FOREST PRODUCTS NEWS LETTER

This monthly bulletin is prepared for general circulation by the Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4., and will be supplied free on request to members of the timber trade and timber users who wish to keep abreast with current developments in the field of forest products.

No. 139 1946##139 April, 1946.

INTRODUCTION.

The Monthly News Letter of the Division of Forest Products was first published in February, 1932, and up to the present 138 issues have been distributed. Over the last few years, however, the issues have been somewhat erratic. This has been due to the fact that a number of officers of the Division have been away in the Services, and there has been a serious staff shortage coupled with heavy demands on the Division because of wartime problems.

The Division is now back to its peace-time programme, and the staff position has been eased somewhat as the result of the return of members of the fighting forces.

The change-over from war-time to peace-time conditions has not been an easy one, because the peace-time problems of industry have become no less urgent through having to be relegated to the background during the war years. However, the policy of the News Letter remains unaltered, i.e., to assist in the development of forest products industries in all their phases, and to help in the resolution of their problems. The Forest Products News Letter will, as before, bring you the latest information about the work of the Division, and at the same time keep you abreast of developments overseas which are likely to be of interest to the Australian industry.

Any enquiries regarding the News Letter should be addressed to :

The Editor,
Forest Products News Letter,
Box 18, P.O.,
SOUTH MELBOURNE, S.C.4.

THE PRESERVATIVE TREATMENT OF FENCE POSTS

By N. TAMBLYN, Officer-in-Charge Section of Wood Preservation.

The Division of Forest Products receives many requests for advice on the preservative treatment of fence posts, and in view of land settlement schemes connected with rehabilitation, the time is now opportune for a review of practical treatment methods based on field tests conducted by the Division.

The principal tests are in Western Australia, where they are being carried out in co-operation with the W.A. Forests Department, and were installed in 1930-31 to demonstrate that round fence posts of relatively non-durable timbers could be treated simply, effectively and cheaply without special equipment. The results over 16 years have shown conclusively that many timbers regarded as unsuitable for posts on account of low natural durability will give long and satisfactory service if treated by the method described below

Before considering treatment methods, a general understanding of the problem of fence post treatment and some of the fallacies to be avoided is desirable. The first question for consideration is what type of preservative should be used and how should it be applied. For treatment of fence posts a cheap preservative is required, and in this category creosote oil at approximately 1/1d. gallon, and zinc chloride at approximately 8d. per lb. (current Melbourne prices) are outstanding. Both are readily available in Australia, and have proved thoroughly reliable in service tests. Zinc chloride should preferably be mixed with arsenic, which is also available at very low cost. In general, proprietary preservatives are not economical to use on account of their much higher cost. Method of application is important, as deep and thorough penetration into the wood is the first essential of any treatment where long service is required in exposed positions, and particularly in contact with the ground. However good a preservative, it cannot be expected to give lasting protection under the above conditions if applied merely as a surface coating.

The second question is how can sufficiently deep penetration be obtained by simple methods ? The answer to this question introduces the subject of round versus sawn or split posts, and the relative ease of penetration of sapwood and truewood (heartwood). With round posts the full thickness of sapwood is intact, while with sawn or split posts the sapwood is either cut off or is present only on one face. The important point in this connection is that sapwood is easily penetrated by preservatives, while the truewood (or heartwood) of most Australian timbers is extremely refractory and will take preservative only if treatment is carried out in expensive high pressure plants. Thus the presence of sapwood is not an unwanted defect, but is essential where preservative treatment is to be applied by the method to be described.

In the Western Australian tests a number of different preservatives was used, and the posts were installed in three different localities under varying conditions of decay and termite attack. The results for *round* posts of eight different species after 14 years' service may be summarised as follows : (The posts were butt-treated only) :

Preservative.	% Failed.	% Badly Attacked.
Mixture of creosote and crude oil	1	3
Zinc chloride and arsenic	3	4
Sodium fluoride and arsenic ...	4	11
White arsenic solution	4	14
White arsenic collar	16	23
Tar (brush coated)*	100	—
Untreated	67	15

* Only one timber species treated with tar.

Of the various preservatives tested, the creosote and crude oil mixture used as a butt treatment has proved somewhat better than the mixture of zinc chloride and arsenic, which however, has also performed very satisfactorily. The other treatments were less effective and in particular show the negative value of commercial tar as a wood preservative. In this connection it should be mentioned that crude oil alone also has little or no preservative value, but for economy is often used to dilute creosote. While creosote oil may be used without dilution, crude oil or sump oil should never be used alone.

Method of Treatment :

Round fence posts to be butt-treated should be barked and seasoned for several months, as good penetration will not occur, especially with oil preservatives, unless the sapwood band is reasonably dry. As creosote oil is simpler to use than zinc chloride and arsenic it is recommended that treatment be restricted to this preservative. The creosote oil should be purchased to conform to Australian Standard K.55, and may be

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A NOTE ON SAWDUST AS A BUILDING MATERIAL

Sawdust has received some attention as a possible building material for a number of years. This attention has been given more especially overseas, but also, to a limited extent, in Australia. In general its use has met with only a limited degree of success.

This is primarily because, offsetting the obvious advantages of lightness, insulating properties, and cheapness of the raw material, is the disadvantage of comparatively large movements with changes of moisture content due either to changes in humidity, or actual wetting and drying conditions.

Sawdust may be used in conjunction with various binding agents or cements to suit the particular usage; and Portland cement, Magnesite (magnesium oxy-chloride), gypsum (plaster of paris) and synthetic resins have all been used.

Other materials such as sand, granite chips and bitumen have also been added to obtain special properties such as reduced moisture movement and better wearing, working and finishing qualities.

In the discussion following, remarks are confined to the use of Portland cement only as a binder.

Portland Cement–Sawdust.

Portland cement is perhaps the cheapest binding agent available, and as such it has received first attention with the revival of interest in sawdust-cement products as a possibility for a number of different applications in building.

Pre-Treatment of Sawdust.—Overseas work has shown that in using Portland cement-sawdust combinations, care must be taken to ensure that extractable materials in the sawdust do not upset the hardening qualities of the cement, and special treatments have been advised, some of which are patented.

The simplest method is probably the addition of a preparation of hydrated lime to the mix, and this method, using between $\frac{1}{6}$ and $\frac{1}{3}$ volume of lime per volume of cement, has been recommended by the British Building Materials Research Station for use with the sawdust of several overseas timber species.

Satisfactory setting has been obtained with this treatment on the dry sawdust of Australian grown Pinus radiata and mountain ash in experiments carried out by the Division of Forest Products.

On the other hand, the British work shows clearly that certain species may give setting troubles even with lime present; in this case special pre-treatments are recommended. These consist of (i) Immersion of sawdust in boiling water for 10 minutes. (ii) Washing freely with water. (iii) Further immersion in boiling water containing 2 per cent. ferric sulphate. (iv) Wash and allow to drain.

In using such treated material the lime addition is again recommended, but in view of the expense involved and the fact that some of the Australian species do not need the special treatment, it is suggested that a check test be made upon the sawdust batch to determine whether the proposed mix hardens satisfactorily using only the addition of a suitable quantity of hydrated lime.

Setting Accelerators.—The use of a setting accelerator such as calcium chloride has been found useful. The quantities tested have been about 4 per cent. or 5 per cent. of the cement weight.

Water Quantities.—The quantity of water used in preparing the mix is most important, but it is difficult to make specific recommendations because the water required varies with the condition of the sawdust; and the actual amount of solids present in any volume of sawdust varies considerably from batch to batch.

In general, the best mixes on a strength basis are of such a consistency that it is more or less impossible to draw a cement skin to the surface during trowelling, while a smooth surface can still be produced. The desirable mix usually has a moist earth consistency with no appearance of free moisture. For a 1 : 3 mix (by volume) of cement-sawdust, the weight of water required may range from 0.8 to 1.4 of the weight of the cement used. The wideness of this range is due to variation in the dryness and other properties of sawdust. For any particular sawdust, however, the water : cement ratio is very critical, a variation of only 0.05 from the optimum ratio having an appreciable effect on the final properties of the mix.

Test blocks should be used to check strength, but assuming that a satisfactory set is obtained for any particular mixture proportion, the highest density of product is usually a good indication of satisfactory mixing, placing, strength, and water quantity.

Sawdust Grade.—Sawdust size naturally has an important effect upon appearance, and in general the finer gradings appear to trowel more satisfactorily. There seems to be comparatively little change in strength with grade size, but the effect upon durability is not known.

Proportions.—The practical range of proportions of cement-sawdust mixes is perhaps 1 : 1 to about 1 : 5 of cement to sawdust by volume, and the products at the heavy end of the range are strong and dense, while the 1 : 5 mixes are much lighter and show proportionate loss in strength, fire resistance and increase in movement with moisture changes. The leaner mixes can be cut and nailed readily, but the richer ones become progressively more difficult to nail as drying (maturing) proceeds.

Movement with Change in Moisture Content.—Since sawdust moves more with moisture changes than does cement, it is not surprising that material with higher sawdust proportions shows a higher movement with moisture change, and in use the considerations of increased strength and reduction in movement must be balanced against loss in insulation and nailability and increasing weight and cost.

Wetting and drying conditions acting on a 1 : 3 cement-sawdust mix would cause perhaps six times the linear movement which similar conditions would produce in a 1 : 3 cement sand mix, so that special care must be taken in using the material as a concrete substitute even if the material is applied as, say, precast slabs, even after having been given an adequate maturing treatment.

Methods employed to minimise movement have included water proofing by tar or bitumen after installation in temporary structures, or the use of a special design to allow the movement to be taken up within a building.

Uses.—The use of the material has been proposed primarily for walling slabs, flooring slabs and roofing slabs, and as a timber substitute for shelves.

Manufacture.—In general, for the manufacture of precast products, hand moulding into wooden moulds is satisfactory, and cement-sawdust proportions of 1 : 2 to 1 : 3 represent perhaps the most useful range giving reasonably good crushing strengths. The product should be matured under cover and larger units should not be attempted until the shape has been tested experimentally.

Portland Cement–Sand Sawdust.

Because of the difficulties with shrinkage movement, especially in jointless floors, sawdust-cement mixes have proved critical in their laying conditions; and in endeavouring to reduce this, different tests have been made with the addition of a suitable inert aggregate such as sand or granite chips to the cement–sawdust mix. This gives an effective reduction in shrinkage, but also results in a reduction of some of the desirable properties of low conductivity and softness.

Proportions.—Actual proportions of the constituents may be varied considerably, and on a volumetric basis mixtures of 1 cement –2 sand –1 sawdust, to 1 cement –1 sand and –2 sawdust have yielded products of reasonably satisfactory appearance, but, of course, variation in strength occurs according to the proportions present.

Water Quantities.—The same general remarks apply here regarding selection of the water quantities as with the cement–sawdust mixes and the setting properties of trial mixes should be pre-determined before proceeding with building work.

Adhesion to Base.—Special care must be taken in bonding the surface to the aggregate base, and it should be cleaned thoroughly by wire brushing and then given a coat of cement slurry. The mixture should be applied before the slurry has set, and then be well consolidated and trowelled. Freshly-laid aggregate surfaces are far less troublesome than older ones, but if care is taken with the directions given, results should be satisfactory.

Wear Resistance.—Wear resistance of such floors is not well known, and they are therefore suggested for light wear conditions. Maintenance by oiling with a drying oil or by wax polishing is recommended.

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THE SEASONING OF AUSTRALIAN HARDWOODS

Over the next few years, if our urgent national housing programme is to be implemented, many hundreds of millions of super feet of seasoned timber in the form of flooring, joinery, weatherboards and fittings must be provided from Australia's own forest resources. Through the war years, huge quantities of seasoned timber were needed for innumerable service requirements. That these demands were met, and can continue to be met, is largely due to the work carried out by the Division of Forest Products over the past seventeen years.

Up till 1929 a widespread, and to some extent justified, local prejudice existed against the use of indigenous hardwoods. Ignorance of proper technique in handling species far removed in their seasoning properties from those of the more widely used overseas timbers, frequently produced disastrous results during drying, so that heavy losses from splitting, checking, warping and collapse were more the rule than the exception. As a result, imported timbers were generally regarded as superior to hardwoods of Australian origin for most purposes, the indigenous hardwoods being considered of little value except in heavy construction or for use in the less exacting roles of timber usage.

With the establishment of the Division of Forest Products, the problem of the proper utilization of Australian hardwoods became an urgent and major project. Firstly with the assistance of the industry new techniques for the conversion and seasoning of these timbers were developed and tested ; then the job of breaking down the long-established prejudices held by the general public was undertaken by means of demonstrations, lectures and literature. This phase of the work was then extended to the development of suitable kiln designs, and the supplying of plans and specifications for seasoning kiln construction, since industry itself could not supply this need. Even to-day the demand for this service is high and cannot be properly met elsewhere. To ensure proper handling and operation of the kilns installed, the Division next commenced a correspondence course for training industrial personnel in timber kiln operation, the only course of this type in the world. Some fifty students are actively engaged on this course at present.

The success of the Division's work in establishing the real value of Australian hardwoods may be gauged from the fact that in 1928 the number of seasoning kilns in Australia amounted to 83 only, capable of drying approx. 20,000,000 super feet per annum. To-day some 700 kilns are in operation, capable of drying approx. 250,000,000 super feet per annum on a 1-in. basis ; and this total does not include numerous drying rooms, conditioning rooms, veneer driers and special driers also designed for the industry. Furthermore, it is generally agreed by competent observers, that the standard of kiln drying in Australia is not surpassed in any other part of the world.

During the war years, pressure of immediate laboratory and other industrial projects prevented the Division from giving proper attention to extention work. However, the importance of maintaining general supervision of trade practice in this field is clearly shown by results achieved in a recent examination of kiln plants carried out in Tasmania. In the inspection some 12 kiln installations, comprising under 50 kilns, were examined. It was found that from 15 per cent. to 30 per cent. of the output of individual plants was being lost for want of attention to proper kiln technique. In the aggregate, this loss was found to total 5,000,000 super feet of seasoned timber per annum—enough to supply the seasoned timber requirements for the construction of an additional 2,000 homes annually, and this not only without the installation of a single additional kiln, but with reduced cost per unit of timber dried.

Some of the State Forest Services now have well-established forest products sections, and where this is so the Division works closely in association with these in its extension work.

The Seventh Annual Pulp and Paper Co-operative Research Conference

This Conference was held at the offices of Messrs. Australian Newsprint Mills Pty. Ltd., Boyer, Tasmania, on 19th-22nd February inclusive. These annual Conferences are attended by representatives of the Australian Paper Manufacturers Ltd., Associated Pulp and Paper Mills Ltd., Australian Newsprint Mills Pty. Ltd., and of the Division of Forest Products, C.S.I.R. This year the Division of Forest Products was represented by the Chief, Mr. S. A. Clarke, the Officer-in-Charge of the Wood Chemistry Section, Dr. W. E. Cohen, the Officer-in-Charge of the Wood Structure Section, Dr. H. E. Dadswell, and Messrs. A. J. Watson and A. B. Wardrop. Mr. Clarke was the Chairman of the Conference.

During the course of the Conference, Mr. S. L. Kessell, Managing-Director of Australian Newsprint Mills Pty. Ltd., gave a short address, in which he stressed the need for continuing research in the pulp and paper industry, and expressed his pleasure at the fine co-operation which had been developed between the three paper companies and the Division of Forest Products. In the main the material presented to the Conference consisted of reports of the work carried out by officers of the Division of Forest Products. These reports covered work on the structure of the cell wall and of the eucalypt fibre, studies of wood lignin, investigations of wood carbohydrates, the methods for the preparation of a wood sample for analysis, and the investigations of the pulp evaluation studies which have been carried out by the Division of Forest Products during the previous year. The Conference expressed its appreciation of the fact that the research work being carried out at the Division of Forest Products had attracted considerable interest overseas. This interest was manifested in requests for copies of the Proceedings of earlier Conferences and for additional information from the Secretary of the Technical Association of the Pulp and Paper Industry and from the Secretary of the Technical Section of the Paper Makers' Association in Great Britain.

During the Conference an opportunity of inspecting the bush operations of Australian Newsprint Mills was afforded the delegates. It was of particular interest to the representatives of the Division of Forest Products to observe how the logs of Eucalyptus regnans were handled in the bush and through to the mill.

THE PRESERVATIVE TREATMENT OF FENCE POSTS

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used without dilution or mixed with crude oil in the ratio of 2 parts of creosote oil to 1 part of crude oil by volume.

The essential treating plant consists of one or more tanks and a thermometer with a temperature range up to 240°F. For butt treatment of normal size fence posts the most easily obtained tank is the ordinary 44-gal. oil drum. Posts should be placed butt down in the drums and the height of preservative adjusted to about 30-in. (*i.e.*, a 30-in. butt length will be treated). Treatment consists of heating the creosote oil for about 2-4 hours (depending on the timber species to be treated) at a temperature of about 200-210°F., and then either allowing the posts to cool down in the drum or quickly transferring to a second drum containing the same height of cold preservative. Immersion during cooling is the important feature of this process, as absorption of preservative occurs as the the post cools.

Further details of this process may be obtained on application to The Chief, Division of Forest Products, or from the various State Forest Services.

The Properties of Australian Timbers

COACHWOOD.

(This is a revised description of this species, which was previously written up under the name of "Scented Satinwood" in News Letter No. 72).

Coachwood is now the standard trade common name for the timber known botanically as *Ceratopetalum apetalum*, D. Don. The standard trade common name for this timber has been, until recently, scented satinwood, but the perhaps more widely known name of coachwood has been reverted to, thus bringing the Australian and British standard names for this timber into line. The species is not related to the satinwoods of commerce, *Chloroxylon* from India and *Zanthoxylum* from the West Indies, both of which belong to another family, the Rutaceae.

Distribution.—Coachwood is confined to the brush forests of eastern New South Wales from just south of Sydney to the McPherson Range of the Queensland border. This species reaches its best development in the Oxley Highway area, and the Dorrigo Plateau, the two chief commercial production areas, where in many localities it may become the dominant species and occasionally may form pure stands of limited extent. Generally it is found as a sub-dominant species in association with many other brush timbers, e.g., sassafras, white birch, yellow carabeen, hoop pine, etc.

Habit.—Coachwood is a small to medium sized tree up to 80 or even 100 ft. high, and may attain a diameter breast high of 2 ft. 6 in. though generally under 2 ft. The tree is clean looking and without buttresses, and has a cylindrical bole of up to 50 ft. merchantable length. The bark is smooth and greyish in colour.

Timber.—The truewood of this species is pink to reddish-brown, weathering to a darker reddish-brown ; the sapwood is generally indistinguishable from the truewood, the colour gradually becoming a deeper pink towards the pith, and is not susceptible to attack by Lyctus. The timber may be straight-grained, but if cut from poor logs is often cross-grained. It has a fine and uniform texture, showing a pleasing figure on backsawn surfaces due to bands of soft tissue. It has a characteristic smell reputed to resemble caramel. It is moderately light in weight, averaging 39 lbs./cu. ft. at 12 per cent. moisture content, and has a normal range of 33 to 50 lbs./cu. ft. Coachwood is often rather free in the grain and prone to star and ring shake on felling or cross-cutting. No difficulty should be experienced in satisfactorily air or kiln drying this timber in thicknesses up to 3 in. It also dries satisfactorily in veneer form. During drying it does not readily surface check (it is more prone to internal checking than surface checking with unsatisfactory drying conditions), and there is little tendency to warp. Slight collapse may occur, but this is usually insufficient to warrant a reconditioning treatment. In drying from the green condition to 12 per cent. moisture content, this timber shrinks 8.3 per cent. in a tangential direction (backsawn) and 4.5 per cent. in a radial direction (quartersawn). Kiln drying from the green condition requires from 7 to 9 days in the case of 1-in. stock, and about 5 weeks in the case of 3-in. stock. After partial air drying to a moisture content of 30 per cent., about 4 days are required to kiln dry 1-in. material, and about 16 days are necessary for 3-in. stock.

In comparison with English birch, in the form of plywood, coachwood is lower in density (40 lb./cu. ft. as against 47 lbs./cu. ft.), has lower resistance to shock, lower pliability and a lower shear strength, but has a higher tensile strength-weight ratio, higher tensile strength and a higher modulus of elasticity in tension. Coachwood also has excellent gluing properties, and is pre-eminent in Australia for the manufacture of improved wood, impregnating evenly and readily.

Uses.—Coachwood is a valuable timber for all interior work, furniture and cabinet making, joinery and fittings. It has also excellent turning properties, being favoured for brushes, brooms, finishing lasts, bobbins and small turned articles of all kinds. In recent years, however, apart from its use as rifle furniture, a great increase in production has been in the form of veneer for many war-time purposes, e.g., resin-bounded plywood for small marine craft, pontoons, etc., in the manufacture of aircraft plywood, and as the basis for improved wood manufacture, both resin impregnated and resin bonded, for airscrew manufacture.

Availability.—Coachwood may be obtained, under normal conditions, in the form of sawn boards of narrow to medium width, and in the form of veneers and plywood. The annual production is in the vicinity of 4,000,000 sup. ft.

Forest Products Conference

A forest products conference was held at the laboratories of this Division from 11th to 15th March. It was attended by the following representatives :—

Mr. S. A. Clarke (Chairman)	Division of Forest Products, C.S.I.R.
Mr. M. A. Rankin	Woods and Forests Department, S.A.
Mr. J. Fielding	Forestry and Timber Bureau, Canberra.
Mr. C. J. Irvine	Victorian Forests Commission
Mr. A. L. Benallock ...	" " "
Mr. F. S. Incoll	" " "
Mr. J. B. McAdam ...	Dept. of External Territories (New Guinea Forest Service).
Mr. E. B. Huddleston ...	Division of Wood Technology N.S.W. Forestry Commission
Mr. L. H. Bryant ...	" " "
Mr. A. W. Welch	" " "
Mr. C. Ellis	Q'land Sub-Dept. of Forestry.
Mr. C. J. J. Watson ...	" " "
Mr. W. Young	" " "
Mr. F. Gregson	W. A. Forests Department.
Dr. W. E. Cohen	Div. of Forest Products, C.S.I.R.
Mr. K. L. Cooper	" " "
Dr. H. E. Dadswell ...	" " "
Mr. A. Gordon	" " "
Mr. R. S. T. Kingston ...	" " "
Mr. N. Tamblyn	" " "
Mr. R. F. Turnbull	" " "
Mr. G. W. Wright	" " "
Mr. E. J. Williams	Section of Mathematical Statistics, C.S.I.R.

Mr. J. O'Donnell, who was to have been the Tasmanian representative at the conference, was unfortunately travelling on the Douglas airliner which crashed fatally on 10th March. Deep regret was expressed at the opening of the conference.

The chief reasons for the conference were (i) to get the programmes of the Division of Wood Technology, Forestry Commission of N.S.W., the Queensland Sub-Department of Forestry, and the Division of Forest Products, C.S.I.R., into line to avoid overlap, and (ii) to establish the relative importance of the different lines of work. The reason for the two States, New South Wales and Queensland, being most concerned, was that both have well-organised Forest Products Sections, and both have re-organised their activities to take into account their post-war work in industry. In the other States, well-defined Forest Products Sections have not been formed except in Western Australia, and in this case Mr. Gregson has been on long service leave following his return from Timber Control. These States consequently, have not been in a position to get out comprehensive programmes of work, but it was felt desirable to invite representatives from all State Forest Services to the conference, as all States have urgent problems, and the need for adequate co-operation is increasingly important.

BREVITIES.

Mr. R. F. Turnbull, Officer-in-Charge Utilisation Section, has recently returned to the Division after four and a half years' absence, during which time he acted as Assistant Controller of Timber, Ministry of Munitions. Immediately on return, Mr. Turnbull attended a conference in Perth on the proposed new grading rules for jarrah and karri.

Many readers of the news letter will be interested to hear of two engagements which have taken place within the Division during the last month ; Mr. Alan Gordon, Officer-in-Charge Veneer and Gluing Section, to Miss Heather Leech, a former member of the same Section ; and Mr. Alan Wardrop, Wood Structure Section, to Miss Beulah Brims, Wood Chemistry Section. Miss Brims is the daughter of Mr. Marcus Brims, of D. G. Brims & Sons, the well-known Brisbane timber firm.

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No. 140 1946##140 May, 1946.

WOOD FLOUR . . . Its Importance in Australia

Wood flour, as the name implies, is finely divided wood usually prepared and sold according to the mesh sieve through which it will pass. Coarse material 30 or 40 mesh particle size is sometimes also referred to as wood flour, but wood meal is a better term for this.

It is prepared from selected wood waste, usually sawdust, though shavings from planing machines are also used, and a small amount of sander dust abraided from plywood or other constructions in drum sanding operations. Sometimes merely by the screening of sawdust, the finest material may be taken off and used as wood flour without the usual grinding operation. The percentage of such fine material in sawdust however, is usually small.

The technical requirements of wood flour vary considerably for different purposes. Specifications for flour may include limitations on species, colour, range of particle size, shape, resin or other extractives content, moisture content, specific gravity, absorbent qualities and permissible percentage of foreign matter.

The main uses of wood flour are found in linoleum, plastics and explosives manufacture. In addition, its mildly abrasive and absorbent qualities result in its use for polishing moulded plastics, metal or plated articles. Other products utilising wood flour include glues and cements, dolls' heads, plastic wood, ceramics, electrical insulating materials, and decorative wallpapers of the "oatmeal" type.

The use of wood flour is primarily dictated in many instances by its economy when used as a filler, but it frequently happens that its addition provides improvements in some other quality, such as reducing the density of heavy products, increasing the mechanical properties, especially the impact resistance of plastics, reducing cooling stresses in plastics, or setting and shrinkage stresses which tend to cause crazing in urea-formaldehyde glues if the glue line is too thick.

In the manufacture of dynamite or other blasting explosives, wood flour is used in preference to other absorbent media because, in addition to holding the nitro-glycerine, it has the further advantage of providing carbonaceous material which is rapidly burnt in the excess oxygen set free during the explosion, thus increasing its force.

The machinery employed in the preparation of wood flour comprises pulverising and sifting units with the necessary conveyors. Hammer mills break up the particles by impact, while the rotating stone or steel grinding wheels of attrition mills tend to break up the sawdust into more fibrous particles. In many plants a combination of grinders is used, hammer mills for preliminary breakdown, and attrition mills to ensure a light, fluffy product. The flour is then screened to particle size by mechanical screening through rotating or oscillating meshes of wire or cloth. Such mechanical separation achieves a more uniform type of flour than when air separation is used, the latter often resulting in a large percentage of fines being included.

The protection of wood flour production plants from damage by foreign matter such as metals, fire hazards resultant on the heat generated, especially in attrition grinders, and the possibility of dust explosions must not be overlooked. To prevent damage from nails, wires and other tramp iron, electro-magnetic devices should be used, or gravity traps may be incorporated in the feed to eliminate foreign matter. The presence of such material may result in sparking, which in certain concentrations of wood flour in air will cause a dust explosion. A small quantity of water is usually added to sawdust processed through stone mills. As a protection against fire hazards, some totally enclosed mills are operated in an inert gas such as carbon dioxide or nitrogen. Protection from naked lights or sparking electric motors and switches is imperative to avoid dust explosions.

High grade wood flour for technical purposes is usually made from a limited number of timber species selected with regard to colour, density and specific suitability, in addition to availability. Coniferous woods such as spruce, fir and white pine are preferred overseas, although some broadleaved woods such as poplar, maple and basswood are used. Acidic woods such as oak and dark-coloured woods are not favoured because of their possible chemical action or discolouring of pale products. The raw material must be free from bark, grit and other deleterious substances.

In Australia, wood flour has been made in both impact (hammer) and attrition type mills, being used chiefly for linoleum, plastic moulding powders and explosives. Plants are located in both Sydney and Melbourne, but their capacity will not meet the expanding demands of these industries. Prior to the war, considerable quantities of wood flour were imported, but owing to an apparently world-wide shortage, overseas supplies are practically unobtainable.

Local production originally used sawdust derived chiefly from the sawing of imported logs and flitches of Douglas fir (oregon), hemlock and spruce, but with the restriction of imports of these since 1941, it was found necessary to supplement such sawdust with that of Australian timbers. A number of species including hoop pine, radiata pine, various New South Wales brushwoods, and mountain ash were used, but results were not always fully satisfactory. More recently, special attention is being paid to the use of radiata pine and hoop pine as the most suitable Australian woods. If plants could be suitably placed with relation to supplies of dry sawdust of these species, Australia should become self-supporting in wood flour.

Further details concerning wood flour manufacture are available on application to the Chief, Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4.

Visit of E.S.T.I.S. Conference to Division of Forest Products

During the recent E.S.T.I.S. Conference held in Melbourne, March 18th-22nd, the delegates were the guests of the Division of Forest Products on the afternoon of Friday, 22nd. They assembled in the library of the Forest Products Laboratory a little after 2 p.m. where they were given an address of welcome by Mr. S. A. Clarke, the Chief of the Division. Following this they were divided into a number of small groups and each group conducted through the various laboratories of the Division. In each laboratory the members of the groups were given a short talk on the work being carried out and shown the results of investigations in hand.

At the conclusion all the delegates spoke highly of the work being carried out in the Division and said that they had had far too little time at their disposal to appreciate fully the various details and applications of this work.

Timber Flooring Tests

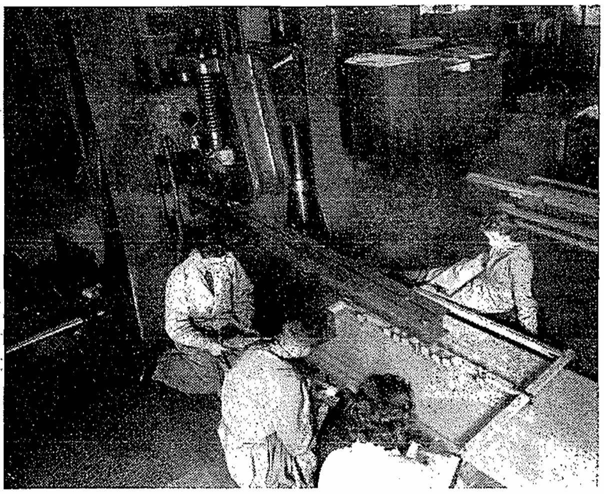
By J. J. MACK, Timber Mechanics Section.

The Timber Mechanics Section of the Division of Forest Products, C.S.I.R., is carrying out a large scale series of tests on timber flooring. Species being tested are those in common usage at the present, namely :—

jarrah	cypress pine
mountain ash	brush box
radiata pine	spotted gum
tallowwood	blackbutt.
Sydney blue gum	

In several species, boards of various widths are being used. In mountain ash and jarrah, test floors are also being constructed containing end-matched flooring. End-matching is a process in which the ends of boards are tongued and grooved so that short lengths of high-grade boards are not cut to waste. The end-matching allows the ends of boards to occur anywhere in a floor, not necessarily on joists, and the transference of a proportion of the load from one board to another.

Tests are also being made on plywood flooring. This type of flooring is becoming of increasing interest because of several advantages over solid wood flooring. These include (*a*) the use of relatively cheap low grade inner veneers, (*b*) pleasing variations of the surface or wearing veneer and (*c*) quick, simple laying. However, plywood flooring has the disadvantage that so-called nogging pieces must be nailed between, and at right angles to, the joists ; some building codes require that this nogging be placed at 18-in. centres, but it is probable that a 3-ft. spacing would be quite satisfactory. Plywood flooring is usually laid in sheets 3 ft. x 6f t. or 7 ft. The plywood for the laboratory tests consists of 3 ft. x 6 ft. sheets of $\frac{5}{8}$-in. resin-bonded 5-ply.



Flooring Test in Progress.

Test floors are made in sections 3 ft. 0 in. wide and 7 ft. 6 in. long (plywood—3 ft. x 6 ft.). The load is applied at certain selected positions at a uniform rate until failure occurs. The loading tool which was developed in the laboratory on the recommendation of the Commonwealth Experimental Building Station, takes into consideration various types of furniture and their supports, it is 0.8-in. diam., with the periphery of the flat loading surface rounded to 1/32nd in. radius. A player or grand piano provides the heaviest load which is likely to occur on the floor of the average dwelling, often up to $2\frac{1}{2}$ cwt. on one castor. Hence it was decided to simulate as nearly as possible the effective loading area of a castor, which on the above instrument is usually $2\frac{1}{4}$-in. diam. and $\frac{3}{4}$-in. wide, while making due allowance for other types of supports which may be used on other heavy furniture such as book cases and chests of drawers.

During each test, the stiffness of the floor is determined by measuring the deflection of the floor at the loading tool ; the compression of the floor under the tool is also being measured. In some tests, the distribution of the load along and across the floor is being found by observing deflections at various points other than at the loading tool.

The present housing shortage and the general difficulty in obtaining supplies of timber for the purpose has brought about a number of unconventional types of flooring. The prime objects of many of them are to permit the use of materials not in short supply, prefabrication and quick and simple laying. However, to give satisfactory performance, a floor should possess certain qualities as regards strength and stiffness. With this in view, the Commonwealth Experimental Building Station, under the directorship of Mr. D. V. Isaacs, has suggested a form of proof test. The test includes the loading of a floor with a concentrated load for a short period of time, using the loading tool as developed in this laboratory. This proof load is also being applied to all the types of floors which are being tested.

The Second Lyctus Conference

At the suggestion of the Division of Forests Products, a meeting was held in Sydney last December at which officers of the New South Wales Division of Wood Technology, the Queensland Sub-Department of Forestry and the Division of Forest Products discussed the various research and commercial problems associated with the preservative treatment of susceptible plywood and solid timber against attack by the Lyctus borer. This first conference was highly successful and a unified programme of co-operative work was outlined.

During the recent Forests Products Conference in Melbourne opportunity was taken to hold a second Lyctus conference which in two evening sessions on March 14th and 15th discussed in considerable detail the various lines of work being developed by the three laboratories. The conference was attended by representatives of the Division of Wood Technology, the Queensland Sub-Department of Forestry, the Victorian Forests Commission, the Department of External Territories and the Division of Forests Products.

The first session opened with an address by Mr. G. N. Christensen (Division of Forests Products), who discussed briefly the applicability of fundamental laws of diffusion to treatment of green timber in boric acid solution, and reviewed the very detailed work on this subject now being carried out by the Division. Progress reports were then given on the work undertaken by the three co-operating laboratories partly as a result of the last conference. The principal lines of work discussed were the development of safe schedules for the boric acid treatment of solid timber(Division of Wood Technology and Queensland Sub-Department of Forestry) and the investigation of simpler and cheaper methods of veneer treatment, including the addition of toxic chemicals to the glue line (Division of Forests Products). The Division of Wood Technology also reported success in the development of a simple method for analysis of boric acid which could be used by a non-technical plant operative to maintain the desired strength of treating solution.

The second session was devoted largely to discussion of future work and of matters of general interest. Among topics discussed were the use of sodium fluoride as an alternative to boric acid for the treatment of solid timber, the preparation of lists of timber species graded according to susceptibility to Lyctus attack, the N.S.W. Timber Marketing Act, and public warning against surface treatments with certain proprietary preservatives.

Laminating is often the solution to the production of small wooden articles for specialty purposes. Sometimes, the laminations have to be thin veneers, but for other purposes pieces of timber up to 1-in. thick can be used.

Thermometers in Kiln Installations

In kiln drying, the only factors under control of the operator in the kiln are the temperature, and the drying potential of the circulating air.

The air temperature is usually measured by a dry bulb thermometer, and the drying potential is normally determined in terms of wet bulb depression, as shown by the difference in readings between wet bulb and dry bulb instruments.

A good operator is usually aware that a thermometer is an instrument which needs regular calibration, but in recent inspections of kilns, members of the Seasoning Section have observed errors in thermometer readings for a number of reasons, and laboratory work has been carried out to determine the magnitude of these errors and the best methods of overcoming or avoiding them. This Division issues guides for the seasoning of Australian timbers, in which the most suitable drying conditions for various species are shown in terms of dry bulb temperatures and wet bulb depressions to be used at various moisture contents. It is obvious that these conditions can have little or no meaning in a kiln installation where the thermometer readings are incorrect.

The most serious sources of error are outlined below :

Location.

In many compartment kilns thermometers are located in the space between the side of the stack and the kiln wall, and this may lead to serious errors. Where this location is unavoidable the errors involved should be fully appreciated.

(*a*) There is a considerable difference in the temperature of entering and leaving air in a green or partly green stack, being dried in a cross circulation kiln.

This temperature difference between entering and leaving air cannot be determined accurately because the difference in temperature varies with the rate of moisture loss from the stack and alters greatly with moisture content and species.

Since schedules are based on entering air temperatures, the readings taken on only one side of the kiln cannot be satisfactory where the circulation is reversed at regular intervals.

Where the side duct thermometer position must be used, it is recommended that a dry bulb element be installed on each side of the stack, and that the reading be taken from the thermometer on the entering air side.

The error in wet bulb reading is not so serious, and the fitting of a wet bulb on only one side is sufficient in most cases, although for best results complete duplication is necessary.

(*b*) If the thermometer bulbs are placed near the kiln wall, and this wall is hotter or cooler than the kiln air temperatures, then local heating or cooling of the air in the kiln occurs, and serious errors in the temperature readings result.

Thermometer bulbs should therefore be placed well clear of the kiln wall to keep this effect at a minimum.

The ideal position for thermometers in a cross shaft kiln is above the stack and below the sub-ceiling. They should be located in an adequate opening cut in the canvas baffle which is installed to prevent short circuiting of air over the stack. This opening in the baffle should be at least 6ft. from the control-room wall so that any small variations in temperatures at the end of a kiln will not be recorded on the thermometer. After installation, the rate of airflow past the thermometer bulbs should be checked. In some cases the fitting of small deflector plates is necessary to ensure correct rate of flow.

Air Circulation.

While the rate of air circulation over the dry bulb thermometer is not very important, a fast flow of air over the wet bulb is absolutely assential. For greatest accuracy this rate of flow should be in excess of 10 feet per second, but providing that the rate is not less than 5 feet per second it will be found sufficiently accurate for timber drying with most types of thermometers.

The kiln operator should make a periodic check of this circulation by means of smoke tests, or other suitable method, since incorrect location of baffles may completely upset the flow past the thermometer and produce false readings.

Water Feed To Wet Bulb.

An essential for an accurate wet bulb reading is a constant supply of clean water at wet bulb temperature to the wick envelopimg tne wet bulb.

Mistakes in installation which lead to serious errors are :—

(*a*) Water at a temperature other than wet bulb temperature dripping directly onto the thermometer bulb. This is to be avoided at all costs, as is the immersion of the wet bulb in the water trough which has been observed in some kilns.

(*b*) Failure of water supply. The most satisfactory arrangement where good water is laid on is to fit a ball cock and valve to a tank outside the kiln and connect this by means of a small diameter copper tube to a small trough beneath the wet bulb thermometer. The level in this trough is thus controlled by the level in the exterior tank. The water feed trough inside the kiln must not obstruct the air flow over the thermometer bulbs, and it must not be located in such a way that the air passes over the water in the trough before passing over the thermometer bulbs.

Drip feeds and similar devices usually require constant attention and become inoperative when most required.

(*c*) Faulty operation and installation of wicks. The material used must convey the water freely from the trough to the bulb. A material of the thin locknit type, *e.g.*, cotton singlets or silk stocking material has been found very satisfactory. The material should be washed with soapy water and rinsed before placing in operation.

Thick materials in general should be avoided because the surface will not remain thoroughly wet under severe drying conditions.

In all installations a regular inspection of the condition of the wick is necessary and replacement should be made when any deterioration has occurred. This is particularly necessary when the water may contain appreciable quantities of dissolved solids.

The wick must envelop the bulb completely and the water should travel upwards from the trough to the bulb through at least 2″ of wick so that the water reaching the bulb will be at the wet bulb temperature.

Conductivity.

Quite a large number of installations have recently been fitted with dial type thermometers in which the bulb unit has been designed for immersion in liquids rather than for measureing air temperatures.These instruments are provided with a heavy supporting flange which is attached directly to the thermometer bulb casing and this flange in turn carries a large mounting assembly which is usually attached to a bracket on the kiln wall.

While the use of such instruments has perhaps been necessitated by a shortage of more suitable equipment, the possible wet bulb errors involved in using these thermometers are very serious.

The brass mounting assembly and flange all tend to reach the dry bulb temperature and cause the wet bulb readings to be higher than the true wet bulb temperature.

The magnitude of this error has been found to be as much as 15°F. when true wet bulb depressions of 30°F. or more are being used. Fortunately, work in the laboratory has shown that the error can be eliminated by removal of the mounting nut and enveloping the flange completely with the wet bulb wick. In practice, this adjustment will entail slight alteration to the water supply tank and re-arranging the supporting members for the wet bulb.

Calibration.

The accuracy of dial type indicating thermometers and recording and recorder control instruments should be checked regularly by comparison with the readings of good thermometers of known accuracy.

The Division will be happy to supply blueprints showing correct layout for water supply and thermometer installations to any operators who may be in doubt as to their most satisfactory arrangements, and also to discuss the particular difficulties of any unusual installation.

The Properties of Australian Timbers

NORTHERN SILKY OAK.

(This is a revised description of this species, which was previously written up in News Letter No. 70).

Northern silky oak is the standard trade common name for the timber known botanically as *Cardwellia sublimis*. The name silky oak has been applied to several Australian timbers which have the typical large-rayed appearance of the European and American oaks (*Quercus* spp.). The Australian species, however, are not related botanically to these oaks, but are derived from a very different family (Proteaceae), the members of which are confined almost entirely to Australia and Africa. The original silky oak of the Australian market was the product of the two southern species *Grevillea robusta* and *Orites excelsa*, but the silky oak of to-day is for the most part the product of the North Queensland species, *Cardwellia sublimis*, and consequently is known as northern silky oak.

Distribution : It is found only in the coastal areas in the vicinity of Innisfail and Cairns, North Queensland, where it is one of the most abundantly represented species.

Habit : Northern silky oak is a tree which reaches a total height of 120 ft. and has a massive bole which provides logs up to 10 ft. and more in girth. The leaves of the tree reach 1 ft. in length, and the bark blaze is a maroon-edged saffron ; it is recorded that the bark has a 5 per cent. tannin content.

Timber : The timber is pinkish to light reddish-brown in colour with a silvery, silky lustre attributable in some degree to the colour and nature of the broad rays. It is usually straight-grained with coarse texture, and the very pronounced ray structure gives mottled figure on the backsawn face and large flaked figure on the quartersawn face. An almost infinite variety of shades and differences in graining can be obtained by varying the degree of quarter and back-sawing, special methods being devised for producing the choicest figure. The wood is light and soft to work, and averages 33 lbs./cu. ft. when air dried to 12 per cent. moisture content, with a range of 27 to 38 lbs./cu. ft. Northern silky oak seasons readily with practically no degrade. Backsawn material dries much more rapidly than quartersawn under similar drying conditions, so that separation of back and quartersawn material is desirable in air drying or in kiln stacks. Preliminary air drying is recommended for the species. Quartersawn material, if cut near the centre of the tree, may show some tendency to collapse, especially if subjected to high temperatures and humidities in kiln drying. When collapse has occurred reconditioning is recommended ; Usually, however, in kiln drying a final high humidity treatment at the end of the run to relieve stress will be all that is required. The shrinkage obtained when drying from the green state to a moisture content of 11 per cent. is only 5 per cent. in backsawn boards, and 2 per cent. in quartersawn boards.

Nothern silky oak is favoured for bending, the backsawn wood having excellent properties for steam bending. The quartersawn wood has also fair bending qualities, but is inferior to the backsawn. This timber is favoured for carving and all kinds of veneer work. The veneer is excellent because of its flexibility and the wide sheets which can be obtained. The log cuts readily and is free from peeling checks. Northern silky oak holds nails well, has little tendency to split, and can easily be glued, stained or polished.

Uses : The wide variety of figure obtainable and the development of staining technique have combined to produce a distinctive series of artistic effects in panelling and furniture. Overseas it is highly regarded as a decorative timber and has been chosen for use by firms specializing in high-class interior decoration. It is also used for joinery, turnery and carving, bent work of railway cars and motor bodies, and furniture and veneers. Locally it is favoured for general building purposes, and is used for studs, plates, floorings, linings etc.

Nothern silky oak must be considered as one of the more important Australian woods, and is of special value because of its beauty, ease of working, and adaptability to so many uses.

Availibility : The annual cut of Northern silky oak is in the vicinity of 8 million super feet in the round ; about half a million super ft. of this goes into the veneer and plywood industry of Queensland. Export of sawn and veneer output to N.S.W., Victoria, and to a lesser extent South Australia and Western Australia is well established. Most of the timber, however, is used in Queensland itself.

Plastics from Wood Lignin

Lignin is the cementing material of woody tissue, and comprises 20–25 per cent. of wood. It is extracted in large quantities during the pulping process, and hence may be regarded as a by-product of the pulp and paper industry. Up to quite recently, however, no satisfactory commercial use for any appreciable quantity had been discovered, but recent research opens up the possibility that lignin may become the source of low cost plastics, and this may tend to revolutionise the industry.

There is said to be a close relationship between lignin and coal, in that the coal substance may have been largely derived by the change (due to pressure, heat, or bacterial action) of the lignin present in the primaeval vegetation to which coal owes its origin.

Coal and petroleum are not only the source of our industrial energy, but they also represent the raw materials upon which the plastics industry has been largely based. Careless treatment of these resources has led to their rapid exhaustion, and there is no possibility of replacing deposits which have been formed over millions of years of geological time, and to which mankind in its infancy has fallen heir. We have, therefore, to look to other sources of raw materials for plastics.

Why should lignin compounds not be converted directly into those plastics which we now make from coal, without going through millions of years of change? This is one of the questions which modern chemists and engineers in forest products are attempting to answer. The solution lies in a knowledge of the precise chemical structure of lignin, and in experiments upon its response to heat and pressure.

Recent work in the United States has shown that pulp sheets to which lignin has been added can be compressed at elevated temperatures into a hard, strong, water-resistant board, the properties of which are comparable with those of the orthodox and more expensive phenolic resins. Other investigations have shown that lignin may be used for moulding powders.

Experiments at this laboratory have recently been carried out to determine the usefulness of lignin-filled pulp sheets as plastic overlays for plywood, thus eliminating some of the natural disadvantages of plywood, such as its tendency to check when exposed to the weather. The process, though promising, has several drawbacks, such as the relatively high laminating temperatures and pressures required. It is hoped, however, that the disadvantages may be eliminated by using the lignin in combination with small amounts of phenolic resin.

For some time, the Division of Forest Products chemists have been concentrating on the question of lignin from Australian eucalypts. The work to date has proved promising, but before the question can be completely solved, it is essential that much additional research on the nature, occurrence and structure of the lignin be carried out.

BREVITIES.

Two members of the Division, W. E. Cohen and Mr. A. Gordon, left for Japan on April 11th. For the period of the visit both officers are attached to the Australian Scientific Mission to Japan, and hold the honorary rank of Lt.-Colonel.

Dr. Cohen will investigate developments in the Japanese pulp and paper industry, and their work on high alpha cellulose and chemistry of wood. Mr. Gordon will investigate the Japanese veneer and plywood industry. It is understood that there are some interesting developments in both fields.

The trees of the mountain ash forests of Victoria, which were largely killed in the 1939 bush fires, played a very important part in providing timber during the war. They are still producing large quantities of high grade timber, although recovery from the log is falling due to increased sun cracking and insect attack.

Victorian Railways Print. 1363–46

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C. S. I. R.

FOREST PRODUCTS NEWS LETTER

This monthly bulletin is prepared for general circulation by the Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4., and will be supplied free on request to members of the timber trade and timber users who wish to keep abreast with current developments in the field of forest products.

No. 141 1946##141 June, 1946.

INTRODUCTION.

Since the publication of News Letters 139 and 140 in printed form, the interest expressed by the timber trade has been so gratifying that it has been decided to issue this and future numbers punched for binding, and to include in the December number of each year an author and subject index. It is strongly recommended that readers of the News Letter bind their copies to form a permanent reference work on forests products.

The Council for Scientific and Industrial Research is now a very large organisation covering a wide range of activities. The Division of Forest Products is not the only one which is building up information for the timber industry. It is proposed therefore, to include from time to time, articles written by officers of other Divisions of the Council, where their work would be of interest to readers of the News Letter. The first such article appears in this issue.

The articles in this News Letter are freely available to newspapers and trade journals for re-publication.

WOOD LAMINATING AND MOULDING

by F. A. DALE.

(Structures and Materials Section, Division of Aeronautics, C.S.I.R.)

Wood Laminating.

With the serious depletion of Australia's timber resources during the war, the need for more efficient means of using timber has become urgent. Laminating, which is the process of gluing together layers of timber with the grain in the same direction to make solid straight or curved members, offers great possibilities both in timber economy and in improving structural efficiency and appearance.

Any timber which can be glued satisfactorily can be laminated, and the thickness of the laminations can vary from $\frac{1}{64}$" to 1" or more. The thickness of the laminations depends on the radius to which they will be bent, 50 times the thickness being a reasonable minimum, but this may vary with the timber and the glue used. The gluing surfaces of the laminations should be flat and parallel, and this is best obtained with a thicknesser. Sawn surfaces can be used in large members, but only if the saw is cutting very cleanly. Well-cut, peeled or sliced veneer should need no further surfacing.

Casein or synthetic resin glues can be used ; animal glues are not recommended. For furniture and other work not likely to be exposed to the weather, commercial casein glues are cheap and convenient, staining being their only drawback. Where the work may be exposed at times to the weather, aircraft quality casein glue will give very good service, especially if the work is kept well painted. In very humid conditions, or where continuous wetting may occur, as in boats, hot-setting phenolic resin glue is the only reliable glue at present available in Australia. Hot and warm-setting (above 70°F.) urea resin glues have durabilities between those of aircraft casein and the phenolic resins.

Moulds or forms on which the laminations are laid up and pressed are usually of wood, rigid enough to withstand the gluing pressure without distortion. Large structural members such as arches can be made up on blocks or posts set at intervals along the curve, but smaller members are best made on continuous moulds. Sufficient pressure should be applied to the laminations to ensure uniform, close contact with the gluing surfaces, and this should be checked with dry laminations before gluing up. Pressure may be applied by bolts, clamps, screw or hydraulic presses, or band cramps. Hydraulic, pneumatic or steam pressure may be used in fire or steam hose to apply uniform pressure (and heat if required) to the laminations. With clamps and bolts, care should be taken to distribute the gluing pressure and so prevent local distortion or crushing. In large structural members, nails may be used to apply the gluing pressure, thus allowing a large number of laminations to be built up over a period of time. For satisfactory results, the nails must be close together and of the correct size.

Heat is applied to the laminations to set the hot-setting resins or to speed up the setting of other glues. Ovens, steam and hot water in hoses, or electrical resistance heaters can be used, the latter being cheap and flexible. High-frequency heating is not yet developed sufficiently except for mass production of simple items, but it can be used to reduce the time in the press very considerably. Recent developments include a conducting glue, and resistance wires embedded in the glue line.

Continuous rings can be made by scarf jointing strips of veneer and wrapping the strip around a rotating drum under tension and radial pressure. Laminating can be used for work formerly produced by steam-bending, and it has the great advantage that the timber is not crushed or partly fractured, as is often the case in bent wood. In structural work, considerable timber economy can be effected by the use of low grade laminations in lightly stressed parts, and the effect of knots and other imperfections is proportionately much less than in solid timbers. In buildings, laminated arches or rigid bents can be used to make a very attractive structure because of their clean, flowing lines.

Laminated wood has been used successfully in skis, tennis racquets, artificial fingers, axe-handles, boat ribs and keels, aircraft structures, bridges, buildings and many other applications. Furniture lends itself particularly to design in laminated wood, as a light, strong, and graceful article can be made, with inefficient joints eliminated, and economies effected in material. A nesting chair of hoop pine and mountain ash is shown in Fig. 1 which clearly illustrates this principle.

Wood Moulding.

The use of fluid pressure in plywood moulding is well known in the form of vacuum bag moulding. In recent years a development of this process, known as the autoclave process, has been used to produce high grade waterproof moulded plywood for aircraft, boats, etc. Equipment for this process is

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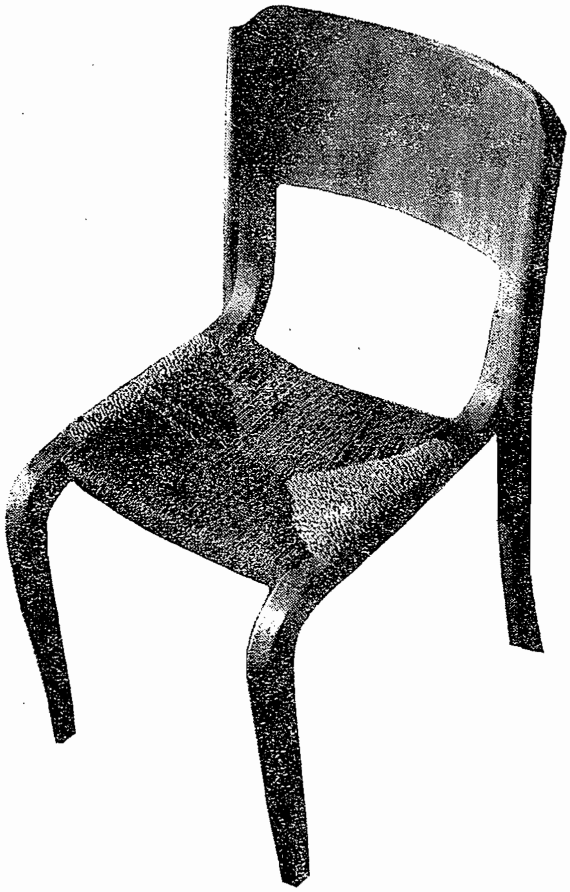

Fig 1. Laminated chair.

installed at the Division of Aeronautics, C.S.I.R., Fishermen's Bend, Melbourne, and has been used for a variety of war work. It is now available for experimental work for industry.

The process consists of making a softwood, metal, or concrete mould to the inside or outside shape of the finished article. This mould should be sufficiently rigid to withstand pressures up to 100 lbs/sq. in. A sheet of paper or cellophane is placed on the mould to prevent sticking. Veneers, coated with a hot-setting synthetic resin glue, are then laid together each with the grain at right angles to the one beneath, until the required thickness has been built up. The mould is then covered with a rubber bag or blanket and evacuated, so that atmospheric pressure forces the rubber and veneers against the mould, holding them firmly. The whole assembly, still under vacuum, is then put in the autoclave or pressure vessel, the door is sealed, and the whole subjected to a steam pressure of up to 100 lbs./sq. in. The steam heat causes the resin to flow and then to set hard; the pressure ensures a thin, uniform glue line. When the resin has set, the pressure is released and the assembly is withdrawn from the autoclave and taken off the mould as one piece of waterproof plywood. In this way articles of single or double curvature can be moulded, but the latter requires the veneer to be "tailored" in strips to avoid buckling.

The autoclave at the Division of Aeronautics is equipped with a flat steel vacuum table, on which the mould is laid and covered with the rubber mat. A self-sealing edge to the table seals the mat and does away with the need for clamps and other devices. It will take assemblies up to 12 ft. x 4 ft. x 2 ft. A special heat resisting rubber mat is used, which will stand about 50 cycles of heating and cooling. A small autoclave, 5 ft. x 2 ft. is also available for experimental purposes.

The process can be used for materials other than wood, such as resin impregnated fabric, glass-cloth, fibre and paper. Overseas, aircraft fuselages, boats, dinghies, jettison tanks, and furniture have been made by fluid pressure moulding, but the initial cost of equipment and the small demand for a particular article has delayed its large-scale adoption in Australia.

A wind-tunnel nozzle, built up in the workshops of the Division of Aeronautics from moulded plywood sections ⅝" thick is shown in Fig. 2.

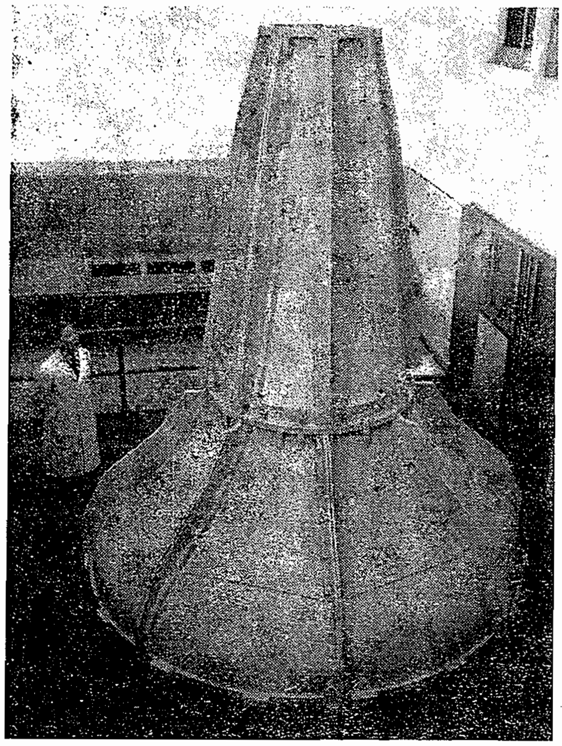

Fig 2. Moulded plywood variable pressure wind-tunnel nozzle.

Further Information.

A comprehensive handbook of wood laminating and moulding is being prepared jointly by the C.S.I.R. Divisions of Aeronautics and Forest Products, and should be published within a few months. Further information is available on application to the Chief, Division of Forest Products, C.S.I.R., 69–77 Yarra Bank Road, South Melbourne, S.C. 4.

Official notification has been received of the retirement of Mr. Carlile P. Winslow from the position of Director of the Forest Products Laboratory, Madison, Wisconsin, U.S.A. Mr. Winslow has been Director of the Laboratory for nearly 30 years and has been associated with it since its formal opening in 1910. Under his able leadership it has grown into an extremely valuable and powerful organisation, on which have been modelled the Forest Products Laboratories of the Empire and other parts of the world.

The Forest Products Laboratory, Madison has been noted for the freeness with which it has given information and assistance irrespective of race. Many of the senior officers of the C.S.I.R. Division of Forest Products were trained there, and the library system, programme of work and experimental records system of the Division are based on those of Madison.

The timber industry of Australia owes a great debt to the Madison Laboratory in general and to its past Director, Mr. C. P. Winslow, in particular.

Mr. Winslow is succeeded by Mr. George M. Hunt, who has been on the staff of the Laboratory for more than 30 years as a chemist, specialising in wood preservation, and who was Chief of the Laboratory's Division of Wood Preservation for many years. For the past two years he has been Assistant Director of the Laboratory. Mr. Hunt has always been exceedingly helpful with advice and assistance on problems of wood preservation, and is the international authority in this field. His selection for the position of Director is a happy and popular choice.

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BOX DESIGN

By C. E. Dixon, Utilization Section.

Before and during the early part of the War, explosives boxes (cordite transit boxes) were made out of 18-in. x 1½-in. hoop pine (the so-called solid box). It was soon found that there was not sufficient hoop pine available for the mushrooming war programmes, and an officer of the C.S.I.R. was seconded to study the problem. Such were the results achieved that this work was extended to cover all transit boxes and wood-work design.

The first boxes studied were the "box, cordite drum," and the "box cordite 100 lbs." For these boxes a glued, cleated, plywood construction was evolved, 3/16-in. three-ply and 1⅜-in. x 13/16-in. hardwood cleats being used. The new boxes weighed less than half the old, required less than half the material, and used materials which were more readily obtained. The cost also was very much reduced—the last contract prices for the "box cordite 100 lbs." being :—

Old box, 39/6d. ; New box, 13/9d.

These cordite boxes were of approximately 2⅓ cu. ft. capacity and carried a load of approx. 100 lbs., but the design was extended for non-explosive products (brass cartridge cases) to a capacity of over 8 cu. ft. and 185 lbs. load. Strangely enough, these larger, non-explosives boxes received less damage than the smaller explosives boxes, due probably to a number of psychological as well as physical reasons.

In the earlier designs of this type of box there was one major inherent weakness—centre cleat punching—which had not been anticipated, and which escaped notice because of an unfortunate set of circumstances due largely to the urgency of the War situation. In the later designs this, and other faults have been corrected, and a very satisfactory box has resulted.

Altogether hundreds of thousands of boxes have been constructed to this design, thus enabling a saving in construction of approximately £500,000, quite apart from savings in freight, and the facilitating of War programmes which might otherwise have been held up by lack of suitable containers.

The re-design of all classes of transit boxes was studied with a view to producing a better box and at the same time conserving materials, particularly those which were unduly costly or in short supply. For boxes for the transport of hygroscopic substances, such as C.E. pellets, exploder bags, N.C.Y. cartridges, it was found that the elaborate compound boxes consisting of a luting-sealed tinned copper lining in an outer screwed, cleated plywood box, could be replaced by a light cleated plywood box in which the inner surfaces were coated with a suitable finish, such as chlorinated rubber paint.

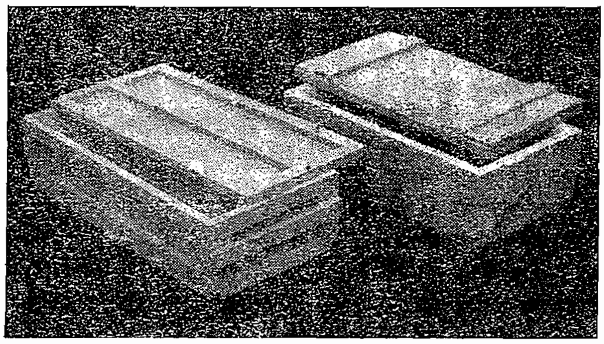
By attention to design and the elimination of costly materials, gadgets, etc., it was found that the cost of some boxes could be reduced to one-tenth of the original—from 42/- to 4/-. The design of each box required a considerable amount of work in the nature of co-operation with chemists, engineers, operatives, manufacturers, box-makers, safety inspectors (Operational Safety Committee), etc., examinations of transport and handling systems ; surveys of the availability and costs of materials ; investigations and testing of new materials and equipment, and of old materials for new purposes ; and sometimes special tests (such as, for instance, "flash" tests). In one factory, alterations to the handling systems were suggested and approved, thus eliminating entirely two types of intra-factory boxes.

A number of new simple, quick-acting, lid fittings and fixtures was designed for the various boxes.

The munitions departments had few, if any, engineers skilled in wood-work design, and advice and design assistance was given to these departments on a multitude of wooden articles and every type of wooden equipment and construction. In fact the design and re-design work in this direction far exceeded the work done on box design. A frequent problem to be overcome was the specification of non-commercial timber sizes. Also, as most wooden equipment was much too cumbrous and antiquated it was not difficult to produce much simpler, lighter and cheaper constructions (often by the use of plywoods, laminated woods, etc.).

The necessity for box re-design was not confined to Government departments ; in fact, what was probably the worst design encountered was that of a private firm. This organisation had constructed a box 135 lbs. in weight, to transport 4 para-bomb percussion heads of a total weight of 28 lbs. A container 6 lbs. in weight was devised for these, with the further suggestion that such a product needed no container at all, and could be wired or strapped together in suitable bundles. However, the box-making firms have always been most co-operative and helpful, and together with wood machinists and other practical men, have given considerable practical information, guidance and assistance.

The peace-time indications also show that there is considerable scope for container investigations in Australia, and that many firms are desirous of availing themselves of improved container science and technique. As an instance of the advantages of research in this direction, there may be quoted the history of a plywood drum, which had been designed by a local manufacturer, and brought to the Division for test. At the first series of rumbler tests it averaged 180 drops to failure. As a result of the information gained during the tests, it was possible to suggest design improvements. Again the drum was tested and further improvements suggested. At the third series of tests the drum averaged 5500 drops to failure—a remarkable improvement in strength and incidentally a very fine performance for such a light-weight container.



Photograph of the old "solid" box (at right), and the new glued, cleated, plywood box, with 3-way corner construction. The new box has less than half the material, and weighs and costs less than half the old box.

Log Storage of Borer Susceptible Timbers.

(The following is an abstract of a report by A. R. Brimblecombe, M.Sc., which was received recently from the Queensland Sub-Department of Forestry).

Wartime demands necessitated the large scale cutting of Lyctus susceptible secondary timber species in southern Queensland, where, because of the heavy summer and autumn rains, a reserve of logs had to be held for considerable periods to keep mills working at full capacity throughout the year.

Yellow carabeen logs (*Sloanea woolsii*), which possess a very wide sapwood normally containing abundant starch, are liable to extensive Lyctus attack, and the log storage scheme was essentially designed to give protection from this. The felled logs were moved from the scrub to the storage dump without delay and all loose pieces of bark about axe-cuts, girth rings, etc. were cut away to expose a clean fresh surface. All exposed wood surfaces were immediately sprayed with a hot creosote emulsion (2 parts of 5 per cent. soft soap solution to 1 part of K 55 creosote) and were finally coated with warm crude petroleum jelly. The powder post beetle cannot attack through bark.

Logs stored for 7 months showed no signs of Lyctus attack or splitting after this treatment. In subsequent trials logs of yellow carabeen and brown tulip oak (*Argyrodendron trifoliolatum*) were similarly treated (shortage of petroleum jelly made it necessary to use some crude lanoline) and after storage for 10 months in one trial, and 22 months in another, remained free from Lyctus attack and serious splitting.

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THE PROPERTIES OF AUSTRALIAN TIMBERS.

Hoop and Bunya Pines.

Hoop pine is the standard trade common name applicable only the species known botanically as *Araucaria cunninghamii*, though in trade practice, hoop pine, or alternatively, colonial pine, embraces not only the timber of this species, but also that of the similar minor species *Araucaria bidwillii*, for which the standard trade common name is bunya pine. Hoop pine is also commonly known as Richmond River pine, Dorrigo pine and Queensland pine.

Distribution.

Hoop pine has a commercial range extending along the coastal watersheds from the Dorrigo Plateau in northern New South Wales to the neighbourhood of Rockhampton, Queensland, and a few limited areas on the Tully and Atherton Tablelands of North Queensland. The species is also found with Klinki pine in the high country of New Guinea, at elevations between 3000 and 7000 ft.

Bunya pine has a much more restricted distribution, being limited to that part of the Queensland coastal watershed lying between Brisbane and Maryborough, where it is sparsely distributed.

Habit.

Hoop pine is a large to medium sized tree, with a butt diameter of approximately 5 ft. and a total height of 160 ft., the merchantable bole reaching 90 ft. The trunk is normally straight and cylindrical, and has a thin tough bark with a papery outer layer which tends to show horizontal bands or " hoops," which in peeling curl up at the ends.

Bunya pine is a somewhat taller tree of roughly the same or slightly larger diameter than hoop pine, but with a heavier crown and a shorter clean length of bole. This tree bears edible nuts in large football-like cones relished by aborigines, white men and wallabies alike.

Timber.

The wood of hoop pine is yellowish white to light brown in colour, while that of bunya is sometimes more pinkish than hoop. Owing to the extreme difficulty of distinguishing the two species from each other, they are often sold together. The woods are characteristically straight-grained, fissile, their texture is close and even, and the figure is usually plain, although sometimes the wood shows fine pin knots. Both are light in weight, but bunya pine is somewhat lighter than hoop pine. their respective densities averaging 28 lbs/cu. ft and 33 lbs./cu. ft. when air-dried to 12 per cent. moisture content, with a range of 22 to 34 lbs./cu. ft. and 26 to 38 lbs./cu. ft. respectively. In drying from the green condition to 12 per cent. moisture content, hoop pine shrinks 3.8 per cent. in a tangential direction (backsawn), and 2.5 per cent. in a radial direction (quartersawn) ; bunya pine shrinks 4.0 per cent. in a radial direction, and 2.0 per cent. in a tangential direction. No difficulty is encountered in kiln-drying either timber in thicknesses up to 2", but in greater thicknesses some care must be taken to obtain satisfactory results. The same kiln drying schedule may be used for both timbers.

Bunya pine is sometimes favoured to hoop pine, although its physical and mechanical properties are slightly inferior, but this is probably due to the fact that compression wood is not so common as in the latter. Compression wood is more prevalent in hoop pine and tends to cause warping in small sizes, but this can, however, largely be eliminated by careful selection.

Both timbers are particularly suitable for the manufacture of plywood and veneer owing to their fine, close and even texture, creamy colour, lightness in weight and relative strength, stiffness and firmness. Hoop pine can be peeled without steaming and formed the basis on which the Australian plywood industry was largely built. Both timbers are non-durable in contact with the ground. They are easily stained and painted. Hoop and bunya pines saw and dress easily, and because of their ease in working are two of the most suitable Australian timbers for all joinery work. The steam bending qualities of both are poor. The ratio of strength to weight of these timbers is high, and stocks of hoop pine were built up during the war as a substitute for spruce in aircraft in the event of the latter becoming unavailable. Their nail and screw holding ability is good, and neither offers any difficulties in gluing.

Being non-pored timbers (softwoods), hoop and bunya pines are not susceptible to the attack of the powder post borer (*Lyctus sp.*), but are susceptible to the furniture borer (*Anobium*) as well as the pin-hole borer. The Queensland borer, *Calymmaderus incisus*, indigenous to Queensland, attacks well-seasoned hoop pine.

Uses.

Hoop and bunya pines have been used during the war for aircraft construction. Both are peeled for the manufacture of veneers, plywoods, match-boxes, match splints, and sliced for battery separators. They are excellent for indoor work, mouldings, panels, joinery, built-in fixtures and food containers. Hoop pine has been used extensively for butter boxes, and is completely safe for the transportation of butter provided an anti-taint spray (casein and formalin mixture) is applied. It is also widely used for other types of cases. Other uses for both timbers include cask heads, agricultural implements, broom handles, printers' blocks, bee keepers' requirements, etc.

Availability.

The annual cut of hoop and bunya pines for the last financial year 1944–45 was in the vicinity of 106 million super feet in the round. Of this, 15 million super feet went into the plywood and veneer industry, and the remaining 91 million super feet were converted into sawn timber.

BREVITIES.

Mr. R. S. T. Kingston, Officer-in-Charge of the Timber Physics Section of the Division of Forest Products, is at present visiting New South Wales and Queensland in connection with the use of Australian timbers in battery separator manufacture, and the supply position of the most suitable species.

Dr. W. E. Cohen, Officer-in-Charge Wood Chemistry Section, and Mr. Alan Gordon, Officer-in-Charge Veneer and Gluing Section of this Division, arrived in Tokyo on April 24th. They have been transferred from the Australian Scientific Mission to the Natural Resources Section at G.H.Q., Tokyo. Originally they were to have spent one month in Japan, but a request has been received from G.H.Q. that their services be made available for six months. From this it appears that their stay will probably be an extended one.

Mr. J. C. Huelin, B.Sc. (W.A.), of Timber Industries Pty. Ltd., Oberon, N.S.W., is spending six months with the Division of Forest Products, studying the latest developments in seasoning methods and a number of other aspects of timber utilization.

Mr. R. C. M. Stewart, B.Sc. (N.Z.), A.R.I.C., has commenced work in the Wood Chemistry Section of the Division of Forest Products, and is studying the occurrence and characteristics of native lignin in timber. The services of Mr. Stewart, who is an officer of Associated Pulp and Paper Mills Ltd., have been given to the Division for an extended period by the Company.

The Grosvenor Laboratories prize of the Australian Chemical Institute for 1946 has been awarded jointly to Dr. W. E. Cohen, Principal Research Officer in charge of the Section of Wood Chemistry of the Division of Forest Products, and to Dr. A. Meller of Australian Paper Manufacturers Ltd. research staff.

This prize has been donated by the Grosvenor Laboratories, Sydney and the award is made for the best contribution to chemical industry during the previous two years.

This is the first award of this prize and it is particularly gratifying that Dr. Cohen has participated in it. The work on which the award was made to Dr. Cohen was carried out in connection with investigations relating to pulp and paper research. It is of interest that Dr. Meller who has been selected to share this prize has also been engaged in the same field of work.

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C. S. I. R.

FOREST PRODUCTS NEWS LETTER

This monthly bulletin is prepared for general circulation by the Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4., and will be supplied free on request to members of the timber trade and timber users who wish to keep abreast with current developments in the field of forest products.

No. 142 1946##142 July, 1946.

A NEW SAWDUST INCINERATOR

By G. W. WRIGHT, Officer-in-Charge Seasoning Section.

Much work has been done, in both the laboratory and commercial fields, in developing methods of sawdust and wood waste utilization. By chemical distillation, by extraction and by hydrolysis a vast number of products can be obtained from sawdust. Even in its crude form sawdust may be used for many commercial purposes; in this latter field the Division of Forests Products, C.S.I.R. is investigating the properties and possibilities of sawdust-cement as a constructional material. (See Forest Products News Letter No. 139.)

Despite technical advances, however, in many places there are a number of factors which combine to make the utilization of sawdust an economic impossibility. In these circumstances the sawdust inevitably produced in the conversion of timber becomes a liability, and needs to be disposed of by the easiest and cheapest fashion possible, which generally is by burning.

Several types of sawdust incinerator which are reasonably efficient in operation are used by the timber industry, but construction costs for these are generally high. The attachment of a Dutch oven and a step grate to existing steam raising boilers has, in large measure, also solved the problem of economic sawdust disposal for a number of sawmillers in Australia: burned on a step grate, even green hardwood sawdust can prove a valuable fuel. Many timber millers, however, do not use steam as a prime moving agent, and because of remoteness or other reasons, have no ready market for their waste. For them the question of sawdust disposal is an ever-present perplexity.

In general, these latter are in the habit of either carting their sawdust to a recognised tip, or of conveying it mechanically to a crude fire place, usually a pit or roughly enclosed uncovered space, located just beyond the mill roof and there burning it. In either case the results are not usually entirely satisfactory: on the one hand carting is expensive, and on the other hand, combustion in the fireplace occurs only as a slow smouldering accompanied by large volume of smoke, as is shown in Figure 1, and as frequently as not, eddies into the mill to the considerable discomfort of the mill crew. At times, with exceptionally strong air eddies, partially consumed smouldering sawdust particles may be carried over into the mill and these form a continual potential fire risk. It is obvious, therefore, that with an increasing tendency for the sawmiller to set up his mill in the town rather than in the bush, the necessity for providing an effective method of sawdust incineration which will operate without smoke and ash disposal, is of great importance.

The following notes covering the development of a new type of sawdust incinerator economical in construction, providing complete combustion of the sawdust particles in air suspension within a simply constructed brick or steel plate structure, without secondary handling, without smoke, and with virtually no "carry-over" of ash through the flue, will therefore be of particular interest to sawmillers faced with the perpetual problem of sawdust disposal.

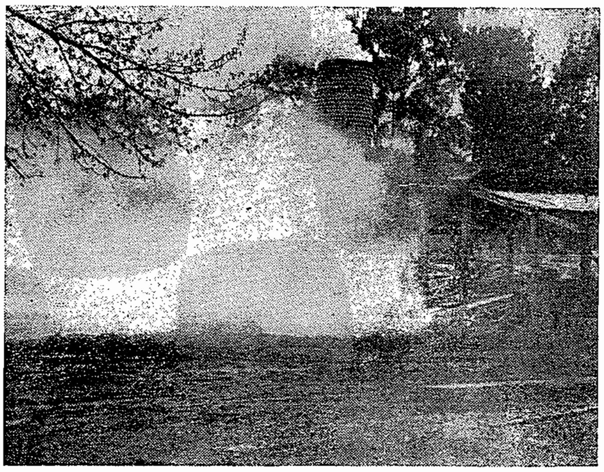

Figure 1

Credit for the early development of this type of incinerator, known as the McCashney incinerator, is due to Mr. R. McCashney of Alexandra, Victoria, who early invited officers of the Division of Forests Products, C.S.I.R. to inspect the unit and gave full permission for performance data to be gathered and used for the benefit of the timber trade.

Based on the principle of the cyclone separator, the general design of the unit is shown in Figure 2. Designed in a range of sizes to suit varying sawdust loads, construction consists primarily of a circular inverted funnel-shaped structure, in brick or steel plate, and lined with firebrick. A damper controlled air duct connected to a square perforated plate-type grate is fitted in the base of the unit, and a fire door is located in the side. This latter provides access for lighting up the initial fire in the incinerator with wood waste, and also provides a cleaning port. To assist initial combustion of the wood waste, forced draught into the basal air duct may be obtained by attaching, at this point, the discharge duct of an auxiliary blower fan.

With the interior of the incinerator well warmed up, sawdust collected from the vicinity of the mill equipment and conveyed from the mill by means of the usual exhaust fan, is then discharged directly into the unit from the fan discharge duct. This latter is fitted tangentially to the incinerator wall so that the sawdust carried into the lower part of the unit, in conformity with the normal principles of cyclone operation, is whirled around the interior of the incinerator, and is there burned in suspension. The excess air is exhausted from the top of the incinerator, which is proportioned to give a low velocity to avoid the discharge of ash particles. A general view of an incinerator of this type in operation is shown in Figure 3.

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Although the principle of operation is fairly simple, design data are fairly critical, specific control of air volume and air velocity to suit the proportions of the base diameter and exhaust diameter being necessary.

Where exceptionally heavy sawdust loads are involved, for which the volume of air to be handled is high, a simple modification of the arrangement previously described is desirable to avoid the necessity of an incinerator of exceptionally large dimensions. This necessitates the inclusion of a cyclone separator in the system to provide for the venting of excess air.

Requests for plans covering the design of sawdust incinerators of the above type should be addressed to the Chief, Division of Forest Products, C.S.I.R. Information covering quantity of sawdust to be handled per day, size of exhaust fan and discharge duct, and volume of air handled by the fan should be included.

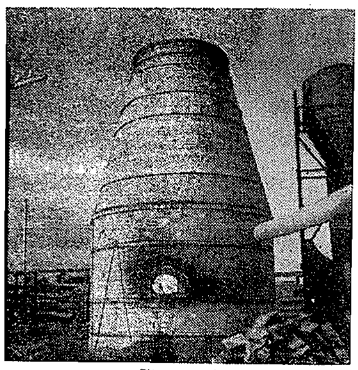
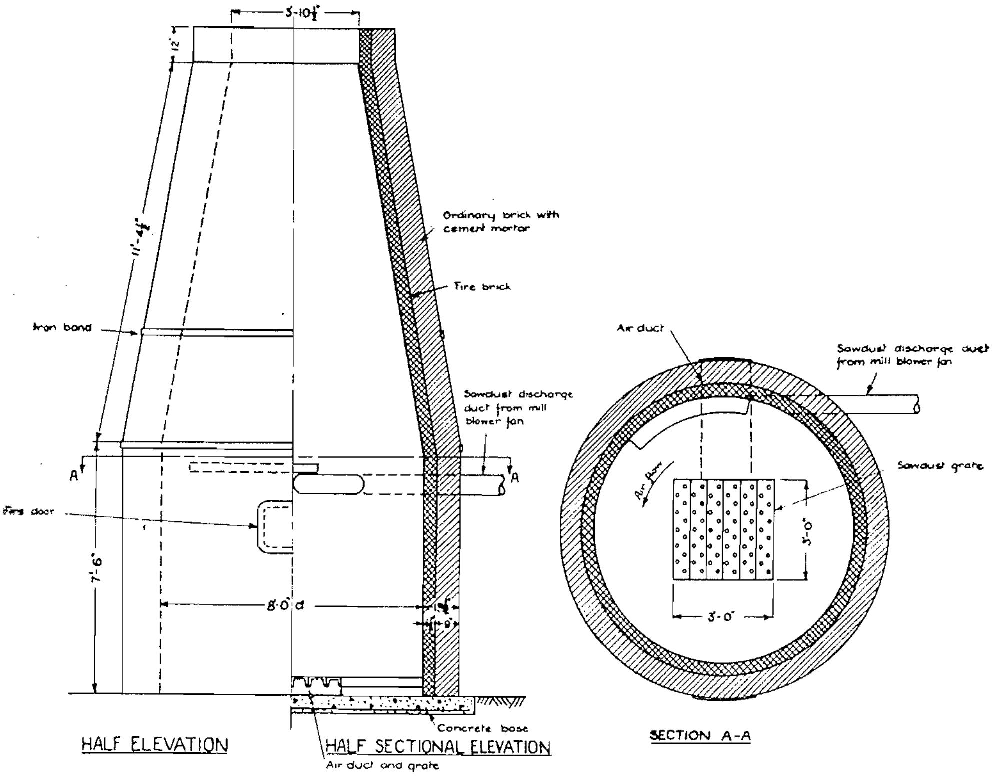


Figure 2



Diagramatic Sketch Of Mc Cashney Sawdust Incinerator

Figure 3

WHAT YOU SHOULD KNOW ABOUT TERMITES (White Ants)—Part 1

By N. TAMBLYN Officer-in-Charge, Wood Preservation Section.

Termites, or "white ants" as they are popularly but incorrectly called, are a serious pest in many parts of Australia and annually claim a heavy toll in the damage or destruction of timber in its many forms. Green and dead standing trees are frequently attacked, together with fence posts, poles, bridge timbers, rail sleepers, and building and other constructional timbers. Materials such as fabrics, cordage, leather, books and the insulation on underground power and telephone cables may also be damaged, while fruit trees, ornamental trees etc. and even sugar cane are susceptible to attack.

Prevention of termite attack or the eradication of infestation once it has occurred is not always a simple problem which can be solved by the purchase of some proprietary specific with a promising name. Effective and economical control is based on an understanding of the life history and habits of termites, and knowledge of local conditions, the adoption of suitable methods of building construction, and the judicious use of chemical control where necessary. The purpose of this article is to summarise the position so that the farmer, the engineer or the householder may approach his particular problem with the requisite knowledge for intelligent and successful counter-measures.

WHAT YOU SHOULD KNOW ABOUT TERMITES—PART I—continued

Life History and Habits.

Australian termites which cause economic damage nest in colonies which are almost always in close contact with the soil. The nest may be visible above ground as a typical termite mound, or may be located completely under the soil, or may be formed in such positions as inside the hollowed butt of a green or dead tree or an old stump. Except in the first case, location of the nest may be extremely difficult.

A typical vigorous termite colony may contain a million or more individuals living in an organised community containing a number of specialised types or castes. In a somewhat simplified case the development and organisation of a colony proceeds as follows:

A new colony is originated by two sexually mature winged termites or "reproductives" which at certain periods of the year are liberated in swarms from well-established colonies somewhere in the locality. These winged termites do not themselves attack timber, but after a brief flight shed their wings, endeavour to mate and locate a suitable site for a new colony. Though liberated from the parent colony in thousands, fortunately very few pairs indeed succeed in establishing a nest. The nest develops slowly as the female reproductive or queen commences egg laying, and usually requires several years to become a vigorously destructive colony containing perhaps a million or more individuals. In such a colony by far the most numerous individuals are the workers, which are soft-bodied, wingless, white or greyish coloured, blind and sexless, with a superficial resemblance to an ant except that the waistline is not constricted. These workers alone are responsible for all destruction caused, and by means of underground channels radiating from the nest, forage in search of suitable food. Present also in the nest and usually accompanying the workers in their foraging are the soldiers, individuals similar in appearance to the workers except for their much larger heads with strongly developed mandibles or jaws. Their purpose is defence of the colony and not destruction of timber.

The maximum distance from the nest which the workers will travel in search of food is not well established and varies with different species. In most cases however it is probably limited to a radius of less than 100 yards from the central nest. These underground foraging galleries are seldom very far below the soil surface and for species investigated appear to be mostly between 3 and 12 inches deep and probably very rarely exceed 2 feet except in the case of the giant northern termite which occurs sporadically north of the tropic of Capricorn.

It is important to realise that with Australian subterranean termites all attack occurs from the central nest via the underground galleries. This applies whether the timber is in contact with the ground or isolated on masonry or other similar foundations. In this latter case the foraging gallery is continued above ground as an earth-covered shelter tube or runway built over the surface of brickwork, concrete etc., or over durable timbers such as wooden house stumps to make contact with more suitable food materials perhaps many feet above the ground. As an indication of the height above ground at which attack may occur, extensive termite damage has been recorded in window frames on the third floor of an Adelaide city building, the covered runways being constructed up the internal face of the wall inside the cavity.

This direct contact with the nest permits the coming and going at will of thousands of individuals from the populous colony, and explains why attack may be very rapid or why termites may apparently disappear from infested timber only to reappear again in great numbers almost overnight. These completely enclosed runways above ground serve the dual purpose of retaining contact with the nest and of maintaining conditions of darkness and humidity which are essential to all termite castes except the winged reproductives. This latter point is of practical significance as once the above ground runways are broken and contact with the soil and nest severed, termites isolated above the break can do little further damage and die out unless soil contact can be restored.

Factors governing the severity of attack.

The degree of hazard and the severity of attack are dependent principally on the locality and the termite species present, the durability of the timber used and the ease with which contact can be established. The amount of suitable and easily available food material present in the locality also affects the hazard. In arid areas termites are greatly attracted to water, and undue wetting of the soil increases the liability to attack. Local knowledge is the best guide to the severity of the hazard in a particular area. In the capital cities and suburbs it is relatively severe in Adelaide and Brisbane, moderate in Sydney and Perth, and almost negligible in Melbourne. In general the hazard is more severe in the semi-arid inland areas and increases in severity north of the Tropic of Capricorn.

Many of the dense heavyweight eucalypt timbers show considerable resistance to termite attack and timbers such as ironbarks, most boxes, river and forest red gum, jarrah and wandoo, tallowwood and bloodwood are among the most resistant. Cypress pine is outstandingly resistant, while of other non-eucalypt timbers ironwood and turpentine are in the highly durable class. On the other hand the majority of light-coloured light-weight timbers possess little resistance against termite attack. More specific information on this subject will be given gladly on request to the Chief, Division of Forest Products, 69-77 Yarra Bank Road, South Melbourne, SC4.

Part II of this article, dealing with methods of Control of Termites, will be published in the August issue of this News Letter.

SUGAR FROM WOOD WASTE

By B. J. RALPH, Wood Chemistry Section.

It has been known for a considerable time that, by the action of acids under suitable conditions, the cellulosic portion of wood, amounting to some 75 per cent., can be converted into simple sugars, mainly glucose or grape sugar and xylose or wood sugar. Glucose, as is well known, can be easily fermented by yeast to yield ethyl alcohol. The xylose, on the other hand, while non-fermentable by ordinary yeast, can be utilized as a medium for growing certain fodder yeast. The possibility of using these reactions as a means of utilizing the very considerable quantity of waste wood arising from the various timber industries has been recognised by numerous investigators, and the patent literature contains the records of many attempts to evolve an economically sound process for the production of sugar from wood. It should be realized that no wood hydrolysis process can completely convert the substance of wood to simple sugars. There always remains a residue of the complex substance lignin, whose nature differs from that of the cellulose portion of wood. The profitable utilization of this substance is a very great problem. It may be mentioned in passing that the disposal of lignin-containing wastes is a problem also of the pulp and paper industry.

Three main types of process for the hydrolysis of wood have been evolved and operated on a commercial scale. They are (*a*) the so-called "American" process, (*b*) the Scholler-Tornesch process, and (*c*) the Bergius-Rheinau process. In the American process waste wood chips are heated in a digester with dilute sulphuric acid for a period of 10 to 20 minutes at a pressure of about 120 lbs/sq. inch. 20 per cent. to 25 per cent. of the dry weight of the wood is converted to simple sugars, of which 65–75 per cent. are fermentable. The sugars are leached out of the digested material, the solution neutralized with lime, filtered and fermented, the resulting alcohol being

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SUGAR FROM WASTE WOOD

(*continued from page 3*)

recovered by orthodox distillation methods. The Scholler-Tornesch process utilizes the same hydrolysis liquor, that is, dilute sulphuric acid, but this is forced through the wood charge over a much longer period (24–30 hours). The pressures employed are 170–180 lbs. /sq. in. By the use of a percolation system decomposition of the simple sugars formed is avoided and high yields (50 per cent.) are obtained in this process. The Bergius-Rheinau process employs 40 per cent. hydrochloric acid, at ordinary temperatures, and high recoveries are obtained. Further, in this process it is possible to recover the sugars in a dry form, without the necessity for the evaporation of large volumes of dilute liquor.

The above details of processes indicate that it is quite possible from a technical point of view to convert completely all the cellulose portion of wood to sugars, and at first sight it would appear that a complete solution of waste wood utilization was available. However, numerous other factors, both technical and economic, have to be considered. Firstly, the two German processes have operated under conditions of high wood costs and a high market price for alcohol, and it seems doubtful whether they could have been successfully run without Government subsidy. Further, their equipment is complicated and costly, especially in the case of the Bergius process, where the construction material must be able to resist the very corrosive hydrochloric acid, and where means of recovering this expensive reagent must be used.

In recent years the threatened shortage of ethyl alcohol in America led to a careful consideration of the economics of the three wood treatment processes described above, and it was found that, given an abundant and easily collected supply of cheap waste wood, the American process, in spite of its low recovery of the total sugars available in the wood, was probably the most satisfactory process for meeting a war emergency. Its great advantages are relatively simple equipment, a cheap treatment liquor and a short cycle of operations. However, further work has been carried out on the Scholler process in America and great improvements in the technology have been reported, e.g., the shortening of percolation time. It remains to be seen whether this process can be operated successfully under American conditions.

At this point a number of questions will doubtless arise in the mind of the Australian reader. Can any of these proven wood treatment processes be employed to utilize profitably wood waste in this country ? Are Australian timbers suitable for treatment by such processes ? A considerable amount of thought has been given to such points by the Council for Scientific and Industrial Research and other institutions in the last few years and partial answers can be given. Work on the treatment of messmate stringy bark (*E.obliqua*) has been carried out at the University of Tasmania and the results of the earlier investigations, using a procedure similar to the American process have recently been published. Interesting results using a percolation process (Scholler technique) have also been obtained. Further, the Division of Industrial Chemistry, in conjunction with the Division of Forest Products has arranged for Scholler pilot plant tests to be carried out in America on four Australian timbers. Reports are expected shortly. From the information available at the moment, it is clear that yields of sugars equal to those from American timbers can be obtained, but a considerable amount of work, especially with regard to fermentability, remains to be done. Disposal of the residual lignin from wood hydrolysis has not received a great deal of attention in these local investigations and must be considered as one of the more urgent problems connected with successful waste wood utilization in this country. Incorporation in plastics has been suggested as an outlet for lignin, but the drastic treatments employed in wood hydrolysis leave a residue not particularly suited to this purpose.

In conclusion, it may be said that disposal of waste wood by such chemical methods has considerable possibilities in this country, provided a clear insight into the fundamentals of the process can be obtained, a profitable method for lignin utilization can be evolved, and a technology adapted to the peculiarities of local conditions can be developed.

The Properties of Australian Timbers

BROWN STRINGYBARK.

Brown stringybark is the standard trade name for the timber derived from the botanical species *Eucalyptus capitellata* Sm., *Eucalyptus blaxlandi* Maiden and Cambage, and *Eucalyptus baxteri* (Benth.) Maiden and Blakely. There has been some botanical confusion between these species, all of which have been called brown stringybark. However the timbers are very much alike; they have been used indiscriminately and brown stringybark has therefore been recognised as a definite timber species.

Habit.—It is difficult to describe the habit of several species, but in general it may be said that brown stringybark is usually a small to medium-sized tree, sometimes dwarfed and with a crooked stem. It grows to a height of from 50 to 120 ft. with a diameter of 2 to 3 ft. The bark in appearance resembles that of the other stringybarks, although sometimes furrowed; it reaches far up the branches, the branchlets alone being smooth. The leaves are narrow and broadly lanceolate, somewhat thick, dark green in colour and shining.

Distribution.—The description of the distribution of the three separate species is not easy but generally they are considered together, hence the records show that brown stringybark is widely distributed from South Australia, through Victoria and into New South Wales, in the latter State especially in the coastal regions where it is found from the Dividing Range down to the coast.

Timber.—The timber is light brown in colour with a medium texture; the grain is usually straight but sometimes with a slight interlock. The wood is moderately heavy with an average air-dry (at 12 per cent. m.c.) density before reconditioning of 55.5 lbs./cu. ft. (95 per cent. probability range 43.7 to 67.2 lbs./cu. ft.). That reconditioning is beneficial to the species is indicated by the fact that the average air-dry density of the same specimens after reconditioning fell to 52.1 lbs./cu. ft. (95 per cent. probability range 39.8 to 64.4 lbs./cu. ft.). In drying from the green condition to 12 per cent. m.c. brown stringybark shrinks 10.3 per cent. in a tangential direction (backsawn), and 5.2 per cent. in a radial direction (quartersawn). The shrinkage after reconditioning is reduced to 5.8 per cent. and 3.2 per cent. respectively. Up to the present no experimental work on the seasoning properties of this timber has been carried out. Brown stringybark falls into strength class B and in this respect is similar to karri and southern blue gum. In durability it falls into class 3; it is ranked as inferior to white stringybark in this respect but superior to red stringybark. The sapwood is rarely susceptible to Lyctus attack. Present indications from preliminary gluing tests show that satisfactory gluing can be expected with urea formaldehyde glue which is more satisfactory than casein glue.

Uses.—In Victoria brown stringybark is used extensively for fence posts and bridge timbers. Other uses are building scantling, sleepers and railway track flooring. In South Australia it is used in addition for shingles and furniture.

Availability.—Brown stringybark is sawn in moderate quantities in Victoria, and figures compiled from the Victorian Forests Commissions returns for 1945 show that over 4,000,000 super feet were milled in Victoria alone.

BREVITIES.

Mr. G. W. Wright, Officer-in-Charge Seasoning Section, and Mr. H. D. Roberts, Technical Officer, Seasoning Section, Division of Forests Products, visited a number of sawmills in the Mansfield, Marysville, Moe and Tanjil Bren districts of Victoria in recent weeks as a preliminary step in the setting up of a comprehensive sawmill study being carried out as a co-operative project with the Victorian Sawmillers' Association.

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FOREST PRODUCTS NEWS LETTER

This monthly bulletin is prepared for general circulation by the Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4., and will be supplied free on request to members of the timber trade and timber users who wish to keep abreast with current developments in the field of forest products.

No. 143 1946##143 August, 1946.

SYNTHETIC RESIN ADHESIVES

1. GENERAL NOTES

Compiled by H. G. HIGGINS,
Veneer and Gluing Section.

(This article is the first of a series dealing with the subject. In the preparation of these articles, liberal reference has been made to the following publications: (a) T. D. Perry "Modern Wood Adhesives" (Pitman) 1944; (b) "Synthetic Resin Glues," a report of the Forest Products Laboratory, Madison, Wisconsin, U.S.A. 1945.)

It is no overstatement to say that the development and improvement of synthetic-resin adhesives during the last few years has revolutionised the timber industry. Plywood, formerly looked on with suspicion for anything except the most unexacting tasks, has now taken its place as one of the most important structural materials—one which can be depended on for the strength, reliability and durability demanded, for instance, in such a construction as a front-line aircraft. Although the development of structures embodying wood and synthetic resin adhesives was accelerated greatly during the war, there is an increasing application of these techniques to the everyday needs of industry and of the people generally.

The term "synthetic resin" originates from the resemblance in appearance between natural resins and some of the synthetic compounds produced in the early years of this century. As now understood however, the group includes a wide range of substances, quite diverse in some ways, and many of which have little resemblance to natural resins. They constitute the major portion of the plastics field, but only a relatively small proportion are suitable for use as adhesives.

Synthetic resins fall into two main classes: thermosetting and thermoplastic. The thermosetting resins, as the name implies, set with the application of heat, and once this process is complete, will not return to their original state. The thermoplastic resins on the other hand, are softened, or become plastic, whenever their temperature is raised above a certain range, and they will set again on cooling. Most important adhesives for wood belong to the thermosetting group, which also includes those cold-setting resin glues, the setting of which is chemical in nature but which is accelerated by the action of heat.

The following is a general classification of synthetic-resin adhesives:—

Thermosetting:
- Phenol formaldehyde
- Urea-formaldehyde
- Resorcinol-formaldehyde
- Melamine- formaldehyde

Thermoplastic:
- Vinyl esters

Of these, the phenol-formaldehyde and urea-formaldehyde resins are undoubtedly of the greatest importance at present, but it is probable that the other thermosetting resins, particularly resorcinol-formaldehyde, will soon come into greater use as adhesives.

The thermosetting resin adhesives are manufactured by the reaction with formaldehyde (formalin) of phenol, urea, melamine, or resorcinol. This reaction is only partial, and is stopped at an early stage. (The setting process is also referred to as "condensation" or "polymerization.") The partly condensed product then awaits the completion of the reaction by the addition of a catalyst or "hardener," by the application of heat, or by both means. When this occurs the bonding takes place providing that the adhesive and the members to be glued have been correctly prepared, assembled and pressed.

The adhesive before use may be in a powdered form, or as a solution, usually in water, or it may be impregnated into thin paper to form a film which can be easily handled and laid between the sheets of material to be bonded. While in this uncured or partially cured state the storage life is dependent upon the temperature, and may generally be lengthened by refrigeration, particularly when in the liquid form. Powdered glues to which the dry hardener has already been added must be stored under dry conditions in air-tight containers. For resin-impregnated films the storage conditions are less critical, but again cold, dry conditions minimise the rate of deterioration. If the resin is allowed to reach an advanced state of polymerization before being used, it loses its adhesive properties.

General use is made of hardeners or catalysts with synthetic resin adhesives. Hardeners are chemicals which accelerate the rates of setting of the resin, and in this they have the same effect as higher temperatures. They may be alkalies, acids or acid-producing salts, or neutral. Urea and melamine glues are almost always acid-catalysed; phenol and resorcinol glues are usually hardened by alkalies. Formaldehyde itself may be used as a hardener with certain resins.

Hardeners are sometimes mixed in powder form with the adhesive, and the condensation commences with the addition of water or some other solvent. Such an arrangement is very convenient for joinery work, but precautions should be taken to keep the ready-mixed powder cool and dry. When the resin is supplied as a liquid, the hardener is added before use, either as a powder or in liquid solution.

Fillers, or extenders, are quite commonly used with resin adhesives, and they comprise materials of inferior value as adhesives, but of lower cost. They are usually added to the glues by the manufacturer, but may be supplied separately for incorporation in the glue by the user. In addition to lowering the cost of adhesives, fillers may be added in small quantities to improve certain working properties. When the resin is highly extended, however, serious reduction in the properties of the glued joint, par-

SELECTION TABLE FOR SYNTHETIC RESIN ADHESIVES.

Adhesive / Characteristic	Urea Resins	Phenol Resins	Resorcinal Resins	Melamine Resins	Thermoplastic Resins
Form	Liquid (usually) or powder	Film (usually liquid) or powder	Liquid	Usually powder	Liquid (solution in organic solvent)
Pressing Temperature	Cold or hot-setting (210°—240°F.)	Usually hot (300°F.); some cold	Cold (70°F.) but preferably higher	Most hot (230°—300°F.) but some 120°—200°F.	Hot (195°—320°F.)
Preparation for use	Liquids : hardener required ; perhaps filler. Powder usually mixed only with water	None with films or liquids. Solids dissolved. Hardeners for cold pressing	Mix with hardener and filler	Mix with water. Sometimes hardener and filler also	None or add thinner
Working life	Several hours to one day	Hot : long period Cold : several hours	Usually 2—5 hrs. cold. Reduced at high temperatures	2—36 hrs. cold	Indefinitely long
Assembly time	Varies from 1 min. to several days	Film : several months. Hot press liquid : 1 min. to several weeks. Cold press : 5-30 mins .	10 mins. to several hours	Usually not critical	At least several hours
Joint strength (dry)	High	High	High if cured at elevated temperatures	High	Low to moderate
Water resistance (cold)	Good	Excellent	Excellent	Excellent	Moderate
Resistance to boiling	Poor	Excellent	Probably very good	Probably very good	Generally poor
Resistance to micro-organisms	Good, unless highly extended	Good	Probably good	Probably good	Good
Staining	None	None with films. Some with liquids	Probably not serious	Probably not serious	None
Heat resistance	Moderate	Good	Probably good	Excellent	Poor if temperature in softening range
Exterior durability	Fairly good	Excellent	Excellent	Probably excellent	Probably moderate
Present cost	Fairly high if un-extended ; low with extender	Fairly high	Very high, but decreasing	Very high	High
Remarks	Water resistant and comparatively easy to use. Some have " gap-filling " properties	Particularly suitable for exterior work	Joints gain strength after removal from press. Combines cold-set with durability. Very adaptable. Some are " gap-fillers "	Moisture content of wood should be above 6% for best results	Must be dried before pressing. Usually several coats. Must be cooled in press. Used for moulded plywood

BREVITIES.

Mr. A. J. Thomas, Dip.For., I.F.A., has resigned from the Division of Forest Products in order to assume a managerial position with C. H. Tutton Pty. Ltd.

Mr. Thomas has been associated with the Division since 1931, when he acted as liaison officer between the Tasmanian Forestry Department and the Division of Forest Products. He joined the staff of the Division in 1932, and was initially attached to the Seasoning Section, where he was instrumental in improving the procedure followed in developing kiln-drying schedules for Australian timbers, and made several noteworthy contributions to the designs of capacity type moisture meters. He was transferred to the Utilization Section in 1934, and participated in field grading studies in Victoria, Tasmania and New South Wales which established the basis for the preparation of Australian standards for structural timber and milled products. He established wide contacts over the next six years in the industrial investigations carried out by the Utilization Section. During this time he collaborated with the Timber Mechanics Section in the preparation of the "Handbook of Structural Timber Design," and Pamphlet 112 "Building-Frames Timbers and Sizes," which has provided the basis for sizes of timber used for house construction in eastern States. In August, 1941, Mr. Thomas was seconded to Timber Control and acted as Assistant Controller (Imports) for some years.

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Synthetic Resin Adhesives (cont.)

ticularly in its durability, may be expected. Typical fillers are wood-flour, walnut-shell flour, starch, and proteins.

In the use of synthetic resin adhesives, there are several factors which must be closely controlled, since their permissible limits for good results vary greatly from glue to glue. These limits are specified by the manufacturer in his instructions to users, and should be closely followed in the preparation of the glues and during the gluing operation. The variables include: the proportions of the different ingredients, the working life of the glue, the rate of spread, assembly times, moisture content of the wood components and the condition of the surfaces to be glued, the pressing conditions (temperature, pressure and time), and the subsequent conditioning. These factors will be dealt with later.

In selecting an adhesive for a particular purpose it is necessary to consider several aspects of its production, use, and properties. The accompanying table may serve as a guide in this respect. Some of the data on resorcinol and melamine resins are not yet definite, as these adhesives are of very recent development, and are still in the process of being tested.

At present the urea-formaldehyde and the phenol-formaldehyde resin adhesives are the only ones in general use in Australia and commercially available. The urea resins are usually in liquid form with a separate hardener, and the phenol resin in the form of a film for hot pressing. Details of the various adhesives, their use, properties, and applications, and of the gluing operation generally, will be dealt with in later articles in this series. In the meantime, information may be obtained from the Chief, Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4.

Survey of Sawdust Supplies

Everyone connected with the timber industry has been impressed at some time or another with the large waste which takes place in the form of sawdust, and many efforts have been made to find profitable uses for this material There is a large number of uses for sawdust but not all of these are economic, consequently new uses are required.

The Division of Forest Products has been carrying out a number of investigations into the utilization of sawdust and is contemplating expanding this work. So that the investigation can be placed on a sound basis and can be of a nature likely to lead to practical result, it is necessary first to have a proper picture of the sawdust supply position in Australia. For this reason a survey is being conducted by means of questionnaire forms asking for the requisite information.

Some 2,000 forms have been distributed, either directly to the sawmiller or through the State Forest Services and to date about 30% of these have been returned. No doubt some millers have felt that the questionnaire is just another form to be filled in and is not likely to result in any practical benefit. While no immediate result can be promised, it must be emphasised that the sawdust problem is a very difficult one and one which is not likely to be solved by finding some single new use which will miraculously give a great value to sawdust. Rather the solution is likely to be in finding a wide range of uses, each one particularly suited to some class of sawdust and set of conditions. For example, the requirements of the plastics industry are reaching the neighbourhood of 2,500 tons of sawdust per year but for this purpose softwood sawdusts are preferred and certain requirements of accessibility to wood flour plants are also necessary.

It is stressed that the information is required in the interests of the industry and it is hoped that those sawmillers who have not already completed the form will do so and return it at an early date in order to make possible an effective analysis of the potential supplies of this material.

WHAT YOU SHOULD KNOW ABOUT TERMITES

(WHITE ANTS)—Part II

By N. TAMBLYN Officer-in-Charge, Wood Preservation Section.

Methods of Control.

Methods of control are twofold, firstly the employment of that type of construction designed to isolate susceptible timber from contact with the soil and to prevent termites gaining access to it, and secondly the use of chemical treatments either to prevent attack or to destroy an infestation once it has commenced.

In any area where the hazard is even moderately high the cheapest insurance for permanent buildings is the use of termite-proof construction designed to prevent termites from gaining access to the timbers of a building. Methods of termite-proof construction are dependent on the type of building to be erected and on the severity of the hazard.

In areas of high hazard buildings to be used for factories, stores, workshops etc. should be built whenever possible on a concrete floor extending outside the building walls for a distance of 6 inches on all sides. All expansion joints and shrinkage cracks should be poisoned with creosote oil at the rate of about 1 gallon of creosote to 100 lineal feet of joint.

All timber framework should stand on the concrete floor and posts should not pass through the concrete to the soil beneath. A building so erected is isolated from the surrounding soil, any termite entry to the building must take place over the external concrete rim, where prompt action can be taken to break the runways and poison the soil with creosote where the gallery emerges from the ground.

If a wooden floor is necessary, the whole superstructure of the building should rest on metal termite caps placed on top of the stumps or piers. There should be no contact at any point between the soil and the protected superstructure above the caps. Concrete piers or stumps of a durable timber should be used, preferably of sufficient height to give crawling space under the whole building. Caps should be stamped from 26 gauge galvanised iron with the lip turned down at an angle of 45 degrees and the bottom of the lip projecting 2 inches from the sides of the stump. Suitable shields are available on the Australian market. In all shielding work precautions are necessary in securing the bearer to the stump or pier. Where concrete piers are used the shield should be bedded on fresh cement mortar, bitumen or pitch to seal any openings around anchor bolts. With wooden stumps the caps should not be pierced by spiking the bearer to the stump. For structural stability bearers may be bolted to the stumps using ½ in. bent bolts passing round the caps and coachscrewed to the stump beneath. Full details for fitting shields to stumps and piers and for incorporating continuous strip shields in masonry foundation walls are described in a publication available free on request to the Chief, Division of Forest Products, 69-77 Yarra Bank Road, South Melbourne, S.C.4.

In addition to the above precautions the site should be cleared of all debris such as tree roots, stumps etc., which may serve to attract termites to the area. If no wood is left in contact with the soil the danger of vigorous termite colonies developing nearby is practically eliminated.

While the above methods can be applied only during the planning and construction of a building, it should be emphasised that a little forethought is by far the best method of permanent control.

Attack occurring in buildings, the construction of which favours the ready entry of termites and at the same time prevents access to the sub-floor area is a difficult problem. Unfortunately these conditions obtain in the majority of cases where attack occurs in residential premises. The nest may be under the house, or anywhere within a radius of up to perhaps 100 yards, and in many cases cannot be located. Local treatment of the attacked wood with repel-

What you should know about Termites (Part II)—cont.

lents usually serves only to kill a few termites present in the timber and to divert attack to a fresh position.

The following control measures are recommended:

(a) Make a careful search for a nest which, if located within a radius of 100 yards, should be destroyed. A simple method is that of poisoning the nest by drilling one or more holes through the centre of the mound or nest with an auger and blowing in about ½ oz. of dry white arsenic powder (arsenic trioxide). The auger holes should then be stopped up with a small plug of moist earth and the nest left undisturbed for several weeks.

(b) Whether or not a nest is located and exterminated, treatment should also be made near the site of the attack. This is a necessary precaution as there may be uncertainty that any colony destroyed was responsible for the damage. The most effective treatment which can be here recommended is the injection of white arsenic powder into the earth-covered runways close to their contact with the ground. Examination beneath the floor should be made to locate galleries leading to the soil. For the success of the arsenic these galleries should not be broken but a small hole about ⅛ in. diameter carefully made and not more than ¼ ounce of dry white arsenic powder gently blown in through the nozzle of a suitable powder blower. The hole should then be sealed with mud, care being taken not to break the gallery.

The success of this treatment is dependent on the use of small quantities of arsenic *without disturbing* the termites or breaking their contact with the ground or their nest. If correctly applied the poison is carried by the termites on their body hairs back to the nest, where their habit of grooming one another and consuming their dead offers a good chance of destroying the colony.

Where it is impossible to locate galleries leading to the soil, treatment of the infested timber may be made and arsenic similarly blown into galleries in the wood wherever active attack is occurring. Again, it is essential that the least possible disturbance be made as otherwise distribution of arsenic by the termites will not take place.

(c) This method of treatment should also be applied wherever termite activity is discovered in fence posts, sheds, old stumps etc. in the vicinity of the building. Arsenic being a deadly poison should be handled with great care and all precautions taken to prevent the operator inhaling the dust.

(d) An alternative to the above method of arsenic poisoning is the formation of a barrier of treated soil around the outside of the foundations. In this method a narrow trench is cut to a depth of about 18 inches completely around the building, and the soil saturated with a repellent or poison as the trench is back filled. Creosote oil may be used at the rate of 1 gallon to 5 linear feet of trench. Application is simple—the bottom of the trench should first be saturated with creosote oil and application should continue as successive layers of soil are filled into the trench. The top 2 inches of soil need not be treated to leave a clean surface. As creosote oil is a plant poison shrubs or plants close to the trench may be killed.

This method should not be applied where arsenic poisoning of galleries or infested timber within the building has been made, as it severs the underground soil galleries and prevents the arsenic being carried back to the nest. It should also be realised clearly that an external trench is effective only where the nest is outside the building. If the nest is beneath the floor the trench can have no effect in preventing further attack.

In conclusion it should again be stressed that eradication of termite attack in unprotected buildings is not always a simple problem and may require retreatments.

BIBLIOGRAPHY OF SCIENTIFIC AND INDUSTRIAL REPORTS

During the war a great deal of research was carried out under the auspices of the Allied Governments. It has been decided that a large proportion of the results of this research should now be released for general use.

The U.S. Department of Commerce, through its "Publication Board," is now issuing abstracts of these reports in the form of a "Bibliography of Scientific and Industrial Reports." The complete Bibliography is now being received in Australia and relevant extracts are reproduced below.

The original reports may be obtained in two ways:

(a) Those marked with an asterisk may be obtained without cost on making application to Secondary Industries Division, Department of Post-War Reconstruction, Wentworth House, 203 Collins Street, Melbourne, C.1.

(b) In other cases microfilm or photostat copies of the original report may be purchased from the United States through C.S.I.R. Information Service. Those desiring to avail themselves of this service should send the Australian equivalent of the **NETT** U.S. price to

C.S.I.R. Information Service,
425 St. Kilda Road,
MELBOURNE, S.C.2.

All other charges will be borne by the C.S.I.R.

Further information on the subjects covered by the reports and kindred subjects may be obtained by approaching the C.S.I.R., Information Service, the Secondary Industries Division, Department of Post-War Reconstruction, or the Munitions Supply Laboratories (Technical Information Section), Maribyrnong, Victoria.

LEONE, LEONARD F. Coated and impregnated vesicant-resistant paper. Mass. Institute of Technology. Chemical Warfare Service Development Laboratory M.I.T.-M.R. 115). Off. Pub. Bd., Report, 7852. 1944. 30 pp. Price: Microfilm—50 cents; Photostat—$2.00.

The object of the work described in this report was to develop coated, impregnated, or laminated vesicant-resistant paper for the fabrication of protective capes, food packages, and coverings for Army equipment and supplies. Materials were developed for a military protective cape, a civilian protective cape, food packaging, gas-resistant MI sack, gas-proof curtains and dump covers, tarpaulins and vehicle seat covers, and litter covers. Materials and equipment, procedure, and results are described. Tables.

RODEBUSH, W.H. Report on "Aerosol filter materials." (O.S.R.D. Report 168). Off Pub. Bd., Report, PB 5546. 1941. 15 pp. Price: Microfilm—50 cents; Photostat—$1.00.

Tests were made on several hand-made and machine-made papers containing asbestos, furnished by Manning Paper Co., and by Knowlton Bros., the object being to find a filter for the training canister. Tables I—IV summarise the data on these sheets. Tests were also run on several different materials as cotton and asbestos mixtures, wood-pulp and asbestos paper, paper A—91, Vinyon, rock wool, Hygienisac paper and glass wool. Results were tabulated. This is a final report of the University of Illinois and it may be considered as a supplement to the previous progress report, Division B, Serial No. 58.

FULLER LABEL AND BOX COMPANY, Pittsburgh, Pa. Moisture proof studies on impregnated paper tubes. Chemical Warfare Service Contract W-266-CWS-217). Off. Pub. Bd., Report, PB 1172. 1942. 10 pp. Price: Microfilm, 50 cents; Photostat, $1.00.

Moisture proof studies on impregnated paper tubes are described. Tables show general appearance of application before immersion and condition after 20 hours immersion in tap water at 80° F. One table giving resistance of plastics to chemical reagents and one table giving property ranges of plastics are also included.

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FOREST PRODUCTS NEWS LETTER

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War-time Developments in Cellulose Packaging and Wrapping Materials

By A. J. Watson—Wood Chemistry Section.

In the early days of the war in the Pacific, the fighting forces were faced with the fact that, although many of their methods of packaging were satisfactory for temperate zones, they were not suitable for the high temperatures and humidities encountered in tropical areas. The problem that arose was to evolve methods of packaging which would protect the contents from damage by water or water vapour, and give the requisite mechanical protection under these conditions. As many materials used in packaging were in very short supply because of the war, new types of packaging materials had to be evolved. It is the purpose of this article to describe the ways in which paper and other cellulosic materials were utilised in producing packaging and wrapping materials which met these requirements.

The problem, broadly speaking, was divided into two main sections. The first consisted in designing packages which would retain their mechanical strength after immersion in water, and so continue to give adequate protection to the contents, and secondly to wrap the individual articles in these packages in such a manner as to prevent water or water vapour from coming in contact with the article.

Containers. Chip board containers have been used for many years for the packaging and transport of many articles. Provided the load packed inside the container was not excessive, and its contents were arranged so as to support the container, these chip board containers had, under normal conditions, given satisfactory service. However, under service conditions in tropical areas these containers had to withstand high temperatures and humidities, frequent wetting by rain, and even partial or total immersion in water for varying periods. Under these conditions the chip board containers softened rapidly, thus giving very little mechanical protection to the contents. The problem therefore was to design containers which would still retain sufficient mechanical strength to protect their contents even after prolonged wetting or immersion.

Considerable research work was carried out on this problem in America and, at a somewhat later date, in England and Australia. The problem was complicated by the shortage of many raw materials, but a container with a high degree of wet strength was evolved by incorporating bitumen in the container board. This was done in two ways. The first consisted of laminating a number of layers of board together to make a final board of the required thickness. These boards were laminated with a waterproof glue containing bitumen. As these boards usually consisted of four or five laminations it meant that the inner plies were protected by a waterproof glue line, and therfore did not get wet even on prolonged immersion in water. Containers made from this board retained a considerable amount of their original strength, even after spraying with water for 24 hours. This is illustrated in the following results which were obtained in the Division of Forest Products on a number of containers made from Australian made bitumen laminated board. These tests were carried out by tumbling the boxes in the box tester at this Division.

Container loaded to 30 lbs.	2350	drops before failure.
,, ,, 40 lbs.	1280	,, ,,
Container loaded to 30 lbs. and sprayed for 24 hours	1350	,, ,,
Container loaded to 40 lbs. and sprayed for 24 hours.	650	,, ,,

In contrast to these results, ordinary chip board containers loaded to the same weight fell to pieces on lifting after 24 hours spraying. As the point of failure is taken when the container starts to split, it is evident that the bitumen laminated container still retained considerable mechanical strength even after it had started to fail, and was still capable of giving some protection to the contents.

These boxes had considerably more strength, even in the wet state, than was required for most purposes, and lower grade boxes were made, using similar methods of lamination but manufacturing the board from cheaper grades of pulp. In England, where the shortage of long fibred pulp, as used in the American type of boxes, was acute, container board was made from chip board and waste paper, which were mixed with bitumen prior to forming the pulp into a board. Although this bitumen-board did not possess the high wet strength properties of the bitumen laminated boards, its wet strength was sufficient for most purposes.

The Division of Forest Products in conjunction with the Army Design Directorate also produced a rather specialised modification of these high wet strength fibre containers. Prior to the Pacific campaigns the bombs for 2″ and 3″ mortars had been packed and transported to the firing line in chip board containers. These proved completely inadequate to protect their contents under tropical conditions. However, after some time cylindrical laminated mortar bomb containers were evolved which could be immersed in boiling water for 12 hours before starting to soften.

Wrapping Materials. The containers described above were designed primarily to protect the contents from mechanical damage. Although they gave some protection from the elements they were not capable of giving adequate protection from water and water vapour. Even if the container were sealed carefully so as to exclude water or water vapour, a single puncture during transit or storage would render all of the contents liable to damage by corrosion. To overcome this difficulty the practice was adopted of wrapping each article separately in material which would act as a barrier to water or water vapour. With most articles it was not anticipated that they would be subjected to prolonged periods of immersion in water, but it was realised that even when stored under cover it would still be necessary to prevent water vapour entering the package and damaging the contents.

The problem was to devise a material which had a high resistance to the passage of water vapour under extreme tropical conditions, and which possessed the requisite mechanical properties to enable it to be used for wrapping purposes. The fact that many materials were in short supply limited the numbers available for the construction of wrapping materials. The majority of these wrappers consisted of cellulose, either in the form of paper, or as regenerated cellulose generally laminated with other materials to give increased moisture resistance or mechanical strength.

Various materials were developed in the U.S.A. but in many cases the supply position prevented their use in Australia. However, the Army Design Directorate and the Division of Forest Products, in conjunction with the various manufacturers concerned, succeeded in producing locally a number of wrapping materials which had a high degree of resistance to the passage of water vapour.

Samples were examined under rigidly controlled conditions of temperature and humidity (100°F. and 90% relative humidity)

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and were tested both in the plain and in the creased condition. In all, over 100 different wrapping materials were examined by the Division in the course of this work. The following table gives the moisture vapour permeability values obtained for a number of the materials examined. No attempt has been made to give results for individual papers, but the values presented are indicative of the efficiency of the various types of wrapping material examined.

Material	Moisture Vapour Permeability (gms/sq. metre/24 hrs.) Plain	Creased
Metal foil laminated to paper or cloth	0.0 –0.1	Not tested
Waxed cloth for conforming wraps ...	0.4–4.0	0.7–6.1
Bitumen laminated paper	10–40	15–50
Waxed paper	3–60	100–250
Cellophane (plain)	16–30	Not tested
,, (wax laminated) ...	5–8	7–9
Ethyl cellulose sheeting	2–4	Not tested
Phofilm	5–40	,,
Glassine (waxed)	0.3–0.6	10–11

It will be noted that some samples were not tested in the creased condition. This was because these materials were resistant to creasing and did not appear to be damaged by it in any way. It should also be understood that the values given above are only a general indication of the results which are obtained with various types of wrapping materials. These results may be greatly modified either by altering the thickness of the materials or by changing the laminating materials.

A few of the materials mentioned above warrant further description. The conforming wrap consists of a light fabric material or a stout crepe paper which was saturated with a non-setting wax. These materials, as their name suggests, were used for wrapping articles so that the wrap closely conformed to the shape of the object. In this way practically all the air was excluded from inside the wrap. The bitumen laminated papers were similar to many of the well known building papers, except that in some cases lighter weight paper was used. The waxed papers were made by dipping a good grade of kraft paper in various waxes and then testing. The wrappings made from the regenerated cellulose and various synthetic resins were, in general, tested in single sheets, although in some cases they were laminated with other materials.

The efficiency of these various wrapping materials in excluding moisture from the packages is also dependent on the efficient sealing of the wrapping. In some cases it was possible to heat-seal the packages, but the most widely used method consisted of dipping the wrapped article into a hot wax mixture, thus effectively sealing all openings and at the same time the wax coating on the wrapping increased its efficiency as a water vapour barrier.

The effectiveness of these improvements in packaging and wrapping techniques, together with other advances in packaging in general, can be gauged from the fact that towards the end of the war the damage to stores by water and water vapour, which had been a very serious problem in the early days of the Pacific campaign, was reduced to negligible proportions.

WHAT IS THE STRENGTH OF TIMBER ?—Part I

(Prepared by Timber Mechanics Section.)

Quite often, the research worker is asked for the strength of a certain species, and invariably the retort is " Well, what do you want it for ? " The word " strength " as used in the question is indefinite and almost meaningless, as a very large number of different types of test might be carried out on a particular species, any one of which might be said to give the " strength " of that timber. However, to determine the suitability of a timber for most practical purposes, fewer than a dozen standard strength tests are normally applied, and each of these yields one or more results, each of which is known by a distinctive name, e.g., compression strength parallel to the grain, radial shear strength, modulus of elasticity, etc.

In order that information published by this Division may be readily understood, it is intended that this article should be the first of a series in which the various scientific terms used in describing the strength properties of wood are made more intelligible to the timberman.

1. Modulus of Rupture :

This is most frequently the property required when the question " What is the strength of such and such a species ? " is asked. Modulus of rupture is a term used to denote the bending strength of beams, which are commonly used in structures.

Let's say we rest a 2″ x 2″ mountain ash beam on two supports 6 ft. apart and apply weights to the middle of the beam until it breaks. If it is of average strength, then a load of about 1260 lb. would just break the beam and one could say that for this particular beam, 1260 lb. was its " breaking load." Had the beam been twice as wide, *i.e.*, 2″ x 4″ and tested over the same span it would have taken twice the load, *i.e.*, 2520 lb. to break it. If it had been twice as deep, *i.e.*, 4″ x 2″ it would have carried four times as much, *i.e.*, 5040 lb. However, if the supports had been set at 12 ft. instead of 6 ft. it would have taken only 630 lb. to break the 2″ x 2″ specimen. Thus it can be seen that for this one piece of timber, we may obtain any one of an infinite number of breaking loads by varying the width, depth and span either separately, two at a time or all together.

Obviously such a figure would be practically useless for comparing say the bending strength of mountain ash with that of hoop pine unless an exactly similar beam of the latter species was tested in an identical manner. To overcome this difficulty and to simplify comparisons, the value known as " modulus of rupture " is used. It is, for most practical purposes, independent of the size of the beam, and so may be used to compare directly one species with another. From standard tests on small specimens, the modulus of rupture for dry mountain ash is approximately 17,000 lb./sq. in. and for hoop pine at the same moisture content it is approximately 13,000 lb./sq. in. This may be interpreted as meaning that the first-named species is about a quarter as strong again as hoop pine. In addition, and of course of similar importance, the engineer or architect can use this figure for computing the size of a beam to do a certain job, or contrariwise the load a beam of given size may be expected to stand without breaking.

2. Modulus of Elasticity :

This value is a measure of stiffness or resistance to deflection ; the higher the modulus of elasticity, the less will be the deflection or, in other words, the greater will be the stiffness. For instance, if a timber beam of a certain size under a given condition of loading deflects 1 inch when the timber has a modulus of elasticity of 1,000,000lb. /sq. in., it will only deflect ½ inch if the timber has a modulus of elasticity of 2,000,000 lb./sq. in.

If we take a 4″x4″ wooden beam of a known M. of E. of 2,000,000 lb./sq. in., support it over a span of say 10 feet, and load it in the centre, it would deflect 1 inch under a load of approximately 1850 lb. Under the same load, the beam would deflect 8 inches if the span were doubled, or only ⅛ inch if supported over half the span. Should the beam be twice as deep it would only deflect ⅛ inch over the 10 ft span, and a beam twice as wide would deflect ½ inch. In other words, the deflection of a beam varies as the cube of the length, inversely as the cube of the depth and inversely as the width.

As was pointed out previously, doubling the depth of a beam has the effect of increasing its bending strength four times, so it can be seen that the deeper a beam the stronger and stiffer it will be. This of course is well known, the usual practice being to stand a beam on its edge rather than on its face.

However there is a limitation that must be considered, and that is that beyond a certain ratio of depth to width a beam becomes unstable and is liable to twist unless supported in some manner. A ratio of depth to width of between two and two and half to one is the best compromise unless some lateral support (such as herring-boning) is provided.

(This and subsequent articles have been largely based on D.F.P. Trade Circular No. 26 (at present being reprinted) " Some Terms used in the Mechanical Testing of Timber," and in some cases extracts without alteration have been incorporated.)

<< Content

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SYNTHETIC RESIN ADHESIVES

II. Some Properties of Thermosetting Resins.

(Compiled by Arthur W. Rudkin, Veneer & Gluing Section.)

The four main types of adhesive classified as thermosetting synthetic resins (urea-formaldehyde, phenolformaldehyde, resorcinol-formaldehyde and melamine-formaldehyde) have at least three properties in common which distinguish them from most other types of adhesive. These are :—

1. **Irreversibility** : The thermosetting resins set by an irreversible chemical reaction, and not merely by changing from a molten to a solid state or by evaporation of water from a gel or solution. In this they resemble the protein-formaldehyde glues and casein cements containing lime, but differ from all other "natural" adhesives and also from the thermoplastic resins.

2. '**Crazing**' : Many of them, especially the urea-formaldehyde resins, tend to crack in the plane of the joint in course of time unless the glue-line is kept very thin. Other adhesives in common use rarely or never show this fault.

3. **Tendency to cause dermatitis** : Like other chemicals containing formaldehyde, the thermosetting resins cause dermatitis if they come in contact with the skin of persons who are allergic to this material.

Irreversibility.

The irreversible nature of the setting process, plus the fact that the cured resin is practically insoluble in water, at least in the cold, and all other common solvents, is mainly responsible for the durability of these glues, but it has certain attendant disadvantages.

The curing reaction proceeds slowly even at ordinary atmospheric temperatures and in the absence of a catalyst, and when it has proceeded to a certain point the resin is of no further use as an adhesive. The "shelf life" of these resins under good conditions varies from three or four months to a year or more. Most manufacturers stamp the latest date for using the adhesive on the container at the time of manufacture, but if it is stored under unfavourable conditions it may be unusable before that date.

Once the catalyst or hardener has been added to a liquid resin or the solvent to a powdered resin, the glue must be used within the specified time, ranging from 2 or 3 hours to a day or two according to the temperature, type of hardener, and type of resin, and assembly times must be kept within specified limits, otherwise curing proceeds too far before pressure is applied.

The cured resin is extremely difficult to remove from hands, clothing, furniture, etc., and any resin which is spilt where it is not wanted must be washed off before it sets. Pots, mixing vessels, etc., must also be thoroughly washed immediately after each batch of glue is used up or discarded, otherwise they will be very difficult to clean, and contact with cured or partially cured resin will reduce the pot life and adhesive strength of subsequent batches.

"Crazing."

The tendency to "craze" limits the use of thermosetting resins, especially cold-setting urea-formaldehyde resins, in ordinary joinery work, where it is not always possible to ensure perfectly fitting joints and intimate contact over the whole gluing surface, and necessitates the use of high pressures in the manufacture of plywood, laminated structures, etc.

Various "craze-resistant" or "gap-filling" resins however, are on the market, and some manufacturers supply liquids which can be added to their products to improve gap-filling properties.

Research carried out by W. G. Campbell at the Forest Products Research Laboratory, Princes Risborough, Aylesbury, Bucks, England, indicates that "crazing" is not due to any chemical peculiarity of thermosetting resins but to non-uniform shrinkage caused by initial hardening of the surface as a result of concentration of the catalyst by evaporation of water from the surface. By cutting down the rate of evaporation of water (*e.g.*, by pressing in a humid atmosphere), so that setting proceeds at a uniform rate throughout the glue, differential shrinkage and hence also crazing can be minimised (see article by W. G. Campbell in the Journal of the Society of Chemical Industry, Vol. 61, p. 161, Apr. 1942).

Certain manufacturers in Great Britain and elsewhere have developed special hardeners which, when used with their products, confer gap-filling properties upon them. This peculiarity in the action of the hardener appears to be due to the fact that the acidic constituent has a vapour pressure of the same order as that of water at the pressing temperature, so that evaporation produces little change in the concentration of the catalyst.

Dermatitis.

Fortunately most people are immune to dermatitis caused by formaldehyde compounds, but the allergy is common enough and the complaint painful enough to warrant precautions.

Allergic people sometimes acquire immunity after repeated exposure, but a more usual effect of repeated attacks of the dermatitis is to increase sensitivity.

Frequent washing of the hands when using the material greatly reduces the risk of incurring the complaint. Those who are too allergic for this to be sufficient should wear gloves, or use one of the barrier creams now available, or avoid handling materials containing formaldehyde at all.

The resins only possess this unfortunate property before and during the curing process. Resin-bonded articles, once the adhesive has set hard, can be handled without risk.

BREVITIES.

A further stage in the development of a comprehensive sawmill study, covering the effect of class of sawing on mill recovery and output from "ash" and "messmate" mills in Victoria, was completed during the month with an examination of mill performance at two mills in the Marysville district. This work is being carried out by officers of the Seasoning Section of the Division of Forest Products as a co-operative project with the Victorian Sawmillers' Association.

* * *

Recent overseas visitors to the Division of Forest Products included :

Mr. D. Henry, Managing Director, N.Z. Forest Products Ltd., Auckland, N.Z.

Mr. M. R. Buckett, Logging and Milling Manager, N.Z. Forest Products Ltd., Auckland, N.Z.

Mr. T. Younghusband, Raysco Products Ltd., Auckland N.Z.

Mr. R. McCracken, N.Z. Plywood Ltd., Auckland, N.Z.

* * *

In co-operation with the Division of Economic Entomology, C.S.I.R., Mr. G. W. Tack, Wood Preservation Section, spent from Aug 3rd–8th in Canberra inspecting the International Termite Test Site and several Division of Forest Products termite test sites in the same locality.

U.S. Bibliography of Scientific and Industrial Reports

During the war a great deal of research was carried out under the auspices of the Allied Governments. It has been decided to release for general use a large proportion of the results of this research, together with information taken from former enemy countries as a form of reparations. With this end in view, the U.S. Department of Commerce, through its Publication Board, is making a weekly issue of ABSTRACTS of reports in the form of a "Bibliography of Scientific and Industrial Reports." This Bibliography is now being received in Australia and relevant extracts are reproduced hereunder.

Copies of the original reports may be obtained in two ways :
(*a*) Microfilm or photostat copies may be purchased from the United States through C.S.I.R. Information Service. Those desiring to avail themselves of this service should send the Australian equivalent of the nett quoted U.S. price to :

C.S.I.R. Information Service,
425 St. Kilda Road,
Melbourne, S.C. 2.

and quote the PB number, author's name, and the subject of the Abstract. All other charges will be borne by the C.S.I.R.

(*b*) Those marked with an asterisk may be obtained by approved applicants without cost on making application to the

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Secondary Industries Division of the Ministry of Post War Reconstruction, Wentworth House, 203 Collins Street, Melbourne, C.1. Copies of these are available for reference in public libraries.

Further information on subjects covered in the reports and kindred subjects may be obtained by approaching the C.S.I.R. Information Service, the Secondary Industries Division of the Ministry of Post War Reconstruction, or the Munitions Supply Laboratories (Technical Information Section), Maribyrnong, Victoria.

McGOVERN, J. N.—Manufacture of pulp and paper and related products from wood in western Germany. Off. Pub. Bd., Report, PB 7735. 1945. 179 p.
Price: Microfilm, 2 dollars; Photostat, 12 dollars.

The purpose of this investigation, which was conducted within the American, British, and French occupation zones, was to ascertain the status of the pulp and paper industry in Germany. Particular regard was paid to the production of pulp for nitration and other chemical purposes, utilization of sulfite waste liquor, manufacture of paper and paper product specialties, and pulp and paper research. Mills representing major phases of the industry were visited and individuals qualified in special aspects of the trade were interviewed. Details of manufacturing procedures used in the many branches of the industry were obtained whenever possible. The German pulp and paper industry was found in general to have been less advanced than the same industry elsewhere. Report includes manufacturing procedures, research and development data, and literature cited. Appendices give details of the visits, illustrations of equipment, and various special reports.

FLEISCHER, H. O., and SEBORG, R. M.—Research Institute for World Forestry and Silviculture (Staatliche Forschungsanstalt fuer Weltforstwirtschaft und Bodenkultur). (C.I.O.S. Item 22, File XXXI-74). Off. Pub. Bd., Report, PB 6643. 53 p.
Price: Microfilm, 1 dollar; Photostat, 4 dollars.

This is a report of a visit to this laboratory on June 7 and 11, 1945, Dr. Franz Heske, the Director, stated that research had been concerned particularly with the utilization and silviculture of African forests. His paper on the forestry problems of present day Germany is presented. A lengthy list of manufacturers of glued wood products, and an up-to-date bibliography on the subject, both supplied by Dr. Runkél, are reproduced. Dr. Runkel explained his theory that paper strength is dependent on the thickness of the cellulose cell wall. Experiments on this theory have been conducted by using tropical woods composed of cells of a single type. He did not know about any recent developments in the use of lignin as a glue, the application of high frequency in gluing or drying wood, or salt water exposure tests on glued joints. Tables are included.

SAEMAN, J. F., LOCKE, E. G., and DICKERMAN, G. K.—Wood and cellulose research in Germany. (FIAT Final Report 450). Off. Pub. Bd., Report, PB 7750. 1945. 50 p.
Price: Microfilm, 50 cents; Photostat, 4 dollars.

Some of the leading German wood and cellulose research workers were interviewed as part of an investigation of wartime developments in the field of forest products. It was learned from Dr. H. Scholler, Soelln Laboratory of the "Technisches Buro Periola, G.m.b.H.", that important advances had been made in the fermentation of wood sugars to alcohol and to yeasts. Details were obtained from the Fredrich Bergius Research Laboratory for an interesting process for the continuous concentrated acid hydrolysis of wood. This had gone through only the first stages of development in the laboratory. A list of the persons visited, with their locations and fields of research is appended. Lists are also given of recent publications of several of the persons interviewed. Still another list contains selected references from Professor G. Jayme, Director of the Institute of Cellulose Chemistry of the Darmstadt Technical High School, in the fields of yeast production, hydrogenation and oxidation of polysaccharides and prehydrolysis.

WINSLOW, C. P.—Centre International de Sylviculture (International Forestry Centre). Off. Pub. Bd., Report, PB 5511. 1945. 17 p.
Price: Microfilm, 50 cents; Photostat, 2 dollars.

Account of the work and personnel of the C.I.S. (International Forestry Centre), presently located at Salzburg-Morzg. Staff members and their present locations are listed. An appendix lists published documents descriptive of the purposes, organization and operations of C.I.S. These as well as four photographs of building near Salzburg occupied by the C.I.S. were sent to the Forest Service, U.S. Department of Agriculture, Washington, D.C. The author of this report recommends that the valuable library of the C.I.S. should be transferred to the headquarters of the Forestry Section of the International Food and Agriculture Organization.

Properties of Australian Timbers

W. A. BLACKBUTT.

W.A. blackbutt is the standard trade common name for the timber known botanically as *Eucalyptus patens*, Bentham. The fact that the thick deeply furrowed corky bark is frequently blackened by fire and remains so at the butt of the tree has given rise to this common name.

Distribution : The species is confined to South-Western Australia, and occurs in the tree form throughout the jarrah and karri forests and nearly as far east as York. To the north of the Blackwood River it is characteristic of swamps or flats in a sandy soil ; to the south, however, it occurs on the hills with jarrah. A shrubby form is found as far east as Esperance, but is rare.

Habit : The tree attains a height up to 100 ft., with an erect trunk and spreading or more or less erect branches, but without the umbrella-like top of jarrah. The bole generally reaches 40 to 50 ft. in length, and the trunk sometimes reaches 5 ft. or even 6 ft. in diameter. The bark, persistent throughout the tree, is of a light grey colour (frequently blackened by fire), and has an almost corky appearance, being light, friable and yellowish in fracture. The tree flowers during February to April, the flowers being white.

Timber : The timber of W.A. blackbutt varies from light to dark brown in colour, is of open texture, usually fissile and with straight grain, but is sometimes interlocked. The wood is moderately heavy, with an average air-dry density (at 12 per cent. m.c.) before reconditioning of 54 lb. per cu. ft. (95 per cent. probability range 44.9 to 63.1 lb. per cu, ft.). The average air-dry density after reconditioning (at 12 per cent. m.c.) is 51.2 lb. per cu. ft. (95 per cent. probability range 41.5 to 60.9 lb. per cu. ft.). Information on the seasoning of this species is very limited. The timber tends to check somewhat more freely than jarrah and for this reason it is good practice to protect seasoning stacks during periods of high temperature and low humidity. The drying rate, however, is rather slower than that of jarrah. Up to the present no investigations have been carried out at the Division of Forest Products for the calculation of shrinkage figures for this species.

W.A. blackbutt is hard and strong, and falls into strength class B, being similar to karri in this respect. In durability it is placed in class 3. The sapwood is susceptible to Lyctus attack.

Present indications from preliminary gluing tests on this species show that very good gluing can be expected with urea-formaldehyde glue, which has been found more satisfactory than casein glue.

Uses : This timber has been used to some extent for farm implements, railway truck building, and furniture. The oak-like colour of the timber and the hardness of the wood make it an excellent flooring timber.

Availability : The supply of W.A. blackbutt is limited, it can never become a common timber, but there is sufficient timber available for it to be cut in conjunction with jarrah to supply a restricted market. The annual cut for this species in the year 1944/45 was approximately 2,000,000 super feet in the log.

Victorian Railways Print. 3291-46

C. S. I. R.

FOREST PRODUCTS NEWS LETTER

This monthly bulletin is prepared for general circulation by the Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4., and will be supplied free on request to members of the timber trade and timber users who wish to keep abreast with current developments in the field of forest products.

No. 145 October, 1946.

CREEP IN TIMBER

REPORT OF INVESTIGATIONS, 1937-1946

By R. S. T. Kingston, Officer-in-Charge, Timber Physics Section.

In 1937, as a result of numerous observations of sag in wooden beams which had been under sustained loading for a long period, it was realised that "creep", that is, increasing deflection with increasing time of loading, was a very common phenomenon in timber structures in this country. This was thought to be due to the frequent use of green or partially green timber for structural purposes. The use of green timber is rendered necessary by the difficulty of drying most Australian hardwoods in larger sizes. It was decided, therefore, that creep tests would have to be undertaken, despite their prolonged duration and high cost. Very few tests of this nature have been carried out on wood overseas, where the problem is less important on account of the extensive use of softwoods, which are more readily seasoned.

In the first place, attention was paid to creep in beams because the apparatus involved was comparatively simple. Work was envisaged in which both green and dry wood were to be tested, but owing to the outbreak of war in 1939, the green beams which had been erected in 1938 were dismantled. At this time no dry material had been tested other than two preliminary beams which showed a much smaller creep than green ones.

At first, test beams were 4 inches x 2 inches in cross section. As the deflection increased, the beams became unstable and buckled laterally, so to overcome this, a roller carriage was fixed to the beam. As the beam deflected, angle irons guided the carriage and thus prevented lateral buckling. However, when these were placed at the centre, the beams still buckled, but in two loops. Rectangular beams were therefore discarded and square ones having approximately the same section modulus adopted so that the same weights could be used.

Tests were carried out on beams loaded over spans of 6, 9, 12, 15 and 20 feet to an extreme fibre stress of 4,000 lb./sq. in. In addition, 12 ft. beams were loaded to extreme fibre stresses of 2,000 and 6,000 lb./sq. in., the loads being placed at the quarter points. These beams were in some cases under load for over a year. All beams loaded to 6,000 lb./sq. in. stress failed within a few weeks, some in a few days. Fig. 1 shows one of these photographed a few hours before failure. One beam failed at 4,000 lb./sq. in.

The deflection, in the case of beams subjected to an extreme fibre stress of 2,000 lb./sq. in., increased about fivefold over a year. The deflection of beams loaded to an extreme fibre stress of 4,000 lb./sq. in. increased even more in most cases. The reduction in apparent elastic modulus under sustained loading varied very considerably from beam to beam. It was apparent therefore that further tests would be necessary before any conclusions could be drawn other than that of the unexpectedly great reduction in the apparent modulus of elasticity. The tests were carried out on select grade mountain ash because, although it is not a major structural species, it was readily available within a hundred miles of the laboratory.

With the entry of Japan into the war and the consequent enormous increase in military construction in this country and New Guinea, a scarcity of steel resulted in the greatly increased use of timber in large structures, such as hangars and army stores. In some cases, these buildings, which were designed using unusually high stresses to economise in material, although apparently safe when erected, suffered from buckling or the failure of highly stressed members after six months or a year, partly or wholly due to the effect of sustained loading. It therefore became obvious that creep tests should be recommenced, although the war ended before further test beams had actually been set up. These tests have now been commenced and one group of beams over a span of 12 feet is shown in Fig. 2.

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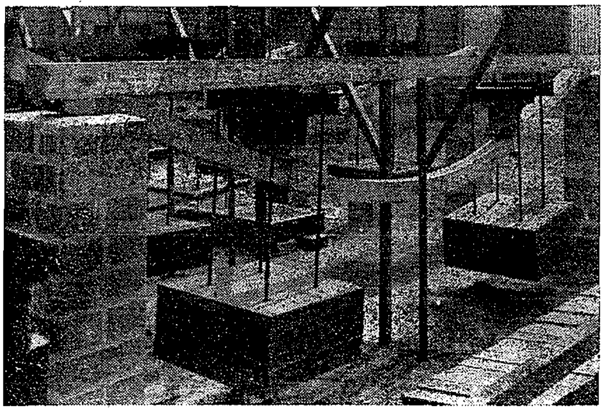

Fig. 1.—Creep Tests on Beams: The highly deflected beam near the front is one of those stressed to 6,000 lb./sq. in. The photograph was taken just before failure.

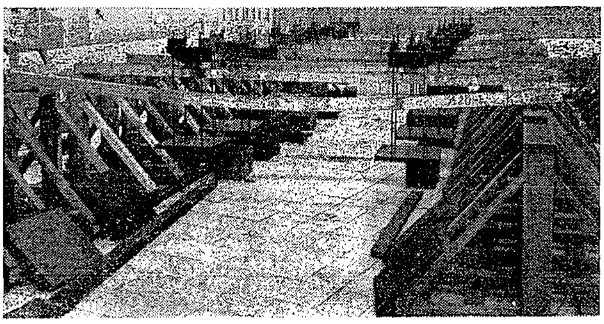

Fig. 2.—Tests at present in progress. This shows the group being tested over a span of 12 ft. The unloaded beam in front was subjected to a stress of 4,000 lb./ sq. in., and had to be unloaded owing to the weights touching the ground before failure occurred. The considerable recovery that has taken place is very noticeable.

The work planned includes:—

1. Creep tests on wood in tension and compression.
2. Sustained loading tests on beams.
3. Sustained loading tests on columns.
4. Creep in timber connector joints.

Creep in Tension and Compression: To eliminate the effects of variations in temperature and moisture content, these tests will be carried out in air-conditioned cabinets, which are insulated with four inches of high-grade rock-wool, as is also the building in which they are housed.

Tests will be carried out on green timber and timber at 14 per cent. moisture content under a series of different stresses to determine the relationship between stress, strain, and time. In all, about 250 tests are involved, which may last anything from two to five years, or even more, although valuable results should be available within a year or so of the commencement of the tests.

Long-Time Loading Tests on Beams: A further set of green beams has now been set up and matched beams are being air-dried for testing. Most of them are stressed to 4,000 lb./sq. in. but a few have been stressed to 2,000 lb./sq. in. A few will be subjected to repeated loading and unloading in an attempt to see what proportion of the creep is due to delayed elasticity, disappearing when the load is removed, and what to permanent distortion. The need for a considerable number of replications is clearly apparent from the fact that two beams from different trees, loaded under identical conditions, have during the same period of time increased in deflection by 50 per cent. and 100 per cent. respectively of the initial value.

Columns Under Sustained Load: Preliminary tests have been carried out on columns under long-time load, the load being applied eccentrically and the ratio of effective length to least dimension being from 30 to 50. Stringybark and Douglas fir columns have been tested. Most of these were 2" x 1½" in cross section with an initial eccentricity of 1/360 of the effective length, which was 45 inches. An extensive set of tests at varying loads using three species (B, C and D group structural timbers respectively) has been planned and apparatus is now being constructed.

Creep in Timber Connector Joints: One type of failure in timber connector joints, found mostly in timbers having a high shrinkage, is apparently caused by drying stresses combined with shear stresses and tensile stresses perpendicular to the grain. A split occurs, at the end of tension members, which widens and lengthens, or another split develops, until ultimate failure takes place by pulling out of the connector. Similar troubles to those described above have been reported with Douglas fir in the U.S.A.

As far as is known, no long-time loading tests have previously been carried out on timber connectors. An extensive investigation of the cause of failure and of methods of preventing it, which involves initially 300 individual tests, is now in progress. Possible variations in the end conditions which are being investigated are:—

1. Increase in end distance.
2. Use of stitch bolts.
3. End coating of the loaded member.

Yellow stringybark, mountain ash and Douglas fir are being tested at various loads from half to twice the design load, and short-time strength tests on each type of joint included in the creep tests are being carried out on matched material to facilitate the interpretation of the results of the latter.

Information: Until the results of these tests are published, requests for additional information should be addressed to The Chief, Division of Forest Products, 69-77 Yarra Bank Road, South Melbourne, S.C.4.

ERRATUM.

An error occurred in Forest Products News Letter No. 141 (June, 1946) in the article "The Properties of Australian Timbers—Hoop and Bunya Pines." In para. 4, lines 15 and 16, the words "radial" and "tangential" were misplaced. This should read "4.0 per cent. in a tangential direction and 2.0 per cent. in a radial direction."

ABSTRACTS OF RECENT REPORTS

The following abstracts are from internal laboratory reports, some of the results of which will eventually be published in research or trade journals. The reports are not intended for general distribution, but in some cases where spare copies are held, and the circumstances warrant it, the full report may be obtained on loan on application to The Chief, Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4.

Veneer and Gluing Section.

1. **Effect of Conditioning Time upon the Strength of Plywood Joints made with a Urea-Formaldehyde Glue.**—By H. G. Higgins.

Plywood joints made with an extended urea-formaldehyde glue were tested for glue shear strength at the end of periods ranging from one to twelve days from the time of application of pressure. It was found that the effect of time upon strength under atmospheric conditions was not significant within this range.

2. **Peeling of Five Jarrah Logs.**—By C. Alexander and H. G. Higgins.

Peeling tests were carried out on five logs of jarrah (*Eucalyptus marginata*). When the logs were suitably heated before peeling, and with the proper lathe set-up, good veneer was produced. The main species defect, which could not be eliminated, was the presence of gum pockets, which increased clipping waste. The veneer was dried successfully without excessive degrade. Buckling generally was not serious, but the thicker veneer, being less susceptible, showed a higher drying recovery than the thin veneer.

3. **Gluing of Fibro-Cement, Masonite and Mountain Ash for Use in Prefabricated Buildings.**—By A. W. Rudkin.

Tests were carried out to determine whether fibro-cement could be glued satisfactorily with casein to fibro-cement, masonite, and mountain ash (*Eucalyptus regnans*). In all cases glued joints were found to be stronger than the materials, both in shear and in tension, with the particular types of test rigs used.

4. **The Determination of Veneer Quality by Means of Mechanical Properties.**—By H. G. Higgins.

Preliminary experiments were carried out with the object of establishing a quantitative method of determining the degree of "tightness" of veneer—a property which has hitherto been evaluated only in a qualitative way. The minimum bending radius of veneer tested across the grain was found to vary significantly with the pressure bar setting on the veneer lathe, with the original position in the log of the veneer, or with both of these factors. This relationship may provide a basis for evaluating veneer quality.

5. **The Effect of the Dimensions of the Test Specimen up the Apparent Strength of Plywood.** — By H. G. Higgins.

An investigation was made of the effects of "overlap" (or distance between the saw cuts), and of veneer thickness, in the usual type of plywood glue shear test specimen upon the apparent failing stress of the plywood joint. Both factors were found to be highly significant: an approximately linear decline in apparent failing stress with increasing overlap was observed in the range from ½ in. to 2 in. overlap, and the existence of both a maximum and a minimum value of apparent failing stress was demonstrated in the curve relating it to thickness. The maximum occurred where, with increasing thickness, tensile wood failure was no longer operative; the minimum where the bending of the specimen prior to failure was no longer highly significant. Overlap and thickness were found to determine also the type of specimen failure.

The results have application in the drafting of specifications for plywood of different thicknesses, in the conversion of glue shear strengths from one system of measurement to another, and in structural design.

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RECENT DEVELOPMENTS IN TIMBER DRYING

By G. W. Wright, Officer-in-Charge, Timber Seasoning Section.

Over the past decade considerable attention has been given by the timber industry generally, and by timber research institutes, to the development of improved methods of timber-seasoning. In the main, the crude seasoning practices of earlier days have been replaced by methods which not only effectively recognise the special drying characteristics of timber, but are also designed to take into account inherent variations in the drying behaviour of differing species.

The application of these methods is most generally recognised today in good air and kiln-seasoning practice, and it is unlikely that for many more years at least, for the great bulk of timber required to be commercially seasoned, these methods will be supplanted by procedure radically different from that at present in operation. It is of value to note, however, that new techniques in timber-seasoning are being developed, and that, for certain specific purposes, considerable merit seems to attach to some of these processes. The following notes are intended as a very brief description of these new treatments, now generally known as solvent seasoning, vapour drying, and high frequency drying respectively.

Solvent Seasoning: The solvent seasoning process depends for its action on the removal of water by a solvent: it is a development from work initially undertaken by the Western Pine Association at Oregon, U.S.A., with the object of evolving a method of extracting oils and resins from knots in timber so that subsequent weeping after painting could be avoided. The early experimenters were so impressed with the speed at which the solvents used also extracted water that the development of this latter phase of the work soon became the major object. It has since shown such promise that a 100,000 dollar pilot plant of semi-commercial proportions, designed to take a charge of some 3,000 super feet, has been erected and is in operation.

Solvent seasoning consists primarily of loading the timber to be dried, which has previously been stacked with fluted stickers, into an extractor: this is then sealed with a vapour-tight cover fitted with rubber gaskets. The timber is then sprayed with acetone heated to a temperature variously reported as being 180° F. and 250° F., for several hours. On the completion of this treatment any residual liquor, which contains oils and water, is pumped out and distilled through a fractionating column, where the water is drawn off and the oils are separated from the acetone, this latter being returned to storage for re-use. Hot air is then circulated around the timber to remove liquid and absorbed acetone, and this is then passed off to scrubbers and a condenser for subsequent return to the storage tank.

It is claimed that typical cycles for drying softwood of the nature of western yellow pine, from a moisture content of 150% or more to a final value of about 12%, and assuming re-circulation of the acetone in cascade, are as under:—

(a) 1-inch thick stock: spray for 24 hours followed by hot air circulation for a further 4 to 6 hours.
(b) 2-inch thick stock: spray for 36 hours followed by hot air circulation for a further 6 to 8 hours.

If the solvent is not used in cascade the drying rate is appreciably faster.

So far, work appears to have been confined to western yellow pine. Complete extraction of resins from the sapwood is claimed, leaving it more amenable to preservative treatments but, as yet, this does not seem to have been achieved with sections of truewood (heartwood). It is said that the wood structure is not affected, at least so far as physical properties are concerned. In commercial operation, one of the greatest difficulties appears to be in holding down solvent loss, apart from that retained by the dry timber, to an economic figure. Acetone is extremely volatile and requires a completely closed system. The experimenters hope that, ultimately, the value of the extractives obtained will cover the cost of the drying treatment.

In Australia, it is possible that, when more fully developed, the treatment may have application for the seasoning of indigenous and plantation-grown softwoods.

Vapour Drying: To date the principal application of vapour drying appears to have been directed to the seasoning, or semi-seasoning, of poles and railway sleepers as a pre-treatment to a preservative process. The treatment has been developed by the Taylor-Colquitt Co. of South Carolina, U.S.A., and consists primarily of exposing the timber to be dried to an organic vapour, maintained at a temperature of the order of 350° F., within a tightly closed cylinder or compartment. Any one of a number of drying media, the liquids of which have boiling points lying within the range 212° F. to 400° F. (e.g. coal tar fractions) may be used to provide the vapour which is introduced into the drying chamber: as the organic vapour is inert no deterioration from oxidation occurs.

After distilling moisture from the wood, the vapour is passed through a condenser and then a separating tank in which the water is separated from the organic liquid. This latter is returned to a storage tank and is available for re-circulation through the system after reconversion to the vapour state. At the conclusion of drying, the timber contains an appreciable quantity of the condensed vapour absorbed during treatment: this may be removed by drawing a vacuum on the drying chamber and the timber charge.

It is claimed that relatively little surface checking occurs in sleepers or poles so treated; and that less subsequent surface checking occurs, in service, than in matched air-seasoned material. It would appear that this is due to the development of internal checks, ranging in length up to 1½ inches, within the timber section during drying, and that the presence of these checks acts to relieve stresses which would otherwise develop from alternating swelling and shrinking with wetting and drying.

As yet schedules have not been developed for timber of sizes normally kiln-dried in Australia, and it would appear that variation from the straight-drying process to an alternating process by intermittently drawing a vacuum on the drying chamber, will be necessary to avoid the development of excessively steep moisture gradients. It is claimed that red oak railway sleepers can be reduced from an initial moisture content of 70% to a value of 40% (sufficiently low for a subsequent preservation treatment) in about 14 hours.

High Frequency (Dielectric) Drying: With high frequency drying the wood to be dried is located in an electrostatic field (i.e. as the dielectric of a condenser system), alternating at some millions of cycles per second. With cycles of this rapidity, the molecular structure of the dielectric (i.e. the timber) is affected, and this interference is manifested in the form of heat: this heat is effective throughout the entire electrostatic field. Although the electrical properties of the wood change with moisture content, the heat input can be maintained substantially constant, or varied as required throughout drying by suitable manual or automatic adjustment of the electrical circuit.

This method of drying appears to have considerable potential interest but, as yet, many practical difficulties of application have to be overcome, and the economy of this method of drying has yet to be proved.

The advantages of high frequency drying are said to lie in the speed and uniformity with which heating, and

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RECENT DEVELOPMENT, ETC. (continued).

so drying, can be accomplished, the relative advantage of this factor compared with orthodox drying increasing with increase in dimension. However, the extent to which this property can be used is likely to vary largely with the particular species being dried, i.e. one would expect pervious wood of the nature of sapwood could well take advantage of the faster drying rate offered, whereas with some impervious timbers internal fracturing could well occur under attempts to increase the rate of moisture transfusion.

As yet the cost of electrical equipment for high frequency heating is high: it has been calculated that the initial cost of an electrical (dielectric) installation is not less than £200 per kilowatt. An ordinary kiln charge of about 6,000 super feet would require a heating capacity or some 60 k.w., so that the electrical installation cost for the equivalent of one kiln would be not less than £15,000 against the total cost for an orthodox kiln of about £800 to £1,000. Furthermore, operation of the equipment in its present stage of development requires considerable technical skill; and it should be remarked that timber, especially when green, can be damaged much more easily by faulty operation of the dielectric equipment than by equivalent lack of skill in orthodox drying.

Perhaps the most promising field for high frequency drying lies in the drying of specialty items of relatively large section.

BREVITIES

Mr. K. L. Cooper, Officer-in-Charge of the Timber Mechanics Section, was the official representative of the Division of Forest Products, C.S.I.R., at the conference of the Australian and New Zealand Association for the Advancement of Science held in Adelaide from 21st to 28th August. He read a paper to the Engineering and Architecture Section entitled "Advances and Applications of Timber Research" which dealt with recent developments which have taken place in this field, particularly those which, owing to the war, have not previously been publicised, and so would be of interest to architects and engineers.

Mr. C. W. Glynn, B.E., is spending several months at the Division of Forest Products gaining an insight into research methods on timber, its uses, properties, etc., and recent developments in veneer and gluing technique. Mr. Glynn is associated with Prufwood Ltd. of Sydney.

Mr. B. J. Ralph, B.Sc., who joined the staff of the Chemistry Section, Division of Forest Products, in February, 1946, has been awarded an I.C.I. Fellowship overseas for three years. Mr. Ralph is leaving almost immediately to pursue his studies at Liverpool University.

Mr. Charles Morgan, of the technical staff of Masonite Corporation (Aust.) Ltd., Raymond Terrace, N.S.W., was given training in methods of wood identification, fibre analysis, etc., in the Section of Wood Structure, Division of Forest Products, during August.

Mr. J. Womersley, B.Sc., who has recently been appointed forest botanist of the Department of Forests in the New Guinea Administration, spent a month at the Division of Forest Products becoming familiar with the New Guinea timbers in the Division's collection, and with the methods employed in identifying them.

Mr. A. B. Wardrop, M.Sc., of the Wood Structure Section of the Division of Forest Products, has been awarded a C.S.I.R. studentship which will enable him to study abroad. He proposes to leave Australia early in November for England, where he will work under Dr. R. D. Preston of the Botany Department, University of Leeds. Dr. Preston is well known for his investigations on the structure of the cell wall.

The Properties of Australian Timbers

MANNA GUM.

Manna gum is the standard trade common name for the timber known botanically as *Eucalyptus viminalis*, Labill. The tree is sometimes called ribbon gum, but is known more generally by the name of manna gum, from the sugary substance exuded by the leaves when punctured. The leaves of this species form part of the diet of the koala bear.

Distribution: It is found in New South Wales on the tablelands and upper slopes, being common in the south-coast district; in Victoria it is located in the eastern mountains and on the slopes of the eastern and western coastal divisions; it is found also in the south-eastern part of South Australia and in the Mount Lofty Range; it occurs also in most parts of Tasmania. Manna gum is one of the most widely distributed species of the genus in these states.

Habit: Near the coast manna gum grows only to a small tree with a dark, rough bark on the trunk. In the rich soil of the mountain forests, particularly in gullies and along water courses, it attains a very considerable size, rising to a height of 200 ft. or more and a diameter of 6 ft., with a striking white bark on the bole, and long streamers of bark hanging from the base of the branches.

Timber: The truewood is light-brown to pinkish in colour and the sapwood, generally indistinguishable in colour from the truewood, is moderately susceptible to Lyctus attack, owing to the presence of starch. The timber may be straight-grained with interlocked grain often occurring; the texture is fairly open and growth rings are distinct in many cases. The wood is moderately heavy with an average air-dry density of 50.6 lb./cu. ft. (at 12% m.c.), and a range of 43 to 59 lb./cu. ft. Manna gum is prone to surface check during seasoning, particularly if backsawn, and as with most of the eucalypts quartersawing is therefore recommended. Attention should also be given to the protection of air seasoning stacks during periods of hot dry weather. During drying pronounced collapse may occur, but satisfactory recovery can generally be obtained by a reconditioning treatment. The timber is not prone to warp provided proper stacking methods are used. Kiln drying from the green condition should be avoided if possible. Approximately 7 days are required to kiln-dry 1 inch stock which has been partly air-dried to a moisture content of 30 per cent. In drying from the green condition to 12 per cent. moisture content, manna gum shrinks 9.2 per cent. in a tangential direction (backsawn) and 2.4 per cent. in a radial direction (quartersawn). The shrinkage after reconditioning is reduced to 4.6 and 1.5 per cent. respectively.

The strength of manna gum varies considerably with the locality of growth; generally it is harder and somewhat stronger than mountain ash, though both fall into strength Class C. It is of medium toughness, dresses and planes easily, and finishes moderately well. It is non-durable. Preliminary gluing tests gave fairly satisfactory results with casein and urea-formaldehyde adhesives.

Uses: Manna gum is principally used as a framing timber for studs, joists and rafters, the better qualities being also used for flooring and weatherboards; it is regarded as a good carriage timber. It can also be used for pick, shovel and hoe handles.

Availability: The Victorian Forests Commission's returns for the year 1945-46 show that approximately 10 million super feet of manna gum were milled in Victoria alone during that period.

Victorian Railways Print. 4041–46

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C. S. I. R.

FOREST PRODUCTS NEWS LETTER

This monthly bulletin is prepared for general circulation by the Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4., and will be supplied free on request to members of the timber trade and timber users who wish to keep abreast with current developments in the field of forest products.

No. 146 1946##146 November, 1946

SYNTHETIC RESIN ADHESIVES

III. UREA-FORMALDEHYDE RESINS.

Compiled by A. W. Rudkin,
Veneer and Gluing Section

The urea-formaldehyde resin adhesives, more usually referred to as urea or U/F glues, are by far the most widely used of the synthetic resin adhesives at the present time, at least in Australia. Although somewhat inferior to other thermo-setting resins in most of their properties, they are less costly than the phenolics, resorcinols and melamines, and are far superior in performance to most "natural" adhesives (hide glues, casein cements, starch glues and vegetable protein adhesives), and have the added advantage over other thermo-setting resins at present available in Australia of requiring much lower curing temperatures (70-240° F., as compared with 280-320° F. for hot-press phenolics).

The principal ingredients used in the manufacture of U/F resins are urea or one of its derivatives, such as thiourea, or a mixture of these, and an aldehyde, usually formaldehyde or mixture of aldehydes. The chemical reaction between these substances is stopped at a fairly early stage during manufacture of the adhesive, and is completed in the press during its gluing operation by the application of heat or a catalyst ("hardener"), or both, forming a hard, heat-resistant substance which is practically insoluble in water and other common solvents.

U/F resins can be prepared in the form of a viscous liquid, a powder, or a film. All those at present manufactured in Australia are liquids, but at least one imported powder has been used extensively here. A U/F resin film was developed in Germany some years ago but has not come into general use anywhere.

Liquid resins are invariably sold with separate catalyst or hardener, the latter being nearly always an acidic substance, but alkali-catalysed U/F resins can be prepared. The powders usually, but not invariably, have incorporated with them an ammonium salt or other substance which, on the addition of water, gives an acid solution which catalyses the reaction.

Although the U/F resins can be cured by heat alone, a hardener is always employed, even in hot press work, to reduce setting time. The hardener may be mixed with the resin in the required proportion just before use, or the resin may be applied to one member of the joint and the hardener to the other. Both the "ready mixed" and "separate application" techniques have their peculiar advantages and disadvantages.

Principal advantages of the separate application technique are:—

(1) Elimination of weighing, measuring and mixing and hence of close supervision and of precision apparatus.
(2) Almost indefinite pot life, eliminating the need for time indicators, ice boxes, etc., and also of waste, since glue does not set in the pot.
(3) Possibility of using shorter pressing time by using hardeners which are too rapid in their action for use in mixed glues, owing to inconveniently short pot life.

Its principal disadvantages are:—

(1) Need to use two pots of material instead of one.
(2) Difficulty of adapting the method to use with mechanical spreaders.
(3) Need to spread both gluing surfaces; with mixed glues it is usually sufficient to spread one surface only.
(4) Risk of omitting the hardener from some glue lines.
(5) Need in most cases to keep closed assembly times shorter than is usual with mixed glues, owing to the uncertain proportion of hardener.
(6) Existence of a concentration gradient of hardener through the glue line, increasing crazing tendencies. Few gap-filling glues can be adapted to the separate application technique without impairing gap-filling properties.

Well-made U/F wood to wood bonds are usually stronger than the wood itself and very durable as compared with "natural" glues under all ordinary temperate atmospheric conditions, provided the glue line is thin enough. They will resist the action of cold water almost indefinitely but break down rather quickly in hot or boiling water. When hot pressed they are resistant to dry heat, but recent tests indicate that when cold pressed they may be rather less durable than, for instance, casein cements, at temperatures very much in excess of atmospheric. They are practically unaffected by all common solvents and by all but the most corrosive chemicals, and do not support the growth of moulds and micro-organisms.

Owing to the relatively small amount of water in the adhesive, the bond requires rather less reconditioning than those made with "natural" adhesives, but as some U/F resins, especially the cold-setting ones, attain their maximum strength and water-resistance rather slowly, it is not advisable to subject them to further machining or exacting conditions of use for at least several days after removal from the press.

Success with U/F glues requires rather closer control of gluing conditions than with, for instance, casein cements, but does not involve any serious difficulties. The principal requirement for success is intimate contact of the surfaces to be joined, in order to avoid "crazing". This is achieved by accurate machining, correct moisture content to avoid warping in the press, and adequate pressure. Where glue-lines more than 0.01 in. thick cannot be avoided a gap-filling glue must be used.

Since the setting process is irreversible, resins which have thickened in storage or in the pot cannot be made fit for use. (See News Letter No. 144, p. 3, "Some Properties of Thermo-setting Resins", for discussion of shelf life, storage conditions, pot life and cleaning of vessels.) Most manufacturers specify maximum pot life for mixed glues over a convenient range of temperatures, and this should not be exceeded.

When cold-setting resins are used with separate hardener, assembly times should be kept as short as possible. The proportion of hardener specified by the manufacturer should be rigidly adhered to and carefully measured. Too much hardener renders necessary inconveniently short assembly times, and too little unduly extends the necessary pressing time. When the hardener is separately applied, open assembly times may be as long as desired, but it becomes more than ever necessary to keep closed assembly times short, owing to the uncertain amount of hardener

SYNTHETIC RESIN ADHESIVES.—Continued

used. With hot-setting resins, assembly times are usually not critical, but once the assembly has been placed in the press, full pressure should be applied as quickly as possible. Failure to observe these precautions may mean that the glue will become unduly viscous before pressure is applied, with consequent inadequate squeeze-out and thick glue-lines.

Pressing times must be adequate. It is difficult to obtain good bonds even with cold-setting resins at temperatures below 70° F., so it is advisable to heat the plant artificially in cold weather. If this is not practicable, longer pressing times than those specified by the manufacturers of the resin must be used.

Pressing times for hot press work vary from 3 to 20 minutes or even longer, depending on platen temperature, distance from platen to furthest glue-line, thickness of core, type of resin used and type of hardener. Manufacturers supply formulae for calculating minimum pressing times under various conditions. Longer pressing times do not weaken the bond but are wasteful of power. Most U/F resins manufactured in Australia for hot press work at present give best results at about 240° F. Elevated temperatures are often used with cold-setting resins to reduce pressing time.

Further details of the gluing operation will be the subject of a future article.

The use of U/F resins in joinery work, where close-fitting joints can rarely be guaranteed, is unfortunately limited by their tendency to "craze" in thick glue-lines; but they are the best available adhesives for use in the manufacture of plywood, laminations, etc., where the degree of water resistance required is higher than can be obtained with "natural" adhesives, but not high enough to justify the greater cost and more exacting technique required with phenolic resins. They are extensively used in conjunction with starch adhesives; 5 to 20 per cent. by weight of a suitable U/F resin mixed with a good starch glue gives an inexpensive adhesive whose strength and water resistance compare favourably with those of good casein cements. Mixed with blood albumen glues, U/F resins give bonds of great durability with a fast low-temperature cycle.

AN APPLICATION OF SAWDUST-CEMENT AS A FLOORING MATERIAL.

By C. V. Lansell, Seasoning Section.

During September an interesting opportunity arose to prove the practical value of sawdust-Portland cement flooring compositions, when over 600 square yards of this material, in several mix ratios, were laid (using normal commercial methods), in the 10,000 ton diesel-engined M.V. "Wanganella". The work was carried out by private contract to specifications prepared by the Division of Forest Products. Previous experience in this work had been gained by the contractor in laying experimental floors in the sawmill and Seasoning Sections of the Division.

The re-fitting of the ship after war service entailed, amongst other things, the erection of a deck house and the remodelling of two rooms into children's play houses. A floor fill of considerable thickness was required for this interior work in order to level off the deck plates before laying a linoleum mat. In addition it was necessary to cover the roof of the deck house, and here a special water-resistant sawdust-cement fill was required, over which was to be laid a cork-bitumen cover.

For the purpose indicated above, a low density composition, combining resilience and sufficient strength to withstand any racking action in ship's members caused by the motion of the ship at sea, was demanded. It was considered that sawdust-cement carefully applied could fulfil these requirements, and, in addition, supply good sound and heat insulation for the crew's quarters.

An adequate keying of the sawdust-cement composition to the steel deck of the ship was considered to be of prime importance in ensuring the success in this particular application. These requirements were secured in two ways: first by end welding 1 in. lengths of steel angle iron to the deck surface at about 2 ft. centres in each direction, and secondly by the application of a proprietary bitumen emulsion coating over the whole deck surface. Over the bitumen surface the sawdust-cement fill was then laid to a depth of 2 in. using two different mix ratios. The primary or base 1½ in. thickness consisted of a mix of 3 parts of sawdust to each part of cement (by volume) with the addition of ¼ part of lime and 3 per cent. calcium chloride (by weight of cement); the surface coat, consisting of a ½ in. thickness, comprised a stronger mix made up of 2½ parts of sawdust together with one part of sand to each part of cement (together with neutralisers and accelerators as before), this being laid over the base mix before the latter had set sufficiently to take on a surface skin. Each room in the deck house averaged 9 square yards in area, but areas covered in the play house and deck top at the one time were much greater.

Because of the need for accelerating the progress of other work proceeding in the ship, it was found necessary to permit heavy traffic across the sawdust-cement floors as early as the second day after laying. The use of sisalkraft paper spread over the surface a day after laying was found to give reasonably good protection however, as well as providing an effective moisture barrier to ensure a satisfactory cure. Test samples from batches were taken throughout the work, and seven day compressive strength values determined at the Division. The strength values obtained compared very favourably with those obtained from blocks made from the same materials under laboratory conditions.

It was recognised that the composition to be applied to the exposed upper surface of the deck house would require to withstand very pronounced variations in temperature, and repeated wetting and drying. Sawdust-cement was again used as a light-weight fill, and a cork-bitumen composition used as a water resistant wearing surface. The sawdust-cement was laid to a depth of 1½ in., a nominal mix of 3 parts sawdust to each part cement (by volume) being provided: lime and calcium chloride were added as indicated previously. One quarter part (by volume) of a proprietary bitumen emulsion was mixed in with the cement in order to stabilise the composition against moisture change.

In mixing and laying the sawdust-cement composition, it was found that little variation from normal concrete procedure was necessary. The cost was considered to compare very favourably with other methods of overcoming the particular problems involved.

A NEW TIMBER DRIER.

A pre-drier for sorted timber, which operates on a progressive principle, and yet avoids the necessity for the usual periodic movement of the timber stacks within the drier, has been designed by officers of the Division of Forest Products. Incorporated in the design is a method for utilising boiler exhaust flue gases as the heating medium. The pre-drier is capable of taking multiple timber charges each 8 ft. high and 35 ft. long.

The specific purpose of the unit is to give economic pre-drying, from the green condition to a moisture content of about 25 to 30 per cent., for timber required for subsequent kiln drying. The pre-drier should prove valuable in increasing appreciably the output of seasoning kilns in areas subject to extended periods of poor air-drying weather, such as are found in many parts of Tasmania.

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U.S. Bibliography of Scientific and Industrial Reports

During the war a great deal of research was carried out under the auspices of the Allied Governments. It has been decided to release for general use a large proportion of the results of this research, together with information taken from former enemy countries as a form of reparations. With this end in view, the U.S. Department of Commerce, through its Publication Board, is making a weekly issue of ABSTRACTS of reports in the form of a "Bibliography of Scientific and Industrial Reports." This Bibliography is now being received in Australia and relevant extracts are reproduced hereunder.

Copies of the original reports may be obtained in two ways:

(*a*) Microfilm or photostat copies may be purchased from the United States through C.S.I.R. Information Service. Those desiring to avail themselves of this service should send the Australian equivalent of the **nett** quoted U.S. price to:

C.S.I.R. Information Service,
425 St. Kilda Road,
Melbourne, S.C. 2.

and quote the PB number, author's name, and the subject of the Abstract, All other charges will be borne by the C.S.I.R.

(*b*) Those marked with an asterisk may be obtained by approved applicants without cost on making application to the Secondary Industries Division of the Ministry of Post War Reconstruction, Wentworth House, 203 Collins Street, Melbourne, C.1. Copies of these are available for reference in public libraries.

Further information on subjects covered in the reports and kindred subjects may be obtained by approaching the C.S.I.R. Information Service, the Secondary Industries Division of the Ministry of Post War Reconstruction, or the Munitions Supply Laboratories (Technical Information Section), Maribyrnong, Victoria.

*HILL, ALLAN C., and CAMPBELL, W. BOYD.—Feldmuhle Papier and Zellstoff Werke A. G., Reisholz Works, Dusseldorf-Reisholz, Westphalia. (BI05 Final Report 46). Off. Pub. Bd., Report, PB 7928. n.d. 3 p. Price: Microfilm, 50 cents; Photostat, 1 dollar.

7 Voith continuous grinders of 16 metric tons per day/B.D. similar to those at Schongan are used in the manufacture of groundwood pulp. Performance records are given. In place of bull screens screening is carried out in a Voith Niethammer screen, consisting of a vibrating trough with a screen of suitable perforations at the water level. Such machines are in general operation in Germany.

*HILL, ALLAN C., and CAMPBELL, W. BOYD.—Weissenstein Papierfabvik A. G. Pforzheim-Dillweissenstein, Wurtemberg. (BIOS Final Report 50). Off. Pub. Bd., Report, PB 7926. n.d. 3 p. Price: Microfilm, 50 cents; Photostat, 1 dollar.

The principal production of the mill is Manila and cover board, both of all-chemical pulp finish and containing 50 per cent. or more groundwood pulp. 75 per cent. of the entire production of the Weissenstein mill consists of laminated boards. The laminator, of standard design, consists of two paster rolls, six dryer rolls, a calendar stack and a cutter, slitter and layboy. Three sheets may be laminated together. Laminating machine speeds are from 4 to 35 metres per minute.

KLINE, G. M., and RICHARDSON, R.—Manufacture of vulcanised fibre in Germany. Off. Pub. Bd, Report, PB 13559. n.d. 12 p. Price: Microfilm, 50 cents; Photostat, 1 dollar.

Vulcanised fibre is a cellulose product made by gelatinizing paper and welding many layers together into a relatively homogeneous material. The paper is ordinarily prepared with cotton rags, but because of a scarcity of these in Germany, sulfite paper of high alpha cellulose content was used.

Dynamit A. G. at Troisdorf is the leading producer of vulcanised fibre in Germany, and its product, sold in the form of sheets, rods, etc., is known as "Dynos". This report describes the two processes employed, one involving gelatinization of the cellulose in a zinc chloride solution and the other involving gelatinization in sulphuric acid. Photographs are included.

WINSLOW, CARLILE P., and COLEMAN, DONALD G.—Summary of investigators' reports on technical industrial forest products developments in Germany. Off. Pub. Bd., Report, PB 8265. 1945. 64 p. Price: Microfilm, 1 dollar; Photostat, 5 dollars.

The U.S. Forest Products Investigators collectively reported on over 300 companies, institutions, etc., and interviewed nearly 300 individuals throughout Germany and Austria except in the Russian-occupied territory. The targets investigated covered modified and improved wood, glues and plywood, engineering and wood structure, pulp and paper, wood preservation and seasoning, alcohol and yeast, forestry and sawmill equipment, and miscellaneous targets. The following new or improved developments in Germany which are of real significance to U.S. wood industries and to research in forest products are described: Improved technology for the rapid continuous fermentation of alcohol or protein yeast for food from wood sugar in sulfite pulp liquor and from wood sugar factories; development of a neutral resin adhesive (Polystal); development of techniques for the production of bleached beach sulfite pulp of high alpha cellulose content and its use for cellulose nitrate; application of prehydrolysis to pine pulp chips followed by kraft pulping and the production of a pulp 100 per cent. for cigarette paper; use of nitric acid for producing purified pulps of high alpha content; and the use of resin impregnated wood retainers for high-speed ball and roller bearings.

HOFFMAN, HARRY D.—Wood preservatives. Off. Pub. Bd., Report, PB 1403. 1945. 2 p. Price: Microfilm, 50 cents; Photostat, 1 dollar.

Information in this report was obtained from the interrogation of Johannes Buhr, a chemist specialising in the testing of cements. "Xylamon" (composition unknown) is manufactured by Liefewerke, Consolidwerke Alkaliwerke, Hanover. Another preservative, also used to retard burning of wood, is composed of 90 per cent. silicofluoride and 10 per cent. dinitrocresol. Creosote is also used.

HILL, ALLAN C., and CAMPBELL, W. BOYD.—Interview with Dr. K. Freudenberg, Director of Institut fur die Chemie des Holzes, Universitat, Heidelberg. (BIOS Final Report No. 18). Off. Pub. Bd., Report, PB 7934. 5 p. n.d. Price: Microfilm, 50 cents; Photostat, 1 dollar.

The work of Dr. Freudenberg has covered studies on the structure of lignin and the biochemical formation of lignin. He was interviewed to obtain information on recent advances in lignin chemistry, particularly any which might relate to the industrial utilization of lignin. This report discusses use of lignin for water purification, vanillin from waste sulphite liquor, hydrogenation of lignin, lignin tanning agents, and lignin structure.

HILL, ALLAN C., and CAMPBELL, W. BOYD.—Zellstoffabrik Waldhof-Kelheim Mill, Kelheim, Bavaria. (BIOS Final Report 51). Off. Pub. Bd., Report, PB 7918. n.d. 10 p. Price: Microfilm, 50 cents, Photostat, 1 dollar.

This mill produces bleached sulphite pulp for paper and chemical purposes, absolute alcohol (when cooking spruce wood), and Torula food yeast (when cooking beech wood). It was visited to obtain detailed information on methods of manufacture of sulphite pulp to compare with standard Canadian and American practice, and to follow new developments in pulp production and utilization. Report includes manufacture of sulphite pulp from beech wood, alcohol production, yeast production, and production of chemical pulps at the Johannesmuhle of Zellstoffabrik Waldhof.

*Available as S.I.D. Reports Nos. E.23 and E.27 respectively.

Visitors to the laboratory during October included:—Messrs. Sexton and Bailey, of the New Zealand State Forest Service, Mr. E. J. Dowling, Director, Timber Development Association of South Australia, and Messrs. Geo. Chapman and J. Dunstan, of Cairns Timber Ltd., N.Q.

WHAT IS THE STRENGH OF TIMBER?

(Prepared by the Timber Mechanics Section.)

This article is the second in a series in which an attempt is being made to explain simply the various technical terms used in describing the "strength" of timber. As previously explained, timber has many different strength properties and it is important to know what property or properties are involved when considering the species to use for a particular purpose. The terms "modulus of rupture" and "modulus of elasticity" have already been dealt with, and this article continues with a discussion of "compression strength" and "tensile strength".

3. **Compression Strength.**

The term "compression" is well known to everybody and it is only necessary to point out that a compression load may be applied at any angle to the grain. A compressive stress parallel to the grain is set up in house stumps by the weight of the building, while a compressive stress perpendicular to the grain is set up in floor bearers where they rest on the stumps. At any other angle, the stresses may be regarded as a combination of compression parallel and compression perpendicular to the grain.

If in a table of properties of a certain species, the ultimate compressive strength parallel to the grain were given as 6,000 lb./sq. in., this would mean that a 4 in. x 4 in. post (i.e. 16 square inches) would just carry 96,000 lb. In actual practice it would only be safe to load this post to a fraction of this maximum load, and the various reasons for this will be dealt with in later articles.

When a post is loaded, in compression parallel to the grain, to the maximum it can carry, failure occurs suddenly; for all practical purposes the post is broken and of no further use. But when a piece of timber is loaded at right angles to the grain, no definite maximum load is reached, with increasing load the piece continues crushing and distorting until it has completely lost its original shape. It is therefore of little practical use to determine a maximum load, as the timber then would only be a crushed mass of splinters, so a limit is set on the amount of crushing (usually 1/10th in.) and the stress in the wood under this amount of compression is called the compression stress perpendicular to the grain.

4. **Tensile Strength.**

When a load is applied to a piece of wood tending to increase its length it is said to be subjected to a tensile stress. This stress is usually along the grain (the grain being straight and running along the length of the timber) but it may also be at right angles to the grain, or, if the grain is sloping, a combination of these two stresses will be set up. The tensile strength of wood along the grain is nearly 50 times as great as across the grain. It is important therefore that sloping grain should be avoided as much as possible in selecting wooden members to be stressed in tension. If the tensile strength parallel to the grain is given as 10,000 lb./sq. in. for a particular species, then a straight-grained 4 in. x 2 in. tension member in that species would be expected to carry 80,000 lb., provided the connections used do not reduce the effective area of the piece.

A common example of timber stressed in tension is in the bottom chords of trusses. Usually the tensile strength of such members is more than adequate, the sizes used being determined not so much by the loads they have to carry as by the requirements of the joints used to connect one truss member to another.

BREVITIES.

During October, Dr. M. Chattaway, B.A., B.Sc., D.Phil., joined the staff of the Wood Structure Section of the Division of Forest Products. For many years Dr. Chattaway worked at the Imperial Forestry Institute, Oxford, in collaboration with Dr. L. Chalk, on problems connected with wood anatomical research. Dr. Chattaway will be engaged on the examination of structure in relation to properties.

Mr. Alan Gordon, Officer-in-Charge, Veneer and Gluing Section, returned from Japan during September, after a six months tour. During this time Mr. Gordon investigated the Japanese timber industry, with special reference to the veneer and plywood field. Mr. Gordon was married on 14th October to Miss Heather Leech of Melbourne.

The Properties of Australian Timbers.

SHINING GUM.

Shining gum is the standard trade common name for the timber known botanically as *Eucalyptus nitens*, Maiden. The tree is also known by such local names as white gum, ribbon gum, silver top and silver top gum, in reference to the smooth and shining bark of the upper part of the trunk. Shining gum is related botanically to mountain grey gum of which it was once considered a variety, but is now classed as a distinct species.

Distribution: Shining gum is mainly a high country species, being found at elevations up to 3,500 ft., sometimes in association with Alpine ash. In Victoria it occurs chiefly in the Baw Baw, Rubicon and Matlock districts, but also occurs throughout the North Eastern part of Victoria. This species also extends into the South Eastern part of New South Wales, chiefly from Bago district through the A.C.T. to the ranges north of Mt. Kosciusko.

Habit: The tree is large, growing to a height of 200 ft. to 300 ft. with a stem diameter from 2ft. to 6ft. The bark is deciduous, ribbony and more or less rough at the butt; the upper trunk is smooth and shining with bark often hanging down in strips.

Timber: When freshly cut the timber has a pinkish tinge but on drying becomes white. The wood is straight-grained and of uniform texture; the sapwood, generally indistinguishable in colour from the truewood, is highly susceptible to Lyctus attack, owing to the presence of starch. The wood is moderately heavy, with an average air-dry density (at 12 per cent. m.c.) before reconditioning of 41.4 lb./cu.ft. ranging from 34.3 to 48.6 lb./cu. ft. The average air-dry density after reconditioning (at 12 per cent. m.c.) is 39.1 lb./cu. ft., ranging from 34.2 to 44.0 lb./cu. ft.

The seasoning properties of shining gum are similar to mountain ash. With care quartersawn stock can be kiln-dried reasonably free from checking in thicknesses up to 2 ins.; backsawn stock, however, in thicknesses of 1 in. or over is difficult to kiln season from the green condition free from pronounced face checking. From consideration of cost and quality of drying, preliminary air-drying to a moisture content of 25 per cent. to 30 per cent. is recommended.

Appreciable collapse can occur during drying but a good recovery in size may be obtained by reconditioning. In drying from the green condition to 12 per cent. moisture content, shining gum shrinks 8.8 per cent. in a tangential direction (backsawn) and 4.8 per cent. in a radial direction (quartersawn). The shrinkage after reconditioning is reduced to 5.5 per cent. and 3.0 per cent. respectively. Shining gum has fair mechanical properties.

On the gluing properties of shining gum little work has been done in this Division; however, in general it can be regarded as having much the same gluing properties as mountain ash.

Uses: The uses of shining gum are similar to those of mountain ash and due to its usually high quality it frequently finds use for the more exacting purposes. In addition to flooring and general building constructions, it is used for agricultural implements, oars, javelins, handles and clothes pegs.

Availability: The Victorian Forests Commission's returns for the year 1945-46 show that approximately 39,000 super feet of shining gum were milled in Victoria during that period.

ADDENDUM.

The following information is additional to that published recently (News Letter No. 144, September 1946) on W.A. Blackbutt.

Distribution: The best blackbutt stands in Western Australia were on the Hamilton River, Busselton Block.

Habit: The tree reaches a height of 150 ft. instead of 100 ft. as previously published.

Uses: The timber is accepted by the W.A. Government Railways as a standard sleeper timber; it is known as Yarri by the W.A. Forests Department, which uses the hammer brand with a Y. It is exported to South Australia as an ordinary structural timber.

Victorian Railways Print. 4596—46

C. S. I. R.

FOREST PRODUCTS NEWS LETTER

This monthly bulletin is prepared for general circulation by the Division of Forest Products, C.S.I.R., 69-77 Yarra Bank Road, South Melbourne, S.C.4., and will be supplied free on request to members of the timber trade and timber users who wish to keep abreast with current developments in the field of forest products.

No. 147 1946##147 December, 1946

TIMBERS FOR ENGRAVING BLOCKS

*By W. Russell Grimwade**

About the turn of the century the progress of photography caused a complete revolution in printed illustrations. About the end of the 1890's there were in all centres of the world groups of skilled wood-engravers whose great manual dexterity was called upon to illustrate the books, newspapers and periodicals of the time. Stories still remain of the great cunning and skill of these craftsmen. London "Punch" probably had at its service the best of these craftsmen in the great centre of London and it is said that if a political cartoon for that great weekly had to be done in a hurry by reason of a political change or national emergency, the artist, having made his sketch by pen or pencil, would pass his work over to his specialised wood-engravers. The original would be cut into four or more sections and each different wood engraver would be given a portion which would subsequently and quickly reappear hand-carved in such a manner that the four could be placed in the press contiguously, and the paper's readers would never be aware by any deficiency in reproduction of any departure from the artist's technique.

The relentless progress of photography changed all that in a few years, and the rapid introduction of process blocks left the vocational wood-engraver one of two alternatives—either to die off or change his occupation.

Since that time, wood-engravers, whilst much diminished in number, have at least maintained, if not enhanced, the great skill of their craft, and in all centres of civilization a few people may be found whose self-expression takes the form of engraving on wood for the illustration and decoration of high-class printed matter.

The wood needs of these few remaining artists are by no means great, but they are a little exacting. Their work is all done on end-grain section, and they need blocks of a perfectly plane surface as large as may be cut from one section, or several pieces skilfully joined by dowels and glue.

The wood of tradition for this purpose has been the carefully dried and seasoned timber of the Turkey box (*Buxus sempervirens*)—a wood which entered into the lives of our grandfathers far more than it does into ours, as they were accustomed to have the cosmetics of their day in nice bottles with boxwood stoppers or their toilet table accessories made completely of that lovely timber. Bakelite and fine glass have replaced it, but the wood-engraver is conservative and if asked to decorate a book, immediately seeks those lovely blocks of Turkey box which have never been challenged in their quality for this specific purpose.

A few months ago it was necessary for the writer to seek the services of a wood-engraver in the joint publication of a small book. Supplies of imported Turkey box were simply not obtainable, and the very few pieces that were found at the back of top shelves where they had lain unused for years, provided only about one-tenth of the needs of the wood-engraver for the work in hand. So a search was made amongst Australian timbers for a substitute and four timbers were suggested as having qualities that might make them suitable for this purpose. The four were:—

- Tasmanian sassafras (*Atherosperma moschatum*)
- Huon pine (*Dacrydium franklinii*)
- Tasmanian myrtle beech (*Nothofagus cunninghamii*)
- Sandalwood (*Santalum spicatum*)

and blocks of these were made for trial by the engraver. The blocks, if not in one piece, must be jointed until they are sufficiently large to reproduce facsimile the chosen illustration. They must have an engraving surface, flawless, plane and highly polished, and they must be as close as possible to type high (0.918") and free from wind and distortion. As it is highly desirable that the timber should be pale in colour in order to receive the engraver's preliminary pencil sketch, red or dark coloured timbers are ruled out.

The wood-engraver soon reported that Huon pine was lovely to carve, and sandalwood almost as nice excepting that it had so much oil in it that the chips of carving needed to be blown away, as they would not fall away from the work.

Then there arose the doubt as to whether the nice carving Huon pine would stand the wear of the printing press as well as the harder sandalwood.

Blocks for decoration are generally used nowadays for limited editions of finely printed books, and it is unusual for such blocks to have more than perhaps 2,000 impressions taken off them. Would Huon pine stand up to 2,000 impressions of the printing press?

A block of sandalwood and a block of Huon pine were then set up in a forme of a commercial printing press with a type counter set in the same forme, and over 12,000 impressions were run through in a commercial manner, that is to say, no other care was taken as to their inking and processing than would be usual where such blocks were used. At the end of the run each 100th print was examined critically, and no sign of wear was discernible in either piece with the aid of lower power magnification.

Once again the timbers of the new world of the south have been found to be satisfactory substitutes for the well-tried woods of the old world.

*Mr. W. Russell Grimwade is so well known for his keen interest in forests and forest products that no introduction is necessary. We have pleasure in reproducing this article by him on his private investigations into timbers for engraving.—Ed.

During the month the Division has had a number of interesting visitors from outside Australia. The first of these was Mr. M. A. F. Dykmans, Chief of the Forest Engineering Division of the Netherlands East Indies, who, after a short visit to Australia, is returning to Java to re-organise the forest engineering work there.

American visitors were Mr. R. F. Boyce, Consul-General for U.S.A. in Australia, accompanied by Mrs. Boyce; and Messrs. R. M. Bankes and Gavan of the American Cyanimid Company.

New Zealand visitors were Mr. V. B. Cook, of the firm Wm. Cook and Sons, Palmerston North, and Mr. Sam Bryce, of N.Z. Plywood Ltd., Penrose, N.Z.

<< Content

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U.S. Bibliography of Scientific and Industrial Reports

During the war a great deal of research was carried out under the auspices of the Allied Governments. It has been decided to release for general use a large proportion of the results of this research, together with information taken from former enemy countries as a form of reparations. With this end in view, the U.S. Department of Commerce, through its Publication Board, is making a weekly issue of ABSTRACTS of reports in the form of a "Bibliography of Scientific and Industrial Reports." This Bibliography is now being received in Australia and relevant extracts are reproduced hereunder.

Copies of the original reports may be obtained in two ways: (a) Microfilm or photostat copies may be purchased from the United States through C.S.I.R. Information Service. Those desiring to avail themselves of this service should send the Australian equivalent of the **nett** quoted U.S. price to:—

C.S.I.R. Information Service,
425 St. Kilda Road,
Melbourne, S.C.2.

and quote the PB number, author's name, and the subject of the Abstract. All other charges will be borne by the C.S.I.R.

(b) Those marked with an asterisk may be obtained by approved applicants without cost on making application to the Secondary Industries Division of the Ministry of Post War Reconstruction, Wentworth House, 203 Collins Street, Melbourne, C.1. Copies of these are available for reference in public libraries.

Further information on subjects covered in the reports and kindred subjects may be obtained by approaching the C.S.I.R. Information Service, the Secondary Industries Division of the Ministry of Post War Reconstruction, or the Munitions Supply Laboratories (Technical Information Section), Maribyrnong, Victoria.

HILL, ALLAN C., and CAMPBELL, W. BOYD.—Haindliche Papierfabrik, Schongau Works, Schongau, Bavaria. (B.I.O.S. Final Report 47). Off. Pub. Bd., Report, PB 7929. n.d. 5 p. (S.I.D. E.24.)

Price: Microfilm, 50 cents. Photostat, 1 dollar.

The Schongau Mill is undamaged and manufactures 100 tons of newsprint daily, supplying the paper for "Stars and Stripes." The mill is noted for the development of hydraulic barking in Germany. The barker which works by combining friction action with that of high pressure water jets, has made important savings for the company over earlier methods of rossing and knife-barking. Groundwood pulp manufacture is also discussed.

HILL, ALLAN C., and CAMPBELL, W. BOYD.—Institute fur Cellulose Chemie, Darmstadt. (B.I.O.S. Final Report 54). Off. Pub. Bd., Report, UB 7903. n.d. 5 p. Price: Microfilm, 50 cents. Photostat, 1 dollar. (S.I.D. E.31.)

Dr. Brecht and Dr. Jayme of the institute furnished the information contained in this report. Work has been done on a process for making a groundwood pulp having a fibre length distribution practically the same as that of the mixed groundwood and chemical pulps now used, by the use of a grinder. A wet strength tester has been devised which measures the tensile breaking load of sample sheets made from the same stock. This method of testing is used in the McNeil tester for single textile fibres. The use of beech wood for staple film and rayon and pre-hydrolysis are discussed.

HILL, ALLAN C., and CAMPBELL, W. BOYD.—Papierfabrik-Kabel Hagen. (B.I.O.S. Final Report 55). Off. Pub. Bd., Report, PB 7906. n.d. 3 p. Price: Microfilm, 50 cents. Photostat, 1 dollar. (S.I.D. E.32.)

Papierfabrik-Kabel, near Hagen, makes groundwood papers and some spinning papers. About 135 tons of newsprint per day are made and about 100 tons/day groundwood is made at the mill from Finland spruce. Paper machine speeds are 200 to 270 meters/minute, using 20% sulphite. Newsprint is not super-calendered.

HILL, ALLAN C., and CAMPBELL, W. BOYD.—Feldmuhle Papier and Zellstoff Werke, A. G., Ruhrwerke Division Arnsberg, Westphalia. (B.I.O.S. Final Report 48.) PB 7930. n.d. 4 p.

Price: Microfilm, 50 cents. Photostat, 1 dollar. (S.I.D. E.25.)

This company manufactures white lined imitation chomo board (corresponding patent coated board) for conversion into folding boxes. The patent coated board is made from groundwood pulp, waste paper, and bleached sulphite or unbleached sulphite for the top liner. A comparison of the product with Canadian patent coated board showed the latter to be better. The method of production of groundwood pulp is explained.

HILL, ALLAN C., and CAMPBELL, W. BOYD. — Lurgi Gesellschaft fur Warmetechnik, Frankfurt. (B.I.O.S. Final Report 20). PB 7932. n.d. 4 p.

Price: Microfilm, 50 cents. Photostat, 1 dollar. (S.I.D. E.14.)

This target, one of three divisions of the Lurgi organization, was investigated for information concerning equipment used in sulphite waste liquor concentration. The main problem in the evaporation of S.W.L. is to avoid scaling up the apparatus and to avoid corrosion. The latter is avoided by neutralizing the liquors with lime to pH5.7 and using stainless steel or copper for construction. On account of the neutralization with lime together with the lime originally in the liquor, the concentration of $CaSO_4$ is high and gives most trouble from scale. The Lurgi idea of reducing this trouble is to take advantage of the fact that the solubility of $CaSO_4$ is reduced considerably at temperatures above 40° C. The liquor, which has been clarified by settling about 6 hours, is heated by direct steam to a temperature of 160° C., which precipitates most of the sulphate so that it can largely be removed as a sludge in a manner similar to blowing sludge from a steam boiler. Following this, the liquor is evaporated in equipment of fairly ordinary design.

HILL, ALLAN C., and CAMPBELL, W. BOYD. — Lurgi Gesellschaft fur Warmetechnik, m.b.H., Lurgi Gesselschaft fur Chemie U. Hutterwesen M.b.H., Lurgi Apparateban G.m.b.H. (B.I.O.S. Final Report 19). PB 7931. n.d. 4 p.

Price: Microfilm, 50 cents. Photostat, 1 dollar. (S.I.D. E.13.)

The Lurgi Companies manufacture and install apparatus for sulphite pulp making including digesters, digester circulating systems, apparatus for preparing cooking liquors and apparatus for recovering relief gases and for concentrating by-product liquors. Work has been done on the concentration of sulphite waste liquor, electrical purification of hot burner gas, impregnation of wood under vacuum, and the manufacture of mechanical packers to increase the quantity of wood chips that may be filled into the digester.

HILL, ALLAN C., and CAMPBELL, W. BOYD.—Feldmuhle Papierfabrik, Hillegossen. (B.I.O.S. Final Report 53). PB 7905. n.d. 3 p.

Price: Microfilm, 50 cents. Photostat, 1 dollar. (S.I.D. E.30.)

Report of visit to a mill making good quality papers with and without groundwood content, and with clay and titanium oxide filler. There were two grinders and three paper machines, the latter using threads on the presses to limit the spread of breaks. When a break occurs, the sheet is reformed by moving one or other of the strings over to the next in the same manner as widening the sheet by use of the water jet.

All the above reports are available from S.I.D.

Experimental Treatment of Timber with Preservatives at High Pressures

By N. Tamblyn, Officer-in-Charge, Wood Preservation Section.

The preservative treatment of eucalypt timbers has not been practised widely in Australia in the past due principally to the fact that adequate supplies of durable species have been available at a price which has not attracted the competition of treated timber. In addition eucalypt truewood has proved very difficult to treat and no satisfactory method of obtaining deep penetration of preservatives has been available. This fact, together with the adequate supply of naturally durable timbers, has prevented the establishment of a wood preservation industry in Australia.

In recent years the supply of first-class durable timbers has failed to meet all demands, due mainly to depletion of resources in easily accessible forests. As a result, it is becoming increasingly necessary to utilize lower durability eucalypt timbers for external constructions exposed to decay and termite attack. This is now particularly the case with rail sleepers in Victoria and New South Wales, where the range of acceptable timbers has been gradually extended to include species previously considered unsuitable for this purpose.

Since the inception of the Division of Forest Products in 1929 the problem of developing satisfactory preservative methods has received constant attention. There has been no difficulty in the treatment of round timbers such as poles and posts where the easily penetrated sapwood band is intact. Many field and service tests have demonstrated that treatment of the sapwood band provides a very effective method of preserving such timber, and may be accomplished by simple methods. The treatment of eucalypt truewood, however, has proved an extremely difficult problem as the deep penetration of preservatives essential for permanent protection has not been obtained by conventional methods. Soaking of seasoned truewood in preservatives for long periods has given an entirely superficial result. Treatment by the open tank hot and cold bath method has been similarly unsuccessful, though this process has given very satisfactory results for sapwood, and is the basis of present recommendations for the treatment of round timbers. Standard pressure treatments, used widely abroad and particularly in the United States for the treatment of softwood timbers, have given disappointing results. With the exception of a very few low density species such as mountain ash (*E. regnans*), where somewhat streaky penetration has been obtained, the truewood of almost all eucalypts has failed to treat satisfactorily at normal pressure schedules. The following result for air seasoned Tasmanian messmate stringybark (*E. obliqua*) sleepers treated at 200 lb./sq. in. pressure with hot creosote oil after an initial vacuum period may be cited as a typical example.

"Measurement of side penetration showed this to vary from 0-0.05 inch while the longitudinal penetration varied from 2.5 inches which was fairly evenly distributed to streaks up to 6 inches long. There was no change in the penetration after storage of the sleepers for 3 months."

Service tests of the fluarised* karri (*E. diversicolor*) sleepers although promising have not been entirely satisfactory. Experience under Australian conditions has indicated that the success of a diffusion treatment for sleeper preservation is limited by the tendency of the preservative to leach from the wood, the practical difficulty of obtaining deep penetration, and the frequency with which green treated timber splits during seasoning and in service exposing the inner untreated wood.

The basic problem in wood preservation in Australia today may be stated simply as the development of a method of treatment by which low durability eucalypt truewood is deeply penetrated with a preservative, preferably of an oil type. In a recent review of pressure treatment schedules already tested by the Division of Forest Products with unsatisfactory results, it was apparent that only some drastic change in method could hope to succeed. Further manipulation of initial vacuum period, temperature and duration of treatment offered little promise of success and attention was turned to the possibility that the required penetration could be obtained by treatment at pressures extremely high for wood preservation practice.

In American commercial practice pressures of 100-200 lb./sq. inch are commonly used with an upper limit, seldom if ever exceeded, of 250 lb./sq. inch. Above this pressure there is danger of injury or collapse especially with low mechanical strength pine timbers treated with hot preservatives. Preliminary tests at extremely high pressures (up to 1000 lb./sq. inch) recently made at the Division were thus not expected to succeed without incurring the problem of serious damage to the timber. The first high pressure treatments were therefore made with cold solutions using a length of heavy steam pipe connected to a hand operated hydraulic pump as a crude treating cylinder. Results were promising as lengths of *E. regnans* and *E. obliqua* truewood were completely and rapidly penetrated with water soluble preservatives at pressures of approximately 1000 lb./sq. inch without obvious damage to the wood. For the two timbers tested average absorptions of 21 and 18.5 lb. of solution per cubic foot of wood respectively were obtained after a treatment period of only 30 minutes. Treatment with creosote oil also resulted in good penetration, and it became obvious that extensive tests were warranted.

A preliminary reconnaissance test of a large number of timbers was then planned to compare absorptions obtained with a water soluble preservative (zinc chloride) and an oil type (creosote oil) using pressures of 200 and 1000 lb./sq. inch. This test has now been completed for 31 different eucalypt species and 16 non-eucalypt timbers using specimens, mostly 2-3 feet long with one end lacquer sealed. In these tests treating temperature was raised to 150° F. without causing collapse except in low density softwood timbers such as spruce and King William pine. Results have so far indicated that a number of eucalypt timbers may be penetrated safely and satisfactorily at high pressures. In many cases absorption was doubled or trebled at the higher pressure and 16 of the 31 species absorbed more than 5 lb. of creosote oil per cubic foot. Absorption of water soluble preservative was in all cases much greater than for creosote oil, several species absorbing 20-30 lb. of solution per cubic foot. Non-eucalypt timbers behaved very similarly, Douglas fir absorbing 3.3 lb. creosote at 200 lb. pressure, compared with 10.8 lb. at 1000 lb. pressure.

No conclusions have yet been reached as to the commercial practicability of such high pressure treatment, but a pilot cylinder capable of treating half sleeper sections up to 13 feet in length has been installed for final tests. These tests will commence almost immediately as the problem of treating lower durability eucalypt sleepers is an urgent one. If satisfactory results are obtained with this pilot plant the practicability of designing and operating a commercial size cylinder will be investigated. The potential saving resultant from a successful treatment for rail sleepers alone in Australia would rapidly exceed a million pounds in money.

*The fluarising process was a hot diffusion treatment developed by the Western Australian Forests Department. Treatment consisted of boiling the green sleepers in the preservative for 10 hours followed by a cooling period of 36 hours before removal from the solution. The preservative was a solution of sodium fluoride, arsenious oxide and sodium dinitrophenate.

<< Content
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What is the Strength of Timber?

(Prepared by the Timber Mechanics Section)

5. Shear Strength.

When a force is applied to a piece of timber so that one part tends to slide over the other, the timber is said to be subject to a shearing force. Shear stresses may be set up parallel or perpendicular to the grain, but it can be shown that a shear stress in one direction sets up an equal stress at right angles to it. As wood is much stronger in shear across than along the grain, it is extremely difficult to obtain a true shear strength perpendicular to the grain. The values given in tables of strength properties are for shear along the grain, either parallel to, or perpendicular to the growth rings.

One method of determining the shear strength of timber is the measurement of its resistance to torsional or twisting stresses. The relationship between the shear and torsion tests is beyond the scope of this article, but it might be mentioned that from the torsion test, a value known as modulus of rigidity, which is difficult to obtain from other types of shear test, is determined. This modulus is a measure of the shear stiffness of wood, i.e., its resistance to deflection by shearing. The racking of doors, boxes and panels in general is in reality deflection due to shear stress, although in these cases the observed movement is due to loosening of joints and not to shear deflection of the wood itself, which in most instances is too small to be seen by eye.

Shear stress is important in the design of short deep beams which may be amply strong in bending, but unless properly designed may fail by shearing lengthwise through the centre of the beam. Notches in such beams tend to accentuate any weakness in this direction, as do seasoning checks and large gum veins.

6. Cleavage.

If one visualizes an ordinary clothes peg, and the manner in which it is stressed when in use, then a good picture of the cleavage test is obtained. It is a form of tensile test, the load being applied to a specially shaped specimen perpendicular to the grain. However it is not a simple tensile test, the two halves of the specimen being pulled apart at one end only. The results of this test have not a wide application, but for specific uses such as clothes pegs, they serve very well to compare the relative serviceability of various species.

7. Hardness.

The hardness test measures resistance to indentation, and is used as an indirect measure of the wearing properties of wood. A steel ball is imbedded to half its diameter into the sides or ends of the specimens, and the load required to imbed the ball is measured. This load is quoted as the hardness figure in tables of properties. It is interesting to note that in metal testing it is usual to apply a fixed load to the testing tool, and obtain a measure of the hardness by the size of the impression left in the tested material.

As would be expected, the hardness value for wood increases with increasing density, which means that a relatively light timber such as radiata pine has a low hardness, i.e., it is fairly soft and has a low resistance to wear, and a heavy timber such as ironbark has a high hardness value and a correspondingly high resistance to wear. Many examples could be cited of the use of timber where hardness is a most important property, a few that come immediately to mind are paving blocks, parquetry, hand-truck wheels, and railway sleepers. Where radiata pine is used for sleepers, standard practice is to use plates to reduce excessive wear due to rail-cut on this relatively soft species.

Development of Improved Wood Picking Sticks

Since 1941, the Australian textile industry has been faced with the difficulty of obtaining imported hickory for use in the manufacture of picking sticks—the wooden component which throws the shuttle carrying the weft thread back and forth across the loom. By 1943 the supply position had become so acute and as tests of various substitute Australian timbers had proved unsatisfactory, the Division of Forest Products, C.S.I.R., produced a number of laminated compressed wood (improved wood) sticks for service tests. As very extensive research on improved woods had been made at the Division in connection with the development of improved wood airscrew blades it was possible to design a product with mechanical properties considered suitable for service where resistance to repeated impact was required.

These improved wood picking sticks performed so impressively that full details of manufacture were released at once, with the result that an Australian-made picking stick superior to hickory was in commercial production within a few months.

In 1944 our attention was drawn to a statement in the journal "Textile World" (April, 1944) that an acute shortage of picking sticks was imminent in U.S.A., and full information on the Australian product was despatched by air mail to U.S.A. in August of that year. The story of this simple but important Australian development was also published in the "Australian Timber Journal" for August, 1944.

It is now of interest to read in a recent American publication that a compressed laminated picking stick, apparently of very similar construction to the Australian article, has been developed in U.S.A., and has given such satisfactory results that "broad patent papers . . . are pending." As there is no mention that this development was inspired by Australian success with a similar article, it must be assumed that there has been a parallel development in which, however, Australian research apparently lead the field.

FITTING SHOVEL HANDLES

Wooden shovel handles may be bent and fitted to the shovel neck in one operation.

It is still necessary to heat the wood for bending, which may be done by dry heat, or by heating in oil. Steam is unsuitable as it is liable to cause tannin stains between metal and wood. Oil heating is favoured as the presence of oil assists the insertion of the heated handle into the shovel neck, this being done with a type of press.

Advantages claimed for the method are that costs are reduced, and that a better fit between handle and neck is obtained than with pre-bent handles, which do not always conform to the contour of the shovel neck.

The Eighth Annual Pulp and Paper Co-operative Research Conference will be held in Melbourne on 17th March, 1947. It is understood that representatives of Australian Paper Manufacturers Ltd., Associated Pulp and Paper Mills Ltd., Australian Newsprint Mills Pty. Ltd., and the Division of Forest Products will take part. It is also understood that N.Z. Forest Products Ltd. will be sending over an observer member.

The following new technical officers have been appointed to the Division of Forest Products over the past few months: Messrs. T. A. McLelland (Preservation Section), R. G. Skewes (Utilization Section), L. J. Brennan and J. K. Pinkerton (Seasoning Section), and A. Ack Hing (Timber Physics Section).

Mr. K. F. Plomley has been appointed Assistant Research Officer to the Veneer and Gluing Section.

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