives more trouble than Gmelina leichhardtii. Test samples of Litsea reticulata have been held for five or six weeks in constant humidity, and when taken out there was a wet core inside the timber, when the great bulk of the stuff in the same charge was perfectly satisfactory. There is an occasional stick with a very high moisture content.

Dr. Dadswell: It has very wide sapwood.

Mr. Huddleston: We did look at that, and I do not think it was the explanation.

Mr. Ellis: On observations of kiln dried hoop pine, I have found very consistently small pockets of very high moisture content - wet patches, some 6 in. diameter at irregular intervals in about 10 per cent. of the boards in a charge. In view of the fact that it might throw some light on the question Dr. Chattaway is working on, I was wondering if you would like some samples. It was absolutely marked - some patches 6 inches diameter at irregular intervals. Say about ten out of a hundred in a charge.

Dr. Dadswell: All back sawn?

Mr. Ellis: Most of the boards would be back sawn.

Dr. Dadswell: If you got very irregular heartwood distribution in hoop pine, you could get back sawn parts which would show some pockets of heartwood. That might answer the question.

Mr. Ellis: I did not think so at the time.

22. PLYWOOD FROM ASH EUCALYPTS.

a. Veneer Production.

Mr. Gordon: In the States of Victoria and Tasmania "ash" eucalypts are the only species occurring in sufficient quantity and in log form potentially suitable for veneer and plywood production. It is therefore natural that attention should be given to the manufacture of veneer from these species.

One Tasmanian firm is already using a percentage of ash eucalypts for plywood but the quality of the product leaves much to be desired for furniture, panelling and other uses for which plywood has commonly been used in Australia. Other firms are now interested in the establishment of veneer and plywood plants in these States. The problems as found are dealt with in order as noted during the successive operations from the forest to the finished article.

1. Selection of Logs. It is estimated that only about 10% of the total volume of logs being cut from logging areas will be suitable for conversion into rotary veneer. This is based on (a) variation in form, (b) unsound hearts and (c) (which is probably the most important factor causing loss) the occurrence of popping in the logs.

2. Immediate Conversion into Veneers. It is desirable that logs be converted into veneers almost immediately after falling so that the development of checks on the surface and ends of the logs resulting from drying will be obviated.

3. Losses during Heating of Logs. Some further losses occur as a result of extension of end splits during heating of the logs in preparation of peeling. It is possible that there may be some advantages from heating logs in long lengths as against crosscutting first into peeler blocks before heating. Unfortunately we do not have a heating pit sufficiently large to investigate this factor but it is hoped in the near future to be able to do this at one of the commercial plants.

4. Peeling of Veneers. No difficulty has been experienced in the actual peeling operation and green veneer of commercial acceptability for high grade purposes can be peeled. In grading of green veneer into faces, backs and centres, the presence of splits originating from surface and end checks and from shakes is by far the most important factor causing degrade and the percentage of veneer which can be classed as single piece faces is less than 1/3 of the total area cut, which, of course, is unsatisfactory

unless a market for plywood other than for the furniture industry is available. There are of course many uses for plywood where strength and uniformity of properties rather than appearance are important. Naturally if the percentage of green veneer classified as faces is less than 1/3 of the output it follows, since drying is the major problem in getting dry veneer, that a lower percentage of dry veneer can be classified as faces without considerable additional work of clipping, jointing and taping of veneers which of course adds to the cost of finished plywood. Both green and dry veneers are susceptible to damage from tearing during handling.

5. Veneer Drying. The major problem in preparation of veneer for plywood manufacture comes in veneer drying which will be dealt with subsequently by Mr. Ellwood.

6. Glue Spreading. Some disadvantage is experienced in spreading centre veneer with glue if the veneers have badly wrinkled faces and ends. This is specially important with urea glues where only a light spread can be applied, otherwise the cost of glue would be excessive. Considerable pressure is required to flatten corrugated veneer and pleats and overlaps may occur. With casein glue considerable trouble is experienced as a result of staining where the glue passes through splits and checks and to the face of the veneer, so deteriorating the appearance.

7. Trimming, Sanding & Drying of Veneer. No difficulty has been encountered in redrying of wet glued plywood, trimming to dimension or sanding of faces.

8. Supply of Additional Face Veneer. Previous references have been given to the preparation of plywood from rotary veneers and recovery of faces has been based on single piece veneers. With sufficient clipping in the dry veneer stage however it will be possible to provide enough

faces made from two or more pieces jointed and taped or edge glued together. In view of the fact that there is a potential demand for quarter cut veneer in which degrade during drying is considerably less than with rotary veneer, we have carried out some experimental work on quarter rotary slicing and half rotary slicing of flitches which have been cut from logs which have popped too badly for peeling. Good results have been attained but it is considered that slicing using shear cut obtainable on ordinary commercial slicers would give a much better result. Work at the present time is being carried out on alpine ash from the Mansfield (Central Victoria) district and it is expected that a parcel of six logs of alpine ash from Tasmania will be available in the near future.

Mr. Huddleston: The samples exhibited by Mr. Gordon are very interesting and would serve as an example to a number of N.S.W. manufacturers who are working with easier timbers but not obtaining as good results. Mr. Gordon has shown that mountain ash can be used for veneer with satisfactory results.

Mr. Cokley: We would also like to congratulate Mr. Gordon on his work. We are keen to have some tests carried out on the peeling of our Queensland eucalypts.

Mr. Benallack: I would like to pay a tribute to Mr. Gordon's work on the peeling of alpine ash. This work has proved of great value to us.

b. Drying of the Veneer.

Mr. Ellwood: You are well aware of the importance of utilising more of our native timber species for rotary peeled veneer and plywood production. In Queensland the annual cut of hoop pine, one of the major veneer species, had fallen from 150 million feet a year to 60 million feet a year and appears to be decreasing at the rate of 10 million feet annually. This, combined with the difficulties of overseas supplies is directing more and more attention to other native timber as a source of supply.

Attention has been directed particularly in South East Australia to the ash group of Eucalypts. These species when rotary peeled are liable to severe degrade during drying and this factor is limiting the development of the industry in S.E. Australia. Work was commenced in this Division some 18 months ago on the drying of 1/16 in. rotary peeled veneer from Euc. regnans. This species was selected as it exhibited the highest collapse of the group and would probably present the most problems in drying. However, I should point out that the remarks made in this paper do not necessarily refer in their entirety to the other species of the group or even to the same species grown outside of this State.

Early work in this laboratory did not yield a quality of rotary cut veneer which would ensure production of a first grade plywood. Consequently, a comprehensive study is now being carried out on fundamental and practical aspects of the behaviour of "ash" eucalypts during drying, using a cross shaft compartment kiln. It is hoped to extend the investigation to mechanical driers at a later stage. I shall now give a brief outline of the course of investigation followed, and the salient points arising from this work.

Five trees were obtained and some 500 3-ft. square sheets used for the current investigation. The factors for study included:

1. Kiln schedules i.e. combinations of various dry and wet bulb temperatures
2. Veneer temperatures
3. Tree differences and effect of position in the tree
4. Peeling process - tight and loose
5. Heating Schedule of logs
6. Tray design
7. Effect of reconditioning
8. Chemical seasoning

In order to trace the development of degrade during drying, and to determine optimum kiln conditions, 12 preliminary kiln runs were carried out over a range of conditions from 60° to 175°F., dry bulb temperatures in association with wet bulb depressions from 5° to 40°F. As a result of these runs, several positive requirements of the veneer during drying became apparent and a method of degrade evaluation was evolved.

It was found firstly that degrade developed during drying of the veneer from green down to an average moisture content of 35-40 per cent. moisture content, after which no more degrade became apparent, secondly that all checking appeared to initiate on the tight side, and thirdly, that collapse increased with temperature.

Examination of the sheets showed collapse to be the major factor responsible for the initial degrade and this, in turn, appeared to be related to the growth rings. By isolating small blocks of early wood and late wood from a cross section of a green ash log and measuring behaviour during drying it was found that early wood collapsed approximately 3 times as much as late wood. This differential movement in the veneer during drying appears to be the cause of the trouble. In connection with the second point, an examination of the veneer after peeling revealed the fact that the loose side had, in effect, been divided up into many small sections while the tight side was smooth and unbroken. (This is not unique for the majority of veneer timbers). The explanation of checking on the tight face during drying is that shrinkage stresses acted cumulatively on this side while the small sections on the loose side could shrink independently.

When gross shrinkage (i.e. normal and collapse shrinkage) was plotted against wet bulb temperature a clear relation was obtained and following this the temperature of the veneer was plotted through the course of drying for a number of runs. It was found that the veneer temperature approximated to wet bulb temperature down to an average moisture content of approximately 35 per cent, after which the temperature rose fairly rapidly to D.B.T., i.e., the temperature of the veneer during the critical stage of drying is controlled by the wet bulb temperature.

Also it was found that the best quality was obtained with large wet bulb depressions, the quality not necessarily being best at the lowest wet bulb temperature; the time of drying having a considerable influence.

A report has been prepared on the above work and its implications, and is now being issued.

Continuing from the above work, 9 kiln runs were carried out over 3 different wet bulb temperatures in association with 3 different W.B.D. with fully matched veneer to verify the effect of kiln schedules on veneer drying and to isolate the optimum conditions and to determine the effect of the other variables on drying.

The effect of wet bulb temperature on gross shrinkage was confirmed. The collapse at 125°F. was about double that at 95°F.; this was confirmed by recovery on reconditioning. The quality generally was better at 95°F. W.B.T. There is some evidence to suggest that deformation and strength of the wood together determine the amount of checking and these two factors are affected oppositely by temperature.

Analysis of data showed that the higher wet bulb depressions reduced the apparent gross shrinkage, there being a highly significant appreciation in quality of the veneer from 15° W.B.D. to 50° W.B.D. High humidities are known to be conducive to collapse but comparatively high humidities are often used in solid stock during initial stages to prevent severe moisture gradients and consequent stressing and checking. In this veneer, the evidence shows that sets in thickness are not a serious factor, and that best results are obtained by large initial wet bulb depressions. The effect of the large wet bulb depressions is to reduce the time of drying, therefore, the time for which the veneer is subjected to drying stresses. Increasing the time of loading reduces the resistance of the veneer to failure. There are many analogies of reduction in strength with time, e.g. creep, and this effect may be accentuated in green timber.

Air velocities used were 480-500 per minute through a 3 ft. 6 in. stack. This is probably higher than air velocities used in commercial units but large temperature drops of the order of 20^{o} across the stack were noted for the larger depressions. This factor, in association with the fact that during the critical stages of drying, the veneer is more or less at wet bulb temperature indicates that much higher air velocities or quantity of air through the stack could be used to advantage to reduce the time of drying, which in itself, is a desirable factor as it reduces degrade. We have not yet had the opportunity to continue this line of work, but it appears to be an important factor. It is of interest to note air velocities of the order of 1100 - 1200 ft. per minute in some mechanical driers.

The greatest single feature in this experiment was the difference in quality between sample sheets from different trees, the trees which showed the greatest gross shrinkage showed the least checking and there were indications that this condition also held for different positions within one tree. It is dangerous to generalise on this inverse relationship between collapse and checking for different trees as there are indications that the relationship breaks down at very high values of collapse. The behaviour of various trees may be explained on the grounds that differential collapse is reduced as collapse increases, or that the inherent ability of different samples to relieve stresses by deformation rather than by checking varies. The above behaviour is not inconsistent with the fact that the quality of the veneer generally is improved as collapse is reduced by means of a suitable kiln schedule.

With regard to pretreatment of the veneer with sodium chloride, the quality of the veneer appears to be only slightly improved but this study has not yet been completed.

Tray design is important in reducing buckling and allowing unrestricted air circulation over the veneer. Investigations are not yet complete on the effect of log heating schedule on quality after drying, but there is evidence to suggest that high temperatures increase collapse and buckling but not necessarily the amount of checking.

Reconditioning the veneer after drying is of definite advantage, as increase in width of from 4 - 12 per cent. is gained, fine face checks close up and buckling can be removed. In addition, the veneer is more easily handled without breakage.

Summarising, the optimum drying conditions appear to be to initiate drying with a large wet bulb depression, high air velocity and to maintain the wet bulb temperature at a low value until, at least, 40 per cent. average moisture content is reached. It is desirable that air travel through the stack should be as short as possible, with wide spacing between the drying trays to reduce the drop in temperature.

23. UTILIZATION OF RADIATA PINE VENEER.

Mr. Gordon: We considered it desirable to do some work on the utilization of radiata pine. Commercial firms are already peeling veneer of varying quality from this species. The shortage of plywood is such in Melbourne that furniture manufacturers are buying Queensland sliced veneer for faces and making this up with doubtful quality centres and backs. In addition to investigation of 1/16", 1/12" and 1/8" thicknesses which are commonly used in the plywood and furniture industry, logs from Victoria, N.S.W. and New Zealand have been successfully peeled into veneers varying from 1/133" - 1/2" in thickness. The 1/133" is potentially suitable chiefly for novelty use. Journalists etc. seem more interested in the thin veneer but I think there is a better scope of use for the thick veneer. Our first attempts to peel thick veneer were made with the thought that it would have application for box and case manufacture. We have been very impressed by its possibilities as a substitute for solid corestock involving many sawing and planing operations. From work we have carried out there is promise of being able to peel sound intergrown knots for veneer. It seems from work on hot and cold pressing that panels glued with cold setting glues are less likely to warp than are hot pressed panels.

24. TANNIN-FORMALDEHYDE ADHESIVES.

Mr. Dalton: The use of sometannins, chiefly of local origin, as raw materials for plywood adhesives has been investigated at the Division of Industrial Chemistry. A brief summary of this work is presented here and further details will be available in an account to be published elsewhere (Aust. J. Appl. Sc. Vol. 1 (1949)).

There were two main reasons for undertaking this work. Firstly, resorcinol had been used in recent years to prepare adhesives setting at low temperatures and giving bonds with excellent water resistance, and it was considered possible that tannins, being polyhydric phenols, might be used similarly but at a considerably lower cost. Secondly, tannins are present in extractable amounts in many Australian trees and a concentration in the tree which was uneconomic for the leather industry might be quite economic for adhesives in which high priced phenols are at present being used. Thus the barks of _Callitris calcarata_ (black cypress pine) and _Callitris glauca_ (white cypress pine) contain 10 - 25 per cent. tannin which is not at present being utilised.

A recent example of the development of a naturally occurring phenol for the plastics industry is the use of cardinol from the cashew-nut shell. Various efforts are recorded in the literature for the use of tannins in the preparation of plastics.

The tannins selected for examination were the following:

Acacia mollissima - black wattle. Obtained as the trade product "Mimosa" from South Africa.
Eucalyptus crebra - narrow leafed ironbark.
Eucalyptus redunca - wandoo. Obtained as the trade product "Myrtan" from Western Australia.
Eucalyptus considenians - Yertchuk.
Callitris calcarata - black cypress pine.
Callitris glauca - white cypress pine.

Preparation of adhesives.

The use of tannin resins as adhesives imposes limitations upon their conditions of preparation which must be determined for each tannin. Thus they gel rapidly and so only mild conditions may be used to prepare them. Reactivity is shown by gelation tests to be similar at pH's 2 and 8 and since acid catalysts have been shown to cause aging of the joint, it was decided to use only alkaline catalysts.

As the tannins vary in solubility and in the viscosity of their solutions, conditions of preparation have to be adjusted accordingly. It was found that more spreadable adhesives could usually be made from an alcoholic extract of the tannin.

Only about 8 per cent. formaldehyde for a given weight of the tannin is required to fully set the adhesive

Of the six tannins tested two, the <u>redunca</u> and <u>considenians</u> tannins, were too unreactive to give adhesives setting under reasonable conditions.

Two methods of preparation were adopted. In the first method a resin was prepared by heating the tannin with formaldehyde in aqueous alcohol. The adhesive was then prepared by adding to this stock resin the alkali catalyst, filler, and paraformaldehyde. In the second method the adhesive was formed by adding a previously ground mixture of wood flour and paraformaldehyde to an alkaline stock solution of the tannin.

<u>Conditions of testing</u>.

1. Cold-pressing 25°C. with the solid over-lap specimen $4\frac{1}{2}$ in. x 1 in. x 3/8 in. of mountain ash.
2. Hot-pressing 90°C. and higher temperatures with specimens cut from 6 in. x 6 in. plywood panels of coachwood as described in B.S.S. 1203-1945.

<u>Results</u>.

1. <u>Cold-press adhesives</u>. The bond strengths obtained with adhesives from mimosa and calcarata tannins were lower than those obtained with two commercial adhesives prepared with resorcinol and urea. On the other hand, the wet strength of the tannin adhesives was considerably better than that of the urea adhesives, though still inferior to the resorcinol adhesive. A major disadvantage of the tannin adhesives for cold pressing is their short pot life and open assembly time. The joint strengths obtained are given in the following table.

TABLE 1.

Comparison of tannin and typical commercial cold-press adhesives.

Type of adhesive	Glue shear failing load - lb. Dry	Wood failure (%) Wet[a]
Resorcinol	1065 - 85	825 - 95
Urea	1150 - 80	0 - 0
Mimosa	940 - 65	755 - 70
Calcarata	980 - 75	695 - 35

a. After 3 hours in boiling water.

2. Hot-press adhesives. The bond strengths obtained with mimosa, calcarata, glauca and crebra tannins were all of the same order as those obtained with commercial adhesives. Thus a mimosa tannin adhesive when pressed for 8 min. at 90°C. gave a dry strength of 565 pounds, wet strength after 2 hours in boiling water of 325 pounds and after weathering in an exposed area for 11 months, 345 pounds. Similar strengths were obtained with the other tannins. The pot life and open assembly time of the hot press adhesives are satisfactory for practical application.

A comparison with two commercial adhesives is made in the following table:

TABLE 2.

Comparison of Mimosa Tannin and Typical Commercial Hot-Press Adhesives.

Type	Pressing conditions		Glue Shear failing load (lb.)		
	Temp. °C.	Time Min.	Dry	Wet[x]	11 months Weathering
Mimosa	90	8	565	325	345
Urea	120	8	485	220	315
Phenolic (Tego)	145	8	425	390	340

x 3 hr. in boiling water.

Conclusions.

The tannin extracts examined fall into two groups: those which react with formaldehyde to give adhesives which set at moderate temperatures and produce strong bonds with wood, and those too unreactive to produce satisfactory adhesives.

The tannins need only a small amount of formaldehyde to produce suitable adhesives and these may be more simply prepared than phenolic adhesives by adding paraformaldehyde or hexamine and wood flour to a solution of the tannin. Adhesives from the tannins mimosa, calcarata, glauca and crebra give strong water resistant bands by pressing at temperatures lower than for phenolic adhesives except those containing a polyhydric phenol or catalysed with a strong acid.

Adhesives from the tannins can be set at room temperature but the joint strengths are somewhat below those obtained with commercial cold setting adhesives, except that, in resistance to boiling water the tannin adhesives are far superior to the urea-formaldehyde adhesives. Also the pot life of these adhesives is very short.

The economic aspects of the production of tannin adhesives have not been very fully considered but some factors have been noted in the course of the work. Favouring manufacture of the adhesives are the small proportion of formaldehyde required and the elimination of a resin intermediate. The cost of the tannin, even with lower extraction percentages than normally considered economic, would be very much less than for phenol or resorcinol. Tannin adhesives gel too rapidly to be applied by the dry film method.

A number of Australian trees are well endowed with tannin and barks, containing high proportions of tannins, are at present waste products in the timber industry. Suitable tannins for adhesives could be recovered from the barks of C. calcarata, C. glauca and C. crebra and a further search would undoubtedly disclose others. Thus a brief examination of the exudate of E. callophylla (marri) from Western Australia has given some promising results.

Mr. Huddleston: The Division of Wood Technology has been particularly interested in this work on tannin adhesives and we were fortunate to receive early results from the Division of Industrial Chemistry. Following the receipt of these results we contacted our two main manufacturers of synthetic resin adhesives - Beetle Elliot Pty. Ltd. and Nightingale Supply Co. Both of these firms say there are several major disadvantages with the use of tannin for adhesives at present.

i) There is a world shortage of tannin and any tannin on the market today is eagerly sought by the tanning industry.

ii) If tannin is extracted from timbers which are not being tapped at present at a higher price manufacturers say they may have to pay 1/- - 1/6 lb. for tannin whereas competitors may be able to obtain it for 4d. lb.

From these aspects it would appear that there is little prospect of making use of the work already done on tannins for adhesives.

Another development which shows promise of better application for these timbers containing tan and which are not being used today, is the manufacture of building board. The Division of Wood Technology has done some scout tests on this. These have shown enough promise for a working plan to be prepared. As soon as this is complete we propose to investigate the matter further. It may be found that the project is too big for us and we may have to askthe Division of Forest Products to take it over.

Mr. McAdam: Has work been done on mangrove tannin?

Mr. Dalton: No. There are other trees and barks from which tannin could be extracted for phenolic adhesives but this would resolve into a question of economics. The quantity required for adhesives is probably only 400 or 500 tons/year. This quantity might be able to be drawn from present tannin production. Its application for building boards has been investigated in the U.S.A.

Mr. Turnbull: Can Mr. Dalton give us a lead as to a minimum tannin content necessary for such work? Presumably timbers and barks with a high tannin content would be more reactive with formaldehyde.

Mr. Dalton: I think 10% would be a reasonable figure from which extraction could be made at a reasonable cost.

Mr. Clarke: The position is not as hopeless as Mr. Huddleston indicates. Tannin extract is being imported at £58/10/- per ton free of duty. It may be possible for a local industry producing tannin for adhesives to be protected against competition.

Mr. Hillis: Many of the tannin extracts derived from Australian sources possess a red colour which imparts an undesirable colour to the leather. These extracts could be used as a basis for adhesives if they respond favourably to the qualitative test mentioned. Mangrove tannin is a catechol type of tannin and should make the basis for a good adhesive.

Dr. Fitzgerald: This investigation has not been carried to its final conclusion. There is promise in the investigations but if anybody can show good reason why they should not be proceeded with we should be glad to hear this. Whether the tannins are used for adhesives or building board, the essential principle is very much the same.

Mr. Huddleston: I would not like my remarks to be interpreted that I think the investigations should not be continued. I have just put forward the objections we have received in endeavouring to have the work applied. If any further information can be obtained this should be done.

Mr. McAdam: I would like to see work commenced on mangrove bark. Pre-war we built up an export industry of 700 or 800 tons/year but I feel that there is much larger potential export industry. There are many thousands of acres of mangrove bark which could be drawn on and I anticipate an early commencement of collection.

25. THE BARK OF RADIATA PINE.

Mr. Watson: At the 1948 Forest Products Conference there was discussion on the possible uses of the bark of *Pinus radiata* D. Don. In the near future large amounts of this material will be at hand when the maturing trees from various plantations are milled. It was decided that an exploratory chemical investigation on this material would be made by the Division of Forest Products.

The bark sample collected was taken from several trees whose gross ages were estimated at 20-30 years. As there was an obvious difference between the red-brown corky outer bark and the fibrous inner bark they were separated and examined separately for benzene-alcohol solubles, lignin and holocellulose. The amount of material volatile in steam and soluble in water was determined on the total bark samples. The results obtained are shown in Table 1.

The results show that the bark of *Pinus radiata* is relatively low in cellulosic material as compared with wood. This factor, coupled with the high extractive content, indicates that the bark would not be a very suitable source of cellulosic materials. The inner bark would be more suitable than the outer bark in this regard. This would depend upon a method being developed which enabled the inner and outer barks to be separated readily. The high lignin content of the outer bark is due, in part, to substances other than lignin as this fraction contained a considerable amount of corky material which was not soluble in the usual Klason lignin reagents.

TABLE 1.

Chemical composition of the bark of Pinus radiata (All results expressed as a percentage of the oven-dry bark)

Bark Fraction	Hot Water Solubles %	Benzene-Alcohol Solubles %	Lignin %	Holocellulose %	Material Volatile in Steam
Inner	-	37.1	14.4	44.2	
Outer	-	42.0	36.4	34.0	
Total	16.1	41.0x	32.0x	36.0x	Trace only

x Calculated result based on ratio of inner to outer bark of 1 : 4.

The extractives obtained from the bark may be of interest especially as such large amounts can be removed by straight forward extraction processes. Samples of bark have been forwarded to Dr. Anderson of the Tanning Department of the N.S.W. Department of Education. The results of these tanning tests are not yet to hand and will be reported at a later date.

Some of the bark that had been extracted with hot water was fed into a Van Gelder attrition mill and the stock so obtained made into a board by the Utilization Section. These boards had a modulus of rupture of about 25 per cent. of that given by commercial hardboards. There is little doubt that the board could be improved by a more detailed investigation. As the bulk of the fibrous material in the defibred bark was derived from the inner bark it is probable that screening to increase the amount of fibre and to remove the coarse granular corky material would produce a material better suited for board manufacture.

Mr. Turnbull: I should like an indication from the Conference as to whether further work should be done on bark, particularly with regard to its possible application to building board production. I would also like to ask Mr. Watson whether the cork-like content of the bark was high or low. If it is high, is there any possibility of producing a granulated cork substitute?

Mr. Huddleston: If 8% of tan is sufficient to form an adhesive it might be possible to bind the edgings into a board in a simple plant.

Mr. Turnbull: Is tannin present in the corky fraction?

Mr. Watson: The tannin investigations have been left to Dr. Anderson who forwarded his report to this Division. It may be necessary to remove the corky material by screening if we wish to improve the quality of the boards made from the bark. No attempt was made to determine theamount of corky material present in the bark.

Mr. Turnbull: American practice in the manufacture of hardboards from sawmill slabs is to get rid of the bark because the corky fraction gives undesirable characteristics to the finished product.

26. THE SUITABILITY OF AUSTRALIAN TIMBERS FOR THE MANUFACTURE OF SPIRITUOUS LIQUOR CASKS.

Mr. Ellis: We suggest to the meeting that it may be appropriate for the Division of Forest Products to institute a series of tests on Australian timbers for spirituous liquor casks. This seems an Australian wide problem and the Division would seem the appropriate co-ordinating authority. The States would probably be prepared to supply timbers for this purpose.

Mr. Huddleston: Brush box has been reported entirely satisfactory for wine casks in N.S.W.

Mr. Clarke: This problem should be handled by individual States.

Mr. Ellis: This would bring up the problem of uniform testing. The best way to get satisfactory results would be for the Utilization Section of the Division to institute a comprehensive series of tests.

Mr. Huddleston: All we can do is to get individual firms to test timbers for their own use, unless we are prepared to draw up an Australian Standard Specification.

Mr. Turnbull: We have carried out some tests with baffling results. We set up tests on a laboratory level. We computed the wood/wine surface relation and cut small pieces of various timbers and immersed these in test tubes of wine. We enlisted tha aid of a skilled tester and from our initial tests some half a dozen timbers showed promise. We then made up small wooden tanks and filled these with wine. For a while results from these tanks parallelled the results from the test tubes but suddenly they veered right away and from then on not one timber showed promise. Standard timbers at present in use in industry are white oak for spirits, peppermints and ash group timbers for wine, blackwood for beer. No other timber has been proved 100% satisfactory.

Mr. McAdam: We supplied some oak staves for test in 1941 and six months ago these were still proving satisfactory. The organization of supplies is the difficulty in New Guinea.

Mr. Turnbull: 6,000,000 sp.ft. of timber is used for cooperage annually.

Mr. Ellis: It has been reported from a wine manufacturer in South Australia that tulip oak has proved satisfactory for wine and brandy casks but the identification of the timber has not yet been accurately determined. Red tulip oak has also been used satisfactorily in the manufacture of beer casks in Queensland.

Mr. Huddleston: That bears out my point that timber used is dependent on the timber the individual manufacturer is prepared to accept. A Sydney manufacturer regards brown tulip oak as useless for wine casks.

27. WATERPROOF PLYWOOD AND SYNTHETIC RESIN ADHESIVES.

Mr. Gordon: The Standards Association of Australia has set up a waterproof plywood committee to prepare a standard. The task of preparing specifications was allocated to the New South Wales Committee which has met twice. We worked primarily on a draft which was prepared during the war and issued as A.S. No.(E)F.501 "Marine Plywood". The current specification is titled "water-proof plywood" and covers two grades, one for marine plywood and the other for standard grade for general utility purposes, such as might be used in caravans, internal partitions in ships and boats, external work connected with housing, hutments and so on. Requirements for construction specify generally good workmanship, but for the marine type both species acceptable and construction are fairly rigidly defined. Only adhesives which would fulfil the requirements of a 3 hr. boil test are acceptable. As regards synthetic resin adhesives, there has been no appointment yet of a sub-committee by the Standards Association, but I anticipate that one is likely to be formed at any time now as some new British material has come out and in view of the fact that the Composite Wood Corresponding Committee is moving for uniformity between the Australian and British Standards.

28. LACTIC AND ACID CASEIN GLUES, SUBSTITUTES AND EXTENDERS.

(a) Acid Casein.

Mr. Higgins: Two types of casein have been produced industrially in Australia in the past, lactic and rennet casein. Rennet offers certain advantages to dairy producers insofar as the time required for the precipitation is shorter than for lactic, and lactose may be recovered from the whey. The sugar of milk is used either for baby food or for the manufacture of penicillin. On the other hand, rennet casein is not very satisfactory for plywood manufacture as the viscosity of the glues it makes is very much higher than lactic, and consequently a higher proportion of water has to be added to the glue and this results in a bond of lower strength. Lactic casein, which is satisfactory for gluing purposes, is not favoured by the dairy producer because it takes much longer to complete the precipitation by the natural souring method and furthermore the lactose is fermented in the process and cannot be recovered from the whey. The hydrochloric acid process shares the two main advantages of the rennet process insofar as production is concerned, and investigations have been carried out to test its suitability for gluing purposes, as it was hoped that it might thereby combine the advantages which rennet casein offers to the dairy producers, and lactic casein offers for users of glue. Commercial tests were first carried out in collaboration with the Colac Dairying Company, the casein being precipitated at a pH of 4.6 and about 35°C., that is in the traditional manner. The glue shear strength was found to be satisfactory both with lap joints and with plywood specimens but the working life of the glues was found to be longer than with lactic casein. The differences were such that no modification was required with the casein-caustic soda formula given in our Trade Circular on casein glues, but with the casein-lime-sodium silicate formula the working life was found to be too long to ensure that setting would take place within an adequate period under all climatic conditions. It was noted by Mr. Gordon during a visit to Brisbane a few months ago that one manufacturer encountered difficulties in this regard using the conventional formula. The glue failed to set satisfactorily overnight, probably due to the fact that the temperature was low and the humidity possibly high. Modification of this formula was therefore required and three methods were tried in order to reduce the working life. First, the water content was reduced. This was effective, but it means a larger consumption of protein. Secondly, the time between the addition of the lime and sodium silicate was increased. This was found to increase the viscosity of the glue but had no very great effect on the working life. Thirdly, the sodium silicate was decreased. This was most effective and also involves an economy in the use of sodium salts. On the basis of these tests, we therefore recommend that the formula as used for lactic casein be modified so as to contain 50 parts of sodium silicate instead of 70 when acid casein is used. Further experiments were carried out on the factors in manufacture affecting the properties of acid casein. It is usual to precipitate the casein at pH 4.6 and a temperature of 35°C. or higher. However, a French worker - Brigando - has recommended that a pH of about 4.1 and a temperature not exceeding 25°C. should be used for the best results and in particular for lower ash content. If the casein is precipitated at a low temperature it is necessary to cook it in the serum at a temperature of about 50°C. Experiments were therefore carried out in order to confirm these claims and, further, to determine the effect of these process variables on the actual gluing properties of the protein. I should like to acknowledge the help received from the Dairy Research Section in the supply of material for these experiments. The effect of temperature and pH has been examined not only on ash and moisture content but on the working life and glue shear strengths. The effect of pH is perhaps the most marked, ash content declining as the pH of precipitation is decreased. The equilibrium moisture content of the casein also follows a similar trend and the ease with which the protein can be filtered and pressed is increased at the lower pH. The lower temperature of precipitation with subsequent cooking resulted in lower ash content. As far as the effect of pH and temperature on the working life of the glue is concerned, it was found that the lower pHs and the lower temperature of precipitation, with subsequent cooking, both gave longer working life. The main intrinsic factor controlling working life is, however, the ash content of the protein and this can be clearly seen when the ash content and working life are plotted against each other; regardless of the process variables a strong correlation can be discerned. On the basis of these experiments we therefore suggest that a low temperature and low pH of precipitation should be adopted because it is easier to filter and press the curd, the ash and moisture content are lower, about the same yield is obtained, according to our tests, and the gluing properties are satisfactory in all cases. We hope we have the concurrence of the Dairy Research Section in these recommendations. I have not given any details of the experimental results because they are contained in a report which has just been prepared and which will be distributed at an early date.

To summarize the position -

(1) We have no doubt that the casein is completely satisfactory as a glue base but its longer working life may require modification of some formulae which have been designed for lactic casein. This implies no inferiority insofar as acid casein is concerned, but merely recognizes that its different chemical properties require a slightly different formula.

(2) The production of acid casein seems desirable from the point of view of our overall economy, as it fulfils the requirements both of the dairying industry and of plywood manufacturers and other glue users.

(3) The modifications of the production process which I have suggested appear desirable, though not essential.

<u>Mr. Cokley</u>: With regard to the rennet casein, I would like to say that we were disappointed at the last Conference that there was nothing of a constructive nature to pass on to the manufacturers. As to acid casein, we have been greatly assisted in Queensland by the work of Mr. Gordon at Ipswich. We eventually worked out some tests, the main result of which was that the reduction of silicate gave us a lower wet strength.

I have been pleased to hear from Mr. Higgins the results of experiments carried out in this Division. One point I would like to suggest is that in any further examinations the problem raised by humid conditions such as we have in Northern Queensland might be explored. We are anxious to know whether, with our wet season and high temperatures, plus heavy rainfalls, acid casein can be regarded as entirely satisfactory.

<u>Mr. Lawrence</u>: A short while ago, due to the high price of rennet casein and the shorter working week, certain cheese factories were making rennet casein on the off days when full staff was not available. With the manufacture of lactic casein however it was considered that, due to the less rapid production and also high consequent danger of deleterious bacterial, bacteriophage and other infections, the making of a product such as lactic casein would need separate plant and establishments from a cheese factory. In the case of acid casein precipitated with hydrochloric acid corrosion of the vats used was another difficulty. The process of producing rennet casein

is perhaps a step in the right direction, and probably the solution of the problem of the vats. The use of sulphuric acid with stainless steel vats would appear to be better than the use of hydrochloric acid which has a somewhat detrimental effect.

Mr. Higgins: The tests on the material produced at Colac indicated that the wet strength of plywood was poor. On the other hand, the tests we did later on in the laboratory were quite good, so I think that the wet strength is not so very much inferior to acid casein, and some of the earlier batches may have had something which gave rise to a low wet strength. As far as the keeping qualities are concerned, I see no reason why acid casein should be inferior to lactic casein. As a matter of fact it may be better. Finally, on the point of corroding the vats, the acid used is dilute and the pH does not fall below 4.1. Therefore it does not seem likely that corrosion of the vats would be more pronounced than with other methods of precipitation of the casein.

(b) Peanut Meal.

Mr. Gordon: During the past several years various protein materials have been suggested as potential bases for plywood glues, and one of these was peanut meal. We have had more or less promising results from our experimental work with such samples as we have been able to get from two sources, and we felt that the results could be improved if meal of better quality could be obtained. Consequently, when I was in Queensland in July I got in touch with the Peanut Board and refreshed their memories on the situation. I pointed out that there was a potential market for some hundreds of tons of peanut meal if a satisfactory product were produced, and asked what was the situation regarding supply. I was rather distressed to learn that the maximum production of peanuts was somewhere under 3000 tons and of that production 300 tons was the maximum quantity made available for crushing into meal, that the market for peanut meal was considerably greater than the potential supply, that there was no prospect in the immediate future of the total production of peanuts being increased, and that the firms who crushed the nuts were not at all interested in improving the quality of the product to a condition which we felt would be satisfactory. In other words, we will not do any further work on peanut meal until the supply situation looks much better.

(c) Blood.

Mr. Huddleston: During the year a suggestion has been made that use could be made of large supplies of blood which are available in Casino, Armidale and Grafton, in each of which places we have plywood factories. Following that suggestion enquiries were made from the plywood manufacturers and the abattoirs, and they have expressed interest in the problem. The problem is beyond the scope of my officers, and I have referred it to the Division of Forest Products who I hope will take the matter up. Can something be done about it?

Mr. Gordon: The situation is that I had the opportunity of discussing this matter in Grafton with Mr. Murphy, who is a director of one of the plywood factories concerned and also of one of the abattoirs concerned. He expressed considerable interest in the subject, and in Melbourne I subsequently discussed this with my staff. We decided on a plan and proceeded to ask the abattoirs for samples of dried blood, sending a copy of our letter to Mr. Murphy for his information. In the meantime we set about getting information on technical procedures for preparation and use of blood albumen. Unfortunately we are having some difficulty in getting together the necessary equipment. The Grafton set-up is potentially a very good one but I am disappointed that we have not yet had any results, not even an acknowledgement of our request for samples of blood. I feel sure that two letters to Grafton could not have gone astray.

Mr. Lawrence: I think the search for proteins other than milk proteins will be of great benefit. Milk is of use as a food and in view of the utilization of skim milk, there is likely to be a shortage of milk casein products. It may take a very long time but prove to be very beneficial.

Mr. Cokley: I agree with the last speaker. We have in Queensland already taken up that point, especially with regard to the soya bean. Research has been carried on for a number of years in Queensland. We asked the Agricultural Department for soya bean glues and were told there was no chance of these being produced. There was only one instance in one of Mr. Huddleston's districts. I am pleased that this blood suggestion has been made and is being investigated and feel sure that our own local abattoirs would benefit by inclusion in the negotiations.

Mr. Gordon: The points raised by the last two speakers as regards alternative sources of protein might influence the Conference to take a wider view and consider alternative sources of adhesives. I have expressed this opinion previously, and think it is only a matter of time before casein is largely replaced as the principal glue base in Australia. The price of casein is going up and the price of urea glues is falling. With better utilization of milk for food and the improvement so far as prices are concerned, it is likely that urea glues will become cheaper than casein glues.

Mr. Cokley: I agree with Mr. Gordon that the future glue is the urea glue and other synthetic products, but where can we get our supply of urea glues? We can have only a low percentage of our building materials so glued.

It is doubtful also whether synthetic glues would be satisfactory in our northern area. Because of shipping delays and other hold-ups it would be necessary to provide adequate refrigeration in factories for preservation purposes.

Mr. Gordon: Australia is rather backward as regards refrigeration; and with shipping strikes, shortage of transport and similar disabilities, we are in an unfortunate position sofaras the distribution and storage of synthetic glues are concerned. However, Queenslanders are keen on domestic refrigerators, and it should not be a very far call to the installation of refrigeration for glue storage in factories.

29. BASIC ASPECTS OF ADHESION.

Mr. Higgins: Gluing is an ancient art, and was known to the Egyptian civilization, as archaeological records clearly show. However its scientific study is of recent origin, dating from about the First World War, when interest was stimulated by the need for improved adhesives for use in the construction of aircraft. Prior to this however the investigation of colloidal systems laid a basis for the scientific study of adhesives, and indeed the term colloid was coined by Graham about the middle of the 19th century from Greek words signifying "glue like".

After the First World War, investigations were carried out in England by McBain and co-workers over a number of years under the aegis of an Adhesives Research Committee and their final report did not appear until 1932. McBain distinguished between mechanical and specific adhesion, the first term connoting adhesion arising between porous surfaces and the adhesive simply by a physical interlocking of the glue and the porous material, and the latter, which was supposed to be of subsidiary importance for porous materials referring to specific physical attractions which had to be postulated to account for adhesion between smooth surfaces. Open to doubt as these conceptions were, they nevertheless stimulated research and criticism, particularly by Browne and Brouse at the U.S. Forest Products Laboratory, and in addition McBain's report contained valuable experimental data. Evidence has now been accumulated however to refute the major importance of mechanical adhesion, and it is generally conceded that this factor is of very subsidiary importance in the gluing of even porous materials such as wood.

That surface forces operate between any liquid and solid surface is evident from the fact that contact angles of 180^0 are unknown: when the contact angle is low, strong attraction takes place. The energy conditions on the surfaces of materials, i.e. at interfaces, are very different from those in interiors, and unsatisfied attractive forces may operate normal to the surface, and can be made available for adhesive activity. The peculiar properties of surfaces, as distinct from interiors, account largely for the behaviour of colloidal systems, in which the surface areas of the particles of the disperse phase is very large compared to their volume. In the use of liquid, adhesives, then, a necessary but not sufficient condition for the formation of a strong bond is that the liquid shall "wet" the surface to be glued. Wetting assumes particular importance in accounting for adhesion in cases where the adhesive remains liquid and does not set.

We may enquire what types of bonds participate in adhesion. The answer is the same as that to the question: what types of bonds hold matter together? In general we may distinguish the following types:-

1. Covalent (shared electron) bond. This is a relatively stable linkage.

2. Electrostatic bond. This results from Coulomb attraction between ions, and is easily ruptured in media of high dielectric constant.
3. Hydrogen (or hydroxyl) bond. This has a lower energy content than 1 or 2. It results from surplus energy of the hydrogen valence.
4. Metallic bond. This is a unique type of bond resulting from the electron mobility in metals.
5. Van der Waals, on Secondary Bonds. These are of three types:-
   (a) The dispersion effect (London). This is due to interaction between electron systems.
   (b) The induction effect (Debye). This is due to interaction between permanent and induced dipoles.
   (c) The orientation effect. This is due to interaction between permanent electrical dipoles.

Of these (a) and (c) are most important. According to whether (a) or (c) predominates, we have the old distinction between polar and non-polar materials.

Orientation effect - Hydrophilic, polar materials.
Disperson effect - Hydrophobic, non-polar materials.

1. and 2. are the so-called primary chemical bonds, of high energy content.

The main aim of any investigation directed towards elucidating the nature of adhesion in any particular instance is to characterize the types of bond present, and their particular nature, e.g., where applicable, the chemical groups involved. The phenomenon of adhesion at an interface being closely related to that of cohesion within a solid, it follows that a fruitful line of study should be to study the changes taking place in the glue itself as it proceeds from the liquid state to that in which it possesses mechanical strength and rigidity. Some adhesives appear to operate, in the first instance at least, by the removal of solvent, although it seems extremely unlikely that this process alone would result in strong adhesive bonds. Others, including those most commonly used for bonding wood and other polar polymers, set by an internal mechanism, which is a rate process independent of solvent removal. In gluing practice of course, drying or absorption of the solvent will often accelerate the process, but it is not basic to it.

In studying the development of cohesion within adhesive systems, the first requirement then is to see what physical changes occur when the system is closed, i.e. when no removal of constituents takes place. The most obvious change is the thickening and setting of the glue, and this calls for a rheological investigation of factors other than viscosity alone. Rheology is the study of the flow and deformation of matter, in particular of those materials and systems which can neither be described as ideal solids, in the sense that they follow Hooke's Law, or as ideal liquids in the sense that they flow according to the Newtonian condition that the shear stress is proportional to the rate of flow. Most colloidal systems occupy an obviously intermediate position in that their rheological behaviour exhibits both elasticity and viscous flow.

Rheological studies have been carried out in this laboratory by Mr. Plomley and myself on various adhesives of technological importance which show spontaneous gelation. These fall into two main groups: the protein glues, and the synthetic resins. The protein systems have been confined to various formulations with casein as the main constituent, with other components to provide alkalinity. The synthetic resins have been of the thermosetting group urea-formaldehyde, resorcinol-formaldehyde, and phenol-formaldehyde.

A rotational viscometer was used for this work and instrumental studies were required in order to develop a method of determining non-Newtonian properties and of allowing for the fact that these properties were changing with time.

The practical significance of viscosity in gluing operations is fairly evident, insofar as it is related to the ease with which adhesives may be mixed and spread and with which the optimum glue line thickness may be obtained. Another property having quite important, though less recognized, significance is the yield value of the glue. This may be looked on as the minimum shear stress at which flow will take place, and it largely determines the "body" of the glue: it can be changed appreciably by the incorporation of fillers. The working life of an adhesive, its "tackiness", its ability to be spread in a thin film are properties connected directly with rheological state.

The rheological work yielded some phenomena of intrinsic interest. For example resorcinol-formaldehyde, after the incorporation of the catalyst, displayed practically Newtonian behaviour until its sudden transition to a gel. Again, the system casein - sodium hydroxide - calcium hydroxide - water gives rise to a type of viscosity-time curve which, at suitable compositions, passes through a maximum and a subsequent minimum before proceeding towards the gel point. Other studies on the relation between concentration and viscosity of protein and synthetic resin molecules in dilute solution were directed towards elucidating the changes in shape and size of the molecules which took place during the thickening process.

However rheological studies can only attain real significance of a basic nature when they are related to structural changes occurring in the material under observation. For some adhesive systems the broad lines of the underlying mechanisms of gelation were fairly well known. For instance the phenol-aldehyde systems are known to set by condensation, the network formed being three-dimensional and containing covalent bonds, although much work remains to be done on the detailed kinetics of this reaction. The stable character of the phenol-aldehyde resins in the condensed state arises of course from the fact that they are composed of this tight three-dimensional covalent network. Again in protein systems containing divalent cations the rapid gelation, e.g. of casein - $Ca(OH)_2$, H_2O can almost certainly be referred to the development of heteropolar linkages between the metallic ion and the relatively abundant free carboxyl groups.

However, other mechanisms are not so evident. One of the most interesting problems and one towards the solution of which we have directed considerable effort is the manner in which proteins gel in alkaline solution in the absence of divalent cations. The system casein - $NaOH$ - H_2O has received particular attention. It was formerly contended that the mechanism of gelation in this system was simply solvent removal, but it can easily be shown that intrinsic factors operate.

Certain fairly easily discernible chemical changes occur when casein is treated with alkali. The most obvious is the evolution of ammonia. Another is the evolution of H_2S when the protein is brought back to its isoelectric point with acid. Another more doubtful change is the liberation of acetaldehyde, which certainly takes place at elevated temperatures, but does not appear to be pronounced at room temperature. These changes suggested possible mechanisms for intermolecular linkage, and these were first investigated as a preliminary to more systematic studies. The H_2S is certainly derived from the SH group of cysteine, which it was thought might be involved; an interesting dependence of sulphide liberated on pH was exhibited. Other considerations indicated that the SH groups would of themselves be incapable of explaining the observed gelation phenomena. The origin of the acetaldehyde is unknown, but its liberation would be expected to lead to intermolecular bridges between free amino or terminal amide groups, analagous to formaldehyde-sponsored methylene bridges.

These and other preliminary studies were followed by more systematic physico-chemical investigations by Mr. Plomley, Mr. Hayes and myself. The effect of pH on viscosity, rate of gelation and the extent to which the system deviated from Newtonian behaviour as pH was changed were studied in detail, with results that showed the existence of specific pH regimes in which gelation took place at a very much greater rate than others. Attempts were made to correlate these regions with the reported pK values (pH of ionization) of the free, potentially reactive, groups of the protein molecule. Attention was thus directed to the guanidyl group of arginine, in the principal gelation regime (that in which industrial operations are performed with casein - caustic soda glues), and the possible implication of the free amino group of lysine was suspected in a gelation regime at lower pH. Experiments are in progress on the effect of blocking specific reactive groups in the casein on the propensity to gel, which it is hoped, will throw further light on the types of primary bond involved.

The properties of the gel itself offer another means of obtaining useful information about the general types of linkages formed. Rheologically certain types of behaviour can indicate the type of polymer formed. For instance retarded elasticity, involving a slow recovery from an imposed deformation, is characteristic of linear amorphous polymers, i.e. of a molecular functionality exceeding 2, whereas predominantly elastic behaviour is a manifestation of a three-dimensional network.

Swelling studies can give a good idea of the tightness of the network, and if carried out in liquids of different dielectric constants, the swelling reflects the polarity of the gel. Chemical stability in various solvents is also closely related to the types of bond present, covalent bonds of course yielding the most stable structures, although ionic bonds will be stable in liquids of low dielectric constant. Gels of casein - NaOH - water appear fairly stable chemically in excess water, contrary to earlier concepts, based on the solvent removal hypothesis, although they swell considerably: from these observations a loose covalent network appears to be indicated.

In the study of protein gels forming at high pH another most interesting property of protein molecules has to be taken into consideration. This is the phenomenon of denaturation, which is usually looked upon as an unfolding of the polypeptide chains, which in the native protein molecule are regularly folded into a unique configuration. It is clear that both from the physical and chemical points of view such a change, which may be effected by various means such as acids, alkalis, high temperature and so on, would influence the mechanism of gel formation to a considerable extent. Therefore the degree of denaturation taking place in the casein - alkali system at various pH's has been studied by arresting the gelation process at a fixed instant during the working life, by adding acid to render the protein isoelectric, and then examining the treated samples by various means. Consideration has been given to the appearance of the re-precipitated protein, the viscosity, optical rotation, refractive index, and the turbidity of solutions of constant concentration, and its wide angle X-Ray powder diagram. Although the turbidity measurements confirm the evidence of denaturation suggested by the revelation of the sulfhydryl groups, the other criteria appear to be less sensitive. The X-Ray data, obtained through co-operation with Dr. Wardrop, yield Bragg spacings of ca. $4\frac{1}{2}$ and 10Å, corresponding to the backbone and side chain spacings of Astbury, but show little or no development of the peptide spacing (ca. 3-6Å) which is shown by some denatured proteins.

The above is an outline of aspects of our basic work on adhesion. It must be apparent that in tackling this problem one cannot be too circumscribed by the traditional categories of science, but that it is necessary to draw on concepts and techniques of physics, chemistry and in the protein field, of biochemistry for solution of the problems raised. This is perhaps characteristic of the high polymer field generally. Applications of the casein work extend, we feel, beyond adhesives into the fields of plastics, paper, and paints and to some extent of dairying. Some basic understanding of the phenomena of gelation and adhesion can aid in the development of new glues, e.g. from blood albumen, and in the improvement of existing products, and in addition we hope that the work will establish contact at certain points with physiological problems involving the formation and structure of protein gels, which after all are probably more important than protein molecules, as such, in organic tissues. Thus we contemplate a reciprocal relation between technological problems and the fundamental studies to which they give rise.

30. THE EFFECT OF BORIC ACID AND BORAX TREATMENT ON BONDING WITH PHENOLIC RESINS.

Mr. Gordon: Early investigation of the effects of treating veneers with boric acid and borax prior to bonding into plywood with phenolic resin film (Tego) showed that boric acid had a deleterious effect on the water resistance of the bond but borax treatment was not considered to cause any material decrease in wet strength.

As there are optimum conditions regarding time temperature and pressure for the setting of a resin glue, it was thought that boric acid would prevent a good cure with an alkali curing glue under conditions usually employed. On the other hand borax, being a weak alkali, would not interfere.

However, work on a number of species, especially yellow walnut, has shown that a concentration of boric acid (as boric acid or borax) exceeding 1% causes a marked decrease in both dry and wet shear strength values.

In order to check the supposition that faulty bonding was related to the more acid condition brought about by impregnation with boric acid, veneers of several species were treated with sodium bicarbonate aluminium sulphate, sodium fluoride, borax and boric acid. Reference to Table 1 shows that the pH of the veneers did not affect the bond. The failure therefore appears to be some specific effect of the boron ion. From previous work the only other chemical having a similar effect was arsenic trioxide.

Work by Black[x] of U.S.A. has indicated that borax and boric acid were the only chemicals that had deleterious effect on Tego bonding. Also his work showed that phenolic resin glue was best for bonding impregnated veneers.

Reference to Table 2 shows a falling off of both dry and wet shear strengths when boric acid is used; at 1.5% concentration 57% of dry strength and 80% of dry strength in 3 hour boil test. At a comparable borax concentration 2% (1.4% boric acid) 14% and 46% respectively. These marked differences hold at all concentrations investigated. This establishes that the borax treatment has less effect on the bond than boric acid.

At the 0.2% level the borax results (wet shear) are reasonably good - this is approximately the Lyctus toxicity level, but at 1% the decrease (wet shear) was 18%

Between these limits 0.2 - 0.75% boric acid there will exist a concentration level sufficient to be toxic to Lyctus and yet give a water resistant bond. However, in commercial operations it is unlikely that large batches can be treated within these limits and there is always the possibility that surface concentrations may exceed the upper limit.

The simplest solution appears to be the process used in N.S.W. That is, to use non-susceptible veneers for the centres and immunize the hot plywood in boric acid or borax solution immediately after removal from the hot press.

From work to date the following conclusions may be drawn:-

(a) Dry shear strengths below a 0.5% concentration show little difference between treated and untreated veneers.

(b) Borax has a less severe effect than boric acid (yellow walnut)

(c) Both treatments have a definite and marked deleterious effect on the water resistance of the bond using the following species:

Yellow walnut
Yellow carabeen
Rose alder
White birch.

It is considered likely that effects will be common to all species.

x Black, J.M. Effect of Five Retardant Chemicals on Glues used in Plywood Manufacture. U.S. Depart. of Agriculture. Forest Service, F.P.L., Madison.

TABLE 1.

SPECIES	TESTED DRY				TESTED WET AFTER 3 HR. BOIL				pH
	Shear Strength		Wood Failure		Shear Strength		Wood Failure		
	Av.	Range	Av.	Range	Av.	Range	Av.	Range	
YELLOW WALNUT									
Sodium bicarbonate	344	300-385	32	0-65	290	260-305	26	0-40	8.2
Sodium bicarbonate and borax	225	200-240	35	0-50	160	105-210	21	0-35	8.9
Sodium bicarbonate and boric acid	259	205-305	50	0-80	139	80-168	30	0-50	7.4
Aluminium sulphate	295	275-305	42	0-80	287	230-290	20	0-15	4.1
Sodium fluoride	297	280-315	0		325	260-385	50	40-70	6.6
Control	385	345-425	80	80	300	270-330	72	60-90	5

TABLE 2

RESULTS OF PLYWOOD GLUE SHEAR STRENGTH TESTS ON SPECIMENS IMPREGNATED WITH DIFFERENT PERCENTAGES OF BORIC ACID AND BORAX

Per cent. Concentrationa of Impregnating solution	Per cent. Concentration of H_3BO_3 in samples O.D.wt.	Number of Specimens Tested			DRY(D)		3 HOUR BOIL (B)		48 HR. COLD SOAK (S)	
		D	B	S	Glue shear strength (psi) and percentage wood failure	Per cent. strength loss*	Glue shear strength (psi) and per cent. wood failure	Per cent. strength loss*	Glue shear strength(psi) and per cent. wood failure	Per cent. strength loss*
0% Boric acid		20	20	20	391-70	0	274-100	0	337-44	0
0.1 " "	0.14	20	20	20	315-98	19	219-92	20	220-74	35
0.5 " "	0.60	20	20	20	300-75	23	146-12	47	168-33	50
1.0 " "	1.03	10	10	10	210-89	47	96-26	64	108-22	68
1.5 " "	1.68	10	10	10	170-51	57	56-32	79	68-7	80
0% Borax		34	32	27	377-81	0	321-50	0	348-55	0
0.2 "	0.20	33	38	33	420-89	+11**	309-51	4	367-69	+5.5
1.0 "	0.75	30	24	30	329-93	13	198-19	38	287-62	18
2.0 "	1.40	15	20	19	323-71	14	172-52	46	262-43	25
3.0 "	2.25	37	33	33	257-69	32	64-28	80	165-45	53

**A positive sign indicates an increase in strength.

*The per cent. strength loss is given in terms of the average failing load of the control.

$$\text{i.e. Per cent. strength loss} \left\{ \frac{\text{Average failing load of control - average failing load treated specimen}}{\text{Average failing load of control}} \right\}$$

31. MILL STUDIES AND SAWMILL ENGINEERING.

In the past year the computing and reporting on mill studies conducted by Seasoning Section personnel in previous years has been completed. No new field work has started in the past 12 months. The studies conducted to date relate to milling of cypress pine in Queensland, hardwood in Victoria and jarrah in Western Australia.

Issue of a report on a log edger mill study has been deferred pending action by the owner regarding patents.

Studies of the performance of individual machines have had the attention of the Utilization Section and some data have been gathered on the performance of a Swedish type gang saw, the band saws breaking down hardwood logs, band saws re-sawing pine and hardwoods and a log edger. The material is not yet in a form suitable for release.

A series of descriptions on certain items of sawmill equipment have been published in the Forest Products News Letter as follows:

No. 159 Sawmill Equipment - need for co-operation.
No. 168 Power Chain Saws.
No. 169 Sawmill Equipment - Log Edgers.
No. 171 Plantation Utilization in New Zealand.
No. 172 Double Feed Friction Saw Bench.
No. 173 Automatic Rip Saw Bench.
No. 174 Power Chain Saws.
No. 175 Saw Bench Gauges
No. 176 Docking Saws.
No. 177 Gauges for Docking Saws.

Extension of the series is proposed to cover as many features as are deemed to be suitable for wider adoption in the Australian sawmilling industry. The Division would welcome any suggestions that the individual States may have regarding novel features worth publicizing and would be glad to issue descriptions under joint authorship, if that is desired.

The industries' response to these publications has been gratifying, and there is no doubt that they are promoting thought and reaching people who desire to improve their mill equipment. For instance, the automatic rip saw bench seems to have been known to only a few people since it was originally built by the inventor, and for the last 15 years at least, not more than about 3 benches have been installed. In the month following the release of its description in our News Letter, we have received 15 enquiries for further details by people considering its application for their purposes, and several are under construction. The reading of descriptions of equipment has also apparently made sawmillers realise that further assistance can be rendered, and the Utilization Section has received requests for many complete mill designs. The work is growing and is occupying as much time as can be given by the available staff.

A course in Sawmill Engineering has been prepared and was delivered in Brisbane in July, at the request of the Queensland Timber Stabilization Board and the Forestry Department. The equivalent of 10 hours of lectures was taken up under the following headings:-

1. Log Storage
2. Mill Deck Equipment
3. Log Carriages
4. Breaking-down units
5. Benches, resaws and dockers
6. Conveying machinery
7. Power requirements
8. Power plant
9. Transmission equipment
10. Mill layout.

Work is contemplated on the fundamentals of sawing. Equipment is under construction to allow for the determination of energy absorption during sawing.

Mr. Ellis: The work of the Division on sawmill engineering studies is very much appreciated in Queensland. We have recently appointed a graduate in Mechanical and Electrical Engineering and we hope to send him out into the trade to attend to deficiencies in sawmill engineering. Many small sawmills are in bad shape because the life of the mill does not justify heavy expenditure in replacements. On the other hand there are many mills with an indefinite life which could be brought up to date. The Division's work will be of considerable importance in this connection.

Mr. Turnbull has indicated a gratifying response to his articles and lectures in Queensland. There does seem to be some duplication of effort in that interested millers write both to the Division and to the Queensland Forest Service for the same information. We realise that we are not in a position to provide all the necessary extension service needed in Queensland. I would also suggest that the Queensland office of C.S.I.R.O. should be instructed in the type of enquiries to be sent directly to Q.F.S. and those to be forwarded to Forest Products.

In Queensland we undertake mill studies in relation to costs of production and tie in such factors as extraction cost and stumpage costs. We have conducted studies on 13 hardwoods from 8 men mills to 20 men mills. We have recently appointed a statistician and he has examined the data in hand and has produced a paper "Appropriate Residual Stumpages of Hardwoods collected from Mill Studies". Mr. Grenning will be delivering this paper to the Heads of Forestry Departments Meeting in Perth next month. I shall leave a copy with Mr. Turnbull.

We are also preparing a report which should be available before Christmas on a log edger mill operating on pine plantations.

If the Division has prepared a Working Plan for their project dealing with power requirements for wood working machinery we should be glad to have a copy, because our recently appointed engineer has adopted this as his thesis subject and the report would be helpful to him.

Mr. Clarke: Regarding enquiries forwarded by Miss Todd if Mr. Ellis feels that more effective liaison could be established I would suggest that he contact Miss Todd personally and tell her what type of enquiries he would like referred directly to the Q.F.S.

Mr. Huddleston: I was interested in Mr. Turnbull's paper but was disturbed to realise that the great bulk of the work is concerned with Victoria. I have a sawmill engineer in N.S.W. but he is kept very busy and I would have no objection to C.S.I.R.O. handling extension work in sawmill engineering in N.S.W. My engineer has found all sorts of problems which need investigation on a fundamental or basic research level e.g. correct rate of feed for any particular timber, shape of the saw tooth, power requirements for sawmills etc. If the Division of Forest Products could prepare a Working Plan to investigate these problems this would be a major service to us and to the industry.

Another problem which comes to mind is in the sawing of brush box. After a log of brush box has been sawn in a mill cutting mixed hardwoods the saw is unsuitable for cutting any other species. This, in the past, has been attributed to dulling of saw teeth by silica present in the timber. It has been suggested that one of the chemical constituents of brush box corrodes the point of the tooth and I feel there is a large scope for investigational work in this direction.

There is such a dearth of information on sawmill engineering that the Division could employ a large staff on basic or fundamental research to provide information which the States could apply directly to the industry.

I have contacted Mr. Andrews of the C.S.I.R.O. Information Office in Sydney and discussed with him the type of enquiries to be forwarded directly to the Division of Wood Technology. If he is in doubt on a particular query he rings me up and I suggest to Mr. Ellis that a similar scheme might be applicable in Queensland.

Mr. Turnbull: I am aware of the tremendous field of work here but our staff is limited and projects handled are those most likely to give rapid results. We have not transgressed on the provinces of N.S.W. and Queensland as far as mill design is concerned. The designs have been for sawmillers approaching us, and we have assisted them to the best of our ability. Designs have been prepared for New Guinea, Tasmania, West Australia and South Australia as well as Victorian sawmills.

It is by a gradual process of improvement of individual sawmills that we will get an overall improvement in Australian sawmilling practice which to me appears so necessary.

Mr. Clarke: Some experience in mill design is necessary if our work on the fundamental problems is to be effective. The experimental bench which is nearly completed is not a production bench but a piece of equipment designed to study saw tooth design, design of circular saws and power requirements under various conditions.

I appreciate the problem of overlap and this will have to be kept in mind. At an early stage Mr. Turnbull or one of the State officers might get out suggestions for the collection of material in all States and the free exchange of information on sawmill engineering.

Mr. Huddleston: I would like to emphasize again the need for basic information on sawmill engineering and would like the Division of Forest Products to bring before the C.S.I.R.O. Executive the need for staff and equipment to be made available to undertake this work.

Mr. McAdam: I would support Mr. Huddleston in the need for intensification of attack on this problem. I would also like to thank Mr. Turnbull and members of the Utilization Section for work carried out for New Guinea during the year on sawmill design.

Mr. Clarke: The difficulty is in getting the equipment built. The project has high priority in our programme of work.

32. TANNING MATERIALS.

Mr. Hillis: The uncertainty of future supplies of tanning agents is causing great anxiety throughout the world. The supply of tannin obtained from the American and Italian chestnut stands will be exhausted within a few years, as the major portion of the commercial stands has been killed by blight. Partly due to the reduction of this supply and partly due to the increased consumption of certain extracts as a result of international conditions, serious inroads have been made into the quebracho forests of tropical South America. This tree takes 125-150 years to reach maturity and at the present rate of demand and existing types of forest management, it was stated recently that this supply will seriously decline in 20-30 years. These serious losses of supplies could be overcome, probably, by enormously increasing the acreage of wattle plantations, but such a step would seriously interfere with the world food programme. Moreover, the economics of such a proposal would confine it to those countries with a cheap labour source.

Thus, it is obvious that the position is becoming increasingly serious. In most other countries the situation has been under close examination for the past few years.

Since the beginning of this year, concrete evidence has been obtained by Dr. Theodore White of England, and by this Division, showing that tannin is a mixture of many relatively simple closely-related substances. These two discoveries cast serious doubts on previous theories and speculations. Dr. White has identified many of the components of quebracho tannin and we have commenced a study on two of the components of marri kino. When the components of these tannins are identified, it will be easier to find the essentials for a material to change hide to leather of desired properties. It is indeed fortunate that that this critical stage of consideration of tannin sources, the fundamental study of tannin composition has at last become dynamic. With the above developments, it appears possible that in a few years we will be able to predict the suitability of a tannin source and perhaps indicate a suitable modification.

However, in the meantime, the possible future supplementary sources of organic tanning agents can be divided into -

(a) Synthetic tanning materials,

(b) Lignin derivatives,

(c) New natural tannin sources.

(a) <u>Synthetic Tanning Materials, or "Syntans"</u>. The raw materials are usually phenols, naphthalene, urea, etc., formaldehyde and sulphuric acid or sodium sulphite. Some are able to replace vegetable tannins, some are auxiliary and combination types which act as dispersing agents or adsorb on vegetable tannins to make them more lyophilic. The high cost of raw materials limits their use but Germany alone produced 23,000 tons of syntans in 1943. Research in this field is currently active in attempt to remove disadvantages and reduce costs.

(b) Lignin Derivatives. The tanning potential of lignin has been widely studied and definitely demonstrated. Limited quantities of the so-called "sulphite cellulose" - ligno sulphonic acid - are being used. The general conclusion has been reached that fixation of lignosulphonic by hide protein occurs at the free amino groups. Recent evidence indicates that magnesium lignosulphonate fixes at points other than the free amino groups and that it is this additional fixation which enables the production of a more satisfactory leather than has been possible with other types of lignins.

Because there is an abundant wastage of lignin at pulp mills, it can be produced cheaply enough to justify investigations aimed at chemical modification to produce satisfactory tanning agents. Already the Foundation Tanner's Council of America has iniated a programme of investigation into this field.

(c) New Natural Tannin Sources. The above two sources can only assume importance after a long range research programme. Sources capable of a quicker return of positive results should be sought and in this regard Australasia appears to be more fortunate than the older nations. All the natural and existing tannin sources have not been accurately assessed and moreover those known to exist, although perhaps in a new and unusual manner, have not been examined to the extent they justify.

Australia's potential sources are to be found in the kinos and from the usual tannin sources.

(i) Kino field. The causes of kino vein formation has been studied by the Canberra Forestry

Bureau and their results suggest that it may be possible to produce free kino, at will, and in such quantity that the tree may be harvested not for structural timber but for tannin. The possibility of utilizing the extracted wood as a raw material for pulp also exists. The fundamental problem is to devise a suitable method for removing the kino in form suitable for tanning hides.

This Division has initiated an investigation on jarrah and marri, the former containing cellular kino, the latter free kino. This field of study is almost entirely new and the investigations are still in the exploratory stage.

Since 1940, oversea workers have shown that a resistant intercellular membrane substance exists in certain timbers. This membrane prevents certain solvents dissolving the cell contents. This effect was first observed by Erdtman in *Pinus sylvestris* and recently two Indian workers reported the results of an examination of *Acacia catechu*, which indicate the presence of a similar membrane.

In jarrah, Dr. Chattaway has observed what might be a similar type of membrane. Unfortunately, it has not been possible to demonstrate its nature decisively. At least, we know that it is more resistant than Erdtman's membrane substance. If, as we think, such a membrane is present, then it will be impossible to extract, completely, the extraneous components until this membrane is ruptured or dissolved. Obviously the standard tannin analysis will not give the true tannin content of some of our eucalypts.

At the moment we are searching for a solvent that will remove completely the cellular kino in an unchanged form from jarrah. When this is achieved we will commence its examination, with the ultimate aim of designing an extraction procedure which will yeild a cheap and suitable tanning extract.

We have separated marri kino into a red brown coloured tannin fraction and a blood red pigment fraction. From the former we have separated a crystalline compound and from the latter aromadendrin - a material of unknown constitution. Both of these substances are being currently investigated.

The new paper partition chromatography technique has been applied to the kinos and developed with spectacular success. It shows that marri kino contains at least six components. Compound B has an intense purple fluorescence under ultra violet light and this technique shows that it is the principal component of the jarrah extracts so far obtained. Also this technique shows that the above red pigment is not a separate entity and at the moment it is not possible to say just what constitutes the tannin fraction and what is responsible for the red colour. However, we hope to be able to isolate those materials responsible for the colour and because they could conceivably be responsible for the colour in mangrove and ironbark tannin, a detailed knowledge of them may be valuable in this connection. In fact, the red colour is a major disadvantage with many of our undeveloped tannins.

(ii) <u>Usual Tannin Sources</u>. About 10,000 tons of "Myrtan" (from bark and wood of <u>E. redunca</u> var. elata) are produced in Western Australia. Also that State has a plantation of 17,000 acres of mallet which will soon be ready for harvesting.

There are still large natural stands of wattle that could be exploited, but lack of labour presents a problem. It is little cheaper than the imported wattle extract and we have little use for the timber. For economic reasons, the best approach for Australia appears to be to find a non-seasonal raw material supply, requiring a minimum of labour.

The most attractive alternatives appear to be either the use of a complete tree (as with E. reduncа) or by using suitable sawmill waste bark. In this regard Anderson and his school in Sydney have examined from a tanner's viewpoint the barks of Callitris calcarata and C. glauca, E. rostrata, E. crebra, and Rhizophera mangrove, also the wood of E. sieberiana. They have reported results that are on the whole encouraging.

In 1937, the U.S. Department of Agriculture published an excellent survey carried out on the potentialities of Western hemlock bark as a tanning material. Amongst other important conclusions they stated that the smallest practical extract plant should have an annual capacity of 2000 tons powdered hemlock extract (55% tannin) per year from bark with a tannin content greater than 7 per cent. In suitable extracts the tannin content is greater than the non-tannin, i.e., purity is greater than 50. Thus successful utilization of bark hinges on a rather narrow working range. It may be possible to use a timber with a lower content of tannin if an extraction stage could be included in the manufacture of paper pulp.

Coghill's Bulletin No. 32 "A Survey of the Tannin Materials of Australia" is commonly used as a guide to determine the suitability of Australian raw materials. However, the reliability of his figures have been questioned by later workers. In view of the introductory remarks made in this talk, it appears advisable that a new tannin survey should be made, with attention to all details of sample collection.

The following factors should be considered:

(a) Samples should be collected from trees identified by a botanist,

(b) Samples should be collected in accordance with a statistical plan, which should consider variations due to season, age of tree, height and aspect at which the sample is taken.

As samples often have to be examined some distance from the collection area, particular attention must be paid to the factors of -

(c) Protection against enzyme action. This can rapidly reduce the tannin content and impair the colour. Phenylmercuric acetate is the best sterilizing agent available and is effective in 1 part/200,000.

(d) Protection against oxygen which may proceed without the catalysing effect of enzymes. It has the same detrimental effect as the enzymes. The sample may be protected by placing under oil, or in the smallest possible airtight container.

(e) Protection against heat. Increase in temperature increases the rate of absorption of oxygen and also modifies the tannins by increasing the rate of condensation to unsuitable forms.

(f) Protection against light. Ultraviolet light has been reported as reducing tannin content and producing a deeper colour.

(g) Although little protection can be taken against the action of metals when preparing samples, it is well to remember that their presence can cause serious changes in the tannin molecules sufficient to lower the estimated content. Most of them assist oxygen absorption.

<u>To summarize</u>, it appears that Australia is potentially capable of supplying an appreciable proportion of the world's demand of vegetable tannins. Future planning would be greatly assisted if reliable figures of the tannin content of our raw materials were available. Also this country is greatly in need of the results of an extensive survey of the potentialities as a tanning agent of one of our promising barks. Because most future extraction plants will have to work on a rather narrow profit range, slight variations in factors such as labour and transport cost, price of oversea supplies etc. may mean the difference between success or failure on a monetary standard. In order that this survey may ascertain all the factors necessary for the successful operation of

an extract plant in Australia at any time, it is suggested that the survey be done in collaboration with an economist.

Mr. Huddleston: We are particularly interested in a tannin survey and the development of tanning materials. We have had a survey conducted recently on the south coast of N.S.W., which was the main wattle producing district of the State. We were alarmed to find a very limited supply of wattle left. The eucalypts are excluding the wattles.

With regard to other materials for tannin extraction we have been conducting a survey and will be issuing a progress report shortly. We are mainly concerned with the silviculture of black wattle. We have examined a number of samples grown from selected seeds of high yielding strains of wattle and this examination has revealed that the high tannin content is affected by site and other considerations. We are also conducting a survey to ascertain suitable areas for reafforestation of black wattle.

Examination of the bark of black pine was made by Dr. Anderson on the suggestion of our Division and following information supplied by him we have endeavoured to have black pine bark included in the normal tanning industry. Last week we were successful in getting a sawmiller and a tanner to sign a contract for £10 ton. The contract was on the basis that the average tan content of the bark would be 20% or better and the Forestry Commission has undertaken to check this content every two or three months.

We have appointed a chemist in order that the work may proceed. He has been trained by Dr. Anderson for 6 months in methods of tannin analysis and is now doing the Diploma of Leather Chemistry at the Sydney Technical College. We will be glad to do our part in the extension work which the development of tanning materials will require. When the Division of Forest Products is undertaking work on tannin, whether basic research or extension work, my Division will be pleased to cooperate.

Mr. Ellis: Has the question of a survey been discussed with the Leather Research Association or with the Department of Secondary Industries?

Mr. Clarke: This Division would not undertake such a survey. We are interested more in the chemistry of the timber at this stage and in the possibility of integrating industries. You could bring the matter to the notice of the Leather Research Association and ask them to carry out the survey.

Mr. Payne: Most Tasmanian wattle is situated on the east coast and is grown in conjunction with sheep farming. Reliable production figures should be easy to obtain and I will forward these to the Division on my return.

Mr. Benallack: Production of wattle bark in Victoria has been severely limited by lack of labour as shown by a recent survey of the position. The fact that harvesting is seasonal makes the labour situation more difficult, and as the Acacia is short lived, we realize that considerable quantities of bark are lost when stripping cannot be carried out regularly each year. As yet we can see no remedy to meet the labour problem.

Mr. Huddleston: A difficulty in stripping wattle bark is the scattered incidence of the tree. Stripping is expensive and men can earn better money in the sawmilling industry.

Mr. Hillis: I would like to emphasize the seriousness of the position. There are 120,000,000 tons of wood in the quebracho forests. At an annual cut of 4,000,000 - 5,000,000 tons this will be seriously diminished in 20 years' time. American chestnut stands produce 60,000 tons/annum and will not last much longer. 50 years ago mangrove extract was regarded favourably by tanners but has been supplanted by lighter extracts. Can Mr. McAdam give an indication of the labour position in New Guinea?

If mangrove extract could be produced there at a lower cost than wattle this might allow sufficient margin to pay for reduction of the dark colour.

Mr. McAdam: The labour position in New Guinea is very bad. Only 60,000 labourers are available for plantations, gold mining and oil projects. Mangrove forests are composed of about twelve species and quite a lot of work would have to be done on the relative merits of the different species. Would the Division of Forest Products be interested in doing some work if we supplied specimens?

Mr. Clarke: Such specimens should be supplied to Dr. Anderson for analysis and report.

Mr. Hillis: He has examined a Queensland Rhizophera with unfavourable results.

Mr. McAdam: There is a big problem associated with collection of mangrove bark in that there is no outlet for the resultant timber. Mangrove timber is hard to nail and checks badly.

Mr. Turnbull: Has any consideration been given to the applicability of mechanical and hydraulic de-barkers developed for the pulp industry? These might overcome the labor difficulty in tan bark harvesting.

Mr. Huddleston: We have examined the possibility of using such de-barkers and feel that these would be suitable if we could get an integrated industry to use the resultant timber. Black wattle is felled solely for its bark. If we are to establish an extract plant it will have to be associated with some industry that will make use of the vast quantity of timber produced.

33. THE MINOR CHEMICAL PRODUCTS OF QUEENSLAND RAIN FORESTS.

Mr. Amos: The following material was prepared by Mr. L.J. Webb of the Division of Plant Industry, C.S.I.R.O.

As sources of special extractives, the ready availability at sawmills of the bark and sawdust of commercial timbers is certainly attractive. But the tabulation, on an authentic and systematic basis, of the constituents of our local rainforest trees is a task which will take many years. It is in many cases impossible to predict whether any of the substances which are isolated and identified will have any value. Of course, if an alkaloid with desirable therapeutic effects were found in considerable quantities - such as hyoscine in Duboisia - the possibilities of its successful commercial exploitation would be high. But in the case of new alkaloids, or nondescript compounds, much will depend on the thoroughness with which their physiological effects are tested. Since pharmacological facilities in Australia are comparatively limited, this means that, as far as development of new compounds in medicine is concerned, we generally look overseas for "leads". The same would be largely true of industrial developments. An example from the medical field might make this clear. About three years ago, workers in the National Cancer Institute, Bethesda, U.S.A. found that the roots of Podophyllum peltatum yielded a substance inimical to tumour growth in mice. Its rather sensational promise as an anti-cancer agent prompted a systematic search of plant products for similar activity and this research is now in progress. Last year it was reported that, out of some twelve hundred organic compounds screened for anti-tumour activity in mice, eight out of fifty-three alkaloids, as well as a number of other types of compounds, were promising. Screening tests which reveal certain types of anti-cancer agents were recently begun in Canberra, and already several plants have shown great promise.

The point to be made in this case is that, without the "lead" from overseas workers who have adequate facilities, we would not have known which type of substances to search for.

A more recent example is cortisone, from the seeds of an African Strophanthus. Cortisone has been acclaimed of great value in the treatment of arthritis and rheumatic fever. Have we a rich source of cortisone in any of our plants? Results of preliminary tests for this type of compound suggest that we have a number of species worthy of further investigation.

For example, a resin acid called podocarpic acid has been isolated from the wood of Dacrydium cupressinum and Podocarpus dacrydioides. This was shown last year by Brandt and Ross to possess oestrogenic activity - that is, to have an effect like the female sex hormone. Certain Mexican plants have recently been developed as commercial sources of the male sex hormone (testosterone). Therefore there is considerable scope for the preparation of useful therapeutics from substances of this type. We have already found several of these "lignanes" in Queensland trees, and they should certainly be followed up.

Another example is rutin, a pigment with an effect like Vitamin P, which keeps the walls of the smaller blood-vessels in a supple and healthy condition. The use of rutin in medicine was developed in America several years ago, using buckwheat as a source of the drug. Over fifty years ago, rutin had been recorded in the yellow stringybark (Eucalyptus macrorrhyncha) by Smith. Until the recent American developments, this record was an academic curiosity. Now we have shown that the leaves (particularly the young leaves) of the yellow stringybark is a far superior source of rutin than buckwheat, containing up to four times the amount of the drug in the latter.

So much, then, for the possibilities and the difficulties attending a phytochemical survey in Australia.

But already the chemical and pharmacological survey of Australian plants has produced positive results, and you may be interested to hear something about this work and its historical background, particularly with regard to alkaloids.

In 1861, Zeyer inaugurated the investigation of Australian plant alkaloids by his paper on "Southern Sassafras" (Atherosperma moschatum), a rainforest tree of Southern Australia and Tasmania. He obtained a white, bitter powder which melted at 128°, and which he called "atherospermine". He was not able to establish its formula. Eighty-six years later, that is, in 1947, Dr. Price of C.S.I.R.O. followed up this work. The main alkaloid was found to be a bisbenzylisoquinoline, which type is common in Monimiaceae, Lauraceae and certain related families, and further work is proceeding.

Soon after Zeyer's work, Palm, Jobst, Hesse and others examined the alkaloids in species of Alstonia, which include "Bitter Bark" and "Milky Pine" or "White Cheesewood". As an illustration of the difficulty of this type of work, the alkaloid from "Bitter Bark" was not obtained crystalline until 1934.

In the 1870's, Dr. Joseph Bancroft, in studies which are now classical, discovered the powerful therapeutic properties of native Duboisia spp., sometimes called "Corkwood". The successful exploitation of D. leichhardtii and D. myoporoides as sources of the drugs hyoscine and atropine since about 1942 is well-known.

His son, Dr. Thomas Lane Bancroft, carried on his work, paying particular attention to the pharmacology of native plants. Towards the end of last century he recorded some dozens of local plants which exhibited toxic properties.

Although by present-day standards, their work lacks the sophistication and thoroughness associated with modern chemical and pharmacological laboratories, it is freely admitted that the Bancrofts pioneered these aspects of plant science in Australia.

At the turn of the century, interest in vegetable drugs began to wane. With some exceptions, it was not until the present decade that any systematic attention was paid to the chemistry of the native plant products.

This attention was stimulated by developments overseas, by which powerful new antibiotics, anti-malarials, insecticides, and so forth had been revealed in the plant kingdom. (In the forest products field, the American journal "Chemurgic Digest" gives many fascinating examples of increased utilization (such as tannins) and is recommended to anyone interested in this aspect). Prompted by the emergencies of war, C.S.I.R.O. began a search of the native flora for strategic drugs. This search has now broadened out, with the co-operation of Australian Universities, into a systematic phytochemical survey.

Over forty chemists and several physiologists are now involved, and their interests range from pigments and resins to prussic acid and alkaloids.

Perhaps you may be interested to know how we tackle the problem of selecting interesting or promising plants. The first step was to collate recorded information about native plants on a botanical, chemical, and pharmacological basis. We started in Queensland, because of the variety of species offered by the tropical rainforests. In 1946 a Bulletin (C.S.I.R.O. Bulletin 232), entitled "Guide to the Medicinal and Poisonous Plants of Queensland" was prepared. Unfortunately, the publication of this Bulletin was delayed, but it became available a couple of months ago. Since 1946, our card index of information has grown considerably, and includes many tests and analyses made in the current survey.

On the basis of this collated information, species were then located, identified, collected and screened "in the field" for alkaloids, saponins, sterols, triterpenes, cyano-genetic glycosides, nitrates, pigments, pectins, rotenone, essential or drying oils, or whichever general class of compounds was required. A system of semi-micro tests for many of these compounds was evolved, enabling the rapid and generally reliable screening of fragments of bark, leaves, wood etc. As a matter of interest, this method has been extended with success to fragments from herbarium specimens in the Queensland Herbarium. A reconnaissance of the Queensland Rutaceae, for example, revealed that, of some 120 species, we can expect about 30 to yield alkaloids in appreciable amounts. In the case of groups with stable alkaloids, the method is remarkably effective. An interesting record was the discovery of alkaloids in samples of leaves and branchlets of the small tree Acronychia baueri, which had been collected by Alan Cunningham 125 years ago.

Plants which give good positive spot-tests are extracted, and the occurrence of alkaloids confirmed, because occasionally pseudo-alkaloids (such as betaines, proteins etc.) may give positive results in the preliminary test. For example, out of a total of about 120 genera listed as commercial timbers (in Part II of Trade Circular No. 47), 14 genera contained species giving excellent spot-tests for alkaloids. Alkaloids have been confirmed in eight of these genera (Alstonia, Atherosperma, Cryptocarya, Daphnandra, Doryphora, Erythrina, Erythrophloeum, Flindersia). Twelve genera have not yet been tested.

In Francis's "Australian Rain Forest Trees", there are about 180 genera. Thirty-five genera gave excellent spot-tests for alkaloids. Alkaloids have already been confirmed in 22 of these, which include the following genera additional to those mentioned above: Acronychia, Alangium, Duboisia, Evodia, Hernandia, Himantandra, Hodgkinsonia, Medicosma, Melicope, Ochrosia, Pentaceras, Pithecolobium, Solanum, Strychnos and Zanthoxylum.

Promising species are then collected. Sometimes up to one cwt. of dried bark or leaves may be required for detailed analysis. The samples are then forwarded to laboratories at Sydney, Melbourne or Queensland Universities, or to C.S.I.R.O. laboratories at Canberra or Melbourne.

The original idea was that the species would undergo a second "pharmacological screening" at the Physiology Department, University of Melbourne, and any promising plants (for example, narcotics, local anaesthetics) passed over to the organic chemists for isolation and purification of the alkaloids etc. These would then be returned to the pharmacologist for complete testing.

Unfortunately, limitation of facilities at the Physiology Department, Melbourne, caused a "bottleneck". Samples were then passed on directly to the chemists, care being taken, where possible to select species not only because they gave good tests for alkaloids, but also on the basis of their affinities to species yielding known drugs. The chemist then passes over his chacterised compounds to the pharmacologist, but in view of the tedious nature of isolation and crystallisation, the process before pharmacological testing, in this case, may be a long one.

Fortunately, we have now been promised additional pharmacological facilities at Sydney University early next year, and this should relieve the position.

It is pleasing to report, however, that chemical facilities have expanded about tenfold since the survey began in 1944, when only a handful of organic chemists were available.

In the Chemistry Department at the University of Queensland, Sutherland, Davenport, and an honours student are working on essential oils, while Lahey and Hegarty are working mainly on alkaloids. At the Physiology

Department, Miss Scott is tackling the pharmacology of several plants poisonous to stock.

At Sydney University, in the Chemistry Department, is the biggest team of chemical workers, directed by Hughes and Ritchie. Lecturers, research fellows, and honours students are involved. A routine procedure in this laboratory is to extract every sample with a number of solvents (such as ether, alcohol, chloroform etc.). Anything recovered which looks interesting is immediately seized, crystallized, degraded, synythesised, and in general made the subject of a very vigorous and systematic investigation. This policy has already paid dividends, and numerous alkaloids, coumarins, lignanes, sugars, alcohols, glycosides, triterpenes, pigments and acids - many of them new - have been isolated and in some cases characterised. Several of the alkaloids, with the limited testing so far available, have shown promise from the pharmacological point of view.

At Sydney Technical College is another active group of chemists (Reuter, Dunstan, Simes, Eade and Shaw) whose interests range over pectins, saponins, resins and antibiotics.

At the Chemistry Department, University of Melbourne, Dr. Price of C.S.I.R.O. has accommodation, and with several assistants is actively pursuing a comprehensive programme whereby nearly 30 alkaloids have already been isolated and many of them characterised. Cooke and an assistant, also in the Chemistry Department, are working on pigments, and have reported several new "finds". In addition to these four major chemical groups, are several smaller groups and individuals (including an active group at Perth) working on the chemistry of natural plant products.

It would be out of place to attempt to itemize the results of the phytochemical survey to date. A number of papers has already been published, and many more are with the printer and in course of preparation. One or two examples may, however, be selected to illustrate the relevance of this research to the forest products field.

From a physiological point of view, the most spectacular "find" to date is Cryptocarya pleurosperma, now popularly known in North Queensland as "Poison Walnut". The sap and bark of this rainforest tree yield a highly toxic and blistering alkaloid, and cause unpleasant symptoms of poisoning when handled or otherwise brought in contact with the skin. A summary of these effects, together with a discussion of their relevance to timberworkers, appeared in a recent Forest Products Newsletter. This story is not by any means finished. Recent tests by Dr. Barnard at Canberra suggest that the alkaloid "cryptopleurine" has an action on the chromosomes of dividing cells which is comparable with that of colchicine. The chromosomes at metaphose in mitosis are much shortened: they divide but formation of a spindle is inhibited. The chromosomes do not separate normally into two groups, each group becoming a daughter nucleus but revert to a resting stage with the result that many nuclei are formed with double the usual number of chromosomes. This "colchicine" action is also a character of podophyllin, of which previous mention was made in connection with anti-tumour action. Cryptopleurine is therefore worthy of testing for similar anti-cancer properties.

Another unpleasant plant of the rainforests, whose notoriety is of long-standing, is the Stinging Tree (Laportea spp.). A chemical and physiological investigation of leaves of L. moroides, the Mulberry-leaved "Stinger", which is probably the most virulent, was begun recently by Professor Shaw of Melbourne University. One aim of this work is to evolve, if possible, an antidote. Those of us who have made the acquaintance of the "Stinger" or "Gympie" will wish Professor Shaw every success in his humanitarian venture.

Last year, the Secretary of the Queensland Forestry Department supplied a list of 24 trees of millable size which are reputed to be injurious to the health of timber workers. In only a few cases is the poisonous principle known. An irritant saponin occurs in Albizzia (Siris). A powerful proteolytic enzyme and possibly an irritant phenol occur in Exaccaria ("Blind-your-eyes"). Cardol (another phenol) is probably responsible for the irritant action of the Tar Tree (Semecarpus). It was suggested that the trees be investigated, with an eye to prevention or treatment of the irritations.

Actually, barks from about fifty commercial timber species have been collected for examination in the phytochemical survey. These are:-

White siris	...	*Ailanthus malabarica*
Red siris	...	*Albizzia toona*
Red almond	...	*Alphitonia excelsa*
Smooth-barked apple	...	*Angophora lanceolata*
Southern sassafras	...	*Atherosperma moschatum*
Ivory birch	...	*Baloghia lucida*
Rose butternut	...	*Blepharocarya involucrigera*
Black bean	...	*Castanospermum australe*
Orange boxwood	...	*Celastrus dispermus*
Red cedar	...	*Cedrela toona*
Oliver's sassafras	...	*Cinnamomum oliveri*
Corduroy, silver sycamore, etc.	...	*Cryptocarya* spp.
Socket wood, northern sassafras	..	*Daphnandra* spp.
Native tamarind	...	*Diploglottis cunninghamii*
Sassafras	...	*Doryphora sassafras*
Spur mahogany	...	*Dysoxylum pettigrewianum*
Silver quandong	...	*Elaeocarpus grandis*
Sandalbox	...	*Eremophila mitchelli*
Grey Corkwood	...	*Erythrina vespertilio*
White evoida	...	*Evodia micrococca*

Native cherry	...	*Exocarpus cupressiformis*
Ashes, maples etc.	...	*Flindersia* spp.
Green satinheart	...	*Geijera salicifolia*
Saffron-heart	...	*Halfordia scleroxyla*
Tulipwood	...	*Harpullia pendula*
Fibrewood	...	*Laportea* spp.
Bollywood	...	*Litsea* spp.
Basswood	...	*Panax* spp. (*Polyseias* spp.)
Satinbox	...	*Phebalium squameus*
White holly	...	*Pittosporum rhombifolium*
Silver aspen	...	*Pleiococca wilcoxiana*
Brown pine	...	*Podocarpus elata*
Cheesewood	...	*Sarcocephalus cordatus*
Yellow boxwood	...	*Sideroxylon pohlmanianum*
Ivorywood	...	*Siphonodon australe*
Satinay etc.	...	*Syncarpia* spp.
Silky beech	...	*Villaresia* spp.
Yellow hollywood	...	*Vitex lignum-vitae*
Native pear	...	*Xylomelum pyriforme*

I am sure that the publication of the results of investigations with these commercial timbers will be of great interest to those interested in forest products.

And now, before concluding, a few comments on matters of more immediate and practical importance to forest products research.

Chemical compounds, as well as morphological characters like leaf and wood-pore shape and size, can be used to characterise species. When a rapid spot-test is available, chemical methods may be used as an aid in identification. Froth tests - depending on the presence of saponins - are already used in the Division of Forest Products' key to the identification of commercial timber species. Dr. Cohen has used some simple chemical tests on wood extracts of the genus *Eucalyptus*, as an adjunct to microscopic examination.

It is conceivable that further simple spot-tests for alkaloids and so on may be useful in certain cases. A number of closely related species of Evodia, Acronychia, and Melicope, for example, are readily distinguished in this way. Thus, of the closely related M. fareana and M. sessiliflora, the former is rich in alkaloids, while the latter has no alkaloids.

The "chemical picture" of plants may also be useful in their classification. For example, it has been suggested by Dr. Dadswell and Mr. C.T. White, on the basis of anatomical and other evidence, that the genus Flindersia (now placed in the family Rutaceae), should be separated in the monotypic family Flindersiaceae. Results to date on the alkaloids of Flindersia do not support this suggestion, at least as far as the F. collina - F.maculosa group is concerned. The former contains a furanoquinoline type of alkaloid, in common with certain other members of Rutaceae. As this type of alkaloid is relatively restricted, the chemical evidence suggests - as Robert Brown pointed out - a close taxonomic connection between the Flindersias mentioned and the tribe Xanthoxyleae of Rutaceae.

The chemistry of decay-resistance is another subject which is in its infancy. Plant pathology, dealing with abnormal disturbances in plants and their remedies, is beginning to find that specific chemical substances may be responsible for the resistance of plants to certain diseases. Work of this type has been proceeding for some years as part of the programme of the Forest Products Research Board, D.S.I.R., London - such as the biochemistry of the wood-rotting fungi Lentinus and Trametes investigated by Birkinshaw and others. A topical example is the suggestion by Amos and Dadswell that marine borer-resistance (Teredo) in Australian turpentine may be correlated with high silica content. Similarly, the immunity of cypress has been attributed to certain phenols. Phenolic compounds, in particular, seem to play an intimate role in determining resistance of certain timbers to attack by insects and fungi. Grundon and King showed early this year that Iroko, the decay-resistant timber of Chlorophora excelsa, an African tree, contains 2-8 per cent. of a phenol of the stilbene type.

This fascinating and little-trodden path has obvious economic implications. The explanation of specific resistance would at once provide a weapon against specific diseases. If the chemical agent responsible - or some more powerful derivative - could be prepared cheaply, treatment of the timbers would be possible.

But perhaps enough has been said to illustrate some of the ways in which the phytochemical survey may be of value in the forest products field. The attendance of representatives from this field at our "Phytochemistry Conference" last January began what I trust will be a long and mutually beneficial association.

Finally, a word should be added in acknowledgment of the assistance by collection of samples which we have received from the various State Forestry Departments. In Queensland in particular, where most of our work has been concentrated, the Brisbane staff and field officers of the Forestry Department have gone out of their way to help the phytochemical survey. I hope that future results will vindicate their generous interest.

Mr. Ellis: It is very gratifying that this work is proceeding and being handled by such an enthusiastic and capable man as Mr. Webb. We have been very happy to co-operate with him. We hope that Mr. Webb will continue his work until he obtains complete satisfaction.

I would suggest that Mr. Tamblyn contact Mr. Webb in connection with the collection of forest fungi. He would be in a better position to carry out a systematic forest collection than any other Queensland forest officer.

34. STANDARDIZATION OF TEST FOR YIELD OF ESSENTIAL OILS FROM LEAVES AND METHODS OF WOOD ASH ANALYSIS.

Mr. Cokley: We are doing some work in Queensland on essential oils and on wood ash analysis. We have no standard set up for sampling and testing in the laboratory for either essential oils or wood ash. As an example, in testing for essential oils, where you have a branch of ½ in. thickness, do you just take the leaves, and for what chemicals should you check etc.? In the case of wood ash, what size mesh should you use for taking samples, and what chemical constituents should you look for?

We wonder if it would be possible to get a uniform system in each case. In the case of essential oils, I would suggest we adopt Mr. Bryant's system - he has done a lot of work on this - and in the case of the ash samples to adopt a system that your Division is using for this purpose.

Mr. Huddleston: I am afraid I cannot add much to this discussion. I agree that if we could find a standard method of dealing with essential oils it would be very desirable to standardize. But the method of analysing for essential oils depends on where the oil appears in the tree. We have adopted methods for particular oils, methods of sampling and methods of analysis to obtain the yield, but the development of a method of sampling depends on the occurrence of the oil and the nature of the tree. I think all we can do is to maintain fairly close contact with each other.

Mr. Watson: The Division has no standard method for wood ash analysis. All that is laid down is in an old publication on the determination of alkalinity of ash. This states that a sample of wood is heated at a dull red heat for about one hour.

Recent work has shown that this procedure is unsatisfactory because it does not define the conditions closely enough. There are two problems: the determination of the total amount of ash, and the analysis of the ash constituents. We have done very little on the latter but we frequently carry out ash determinations on wood and pulp samples. The first essential is to state the temperature to be used during the ashing. If this is to be done it requires a fairly accurately controlled furnace. The sample size and method of preparation also require some consideration, but we have not given very much attention to them. We have taken samples prepared in the Wiley mill or prepared by rasping. In work carried out in this Division by Mr. Amos and Mr. Stewart they obtained better agreement in ash values if, in addition to using accurate temperature control, they added a standard amount of ammonium nitrate to the ash towards the end of the ignition.

One other method of ashing which overcomes some of the possible loss of volatiles is to carry out ignition in the presence of sulphuric acid. This precludes carrying out tests for the presence of various anions.

Mr. Cokley: Might I suggest that we correspond with your Division and with Mr. Huddleston, and whatever method is decided upon between us as a result of that correspondence be adopted by us? Our attitude is that we are just starting off, and we want to follow the same procedure as your Division and Mr. Huddleston.

Mr. West: A minor point - is the ignition done in a muffle or over a flame?

Mr. Watson: In an electric muffle furnace.

Mr. Bland: I have done more ash determinations on coal than on wood; with coal I have found that very much better and cleaner ashes are obtained if the sample is placed in a cold muffle and the muffle is then switched on and taken up to the temperature. If the sample is placed in a hot muffle there is an immediate escape of gas which ignites and carries away part of the sample. Also rapid charring leads to the formation of carbon which is difficult to get rid of. This is probably less important with wood than with coal, but I think it is something that should be considered.

Another point, small but important, is that we should always take the trouble to distinguish between wood ash determination and wood ash analysis. It is a mistake that often occurs and it can lead to confusion. I think we should start on the right foot: consider these two things as separate items, and to stick to the correct terminology.

Ash determinations done here range from less than 0.1 per cent. to 5 per cent., therefore a method must not be so rigid as to tie the analyst down to a given quantity of sample which might give almost no ash in some cases, and large amounts in others.

Mr. West: Regarding the reason for not putting it straight into a hot muffle, do you oven-dry the sample before it goes in?

Mr. Bland: No the sample is used air dry.

Mr. West: It would have 10 or 12 per cent. moisture.

Mr. Bland: Yes, but the evolution of gas by decomposition is the more important factor.

35. GENERAL ITEMS.

A. Library of Educational Films for Forest Products.

Mr. Ellis: This item seems to be a carry-over from last Conference. I am not aware of any matter that requires further discussion. My recollection is that it was decided that the matter of an educational library was one for individual consideration, since a central library had been tried and found not satisfactory.

Mr. Clarke: The decision at the last Conference was that each organization represented should inform the others of any films available or in course of production.

Mr. Turnbull: A film on the Division of Forest Products as a separate entity is to be prepared.

Mr. Irving: There is another film prepared by the Shell Co. "Around the Gum Tree". The photography is reported to be excellent.

Mr. Turnbull: I saw that film at the invitation of the Shell Company. It deals with gum trees, just taking shots of typical species. They are predominantly Victorian species, although there are several shots of karri in the West. There is nothing in the way of industrial uses, but it increases the familiarity of the audience with gum trees. It is quite interesting.

B. The C.S.I.R.O. Act.

Mr. Elliot: The most outstanding change is not due directly to the Act, but it has come to a head with the formation of the C.S.I.R.O. This is the more detailed long term planning of the work of the organization, a question which has a definite bearing on this Conference. In the opening session, Mr. Ellis was speaking of unlimited funds in the Commonwealth and the unlimited amount of work we can do. I am sorry to have to say that is not so. The actual staff of this Division has been virtually fixed at its present establishment. We have been asked to get out a five-year programme of work, covering staff requirements amongst other things. As far as staff is concerned, we have decided that we shall ask for only one additional officer in the next five years, apart from a couple on other than laboratory work. There is, therefore, not much room for an increase in work. Similarly, the expenditure on work apart from salaries is being watched very closely. For example, we have had to put in a very strong argument for approval to spend £1,500 on a high pressure cylinder to follow up our initial work on high pressure treatments.

The new Executive is going round all Divisions at present, discussing the programme of work, and the indication is that every Division is going to be asked to give good justification for any work and the expenditure involved.

Mr. Irvine: If I have understood Mr. Elliot's statement correctly it would appear that if any work not already in hand is recommended by this Conference, it may be five years before consideration can be given to it.

Mr. Clarke: Or it may take the place of work we are now doing.

Mr. Irvine: Once a programme is approved, it is not, then, as rigid as an accountant's statment?

Mr. Clarke: We are not tied down to a hard and fast programme for the next five years. The main reason for this investigation of our programme for the next five years is to find out the implications of present decisions regarding our programme. It is easy to approve of a small expenditure starting up a project today, and so find that in a year or two's time a large further expenditure has to be approved, or the project dropped and the initial work wasted. The problem is not such a complicated one in our Division as in some of the newer Divisions. We had already decided that this Division had reached a reasonable limit of staff, and over the past year or two, new appointments have been for replacement purposes and for minor positions balancing up teams, etc. The position is that we cannot expand our work indefinitely. In future if we want to take on new work we will have to drop out other work and as we clean up old work we shall concentrate our staff more on the important projects we are handling. That is why we have been so keen on the States taking over more of our work.

Mr. Ellis: I think we agree it is regrettable from our point of view that these limitations are being imposed on the Division. At the same time we realize a close examination of expenditure is required, and cannot very well quarrel with C.S.I.R.O. for their approach to it. But in spite of what has been said I cannot believe that at the present time if a project might be extended along interesting and important lines, such extension would be stopped. For instance, if from Mr. Hillis' recent work it can be proved that Australia could supply the world with tannin, I do not think Mr. Chifley would say we could not have more money for equipment, or ask us to drop work on seasoning. I cannot imagine the Commonwealth not meeting such a situation should it arise.

C. Education on Wood Technology.

Mr. Huddleston: Insofar as N.S.W. is concerned, we have had for a number of years a course designed for people in the trade at the Sydney Technical College. This course is available to people working in the metropolitan area but has not been available for people in the country. A series of correspondence lectures has now been written and I understand the Sydney Technical College will be starting a correspondence course in this line early next year. In addition consideration has been given to a more comprehensive course, possibly taking the form of a full diploma course, designed for the training of mill managers and people of similar standing in the industry.

Mr. Payne: Tasmania is interested in this question, and there is clearly a need for technological development there. It seems that the training of personnel in sawmills and wood working plants generally is needed before that development can be pushed far ahead. I have had discussions with the Director of Technical Education, Hobart, and also with Mr. Alec Crane. We all see the need for such a course as outlined by Mr. Huddleston and given with success in Brisbane and Sydney. Unfortunately on the island we have not the concentration of industry such as you have in Sydney, Brisbane and Melbourne, and we come up against the difficulty, not so much of providing the course, but of getting people interested in such a course together. We considered Launceston, but the number of people likely to be available to attend technical classes seems to be too small to warrant their introduction. I am interested to hear of the correspondence course proposed in Sydney. I was going to ask the Conference to consider the question of technical training in Tasmania, and any advice that I can get from State delegates arising from their experience would be useful to us. I hope it will clear the way for the introduction of a course in Tasmania.

Mr. Ellis: The situation in Queensland is that as far as the Technical College is concerned it is an impossibility for them to make provision for classrooms in their present accommodation in Brisbane. There is no prospect of full courses being established there as a regular thing for at least three years. We might have a correspondence course for people in Brisbane on the lines being developed in N.S.W.

We have approached the educational authorities in Queensland to bring wood workers into an apprenticeship scheme. The unions would like to see an apprenticeship course and at the present time the matter is being explored by a small committee representing sawmill organizations and the educational authorities.

Mr. Clarke: There are two points in Victoria. I have been in touch with the Melbourne Technical College over the possibility of establishing a course in Melbourne similar to those in Sydney, and we have drawn on the example set by N.S.W. Mr. Ellis, the Principal, is very sympathetic towards it and realizes the need for a course, but the difficulty is the provision of lecturers.

The other matter is in connection with the Melbourne University, where we have suggested there should be a lecturer in wood technology. It came before the Standing Committee on Forestry of the Faculty of Science and is being referred to a small sub-committee for consideration. We are hoping it may be possible to have a lecturer in wood technology there as a first step towards the development of this as a group of university subjects.

Mr. Ellis: I am very interested to hear about the Melbourne University, and will be very grateful if you will keep us informed. In Queensland we have a sympathetic Engineering Faculty, and if Melbourne develops such a scheme I feel something would be done in Queensland. I am interested in the details and results of discussion, and the progress made here.

D. Co-operation with Building Research Liaison Service, Department of Works and Housing.

(a) General.

Mr. Banks: Dr. White, in opening this Conference, referred to the Building Research Service, formed since Sir Reginald Stradling's visit in 1947. I would like first to fill in a few more details of that statement so that you will have a broad background as to what our activities are expected to be.

Sir Reginald Stradling's report, after reviewing the facilities in Australia for building research, drew attention to the need for a closer coordination of the work, both in research in the laboratories and in the building industry, which includes civil engineering and construction. The arrangements agreed to included the formation of the committees which are part of the machinery we have to set up for any coordination work.

First the Building Research and Development Advisory Committee brings in representatives of the professions of business and of the construction side of the building industry. The Chairman is the Dean of the Faculty of Engineering at Melbourne University, and the Committee includes building materials manufacturers, architects, engineers, building contractors and building operatives, as well as representatives of the C.S.I.R.O. and of other Commonwealth Departments concerned. The Committee's terms of reference are:-

(i) To advise Commonwealth organizations concerned in building research and development on the technical problems of industry and where research investigation, development work, or technical liaison activity is required.

(ii) To assist in the dissemination of knowledge of the activities of the organizations undertaking research and development work.

The responsibility for arranging the detailed coordination of the research and development programme is in the hands of a Building Research Committee which includes senior officers of the research, development and liaison organizations, together with the Chairman and one other member of the Advisory Committee.

To provide for executive action arising from the recommendations of the Advisory Committee other than those concerned with research work, a Building Research Liaison Service was established. The functions of this Service were set down briefly as being to examine the problems of the building and civil engineering industries generally, and to report these to the Advisory Committee; also to distribute research and development information as widely as possible throughout these industries.

Against that broad background, work has been going on over the past twelve months. In the course of examining the scope of potential activity I have had numerous contacts with the research organization and with individuals throughout the industry. I will try to make it clear to you just where the timber side of our industry will need to fit in.

First, the problems of the industry. We have to realize that the ultimate aim of research is related to the performance of the finished product. The product so far as this industry is concerned is the building or completed civil engineering work. In the building industry the responsibility for different parts of the work is scattered among a wide variety of people, not closely linked together in such an organization as a manufacturing industry, but working independently. Nevertheless these people are all called upon to cooperate in the execution of individual projects. First there is the architect or designer-builder, whose problems are concerned with design and construction, and choice of materials. Then there is the builder and sub-contractor, the foreman and his operatives, who have to interpret the plans and specifications and instructions of the designer. They are concerned with details of construction, methods of assembly, organization of site work and use of mechanical devices. Behind them is the manufacturing group, with problems of production of materials of satisfactory standard, etc.

I do not propose to deal with the manufacturing group, because this represents a separate problem being handled separately from the major problem, namely the building industry concerning design and construction.

The position how in Australia is that provision has been made for carrying out fundamental and applied research into building problems. Also we have access to results of research overseas, particularly in Great Britain, the United States and Europe. In Australia applied research has been going on for a period of about five years. Provision has been made to examine problems in these spheres of research, and there is room for the expansion of work to bring in the investigation of new ideas and new materials from overseas. There is practically no provision for field or developmental research. There may be individuals doing it, but the work is not co-ordinated and there is no established link between the industry and fundamental and applied research. Therefore an immediate need is to establish such a link, and I am proceeding to do that through the existing professional and trade organizations in the Industry. In the early stages the link will be pretty tenuous. We cannot expect too much constructive effort on the part of the link tied in with industry, but I think, and it is borne out by the experience of D.F.P. in Australia and of D.S.I.R. in Great Britain, that if research is to be effective, the industry's active interest in research must be developed, otherwise research will continue to be something imposed on the industry from the outside. The stage should be reached when the industry demands results from research. Through research committees from the Institute of Architects, and the Master Builders' Associations, I hope we shall develop that relationship over a period of years.

We realise that in the early stages we have to deal with and educate a number of individuals, all of whom operate independently. There are the architects and engineers, master builders and other contractors, and technical and professional officers in Commonwealth and State departments, totalling something like 30,000 individuals who need to be educated to the stage where they are ready to seek the results of research when applied to their work. There are perhaps 80,000 people working for wages in the industry.

The question of educating newcomers to the ranks of the industry is a problem for the education institutions, and is a separate problem. The immediate task of the Liaison Service is to set up means for informing the people who are in the industry now on as broad a basis as possible, not by ourselves entirely, but through all existing agencies, to supplement their efforts and assist where necessary, but not to duplicate them.

The next stage is to encourage the interchange of ideas within these groups, and also the interchange of ideas between people doing the work in the industry and those working in research organizations. I think trade and professional organizations should make provision for this.

Lastly is the need to develop specific co-operation between interested people in the industry and in the research organizations when the work reaches the stage in the laboratory where it cannot be carried any further, and where field work is necessary. At present it looks as if the use of Commonwealth and public utilities will be the first step in that development, but as time goes on there is no reason why designers and contractors in the industry should not cooperate also.

To achieve these objects we are setting up the mechanism of the Liaison Service. There will be two or three technical officers, carefully selected from the point of view of experience and training and general personal attributes. Attached to each branch of the Department will be a Field Officer. There will be co-operation both in the Central Office and at Branch Office level with the Commonwealth Experimental Building Station, Building Research Laboratory, D.F.P. etc., and in the State offices with organizations such as the State Forestry Services, Timber Development Associations and any others of a similar kind. That is the broad structure.

I have listened to the proceedings during the last few days and I have gained not only a much broader and more detailed picture of the scope and magnitude of the work going on, but I have been able to gauge also the measure of cooperation existing between D.F.P. and the people who represent the corresponding State departments. Also there are the Timber Development Associations. You have gone a long way along the road in the timber industry on which we want to go in the building industry. You have made good contacts with a number of architects and builders, who no doubt use the results of your work more widely than they use the results of other organizations. There is no doubt that these contacts must be broadened and strengthened. The scope for expansion in the building sphere, at any rate, is very great, and it is in developing that work that we hope to be of some assistance to you. I take the view that it is not possible to lay down any formula as to how cooperation shall be effected in a particular State. I believe that, provided we agree about broad principles, the way in which a problem is worked out on the spot largely depends on the individuals concerned, and how they cooperate. In other words, on who does the work will depend the organization of the work. Our purpose is not to duplicate. I do not see the need for building a large organization in the Liaison Service, but I see scope for continuous activity to encourage and stimulate action on the part of other people. Some disquiet may be caused you by the belief that you may be inundated with people wanting information on all sorts of subjects, and your research work jeopardized. It is a possibility I can foresee, and because of that I feel the work must proceed circumspectly. There is no purpose in rushing ahead too quickly - research organizations are not enquiry offices. Many enquiries are being referred to research workers, the answers to which well-informed people in the industry should, and probably do, know. The industry should provide for dealing with this type of enquiry. If the industry can be encouraged to make arrangements on these lines the status of enquiries reaching you will be raised, and our activities will not have the effect of embarrassing you, but may assist you in getting a clearer picture of the problems in the industry on the one hand and feeling that the results of your work are being made use of by the industry. The principal problems which occur to me on which architects and builders need your assistance are -

(i) Appreciation of properties of available timber species,

identification,

grading for imperfections and selection for various purposes,

measurement of moisture content and its relationship to site conditions.

(ii) Knowledge of best methods of using and protecting available timber for required behaviour of completed structure, including strength and stiffness: durability and low maintenance, e.g., protection against decay and attack by destructive agencies: fire resistance and retardation.

Mr. Clarke: We find that in developing his Liaison Service Mr. Banks has done so with every consideration for the research bodies concerned, and as a result we have found he has been most helpful. I feel the experience of the States will be the same, that he has made a definite effort to assist us in the direction of our disabilities and has certainly not tried to add to them.

Mr. Huddleston: We have had contact with Mr. Banks in the past arising from correspondence. As far as we are concerned, we have formed a picture of what the organization is trying to do and we are happy to assist in any way. I feel he will have the effect of helping us rather than hindering us.

Mr. Ellis: I have had an opportunity during the week to discuss Mr. Banks's programme in relation to Queensland, and I feel he is tackling his problem and ours in a satisfactory manner. He has indicated he is fully aware of the difficulties ahead, and that there is a real problem in seeing that the information which should be available to the building groups is made available. Mr. Banks has not given us very much detail as to how he expects his officers will proceed, and I was wondering whether he had in mind at this stage any ideas as to how education on general lines may be given to the 80,000 workers, apart from the 30,000 people engaged in the industry. I am more concerned in getting the story over to the operators in the building industry.

Mr. Banks: I am sorry I cannot tell Mr. Ellis that, because I do not know. The only contacts I have made to date have been with trade union people, some of whom are on our Advisory Committee. I think the experience of your Division and the way you have made contacts with individual groups is probably the best line and one we should need to follow. Frankly we have not faced up yet to how we are going to educate all the operatives. We are still in the early stages of getting architects and builders to toe the line.

Mr. Clarke: I might mention that Mr. Banks's reference is to the fact that we have had quite a number of requests from branches of the Building Workers' Industrial Union for night lectures by our officers. We have been giving these, and demands have been coming in fairly steadily. We find they are very good audiences. They vary - the lowest would be about 12 and the highest 80 or 90. One lecture nearly always results in a request for further talks on other branches of our work.

Mr. Ellis: One difficulty in Queensland, which is probably common to other States and yourselves, is the matter of providing lecturers to the industry. We have had to turn down requests for lectures in the last few years. With Mr. Banks's organization I expect we shall continue to get still more requests. I should think one of Mr. Banks's first objectives should be to establish some sort of lecture service to handle this. We will not be able to provide lecturers to classes, or by way of correspondence. The field division will get more enquiries than we will. I agree with Mr. Banks that this is a problem that will have to be tackled.

One further point. Has Mr. Banks any individuals in each State to whom the development in his service can be communicated from time to time? He has in mind the liaison officers. I do not know any individual in Queensland who might be in correspondence with Mr. Banks's Head Office in Melbourne. I thought perhaps the Professor of Engineering or of Architecture in the University might be a satisfactory person to whom any developments might be sent from time to time, and it would be his responsibility to see that the organizations in the State were properly informed, and possibly to act as convenor for discussing any point Mr. Banks might like to have discussed in each State. There seems a possibility there for Mr. Banks to have some sort of State organization set up, to speak as a State organization on any question Mr. Banks might like to have information on, or on which he would like some development in the State.

Mr. Banks: The intention is to have well qualified and experienced technical officers, either architects or engineers attached to branch officers as Liaison Service Field Officers. Their job will be to act as points of contact. We have the part-time services of very good men in several of the capital cities, and in due course will have them in other capitals. There will be at a later stage full time officers in these positions. It was originally contemplated by Sir Reginald Stradling that the advisory pattern would be repeated in each State, bearing in mind that many building problems are local. It may be that a committee as suggested by Mr. Ellis might develop. We realize that to bring a committee into being before there is a real demand for it is a great mistake. You only add more paper work with no apparent result. As the work develops people can get in touch with us, and if there is the necessity for a committee it can be formed. I would rather see it develop as a necessity rather than arbitrarily at this stage.

(b) Flooring Tests.

Mr. Ellis: The matter of the adoption of thinner floors as recommended by D.F.P. was discussed at a recent E.S.T.I.S meeting in Tasmania, and I understand that the meeting was distinctly unfavourable. As it now stands the recommendation is not acceptable to sawmillers, and I would like to ask whether any purpose would be served in reviewing your recommendations, or taking the matter further. I do not know the architects' attitude but gather from Public Service Department in Queensland that they are not favourably disposed, and in some cases are distinctly hostile. I am not satisfied with the position and think we should review the present recommendation. A thickness of 9/16 inch might be quite all right for the average run of timber but not for brush box. Brush box presents a problem not met anywhere else, and that is on account of warping and twisting which occurs in up to 20 per cent. of boards. Such warping makes it difficult for the machinist to keep the tongue or the groove well matched throughout the full length of a board. Thus, more sanding of the floor is necessary with a consequent reduction in the 9/16 inch finished thickness.

<u>Mr. Clarke</u>: We have this matter under discussion with Mr. Banks with the idea of carrying out some further demonstrations in connection with the 9/16 inch flooring. As you know, all changes in established practice first of all meet with either active or passive resistance, and it is to be expected in this suggestion. We feel that more bulk trials of 9/16 inch flooring are necessary. All sorts of wild statements are made against it. Some may have a basis in fact, but that could be established by bulk trials of material. We ourselves have heard a number of objections to the flooring, but we know some of them are not sound because we did not encounter them in the floor put down in one of the Housing Commission houses.

Concerning brush box, probably a timber such as this will have to be taken into consideration. It may not be possible to apply the 9/16 inch proposal to all flooring materials.

Mr. Ellis: Do I understand you will run further tests? I suggest brush box be included, and also if possible some provision made to measure the amount of timber taken off in sanding brush box. I am at a loss as to how to approach the problem.

Mr. Clarke: There was a case in question in Victoria where a dance floor used as a military post office had to be restored to a proper condition suitable for dancing. To find out how much deterioration had taken place the whole of the sandings were collected. The floor had to be sanded very heavily. We collected the whole of the material and worked out the quantity of material taken off. I think it worked out at 1/16 or 1/32 inch. Many people do not realize how little they take off in sanding a floor. It would be possible to carry out experiments along those lines.

Mr. Ellis: In a brush box floor, before sanding, a board may be as much as 1/16 inch higher than the adjoining board, due to defective finishing.

Mr. Clarke: I still think it would be necessary to find out exactly how much is removed, and I think you will find the amount would be small.

Mr. Huddleston: Why should we provide for bad mill practice. In N.S.W. we say our milling practice is bad, but we do not get 1/16 inch between boards. It may look like it, but when measured it is only 1/64 inch. I feel such arguments do not apply to Tasmanian 9/16 inch flooring. Other arguments in N.S.W. I think are just trade prejudices and it is a question of overcoming them. To make provision for faulty manufacture I think is not good.

Mr. Clarke: It is obvious from the discussion that further demonstration floors are necessary, and all factors must be watched carefully in these floors so that the answer will be available to any query brought up.

E. Sylviculture and Properties.

Mr. Kloot: Before proceeding to outline the work carried out over the last twelve months on the project dealing with relationships between sylvicultural treatment and mechanical properties, it might be useful if I first briefly recapitulate the reports on this project given to the last two Conferences.

No data of any significance on the effect of sylvicultural treatment has so far been obtained from analyses of results of tests carried out to the original working plan of this project prepared in 1937. However, it is not known whether this lack of significant relationships is due to a lack of real correlation between sylvicultural treatment and strength properties or whether the use of standard or near-standard size test specimens has effectively masked the real relations.

Various ideas, including the use of glued specimens, were tried out to obtain specimens small enough to contain only the growth rings laid down during a particular period of sylvicultural treatment. At last year's Conference, it was reported that a method having distinct possibilities had been devised using specimens only 2 or 3 thousandths of an inch thick. The micro-tensile testing machine referred to at the last Conference has now been constructed and has been in constant use for the last 6 months.

As was to be expected the initial work on this machine was devoted to a study of the machine's characteristics the development of a suitable testing technique and the development of an optimum specimen design. At present we are using a specimen 80μ thick (3 thous.), $1\frac{3}{4}$ inch long, waisted to 1/16 in. at the centre.

At present we are engaged on the first experiment directly related to the sylvicultural project.

Specimens cut from pith to bark of two young mountain ash trees believed to be between 8 and 9 years are being tested. These two trees were selected from the same area, one being a free growing tree of about $5\frac{1}{2}$ in. diam. and the other suppressed of 2 in. diam. The testing has only just been complete and will be reported in full at a later date.

Besides measuring the ultimate tensile stress of these specimens an attempt has been made to measure strain by photographic means but this has not developed sufficiently to provide any data of interest to the Conference.

Although the developmental work for this project has been proceeding satisfactorily, much yet remains to be done before we can confidently launch a new working plan. The measurement of density and moisture content of these small specimens has been exercising our minds. Also, as it is believed that tensile strength alone may not provide sufficient indication of the general mechanical properties, it is proposed to investigate the possibility of carrying out other tests on micro specimens. With little modification, a shear test could be effected on the micro-tensile tester and a rough design of a micro-compression tester has been prepared.

We are convinced that the progress made in the last twelve months is in the right direction but as yet we are not prepared to lay down any sort of working plan for the main project. If things go well, it may be necessary to call on one or two of the states in the next twelve months for cooperation in the collection of suitable test material.

The micro-tester, although designed for this particular project, has already been used to a limited extent for investigations in quite a different field and ideas at present in mind may well lead to its use in other fields and if the work warrants it, this may mean the provision of another testing machine. It would be of some help therefore if members of the Conference would express their opinions on the relative importance of this project and whether the project still merits the importance attributed to it when the first working plan was prepared twelve years ago.

Mr. Ellis: Mr. Kloot has asked whether we consider his investigations should be continued. I would like to say that as far as Queensland is concerned we have been waiting eagerly for the last three years to learn the answers sought by Mr. Kloot. We believe the relationship between sylviculture and properties is of fundamental importance for the whole of our forest management in Queensland. We consider it is highly desirable that it should be continued.

Mr. Huddleston: I agree with Mr. Ellis with regard to the continuation of the work.

Mr. Irvine: Victoria wishes it to continue.

Mr. Gray: I understood Mr. Kloot at first said that as far as he knew there was no significant correlation between sylvicultural treatment and properties. Did I understand him correctly?

Mr. Kloot: We have been carrying out investigations on specimens of standard size and the results of that work, on analysis, did not indicate that there was any real correlation between them, but we are not able to say whether there is in fact a lack of real correlation or whether the use of large specimens has prevented us from detecting any real correlations.

Mr. Gray: While Mr. Kloot has made it clear that one cannot expect conclusive results from tests on a couple of trees, I gather that these two trees represent what might be considered extreme forms of treatment, one being a suppressed tree and the other an open grown tree. Did the tests indicate that there was no difference in the properties of timber from these two trees?

Mr. Kloot: The difference of 10 per cent. is no more than one would expect between two trees of the same condition and same size.

Mr. Ellis: It is very important to us that we should know a little more about the development of brittle heart. We believe that in the early stages of growth, say up to 10 inches in diameter, in such timbers as E. grandis the wood is not typically brash, but that at a later stage the wood formed in the early years does eventually become brash. Can Mr. Kloot indicate just when the heartwood of a tree begins to deteriorate towards brittleness. If it is not being investigated by your officers this might be an opportunity to examine it.

Dr. Dadswell: We are working on brittleness in Australian timbers. Brittleness of the brittle heart type is not restricted to eucalypts. You find exactly the same brittle material in all tropical hardwoods and I should think in all hardwoods. We have examined a cross section of young oak (Quercus sp.) grown locally and found that it had some typical brittle heart material at the centre. We know that in the young eucalypts you can have timber practically free of brittle heart, but that in older trees of the same species brittle heart is extensive. In the last twelve months or so the Timber Mechanics Section has been working on growth stresses in trees and as a result a theory has been put forward which will explain the development of brittle heart.

Mr. Ellis: Is it related to timber growth or rate of growth, or if not I would like the material for Mr. Kloot's work to be examined in that relation.

Mr. Kloot: Instead of getting material in log form as we have in the past, it will suffice to have material supplied in small slabs cut from the side of the tree. In that way we hope to test trees every twelve months. So long as we do not damage the tree, we hope to test the same tree twelve months later. In the previous project the period between supplies of test material was of five to seven years.

Mr. Cooper: The answer to Mr. Ellis's question is that we could do something about the investigation. It would be one of the extra uses for this machine which is being developed primarily for the investigation of the effect of sylvicultural relations on strength properties. But I would point out that staff and facilities are limited and that the sylvicultural project alone will involve a very large amount of testing. For example, the number of tests carried out on the two specimens exhibited by Mr. Kloot was about 300 on one and 600 on the other.

F. Utilization of Hardwood Thinnings.

Mr. Ellis: I have not much to report beyond the fact that we have undertaken a mill study of hardwood thinnings. In South eastern Queensland, we have 25 million feet of timber standing as thinnings and unless we can find adequate application for that timber, it will be left on the ground to rot. The timber industry in Queensland is prepared to take hardwood thinnings only for fruit cases. We have therefore designed a project involving 100,000 super feet of timber. These thinnings are up to about 12 inches diameter breast high. The project is in the nature of a cost study as well as a utilisation study. There are 8 species involved. We do not know just what will happen in respect to "popping" but are hoping that, with proper attention to end coatings on logs and to proper seasoning, degrade will not be very extensive. On the utilisation side, we are taking the timber right through the mill for about 12 months seasoning. Our sawing schedule provides that we should cut 4 x 1 and 3 x 1 as far as possible and the rest should go in scantling. We hope to be able to find a satisfactory utilization for these thinnings.

Mr. Clarke: Would they be of interest from the standpoint of sleepers?

Mr. Ellis: Very definitely. My own opinion is that this high pressure treatment should be tested out on more "twoers". Consequently I was hoping to have specimens of a few twoers included in the 2,000 test sleepers from Queensland.

Mr. Clarke: I think you should consider single sleeper blocks as well as twoers. They might be more satisfactory even than twoers.

Mr. Ellis: Is anybody using heart in sleepers?

Mr. Clarke: We have them in the South Australian test in Pinus radiata. The South Australian Railways were rather doubtful over such Pinus radiata sleepers at first, but are now keenly interested.

Mr. Payne: In Tasmania, the utilization of stringybark and, to a lesser extent, of regnans for pole timbers is one of our major problems and I was asked to make a request that D.F.P. bend its energies to the solution of the problem. We have done nothing ourselves yet, but in the south-east, we have a total area of not less than 40,000 acres of 30 to 50 year old poles and at the moment we see no possible solution of the conversion of a lot of this material, before it finally disappears from the forests. I was also interested to see the application of the gang-saw frame at Ringwood. It indicates the possibility of converting young eucalypt into cases and prepared flooring material, and I shall be reporting to the Commission in due course what I have seen. I believe that this problem is going to be a very urgent one for Tasmania and I believe it is going to be an important one for Victoria with regard to the utilization of timber burnt in the 1939 fires.

Mr. Huddleston: I would like to repeat the offer that I made the other day that if Tasmania would like material treated in our plant, that could be done, and if they would stand the cost of bringing the material to and from Sydney, we would be only too glad to treat it for them.

Mr. Irvine: We have had a number of enquiries about poles for export, but can only supply the relatively non-durable eucalypts.

G. Utilization of Sawdust.

Mr. Hebblethwaite: During the past few months, the work of investigating the physical, mechanical, and chemical properties of sawdust was begun according to the working plan prepared in June, 1948. Delay in obtaining equipment has retarded progress, but all the apparatus required for the investigation is now to hand.

A sample of approximately 200 lb. wet weight of Pinus radiata sawdust obtained from a circular breaking down saw has been obtained and is now in course of examination.

Some procedures of the routine examination have been completed and in two instances techniques have yet to be perfected to enable certain information to be obtained.

The Sections of Wood Chemistry and Seasoning are cooperating with parts of the investigation which fall within the field of their activities.

As soon as the investigational technique become routine matters, which it is hoped will be the case at the completion of the Pinus radiata investigation, the examination of sawdust from other species should not be a lengthy process.

Sawdust Pressing.

The Utilization Section has obtained a die in which an 8 in. diameter disc of sawdust can be pressed when used in conjunction with a hydraulic press.

The die is to be used in pressing sawdust alone and in conjunction with binders other than synthetic resins.

Although not allowed for in the Working Plan, it is intended to pay some attention to the briquetting characteristics of each species at the time of examination.

To date, some exploratory pressings of Pinus radiata have been made.

With respect to sawdust synthetic resin board investigations, there is little to add to the information given last year regarding properties of this type of board, and with high cost of resin, it still remains to be shown whether commercial manufacture is possible on the Australian market, except in limited fields.

A report covering this work is in course of preparation and has yet to be issued.

The work is continuing with the object of reducing the resin proportion by the inclusion of other materials such as lignin residues. I have not been actively associated with it but have been asked to make this comment as it will not be referred to elsewhere.

H. Publications.

Dr. Dadswell: The Trade Circular on the Lyctus position has been discussed, reference has been made to the Bulletin on poles and pole treatment and Mr. Tamblyn has said that he hopes to get a revised edition out in the next twelve months. Our supplies of Trade Circulars have become rather low and we have been taking steps to get them replenished. Rewriting has been necessary in a number of cases: officers have been busy on other work and have not always been able to give the amount of time necessary for revision of the subject matter.

Revision of Preservation Trade Circulars is in hand and new editions should be issued in the next 6 to 12 months. There have been difficulties in printing, but we are hoping to overcome this by using the Head Office printing press and outside printers.

There is one other thing. The third edition of the Handbook should be out at any time now. It should come forward at the rate of about 500 per month from now on. Perhaps I should mention that the old Journal of C.S.I.R. has gone out of existence. The new journal which will replace it will be the Journal of Applied Science. Two numbers will be out shortly. Our more technical publications will go to this new journal; publications of a more fundamental nature will be submitted to the Australian Journal of Scientific Research. From both we will get reprints. For publications dealing with mechanical properties - we have ordered 500 reprints. That may be insufficient. I would like a lead from the States as to whether we are getting sufficient reprints for distribution.

Mr. Ellis: With respect to reprints for such subjects as mechanical properties of maple and red tulip oak, there is no great demand in Queensland. These reprints are of no interest to architects nor to engineers, but reprints on some of the other matters would be of interest to us. I will leave it to you, Mr. Chairman, on the basis of Queensland having about 1/6 of the population of the Commonwealth, to estimate our likely requirements. Our main interest would be in seasoning, preservation, etc.

J. Timber Bank for Research Purposes.

Mr. Turnbull: Since the last Conference requests have been made to several States for certain quantities of important timbers, and deliveries have been coming forward. We are very grateful indeed for the material supplied and look forward to building up stocks with representatives of the major timbers of Australia. We have had progress deliveries from N.S.W., Queensland, Tasmania and Western Australia and our collector has been in Victorian forests collecting messmate and associated species. We will let all States know as far in advance as we can as to what we would like to have and embrace as many interests as possible in the Division at the one time in an endeavour to keep the requests to a minimum.

Mr. Huddleston: On behalf of N.S.W., I must apologize for the rate at which this material is going forward. I have asked our field officers to get it, but due to floods, strikes, etc. many of the logs have been collected and have had to be sent back to the sawmills because of the uncertainty of transport. I am not at all happy about the position.

K. Collection of Material.

Mr. Pearson: You may recall that last year there was a short discussion on a new method of collecting timber, which we hoped would considerably speed up the present slow rate of obtaining information about the mechanical properties of Australian species.

The method, in its essentials, involves selecting a pre-determined number of trees of a species as randomly as possible from the forest areas in which the species grows, and testing one or perhaps two specimens from each tree instead of the 5 to 10 specimens previously taken. More trees must be tested than before, for equal accuracy of estimation of the species mean and total variability, but the total number of specimens is much less and hence the time to test a species is reduced. This means more species can be tested in a year. The reason for random selection of the trees is that only in that way can we ensure the sample is representative of the species.

The Division now has a collector on its staff, Mr. W. McKenzie, a graduate of the Creswick Forestry School, and recently he and I tried out this method in Victoria on E. obliqua. The procedure was as follows.

It was necessary first to decide the size of sample. As E. obliqua is an important species, we decided its mean for the static strength properties should be known within ± 5%. From curves which we have derived, we found there was a 1 in 4 chance of getting this accuracy with 18 trees. This we thought enough: if the 1 in 4 chance came off we had not done unnecessary work in testing a larger sample: if it did not come off we could use the test results to determine how many more trees would be required to give the desired accuracy. In case some material went astray or had to be culled we added an extra two trees, making 20 in all.

To cover the geographical range of the species, we selected 20 forest districts at random from those in which the species grew, with the object of taking 1 tree from each district.

Our next step was to worry Mr. Benallack. He smoothed our path for us with the Forest Officers whom we visited in turn. I would like to express my appreciation of their efforts, for without exception, they were very helpful.

Our method in the field, generally, was to ask the Forest Officer the number of areas in his district in which messmate was being felled and to select one of these at random. From the chosen area, we took the first fallen tree of the species we came across, providing it appeared capable of yielding sufficient clear material for our purposes. To ensure positive identification, botanical material was collected for later checking by the Herbarium. If the bole was bigger than our requirements, we selected one or more logs from it, again at random. Cartage was arranged with the miller or the Forest Officer.

Not all the material has arrived yet, so we do not know if the 1 in 4 chance has come off, but the trial has indicated that this method of selection will work.. although details have to be varied according to local circumstances. Such details are probably best discussed on the ground between the Forest Officer and our collector, and it is proposed, subject to the concurrence of the States and as circumstances permit, that Mr. McKenzie should visit the States, discuss the general plan regarding species and districts at the Headquarters of the Forest Service, and, in many cases, select the trees on the spot after consultation with the local Forest Officer. With regard to the species to be sampled, we visualize selecting several of the most important in each State but at the same time picking up from each logging area visited a log of any other species being milled, as we did in our recent trip around Victoria when, in addition to the obliqua, we collected samples of 37 trees from 13 species.

Mr. Irvine: There is one point of interest. Mr. Pearson, in deciding what geographical locality to sample, chose certain forest districts. Each of those 20 districts does not contain an equivalent percentage of obliqua by either area or volume. Does that procedure give a representative sample?

Mr. Pearson: It gives a representative sample of the geographical range. As E. obliqua has not been completely assessed, it was not possible to select according to volume in the forest. This problem of obtaining a representative sample is one item to be decided by consultation with the State Forest Services for any particular species.

Mr. Cooper: Random sampling is the desideratum. At every stage the procedure can be criticised, but I think we have done the best in the circumstances.

Mr. Irvine: Essentially, a sample is a percentage of the population.

Mr. Cooper: There is a different angle. Comparing it with what we are doing - taking 5 trees from each of 4 or 5 districts - there is no doubt that we are much better off. We are approaching our objective more nearly if we take one tree from each of 20 districts.

Mr. Irvine: But you might be worse off too.

Mr. Cooper: It would seem to me that in no circumstances would we be worse off.

Mr. McAdam: That could be proved wrong. You might get 20 districts, in only one of which there is a very dense stand of obliqua and in others a very few trees, but if the property of the timber varied with regard to range and its conditions of growth, then you would not get a true representative sample of the species. In other words you would have 19 trees from a very small portion of your population and only one representing the major portion of your population.

Mr. Cooper: We would not be worse off than by taking 5 trees from each of 4 districts.

Mr. McAdam: Do you think that when choosing samples you should take with you a sylviculturist or a Forest Officer to advise on the distribution of species in his district?

Mr. Pearson: It often happened that there were two distinct conditions of growth in the district, e.g. high and low altitude and the Forest Officer wanted us to take a tree from each area but we decided to stick to taking one tree only from each district. We found that the complete sample included trees from both high and low altitudes.

Mr. Irvine: The 20 districts probably represented 43 forest districts, so that your sampling (with the exception of the Mallee) covered more than half the total area of Victoria. Messmate is widely but not evenly distributed over half of Victoria and yet the effect of the present sampling method is to argue that the samples that you have taken are representative of a species which is unevenly distributed in volume.

Mr. Turnbull: I would like to know if you have data on the origin of every sample you have got out.

Mr. Clarke: He is assuming that if he gets a dense stand, the properties of that material will be different from some other place. It does not necessarily follow. There is still a variation from tree to tree to be taken into account.

Mr. McKenzie: In this particular case, it happens that in Victoria obliqua is a very ubiquitous species. It is fairly uniformly distributed over the whole State. There are mills sawing messmate in a very high proportion of forest districts and in the absence of figures for yearly cut and the potential cut in each district it is difficult to approach a representative sample. What we have got is a random sampling that shows the variation over its range but it would probably not be very far away from the variation as it is cut.

Mr. Cooper: Perhaps we should emphasize that this is brought forward for criticism. The plan might well be varied, but only the States could provide the information to do so.

Mr. Irvine: The position in Victoria is that probably within 10 years we should be able to say how much of this or that particular species occurs in each and every district. If, or when, we do reach the stage of having typed and assessed the volume of most of our stands, this matter of sampling could be looked at from any angle. I do not think that any two people would be prepared to sample it in the same way.

Mr. Cooper: We do want to get a sampling method that the States would be happy about. I think we should try to come to an agreement with the States on this matter.

Mr. McAdam: I would like to make it clear that my criticism was merely theoretical. There is one point which we should take into consideration continuously in this sampling and that is that the sample is representative of the stands of the species still available for harvesting.

Mr. Irvine: There is another possible point.

I do not know just what your approach to the figures, which it is hoped to obtain from the results of this survey, would be, but if the figures are to have a short life and be available to the industry, say within the next 2 years, then the practical approach to the problem would seem to be to sample the areas which are likely to be milled within the next 2 years or whatever the agreed figure is, but if the idea is to obtain figures which will apply to the present millable stands, I am afraid you will have to go by a geographic basis. I think the question of the period over which these figures are to be used is one that must have a major influence on the method of sampling or at least on the population to be sampled, because without doubt, present day messmate, as far as size is concerned, probably will not be available after the existing original messmate or obliqua is cut out. Our regrowth will be smaller.

Mr. Clarke: I think that factor will come in as well as a grading factor, but we should find out the intrinsic properties of timber here and in the application of the knowledge we have, take into account the grading factor. Any reduction in the quality of the log will tend to affect the grading more than the intrinsic properties.

36. PAINTS AND LACQUERS.

Mr. Clarke: At the last Conference, it was proposed that a sub-committee on paints and lacquers should be set up with the idea of keeping the Defence Research Laboratories, who are doing work in this field, informed of the problems of the States, but it was not possible to set up the sub-committee. We suggested that we should give some time at this Conference to the subject so that we would virtually act as a sub-committee at this Conference on the matter. In circularizing the States, we asked them to bring down with them any of the problems which they think should be brought before the Paints and

Lacquers Sub-Committee.

Mr. Cox: I was pleased to hear of the suggestion made at the last Conference that this sub-committee should be set up, because we have been anxious to maintain contact with those interested in the use of timber, so that we might get some assistance in deciding the most important projects to be taken up. Following the last Conference, we circulated copies of programmes of work, either in hand or proposed to be put in hand, and we have had from Queensland suggestions for additional timbers that should be examined. The timbers they have suggested are silky oak, Queensland ironbark, blue gum and spotted gum. I think Mr. Ellis has also suggested grey satinash. We would like any comment from members of the Conference as to the desirability of including all these in the programme on the paintability of timbers and also whether there are any other timbers used in sufficient quantity to warrant special consideration in any such programme. If it is agreed that we should do work on these timbers, we would like the assistance of the States in getting supplies of these timbers for us for the work. I do not mean that we ask the States to supply the timber to us, so long as they can make arrangements for us to get the timber, if need be, through normal commercial channels. When we approach merchants for any special timber, they usually give us last preference. Government bodies are not popular with commercial firms. However, assistance would be appreciated very much. I think that is all I wish to say at the moment. Are there any suggestions from anyone as to the problems we should undertake?

Mr. Huddleston: Mr. Chairman, you have asked us to bring down to this Conference a list of problems that concern us. I have brought some that may be worth considering. First of all, our major need at the moment is for a publication that can be handed out to people who are undertaking painting on their own behalf, people who are not painters but who want to do a good job with their own hands and in their spare time. We get numerous enquiries in this regard. The Defence Research Laboratories have undertaken to get out this pamphlet.

With regard to specific problems, there are two that come immediately to mind. One is a suitable paint for painting over waterproofed plywood when it is used for road signs. As you know, waterproofed plywood is inclined to get crazed on the suface, and we find that the average run of paints are not lasting enough to stand that and the paint surface cracks. It seems to us, that with all the synthetics available today, it should be possible to get a paint surface which is fairly plastic. This is likely to be important in N.S.W. because of the shortage of suitable steel for road signs. I would be glad if a more satisfactory paint surface could be found for this purpose.

We have other problems in hand at the moment, to which we have been unable to find a satisfactory solution. We have had a request for a paint for printing on timber. The particular application under review is at Port Kembla, where they require a paint which will be readable after two years or more of storage in the open. With the paints at present in use, signs cannot be read on hardwood timbers after exposure.

We have the every day problems cropping up of failure with timber which has been painted green and other problems which I do not think it is appropriate to introduce into this discussion. All we would like is an undertaking from the Defence Research Laboratories that we could refer our problems direct to them.

Mr. Cox: I should like to apologize for the absence of Mr. Rischbeith, who, unfortunately is away ill.

He would be more familiar with subjects that come up for discussion. On the question of the publication, we agreed that this was an important matter. There has been a lot of matter published on how to paint various materials and some of the local publications are rather bad. They are written from a rather amateur standpoint. On the other hand, some are too extensive and not the sort of thing that is really required. There has been a publication issued by the Bureau of Standards, U.S.A., which I think is of a type well suited to our requirements and we propose to issue a similar publication designed specifically for Australian conditions.

The problem raised with regard to plywood should not be very difficult of solution, and we would be quite willing to undertake the investigation. Perhaps it would be as well if you could give us detailed information showing the type of failure that has occurred and let us see some samples.

With regard to a timber marking paint, the services, during the war used a lot of satisfactorily weather resisting paints on case timbers. I am not sure whether they were hardwood timbers, which might be a more difficult problem. It should be possible to get satisfactory paints. The painting of green timber might be a more difficult problem but we would be quite pleased to help you on the other two.

Mr. Bussell: We have had a lot of success in marking paint panels with an aluminium pigmented varnish. The markings have lasted up to 4 years. I should say that pigmenting a varnish with carbon black or something similar would probably fit the bill quite well. But we could investigate this problem.

Mr. Ellis: With regard to the actual tests that have been proposed for the Defence Research Laboratories, one question arises. This is in connection with installation and maintenance costs. We are providing a good deal of hoop pine for standard tests and when we were discussing the matter of the exposure tests, it was suggested to us that we might be prepared to install and maintain stations. We adopted the attitude that we were prepared to meet installation costs in Queensland if other States were prepared to meet similar costs of the project in their territories.

Mr. Cox: Most exposure stations are at present on our own property. In N.S.W. we have them in our own laboratory area and we have several others at places which are or have been under Commonwealth control. The reason for asking you directly about the cost of the logs was that I understood that at the last Conference you had offered to undertake these exposure programmes. The Department was not quite clear as to who was going to pay for them, so I thought it best to ask directly. Mr. Ellis, I must apologize for not having replied to your letter to Mr. Rischbieth. We are quite willing to undertake any of the expense involved but we do feel that any exposure station must be on an area where it is going to get satisfactory supervision and we feel it would be preferable if it could be arranged for the people, on whose area racks are being placed, to undertake the responsibility for supervision and maintenance. It is rather difficult to conduct the tests from Maribyrnong. We must ensure that the racks and exposure panels will be looked after properly, because there is nothing more discouraging than to have a programme going on for, say, 2 years and then to find the panels have disappeared. We found that some 12 months work went for nothing because somebody got in and used some of our fabric test strips.

Mr. Ellis: I can assure Mr. Cox that there will be no difficulty whatsoever and any supervision will be attended to. Maintenance will not worry us very much at all. My proposal would be to use State Forest Service areas and test panels would be constantly under the observation of a resident foreman. We would like to have tests of pilularis and I would suggest that it would be preferable to use backsawn rather than quartersawn panels. I did draw attention to the fact that you were not using S.A.A. standard terms.

Mr. Bussell: Mr. Ellis, we admit to that failing, but we are, in fact, a paint research establishment and our knowledge of timbers is what we can glean from our timber section. The first point (on blackbutts) I did not answer, as the information that we had from N.S.W. when preparing the programme was, I think, that the blackbutt there was quartersawn and we obtained it quartersawn for our experiments. A further point that may be of interest to the Conference is that recently in our paintability programme, after two years exposure, we found that quartersawn panels have shown superior performance to backsawn panels. That may be of interest in regard to the painting of such timbers.

Mr. Payne: I do not know if there is to be an exposure station established in Tasmania. I discussed the question of research into such matters with a senior architect of the Agricultural Bank. He is in a position to know timber and he was satisfied that the State was in need of research into paints. His Housing Commission had been in co-operation with the Defence Research Laboratories in the matter. He stressed the need of research, and indicated that the total cost of paint and its application on Commonwealth and State houses in Tasmania was now almost up to 4/6 per sq. yd., equal to the cost of the weatherboards when fixed. Breakdown sets in at 6 months on exposed surfaces and repainting has been needed after 12 to 18 months on the average. The main weaknesses were chalking and checking. They attributed these failures to low lead content and failure to use non-chalking material. They have been able now to get a firm (Berger's) to guarantee their paint and are hoping to get others (Taubman's, B.A.L.M. etc.) to do this also. This architect asked me to ask that, if a Conference were held to discuss either the results of past programmes or future programmes, they might be represented at such a Conference to give practical ideas of field experience in regard to paints. The Housing Division of the Bank could provide the help needed, and if we can help also, we will be only too glad to do so.

Mr. Cox: It is largely a matter of whether a suitable site under suitable supervision can be obtained in Tasmania. If that can be arranged, we will be able to extend the programme to Tasmania. We have heard of the troubles of painting Housing Commission homes. It is only a repetition of what we have heard from the other States, including Victoria, and it is the same story of making an excuse for the poor quality of paints. This is not justified. Manufacturers have just supplied poor material and have attempted to make money out of the fact that the Housing Commission has been purchasing paints without any specification. They have been putting paint on houses without any proper supervision. It was left to sub-contractors to use any paint. As far as Victoria is concerned, they have used a paint which has been supplied by an approved manufacturer. Special paints are made up for the Housing Commission and similar bodies. We have seen many examples of paints being used (particularly priming paints) that have been quite hopeless as far as their formulation is concerned. They should have known that they would not give satisfactory service. Our best recommendation to such an organization is that they should use the S.A.A. specification for house paints and insist on manufacturers' materials conforming to those specifications. They then have some come-back in the event of failures due to poor quality paint.

Mr. Turnbull: Are paints conforming to the specifications readily available?

Mr. Cox: Any reputable manufacturer will supply them. Nearly all the manufacturers wanted us to agree to cutting down the exposure periods to about half of what we wanted. They then used various excuses about uncertainty of supplies of materials but when they were taxed with the question of whether or not their first grade paints would conform to the standard, they all had to admit that they would. Supplies are not exactly ample even now, but linseed oil is not really short.

Mr. Higgins: In regard to the face checking of plywood I should like to draw Mr. Huddleston's attention to the work which has been carried out here on this project. The type of painted surface is not the only factor to be considered, as various factors in the manufacturing process of the plywood can contribute to the development of face checks on panels exposed to the weather. Reports on this work are available. Perhaps the most important single factor in manufacture is the thickness of the face veneers used, the thinner veneers giving less development of checks upon exposure. We have also carried out some exposure tests on panels coated with various proprietary paints and have evaluated the relative degree of face checking after various periods. This information is available but as it refers only to proprietary lines it is probable that Mr. Huddleston would like some more general information regarding the various basic types of paints. However, I think the point regarding the factors in manufacture is worth taking into consideration if large numbers of the road signs, to which Mr. Huddleston referred, are to be used. It is possible that plywood manufacturers might be prepared to modify their process so as to give a plywood panel which will exhibit the best resistance to face checking.

Mr. Clarke: It was suggested at the last Conference that a sub-committee be formed for this work. It seems that such a committee is not really required and that contact can be made directly between the Defence Research Laboratories and the various Forest Departments.

Mr. Huddleston: I feel that, at this stage, the Committee is not necessary. My suggestion would be that we endeavour to overcome the difficulties by personal contact between the workers at the Defence Research Laboratories and in the respective States. If this cannot be made to work satisfactorily, consideration can then be given to the formation of the Committee.

Mr. Cox: I think that would be satisfactory. We may want advice or perhaps sometimes confirmation of the importance of some particular project, or possible advice on timbers at times, but would it be satisfactory if we could refer to your Division for general advice in these respects?

Mr. Clarke: Yes. We would get in touch with the States. If only one State is concerned, it would be best to refer direct to that State. I suggest that we might keep this paints and lacquers item on the programme each year.

Mr. Cox: I think that would be well worthwhile. We could then discuss any point that does require more general discussion.

Mr. Clarke: During the year we had discussion with Mr. Cox over his difficulties in obtaining material from Queensland. Fortunately one of his officers was in Queensland and got in touch with Mr. Ellis. We also put him in touch with Mr. Youl of the Victorian Sawmillers' Association who helped him to obtain supplies.

Mr. Cox: We did get some timber at the time from Mr. Youl. It was not quite satisfactory. I think we should make our requirements known sooner next time because we got desperately short at that stage and it was a matter of what Mr. Youl could supply.

Mr. Clarke: I think we have recognized that there is a timber factor in these investigations and our various members can help the Defence Research Laboratories in facilitating the supply of test materials, but obviously they cannot carry out their tests without any material.

Mr. Huddleston: Has there been any difficulty in N.S.W.? We have received requests from time to time. If there are other difficulties I would like to know of them.

Mr. Bussell: I think the last approach to N.S.W. was in connection with the blackbutt and cypress pine, etc. and since then, we have not needed any from N.S.W., but that was received in good order and was of very high quality and has helped us considerably in that programme.

Mr. Clarke: We will leave this question for direct contact by the Defence Research Laboratories with State Services or through us.

Mr. Cox: While I am here, I would like to extend a general invitation to members from other States to visit Maribyrnong. We would be only too pleased to show you the work we are doing there. We would be very pleased to welcome you all out there and I would like that invitation to go for now or any other time.

Mr. Clarke: I think some of the delegates are leaving soon after the Conference. We might make it a visit for the next Conference. How would members feel about that. We could perhaps bring it up to them when considering the Agenda for the next Conference.

37. ASSUMPTION OF APPLIED WORK BY STATE FOREST SERVICES.

Mr. Ellis: With the new status of the Division of Forest Products and with the restrictions on expansion it is obvious that it will be essential for the State Services to take over more applied work. From the papers presented this week it is obvious that the Division is working along sound lines. It is not possible for Queensland to take over any more applied work at present, without dropping some of our current work. We will examine the position in the coming months and communicate with Forest Products further in this connection.

<u>Mr. Huddleston</u>: I feel it is essential that we should relieve the Division of as much applied work as possible to let them concentrate on fundamental studies. But I am concerned that this assumption of applied work should be made by the two northern States, leaving the Division free to do more applied work for the remaining States.

<u>Mr. Clarke</u>: During the year I contacted the Victorian Forestry Commission to arrange a meeting on the assumption of some Victorian applied work by the Commission. The matter lapsed owing to the uncertainty in the composition of the Commission at the time. Only this week has the Commission been brought to full strength and this meeting can now take place.

I also discussed the matter with Mr. Stoate of W.A. and stressed the desirability of W.A. building up its wood technology staff again. I have offered to train any such officers in the Division. On our part we are encouraging the States to take over more of the applied work.

<u>Mr. Payne</u>: At last year's Conference I gave members an assurance that I would do all I could to induce the Tasmanian Forestry Commission to take over applied work on forest products at present being carried out by the Division of Forest Products. I am able to report some progress.

In March 1950 the Commission proposes to appoint one of its graduates from the Australian Forestry School to full time duties on investigations into the utilization of timber. His first assignment will be mill studies, this being a most important field of enquiry from the Commission's point of view, influencing directly, as it probably will, questions of management and finance. Forest products research covers such a wide range of activities, as is indicated by our Agenda, as to be beyond the compass of one man to handle. It will be necessary in order to obtain effective results that work in Tasmania be confined within fairly narrow limits. But the appointment proposed will at least provide direct liaison between a technical officer in the Tasmanian Department and research officers of the Division of Forest Products. I look forward to introducing this officer to the members at next year's Conference.

Mr. Huddleston: We would be glad to help in the training of such officers if desired. We have a well established organisation covering extension work.

Mr. Clarke: It may be possible for some of the States to carry out some routine mechanical tests on timber.

Mr. Cooper: If more wood technology officers are required it would seem desirable that this side should be emphasized in forestry schools. Overseas one can major in either sylviculture and management or forest products.

With the new Working Plan proposed it should be possible for us in 10 years to test 30 major species and 200 minor species of the 400 or more awaiting test. But this may mean that we shall not be able to carry out sylvicultural or other experimental work and we should like to shed some of this burden.

Every State University in Australia has testing facilities and it may be possible to interest Professors of Engineering to undertake some of this work. In the three months of the vacation one man could test one major species.

Mr. Huddleston: I support Mr. Cooper's contention that forest products work should be emphasized in Forestry schools. I can assure Mr. Cooper that the N.S.W.

Division of Wood Technology will do everything possible to help in this routine testing. We have good timber testing equipment which has not been used for the past two years because of staff difficulties. Our first object would be to fill some of the gaps in our wartime scout testing programme. We random sampled a large number of species and tested these on an accelerated programme. We then transferred to routine specification testing and abandoned the scout testing. Many of the major species were represented by only one or two logs in our scout tests and our aim is to have every species represented by at least five logs. We can undertake that we will test New South Wales timbers in N.S.W. We have ordered 400 logs for testing and delivery of these should commence shortly.

Mr. Clarke: Species which cross State boundaries must not be overlooked. With our new sampling programme we have reduced enormously the amount of material required from each tree for testing. We take small samples from a large number of trees.

Mr. Ellis: If the Division of Forest Products could collate results we could probably arrange for some routine testing.

Mr. Clarke: We would provide the Working Plan and help with the statistical analysis.

Mr. Ellis: On the matter of forest products education, it is to be regretted that the Victorian and Canberra Forestry Schools are not represented at these Conferences, and I think this should be borne in mind for future Conferences.

Mr. Turnbull: There is a Board of Higher Forestry Education which meets regularly. The matter of intensified wood technology training could be referred to this Board.

Mr. Irvine: If the Engineering School of the University or the Melbourne Technical College can undertake mechanical testing of timber I am sure the Victorian Commission would undertake to arrange for collection, seasoning and preparation of samples for test.

Mr. Turnbull: I do not think this routine testing would be sufficient to obtain a higher Degree, which is granted on the understanding that the student has shown some originality in conceiving the work for his thesis himself, in planning and carrying the work out.

Mr. Huddleston: At Sydney University there is a great demand on the testing facilities by the industry, for special tests not covered by other Government testing laboratories.

Mr. Clarke: I am still impressed by the fact that New Zealand has carried out the whole of her mechanical testing on the basis suggested by Mr. Cooper. It is a good suggestion and should be followed up. In our T.M. Laboratory we are working our testing machines from 8 a.m. - 5 p.m. without a break. We will take the initiative in this matter and communicate with the States during the year.

Mr. McAdam: Should we not make a survey of available testing machines in Australia? Arrangements might then be made for the Forest Services to man any available machines.

Mr. Clarke: We could probably get these figures from the National Association of Testing Authorities but I do not think that lack of machines is the limiting factor.

Mr. Cooper: Are mechanical properties required for all species?

Mr. Huddleston: We desire to have mechanical properties of every species growing in our forests. It is significant that we have no available figures on brush box and very few on blackbutt.

Mr. Clarke: As an instance of the need for data we can take a recent enquiry. Tasmania relies largely on the Wadamanna power scheme which has three pipelines, two of which are wood stave. These have exceeded their useful life. They were made originally of karri but we have been approached regarding suitable timbers for reconstruction of the pipeline. The obvious species is Tasmanian E. obliqua and we recommended this although we have no figures to support our recommendation. We could only state that we thought it would be satisfactory but there would be a slight reduction in the factor of safety.

Mr. Turnbull: Authentic data are not available for many important timbers. I think we should rank species according to their availability and aim to cover them in order of importance.

38. STANDARDS.

(a) General.

Mr. Head: The Timber Industry Committee is generally representative of all the main interests concerned with timber. Its function is to assess the value of any new work proposed, allocate priorities to such work, issue directions to the various technical committees and, finally, approve on behalf of the Council of the Standards Association the standards prepared by those Committees. The Industry Committee is a very large one and meets only at long intervals as a full Committee. Within the policy system laid down, the normal work of the Committee is carried out by a small Executive. Although there are State sections for each of the Sectional Committees allowed for, it was realised that some of the States would have insufficient technical personnel to staff a number of Committees and the State organisation was accordingly modified on the following basis.

New South Wales has five State sections, one for each of the Sectional Committees and a sub-committee of the Codes Committee: Victoria has three State sections, one for wood technology (including plywood), one for wood utilization (includes both general and engineering), one for wooden cases and packages and a sub-committee of the Codes Committee. Queensland, South Australia, West Australia and Tasmania either have or will have one joint State Committee which will deal with all matters affecting timber standards.

The terminology of the various Committees indicates broadly their terms of reference. Wood Technology, for example, is concerned with terms and definitions, nomenclature, grading rules and all specifications for timber products as regards quality of material and for standard methods of test. The work in hand by this Committee is firstly the revision of A.S. O.2 "Nomenclature of Australian Timbers", and secondly the revision of A.S. O.3 "Milled Flooring, Part I" being handled by the Victorian and Tasmanian Committees, Part II by N.S.W. and Queensland and Part V by South Australia and Victoria. Grading rules for scantling are being considered in Victoria, Tasmania, N.S.W. and Queensland. Preliminary work has been carried out on a specification covering moisture content in timber. Urgent future work for this Committee includes grading rules for railway sleepers (permanent way), cross arms, joinery timbers and the preparation of standard methods of test for boric acid concentration of treated timbers.

The Timber Utilization Sectional Committee deals principally with dimensions of timber and methods of fabrication. Work in hand includes draft standards for kitchen fitments, wood windows and for doors and door frames. Standards have been issued during the current year for bath room cabinets and timber clothes line posts; all of these standards are in the interim series of the housing group. The Plywood Sectional Committee has issued a draft standard for waterproof plywood which is at present under review. It will consider also the revision of the existing A.S. O.6 "Plywood". Preliminary work on synthetic adhesive specifications has been carried out. A draft standard for battery separators has been prepared replacing the emergency standards (E)D.1504 and (E)D.3003. Preliminary work by a panel of the Victorian Codes Sub-committee has been carried out on the preparation of a carcass code for timber framed buildings.

Mr. Ellis: It is over 12 months since a Standards meeting of the Timber Industry has been held. Would it be possible to arrange a meeting of the Timber Industry Committee to coincide with this Conference next year?

Mr. Clarke: It does seem desirable that another meeting of the Timber Industry Committee should be held to see if the work cannot be speeded up.

Mr. Ellis: The Standards Association succeeded in interesting Queensland people in their work 12 months ago. The enthusiasm is still there but if nothing is done soon this interest will wane.

Mr. Huddleston: The slowness in issuing specifications is caused by the staffing of the Standards Association Committees. The Association has been assigned a tremendous job by industry but has not sufficient funds or staff to adequately cover the field.

Mr. Head: There is a certain amount of slowness on the secretarial side but we ourselves have been reponsible for some delay in the issue of specifications because of our insistence that before any specification is put before a Committee the basic field work shall have been carried out, thus enabling sound consideration by the Committee.

Mr. Banks: As Chairman of the Association's Housing Standards Coordinating Committee, I agree with Mr. Huddleston's opinion that much of the slow progress with the Committee work is due to the S.A.A. staff of technical secretaries being overloaded. Their burden is added to by committees which are apathetic and which are constantly changing their minds. As a result, more speedy progress is often made with work of a less urgent character, because the subject is more straight-forward or the committee more enthusiastic. Looked at from any point of view, I believe that a strengthening of the S.A.A. staff position is essential if the Association is to fulfil the demands being made upon it.

Mr. Clarke: Perhaps a resolution from this Conference could recommend that E.S.T.I.S. should become contributing members to the Standards Association.

Mr. Ellis: I think it would be better for members of this Conference who attend the next meeting of E.S.T.I.S. to convey to E.S.T.I.S. personally the feelings of this Conference on the matter.

Mr. Turnbull: The feelings of this Conference can also be conveyed personally to the Timber Industry Committee Executive at its next meeting.

(b) Grading Instruction.

Mr. Head: The need for grading instruction was discussed at an earlier Forest Products Conference. The need is getting more urgent. This year, in cooperation with the Faculty of Architecture at the University, we gave a series of lectures to 3rd and 4th year architectural students. These should induce them to realise some of the problems associated with timber use and the very real need for them to get an appreciation of grading generally. The 60 students took a very active interest in the lectures. We are also giving lectures to the Building Workers' Industrial Union. We are trying to interest users in the various grading specifications in existence and to make them more aware generally of timber and its properties.

(c) Inclusion of Sapwood in Non-Lyctus Susceptible Species.

Mr. Ellis: Sapwood of non-susceptible species should not be restricted in standard grading rules for hardwoods, particularly with respect to flooring. In specifications which provide for three grades, sapwood of non-susceptible timber has been permitted only in the second grade and I do not see the justification for this. I would be interested to hear the views of other delegates.

Mr. Huddleston: In New South Wales, Interim Standard 202 provides for two grades of flooring - select and standard. Select grade is for polished floors and standard grade is for floors to be covered. There is a restriction of sapwood on the face of the board in select grade. This was brought about by the necessity to avoid changes in colour in polished floors.

The specification being prepared for building scantling in N.S.W. allows for sapwood on timbers sawn from non-susceptible species. Where appearance does not matter sapwood will be allowed in non-susceptible species.

Mr. Ellis: In Queensland today 80% of flooring timber in the middle grade would be select grade except for the sapwood.

Mr. Clarke: Mr. Huddleston seems to have laid down a sound principle that if there is an outlet for all material containing sap in another grade it might be excluded from the highest grade. The position seems to be different in all States. The tendency in most States seems to be to eliminate the specially select grade. Because of the supply position in N.S.W. that State is able to be more restrictive in its select grade but this does not apply to Queensland. 90% of floors in N.S.W. are laid to Standard Grade 202.

Mr. Head: The matter is one for decision by individual States. We will be faced with the high incidence of sapwood in red gum flooring but once the Preservation Section finally determines the susceptibility of red gum sapwood this will influence the decision as to whether the sapwood may be included. All these questions can be handled within the ambit of the present Standard.

39. STANDARDIZATION OF SIZE OF CASE SHOOKS.

Mr. Ellis: In Queensland there is a State Act which provides that case shooks shall be provided by sawmillers in multiples of 2/3". This is contrary to sawmilling practice throughout the Commonwealth. Could the Division of Forest Products take the matter up with an appropriate Commonwealth authority?

Mr. Clarke: Mr. Turnbull will raise the matter with the consultative committee of C.S.I.R.O. and the Department of Commerce.

NEXT CONFERENCE.

Mr. Ellis moved that the next Conference should be held at approximately the same time next year, subject to other considerations.

Mr. Payne moved that the Conference be fixed tentatively to be held in Melbourne next year.

RESOLUTIONS AND SUGGESTIONS FROM THE FOURTH FOREST PRODUCTS RESEARCH CONFERENCE

1. The Proceedings are to be as complete a record of the Conference as is possible.

2. A list of resolutions and recommendations is to be prepared as soon as possible after the Conference.

3. This Conference requests the Forestry & Timber Bureau to prepare an industry report dealing with building boards.

4. N.S.W. to report to the next Conference on further work in connection with building boards.

5. That the work on Standard Nomenclature for Australian Timbers be continued along lines at present being pursued by Division of Forest Products.

6. Mr. Bland to advise Queensland of the organizations and individuals in Queensland who have been circularised with reference to the Phytochemical Register. Queensland to suggest further possibilities if possible.

7. The Division of Forest Products is to prepare a Working Plan with a view to assembling information as to the standard of railway sleepers accepted by various States, which will lead eventually to the uniform preparation of Australian standard specifications for railway sleepers for use in Australia and New Zealand.

8. All States to give consideration to their requirements for the installation in railway lines of test sleepers treated with preservatives at high pressure. When this is done the Division of Forest Products is to lay down a programme so that sleepers will be cut and seasoned ready for treatment when required.

9. New South Wales and Queensland are to make collections for durability tests: fast and slow growing ironbark to be included among first lot of timbers tested.

10. Preservation Section, Division of Forest Products, to seek a suitable laboratory method for testing preservatives with the object of obtaining a quick assessment of the effectiveness of preservatives.

11. Pole bulletin to be produced during the coming year recording the results of the various pole durability tests.

12. The States to suggest modifications to the preliminary list of names of imported timbers circulated at the Conference by the Commonwealth Forestry & Timber

Bureau. The modified list to be returned to the States after it has been placed in order by the Commonwealth Forestry & Timber Bureau, and, on agreement by the States to be forwarded to the Standards Association of Australia for issue as an interim standard, and circulated to the countries concerned for comments with the idea of ultimately publishing a complete Australian standard. A letter should be forwarded by this Conference to the S.A.A. advising this Association of the resolution.

13. A questionnaire on pole tests is to be forwarded by D.F.P. to the States, a Working Plan drawn up, and tests extended to N.S.W., Queensland and New Guinea.

14. A cross arm survey to be carried out in N.S.W. and possibly in Queensland.

15. Mr. Tamblyn to follow up what has happened to Dr. Young's collection of fungi. All State Services are to consider means of collecting specimens.

16. LYCTUS CONFERENCE.

A. A re-examination of the toxicity of boric acid and borax to Lyctus is to be undertaken by D.F.P.

B. Defence Research Laboratories to prepare and forward to the State Forest Services a statement on the health hazards associated with sodium fluoride.

C. Division of Wood Technology to prepare an initial draft for a standard specification for boric acid treatment, and to forward it to the Queensland Forest Service, Division of Forest Products and Victorian Forestry Commission for comment before forwarding it on to the Standards Association.

D. Queensland and New South Wales are to forward to D.F.P. lists of species which they desire to be tested for Lyctus susceptibility, in particular those about which there is not unanimity. D.F.P. is to advise these State Departments of details of specimens required for testing, and conduct such tests.

E. The work on susceptibility of radiata pine to Anobium is to be continued along present lines.

F. Publicity is to be given to the fact that the Conference views with alarm the fear that is being built up in the community that houses containing Baltic timber are liable to be subjected to serious borer attack, and that householders, before involving themselves in spray treatments should get in touch with technical authorities.

G. Division of Forest Products to determine whether it is possible to get the Lyctus Treatment Manual published.

H. That this Conference is impressed with the need for a statistical survey in all Australian States to determine the extent of borer, termite and decay damage to buildings, the object of this survey being to indicate the extent to which preservative treatment of building timbers and/or changes in building practice may be necessary to reduce pest damage.

It is further moved that the Department of Works & Housing and the Division of Forest Products be requested to institute, and to collaborate in, this survey along the lines already being undertaken in N.S.W. by the Division of Wood Technology of the N.S.W. Forestry Commission and the Department of Works & Housing working in collaboration.

J. One hundred sheets of plywood with Lyctus repellents in the glue lines to be made up and tested in various parts of Queensland. The question of testing in furniture to be deferred for 12 months.

K. Queensland and N.S.W. to recommend sampling procedure for analysis of boric acid treated timbers. The Division of Forest Products is to investigate more accurate methods of boric acid analysis.

L. Reject spruce from aircraft manufacture to be tested for battery separators, also southern sassafras, rose alder and parana pine.

M. That the name "Lyctus Conference" be discontinued and the business normally carried out under this title be incorporated in the Forest Products Research Conference.

17. The Division of Forest Products to examine the capacity method for determination of moisture content of timbers, particularly with respect to salt impregnated and preservative treated wood.

18. Action by D.F.P. in preparing a list of Standard Terms and Definitions in Forest Products be continued - the list to be forwarded in one lot to the States for their comment.

19. High priority to be given the experimental work on vapour drying, and the questions of whether

preservatives can be incorporated in the drying medium and of the relative economics compared with ordinary kiln drying to be investigated.

20. The comparative cost figures between the predrier and the combined method of air and kiln drying to be forwarded to all States and Defence Research Laboratories (Mr. West).

21. Mr. Gordon to keep all States informed of the activities of the Composite Wood Corresponding Committee.

22. Division of Forest Products to receive wood samples resulting from A.C.T. E. gigantea seed grown in Tasmania and vice versa.

23. Specific requirements of plantation material for growth studies to be forwarded by D.F.P. to Queensland.

24. In further experiments on adhesives, the problem of whether acid casein is satisfactory under humid conditions should be explored.

25. The use of blood albumen and alternative proteins as glue bases are to be investigated.

26. Tests to be carried out on the use of Queensland eucalypts for plywood.

27. The use of tannin containing timber waste in the manufacture of building boards to be further investigated and reported on by the Division of Wood Technology, N.S.W.

28. Further work to be done on the utilization of P. radiata and mangrove barks for tannin production and/or board manufacture.

29. The Division of Forest Products to give high priority to studies on the following sawmill engineering items

    A. Correct rate of feed for various timbers
    B. Shape of the saw tooth
    C. Power requirements for sawmills.

30. New Guinea Forest Department to take up with Dr. Anderson directly the question of mangrove barks for tannin analysis.

31. Mr. Tamblyn to communicate with Mr. Webb in connection with the collection of forest fungi.

32. Correspondence be initiated between Queensland Forest Service, the N.S.W. Forestry Commission and Division of Forest Products with the object of establishing a satisfactory method of wood ash analysis

33. Division of Forest Products to keep Queensland advised as to progress in having a lecturer in wood technology at the University of Melbourne.

34. Further demonstration floors to be put down, and including brush box, to determine whether the 9/16 inch proposal can be applied to this species in flooring.

35. Work on the relationship between silviculture and properties to be continued, particularly in connection with the development of brittle heart.

36. Defence Research Laboratories to undertake the preparation of a publication which can be issued by the State Services as a result of enquiries on general painting technique.

37. N.S.W. to forward samples of failure and crazing of plywood road signs and Defence Research Laboratories to develop or advise on a suitable paint for the purpose.

38. Defence Research Laboratories to develop or advise on suitable stencil paints for green timber, and for printing on timber exposed to open storage.

39. A paints and lacquers corresponding committee is not to be set up but State Services to submit painting problems directly to Defence Research Laboratories.

40. The "Paints and Lacquers" item to be retained on the Agenda of the Forest Products Research Conference each year.

41. Exposure trials of painted panels to be supervised and maintained by the State Forest Services where exposure tests are made on the Service property.

42. The possibility of a visit to Defence Research Laboratories to be considered for the next Forest Products Research Conference.

43. Division of Forest Products to investigate the utilization of stringybark and E. regnans for pole timbers in Tasmania.

44. The State Forest Services to investigate the possibility of carrying out routine mechanical tests of species with State facilities such as Universities on the basis that D.F.P. would assist if required with Working Plan, analysis and reporting.

45. Mr. Turnbull to raise the matter of standardization of size of case shooks with the consultative committee of C.S.I.R.O. and the Department of Commerce.

46. The next Conference to be held at approximately the same time next year. Melbourne has been tentatively fixed as the place.