C.S.I.R.O.

Forest Products Newsletter

1956##214

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Selling Engineered Timber

An open letter to those who wish to increase sales of structural timber

ARE YOU content to have timber pushed out of its traditional structural uses? Year by year, as a result of research we are getting to know more of the qualities and unique characteristics of timber, so that we should be able to use it in a more efficient manner. However, because the new-found knowledge is not being used fully and effectively, concrete, steel, and other materials are beating timber in the highly competitive structural market.

Competitive materials are defeating timber because their suppliers provide a customers' service. They find out what structural performance the user wants, and they develop means of satisfying the requirement with their material, and at a competitive cost; then, backed with money to make their story widely known, they go out and sell.

With effort and drive some of the field lost to steel and concrete can be regained, but it needs hard work and courage. Every year the customer's time becomes more important to him. He wants to buy guaranteed packaged lines which can quickly be prepared for use, and for which he need not study technicalities or organize elaborate construction labour. Undoubtedly he would be interested in packaged lines of timber construction such as huts, garages, sheds, shelters, and hay barns. Modern modular planning and the use of standard panels for roofs, walls, and floors could have a big market. In timber engineering, scientifically designed construction to use the minimum but adequate amount of material is required. Roof trusses, beams, built-up frameworks, arches, and portal frames could have very wide appeal and be the most profitable constructions and, at the same time, they could provide the easiest and quickest means of combating the competition of steel and concrete.

To sell these products, however, you must be prepared to provide architects and engineers with a guarantee of the quality of the construction and the adequacy of its performance. Consideration must be given to the adaptability of particular units to a variety of designs, to ease of handling and fixing on site, and, at the same time, to competitive cost. To do this effectively you must employ skilled engineers as designers, as factory-production men, and as contacts with engineers and architects on technical matters. Only so will your organization understand the outlook and requirements of structural designers and customers and be in a position to supply their needs satisfactorily and efficiently. Only so can you meet and overcome the competition of steel and concrete in the field of traditional timber usage.

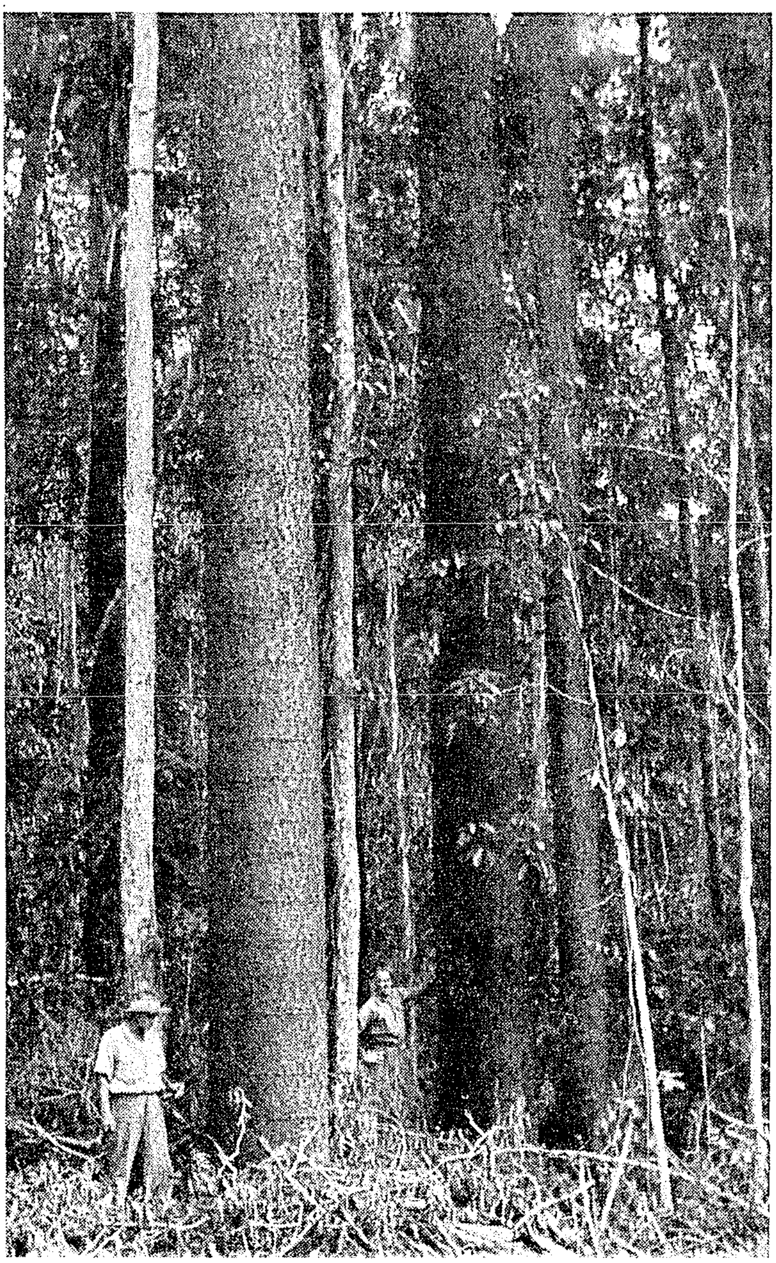
J. D. BOYD,
Officer-in-Charge,
Timber Mechanics Section

Klinki Pine

KLINKI PINE is the standard trade common name of the timber known botanically as *Araucaria klinkii* Lauterb. It is also known as klinki in Australia, and as rassu or pai in New Guinea.

Distribution

Klinki pine grows in some mountainous areas of New Guinea at elevations of 2000-5000 ft above sea-level. It is found in the same locality as hoop pine (*Araucaria cunninghamii*). Both species are common in the mountains near Finschhafen and on the hills of the Upper Ramu River. The best known stand occurs in the Wau-Bulolo district at elevations between 2500 and 4000 ft.



Klinki pine stand about 1½ miles from Bulolo, New Guinea.

Habit

The tree grows to heights of from 150 to 280 ft with a cylindrical bole. About half the total length of the tree provides sound timber of which a high percentage is classed as first grade plywood logs free of knots. Girths at breast height range up to 20 ft, those around 9 ft being very common. The bark, which is often more than an inch thick, is reddish brown and exudes a copious colourless resin.

Timber Properties

Klinki pine is a softwood (i.e. non-pored timber), straight grained, and with close outstandingly uniform texture. The colour of its heartwood is light yellow, sometimes varying to very pale brown occasionally with a pinkish tinge. Sometimes it is undifferentiated from the sapwood, which is straw coloured. The timber has a natural sheen and lustre. As in all softwoods, compression wood is sometimes present, and may be identified by its dull yellow or brownish colour.

Klinki pine is a light-weight softwood having an average density of 28 lb/cu. ft. at 12 per cent. moisture content. The bending and compression strengths of klinki pine are 80 per cent. of the corresponding values for Douglas fir and 90 per cent. of the hoop pine values. In stiffness and impact strength it is equal to these timbers; its shear strength is 70 per cent. of the Douglas fir value and 80 per cent. of the hoop pine value. For structural design purposes klinki pine is grouped with Douglas fir and hoop pine in strength group D as indicated in the "Handbook of Structural Timber Design". The timber seasons easily. In drying from the green state to 12 per cent. moisture content, klinki pine shrinks 2·2 per cent. in a radial (quartersawn) direction and 4·0 per cent. in a tangential (backsawn) direction. Because of its low shrinkage it is ideally suited for pattern making. The sapwood is susceptible to blue stain. The resistance of the heartwood to decay and termite attack is very low, and where these hazards are likely to be encountered it should be impregnated with a preservative. Being a non-pored (softwood) timber, klinki pine is not susceptible to the attack of the powder post borer (*Lyctus* sp.), but it is expected that it would be susceptible to the attack of the furniture borer (*Anobium*) and to the pinhole borer as well as the borer *Caligmmaderus incisus*, which is indigenous to Queensland.

Klinki pine is soft to cut and very easy to work. It finishes well and takes paints, stains, varnishes, and lacquers uniformly without requiring the use of a filler. Its attractive colour makes it particularly suitable for the application of clear finishes.

Klinki pine is easy to peel. Veneer and plywood produced commercially at Bulolo, New Guinea, are of a very high standard. The annual production is about 45-50 million sq. ft. of 3/16-in. and 1/8-in. moisture resistant 3-ply.

Uses

Klinki pine may be used for building framework, roof timbers, flooring, linings, joinery, mouldings, furniture and cabinet making, cases, turnery, dowels, patterns, and for the production of veneer, plywood, battery separators, and pulp.

Availability

Difficulties of access to the klinki forests have been serious obstacles to its production. As logging, sawmilling, veneering, and plywood manufacture are now well established, supplies should become more readily available in the future. In the six months ending July 1955, large quantities of plywood and a little over a million super feet of sawn klinki pine timber were imported into Australia.

Additional or more detailed information regarding this species may be obtained from the Chief, Division of Forest Products, C.S.I.R.O., 69-77 Yarra Bank Road, South Melbourne.

Seasoning of Klinki Pine from New Guinea

By W. G. KAUMAN and G. S. CAMPBELL, Seasoning Section

A SIGNIFICANT proportion of the timber used in Australia for joinery and indoor work, food containers, mouldings, veneers, etc. has, in the past, been provided by the native softwood stands of Queensland and New South Wales. During recent years, however, the commercial availability of species like hoop and bunya pine from these stands has diminished, and the necessity has arisen of finding some substitute timber, combining qualities similar to those of hoop pine with sufficient availability to warrant commercial exploitation.

Such a substitute is being found, at least in part, in klinki pine, which occurs in extensive stands in the Wau-Bulolo area in New Guinea. A log of klinki pine was received early in 1947 for experimental work at the Division of Forest Products, and an article on this species, mainly dealing with the peeling and drying of veneer, was published in Newsletter No. 150 (1947).

During the latter half of 1948, through the cooperation of the Forests Department of the Territory of Papua and New Guinea, the Division received a further supply of klinki pine, coming from the Lae district.

Thicknesses examined included 1-in., $1\frac{1}{4}$-in., $1\frac{1}{2}$-in., and 2-in., and it was found that the timber could be dried very easily without significant degrade occurring in any thickness, even in wide backsawn faces. The most outstanding feature of this species is its exceedingly rapid drying rate, making it possible to kiln dry 1-in.-thick stock from an average moisture content of 70 per cent. to one of 12 per cent. in approximately 27 hr, approximately 54 hr being required to kiln dry 2-in. stock over the same range.

Such rapid drying naturally results in the creation of stresses and sometimes in fairly steep moisture gradients in the timber, but these can usually be eliminated by subjecting the stock to a brief high humidity treatment at the completion of kiln drying.

The shrinkage of klinki pine was found to be relatively small, and this timber should, therefore, not give much trouble through "working" under varying atmospheric conditions.

Economically, the seasoning of klinki pine thus appears to be a very attractive proposition. The schedules set out in the table are tentatively recommended for kiln drying klinki pine.

Kiln-drying Schedules for Klinki Pine

Size and Condition	Moisture Content Change Points (%)	Dry-bulb Temperature (°F)	Wet-bulb Depression (°F)
1-in. and 1¼-in. thick green mixed sawn stock	Initial	180	30
	30 to final M.C.	180	50
	At final M.C. for 2 hr	200	5
1½-in. and 2-in. thick green mixed sawn stock*	Initial	160	30
	30	180	30
	20 to final M.C.	180	40
	At final M.C. for 4 hr	200	5

* In the case of wide backsawn boards in these thicknesses, where the risk of surface checking is somewhat greater, it is recommended that the initial drying conditions be modified to a dry-bulb temperature of 160 °F with a wet-bulb depression of 20 °F. When the stock has reached an average moisture content of 40 per cent. the appropriate schedule given in the table should be followed.

Preventing Seasoning Degrade

MANY FORMS of seasoning degrade such as warping, twisting, checking, and uneven drying can be attributed to improper seasoning practice.

It is important that only seasoned material be used for stacking strips. The strips should be of uniform thickness and cut to a length to suit the particular stack width for which they are intended. For most purposes a strip thickness of ¾ in. and width 1¼-1½ in. is satisfactory. In slow drying areas thickness might well be increased to 1 in. Stack bearers should be placed at intervals to suit the timber species and thickness, and all space strips should be kept in vertical alignment with these. For example, provided the stack is not too high, a strip spacing of 30 in. is satisfactory for boards sawn from the "ash" eucalypts; on the other hand, for 1-in.-thick red gum stock the spacing should not be greater than 12 in.

Stacks with overhanging ends, i.e. with projecting unsupported board ends, are a fruitful source of degrade from end splitting and twisting. The remedy is either "square end" stacks or sorting for lengths and stacking in lengths. It is only the poorly managed yard which does not provide raised stacking supports to ensure adequate understack ventilation or allows weeds to impair this ventilation.

Timber Grading Course in Sydney

PLANS ARE developing for a series of lectures and demonstrations on timber grading to be given in Sydney in February 1956. The N.S.W. Forestry Commission, Associated Country Sawmillers of N.S.W., and the Division of Forest Products, C.S.I.R.O., are collaborating in the preparation of a syllabus that should be of particular interest to builders and architects. Discussions will cover the pattern of wood utilization in Australia; factors affecting timber quality; the influence of defect, moisture, and durability on industrial uses of timber; considerations underlying specifications for dwelling construction; the grading of hardwoods of eastern and south-eastern Australia; the grading of Monterey pine; specifications for housing items; and timber resources, marketing, and utilization in N.S.W.

Practical demonstrations will be given of the application of standard grading rules to the timbers of N.S.W. Invitations to the course are being issued by the Associated Country Sawmillers of N.S.W.

DONATIONS

THE following donations were received by the Division during November:

Lawson and Sons, Mareeba, Q.	£50 0 0
Victorian Sawmillers' Association	£5 5 0

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American Nails with a Difference

By J. J. MACK, Timber Mechanics Section

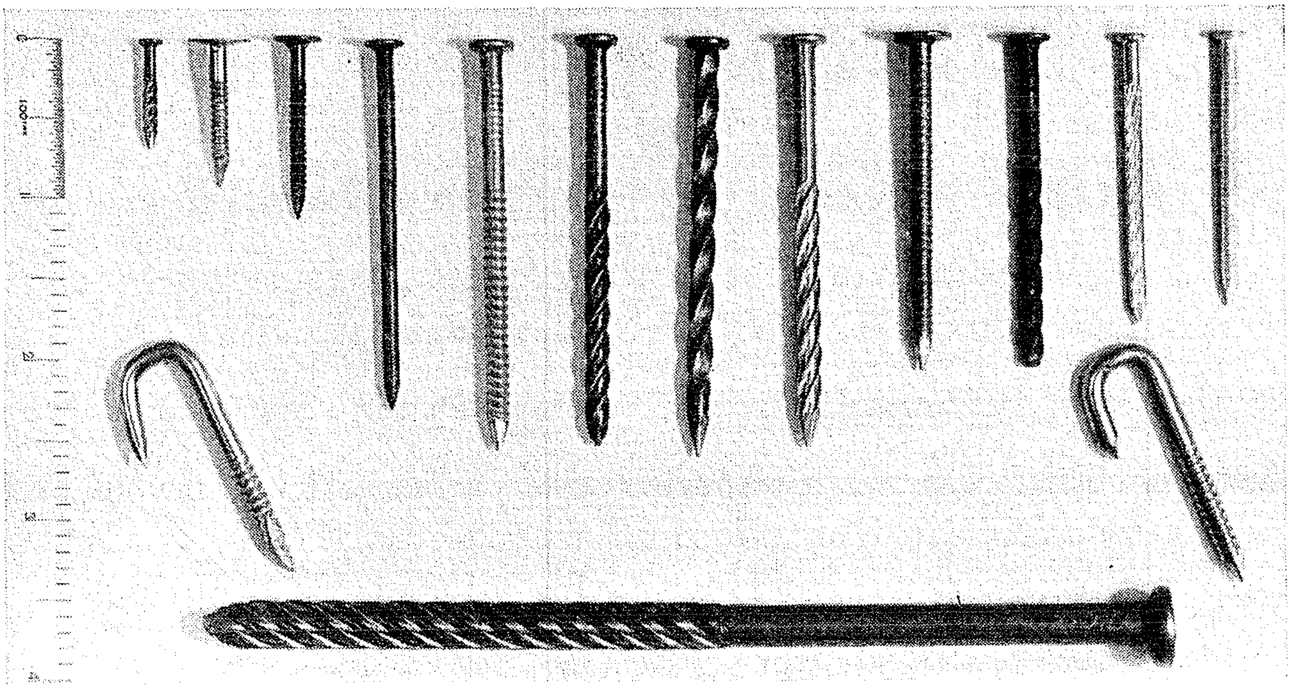
APART from some minor variations in head and point shape, and surface treatments, the call for nails of special design in Australia has been very limited in late years. Prior to the war, some attention was given to various types of barbed and grooved nails, but their manufacture has been largely discontinued, as the plain round wire nail has been found satisfactory for most purposes. This is mainly because of the greater utilization of local hardwoods in place of the formerly imported softwoods. The withdrawal resistance of plain nails in hardwoods is generally quite high compared with most softwoods, and with such species probably little is to be gained economically by using nails with specially shaped shanks.

It may prove however, that with the increasing use of radiata pine in Australia and New Zealand for all kinds of wood products, and with the interest being displayed in the use of nails structurally, there will be a demand in these countries for more efficient nails.

In the United States of America, the utilization of softwoods for structural and non-structural purposes is quite extensive. Also, in recent years, the use of nails in structural connections has greatly increased in that country. When expressed in terms of strength per unit area of joint, the efficiency of plain round nails, especially in softwoods, is often very low compared with that of other means of jointing. Hence, nail manufacturers have been required to increase the efficiency of their products in order to satisfy the demands of builders of structures, pallets, boxes, and other wood products. This they have done by producing nails of special designs and made from wire of special steel.

Some examples of special nails developed with the research cooperation of Professor E. George Stern of the Virginia Polytechnic Institute and patented by an American manufacturer are illustrated on page 2. Laboratory tests have shown that the helically-threaded and annularly-threaded nails driven into softwoods have a higher initial withdrawal resistance than a plain nail. Also, it is claimed that after driving into green wood they retain their withdrawal resistance to a greater degree as the wood dries out. Most of these nails are obtainable in both ordinary wire and hardened wire, the latter providing greater strength in laterally loaded joints.

Work in America has also been extended to the field of fencing staples, and two examples of an improved type are shown on page 2. They are claimed to be particularly suitable for creosoted pine posts which are being used to a considerable extent. The new staple is claimed to have a much greater withdrawal resistance than the ordinary U-shaped staple, and the shape provides for easier wiring. They are available in both ordinary and hardened wire.



Examples of some American nails and fencing staples.

It is obvious that in America the need has arisen for special nails, and there is a possibility that before long a similar need will be felt in Australia.

Saws for Ash Group Eucalypts

By R. L. COWLING, Utilization Section

FREQUENTLY the Division is asked to solve some sawing difficulty, or to recommend such details of saws as, for example, the speed at which they should run, the horsepower required for the drive, the necessary thickness of saw, or the best shape of tooth.

The information given here is not intended to cover any particular set of conditions, but rather to serve as a guide for those sawing the "ash" group of eucalypts, such as messmate stringybark, alpine ash, mountain grey gum, manna gum, or mountain ash. Differences among even this small group of timbers will be recognized by experienced sawyers, so that they may alter their saws to suit; for example, a different set of the saw teeth may be employed when sawing messmate, as compared with that for alpine ash.

Successful sawing depends in no small measure on the skill of the saw doctor, whose art is acquired only after a long and assiduous apprenticeship. Saw-doctoring is not discussed here. Those who seek further knowledge of the art should refer to the publications cited at the conclusion of this article. These are available in the Division's library.

Chiefly, the following information has been collated from the combined experience of saw manufacturers and saw users, but some part of it stems from the results of recent field tests. Should further information become available as a result of either laboratory experiments or continued field tests, the recommendations will be modified or extended.

Mounting of the Saw

Free running of the saw in the bench is essential. There must be no slackness in the bearings or in the mounting of the saw on the spindle. The packing must not force the saw out of its natural position or cause more heating than is needed to overcome undesired vibrations. Packing should not be used as a substitute for proper tensioning of the saw. Care in setting up the saw in

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the bench lessens sawing difficulties. To ensure that the saw teeth are in a perfect circle, the saw should be "stripped" in the bench and then sharpened before use.

The Speed of Saws

The rim speed of saws is generally within the range 8000-10,000 ft/min, power fed saws usually being driven nearer the top of this range. Notwithstanding these figures, new saws should initially be run at speeds recommended by the saw manufacturers. If the saw speed is altered, the tension should be altered, The tension of all saws should be checked regularly by a competent saw doctor.

Gauge of Plate (Birmingham wire gauge)

Normal thicknesses are:

Diameter of Saw (in.)	B.W.G.	Thickness (in.)
10	17	0·058
12-14	16	0·065
16	15	0·072
18-20	14	0·083
22-28	13	0·095
30-34	12	0·109
36-40	11	0·120
42-44	10	0·134
46-48	9	0·148
50-52	8	0·165
54-58	7	0·180
60-66	6	0·203

The above thicknesses are satisfactory for saws which are carefully handled in the bench, given frequent and adequate attention by a competent saw doctor, and not subjected to shock loading or twisting out of line during the cut. Where the conditions are more severe than this it may be advisable to use thicker saws. For example, 42 in. diameter saws in No. 1 breast benches are sometimes 9 gauge instead of 10, and firewood saws and automatic pendulum waste docking saws are usually thicker.

Thinner saws than those given in the table can usually be supplied on request, but should not be used unless specially recommended for particular conditions.

H.P. Requirements

Power depends very largely on rate of feed, depth of cut, and the duty cycle, as well as on other factors such as timber species. For light duty, drives of the following powers are often installed and operators learn by experience the feed rates that can be satisfactorily obtained with them.

Light Duty Saws (Hand Fed)

Saw Diameter (in.)	H.P.
12	1½
14	2
15	3
18	4
20	5
24	7½

Saw benches with power-assisted feed require larger motors as follows:

Heavy Duty Saw Benches with Powered Roller Feed

Saw Diameter (in.)	H.P.
36	50
42	60
48	70

If conditions at breast benches necessitate sawing frequently near the full depth of the saw, larger motors than those listed may be desirable.

It should be remembered that in deep cuts the power for the duration of the cut may exceed the above by as much as 100 per cent. if the feed is fast, and due allowance should be made for this in the selection of prime movers other than electric, and in the design of the transmission.

Number of Teeth

For the rip-saws in common use, adequate gullet space is of far greater importance than the small differences in the number of the teeth. Saw manufacturers vary in their standards, but saws with as many as 54 teeth have been found satisfactory, provided that the gullets are well rounded, as indicated in the sketch of the general shape of rip-saw teeth. Fewer teeth are desirable for small saws or when cutting abrasive timbers.

Cross-cut saws are usually supplied with more teeth than rip-saws. Peg-tooth type saws with from 76 to 110 teeth are commonly used, and the greater number of teeth appear to cut cleaner. Rip-saws are not normally recommended for cross-cutting, but if used the hook should be reduced to zero or made negative if the saw is of the pendulum type or otherwise free to move towards the operator.

Saw Sharpening

Experience is the best guide as to the time when a saw needs sharpening. It is advisable to sharpen before the saw begins to labour in the cut, because less difficulty will be experienced in cutting, and less grinding or filing will be necessary. This has a twofold advantage: (1) greater precision in sharpening is more likely; (2) there is less likelihood of the teeth being "burned" during grinding. A heavy cut with the grinding wheel will overheat the teeth and the properties of the metal are adversely affected.

Sharp corners should not be present in the gullet after grinding or filing as these may set up intense local stresses in the metal and cause tooth breakages. A smooth contour in the gullet assists sawdust movement and saves saw teeth.

In good clean timber free of bark, dirt, and knots, saws should not need sharpening under 2 or 3 hours of continuous cutting. In silvertop ash, for instance, saws may require more sharpening than in messmate stringybark. In alpine ash, saws may last even longer. Runs of up to 6 hours are possible in favourable circumstances.

Precision is highly desirable in saw-sharpening and setting. The first step in sharpening should be to "strip" the saw teeth while the saw is rotating in the bench, so that the tip of every tooth is marked by the file or stone used for the purpose. Grinding or filing the teeth to this mark ensures that all teeth share equally in the work, provided equal care has been taken in the setting of the teeth. The set should be exactly the same for each tooth, and the same on each side of the saw.

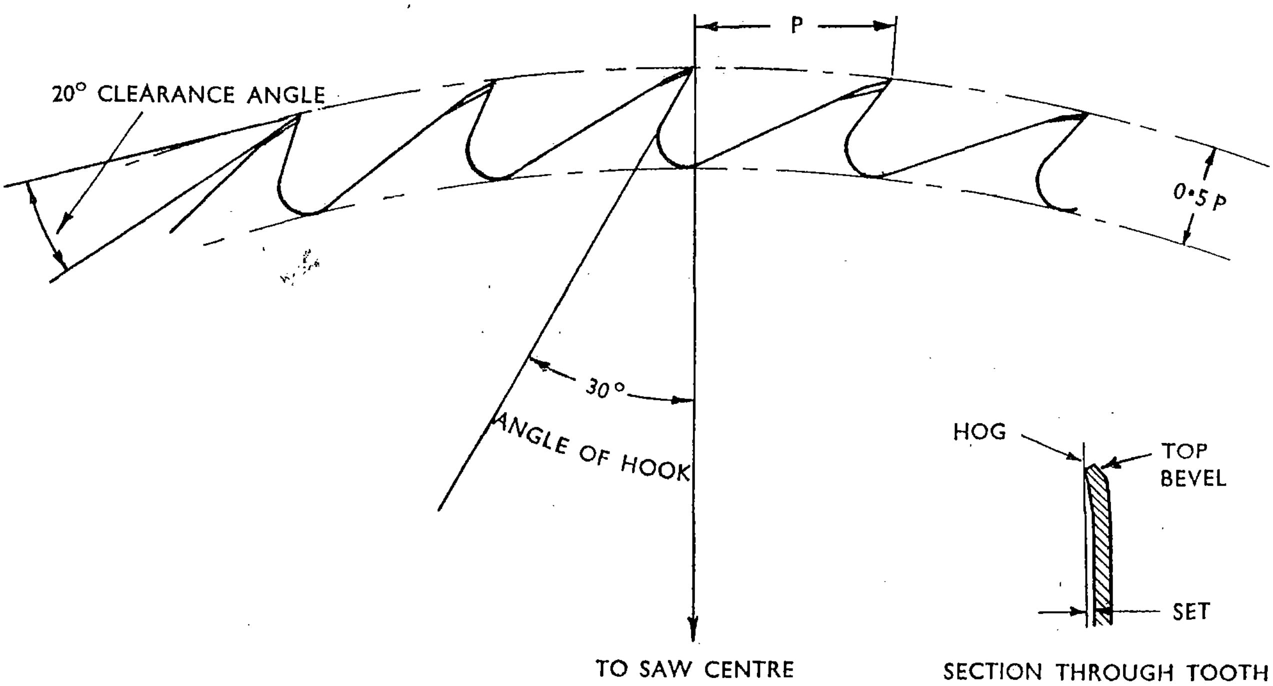
Details of Rip-saw Teeth

Set.—0·020 in. is commonly used for ash eucalypts. Less should be used if experience proves it satisfactory, but more may be required for some timbers.

Top bevel.—Angles of 30-40° are common. The angle can be greater, at the discretion of the saw filer, but should not be less. The length of the top bevel need be no greater than approximately ¼ in., although saws are usually supplied with a much longer bevel.

Clearance angle.—The smallest clearance angle found practicable overseas was 7½°, but much larger angles are in general use in Australia. An angle of approximately 20° to the ridge formed when hog is filed is common.

Hog.—Usually ⅓ hog is filed on saws which are cutting deep and are of about 24 in. diameter or greater. The angle may vary from flat to the same angle as the top bevel. The latter angle is to be preferred.



General shape of rip-saw teeth.

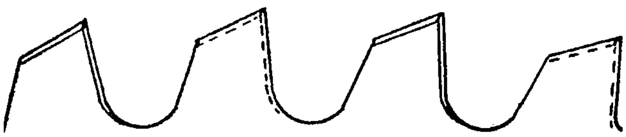
Hook.—Normally 30° (18 teeth in a 54-tooth saw), but may be greater or less depending on conditions of service. Greater hook requires less power, but if too great there may be difficulty in maintaining tooth sharpness and rigidity of the saw.

Depth of gullet.—A depth of gullet equal to approximately 0·5 times the pitch of the teeth is suitable for many conditions. Slightly deeper gullets may sometimes be preferred, but it is most important to provide ample space at the bottom of the gullet for movement of the sawdust. For this reason the gullets should be well rounded at the bottom and of perfectly smooth contour. A suitable shape of gullet is given on page 4.

Details of Teeth for Cross-cutting

Travelling-head cross-cut saw.—Pitch of teeth $\frac{7}{8}$ in. (mesh); hook 5° negative; clearance angle 25°; top bevel 10°; front bevel 5°; gullet depth $\frac{1}{2}$ in.; tooth top $\frac{3}{8}$ in. long; spring set 0·01 in.

N.B.—For hollow-ground saws no set will initially be necessary, but as wear occurs some set may eventually be required.



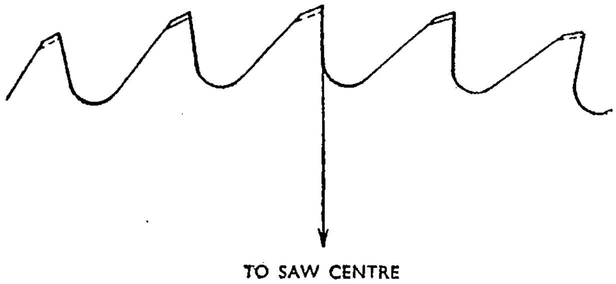
Pendulum docker.—The above form of tooth is also used for pendulum docking. Front bevel need not be applied except where the standard of finish demands it. Top bevel may be increased to 30° and set to 0·020 in. for ordinary purposes.

Peg-tooth cross-cut saw.—Depending on whether the saw is used for accurate cross-cutting to dimension, or as a pendulum docker where accuracy and the surface finish is less important, the details of the teeth should be as follows:

	Dimension Saw	Pendulum Docker
Pitch of teeth	Approx. $\frac{1}{2}$ in.	Approx. 1 in.
Hook	10° negative	20 to 30° neg.
Clearance angle	45°	60°
Back bevel	10°	15°
Front bevel	10°	10°
Set	0·010 in.	0·020 in.

The bevels need be no longer than approximately $\frac{1}{4}$ in.

Use of rip-saws.—Where rip-saws are used for cross-cutting, and the saw is free to move towards the operator (for example, pendulum saws), the hook should be reduced to zero as shown:



The shape of the gullet is not so critical for cross-cut saws, hence the gullets can be deeper, if desired, and narrower, i.e. an old rip-saw which has been worn down so that its gullet space is restricted could be used. Hog is not filed for cross-cutting purposes.

ADDITIONAL READING

Hanchett Saw and Knife Fitting Manual. 6th Ed. (Hanchett Manufacturing Co.: Big Rapids, Michigan.)

Instructions for Hammering and Adjusting Tension of Log Circular Saws in the Filing Room. (Henry Disston and Sons Pty. Ltd.: Sydney.)

Modern Mechanical Saw Practice. 2nd Ed. by J. R. Foyster. (Crosby Lockwood: London.)

Saws and Sawing. 2nd Ed. by S. Lister. (Loman, Erskine and Co. Ltd.: London.)

The 'Mermaid' Saw and Cutter Manual. Rev. Ed. (Spear and Jackson Ltd.: Sheffield.)

DONATIONS

THE following donations were received by the Division during December 1955:

Victorian Sawmillers' Association, Heyfield, Vic.	£10 10 0
Box and Case Manufacturers' Association of N.S.W.; S.A. Box and Case Section, Dept. of Forests of South Australia; West Australian Box and Case Section	£265 0 0

<< Content

Print this page

C.S.I.R.O. Screen Drier for Veneers

By J. W. GOTTSTEIN, Seasoning Section

A NEW compartment-type cross-circulation drier, incorporating an experimentally developed screen and straightener, has been designed by the Division of Forest Products.

Special acknowledgement is made of the assistance provided by Mr. D. M. Cullity and Westralian Plywoods Pty. Ltd. of Perth, W.A. who installed a prototype unit, provided facilities for field testing, and are largely responsible for the handling technique described.

Results of commercial trials show that the unit gives short drying times, improved dry veneer quality and favourable economy, and it should have a wide range of application under present conditions in the Australian veneer and plywood industry.

In contrast to practice in most countries, for many years much of the green rotary veneer peeled in Australia has been dried in the open air. Air-drying with the veneer racked vertically in horizontal fingers has proved economical both in labour and installation costs under the prevailing climatic conditions, drying time in good drying weather ranging from 1 to 3 days for 1/16-in. thickness and the dried quality has usually been satisfactory with a minimum of splits and buckling.

More recently, drying time and moisture content control have become increasingly important, especially the latter, since synthetic adhesives are often hot-pressed at temperatures well above 212 °F, making low veneer moisture content essential. Roller and mesh belt mechanical driers have been used successfully, but the installed cost per unit output is relatively high, especially for the comparatively small production plants common in Australia. On the other hand, counter flow progressive and compartment kilns using the economical vertical racking have not been entirely successful when drying green veneers because of the high incidence of splitting and buckling. These difficulties led to a study of the factors involved and

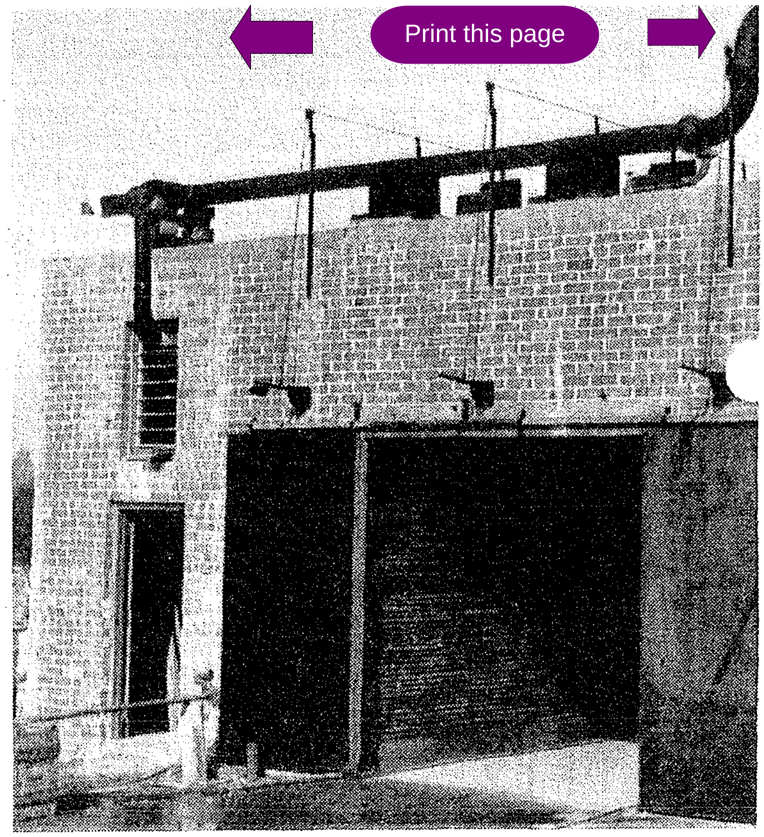


Fig. 1.—Prototype screen drier for 7 by 3 ft veneers during first stages of construction.

ultimately to the C.S.I.R.O. cross-circulation screen drier.

Theoretical considerations and laboratory tests indicated that fairly rapid air circulation with uniformity of air temperature and humidity were essential to good veneer drying quality. Field studies in 1949 showed that air velocities and temperatures in both cross-circulation and counter-flow progressive kilns using vertical racking varied considerably throughout the drying zone.

A laboratory investigation was therefore undertaken to determine possible methods of improvement of commercial design and to determine the effectiveness of such an improvement. Extensive experiments led to the development of a special screen straightener which consisted of square, planed strips of dry pine spaced horizontally at intervals on vertical studs. This screen was placed between the kiln side space and the drying zone. A double screen with horizontal strips mounted on both sides of the vertical studs ultimately proved more satisfactory than the single screen and gave a slightly better air distribution with very little increase in space requirements. However, in order to provide for fan reversal during drying, a screen on each side of the charge space was necessary. The ducts formed by the vertical veneer sheets and the horizontal supporting fingers appeared to assist in maintaining uniform flow once this was established. It was anticipated that the racked charge would have a sufficiently low resistance to air flow so that the air distribution established by the screens would not be seriously disturbed.

The results of laboratory tests were very satisfactory and made it quite clear that the very moderate schedules being used in many commercial kilns were dictated by the deficiencies of the drying unit rather than by the limiting characteristics of most suitable schedule conditions for vertically racked veneers. It was accordingly considered that a commercial cross-circulation kiln using screen straighteners could be constructed economically and should be an effective drier for green veneers.

Design and Construction of Commercial Screen Drier

The first commercial unit constructed was a 26 ft long cross-flow, compartment-type drier with a charge capacity of 240 sheets, designed for double width kiln trucks holding veneer sheets of up to 90 by 42 in. green dimensions. The results with this prototype were so satisfactory that a similar 26 ft long compartment unit suitable for drying veneers up to 102 by 58 in. has since been installed at the same plant. The former unit is shown in Figure 1.

The screened design can be used for any desired kiln length appropriate to production and layout and is equally applicable to cross-flow progressive units. If factory conditions warrant, a moisture equalizing zone could be added for accurate adjustment of final moisture content after drying.

The unit is fitted with low cost, flat-bladed propellor fans providing air velocities of about 600 ft/min, while finned heater units are used to obtain the necessary heat transfer at the high drying rates obtained. Vents are designed to maintain wet-bulb temperatures of about 110 °F with green veneers even when dry-bulb temperatures rise to 180° or 200 °F.

Three vents per fan forming three rows of vents instead of the usual two in cross-circulation kilns were adopted in conjunction with the single row finned heaters. Vents in each row are linked together. The third row of vents takes advantage of the pressure drop across the heaters and permits settings to exhaust only air which is passed through the drying charge.

The double straightener screens developed in the laboratory were adopted. The final screen is based on $1\frac{1}{4}$-in. square strips set at $\frac{5}{8}$-in. spacing. These dimensions were determined by field tests, since the resistance necessary to provide adequate circulation correction depends on the combination of fan, heater, side space, and kiln proportions. The top of the screen should coincide with the top of the longest veneer sheets, and the area between screen and sub-ceiling must be closed, as must the area below the veneer sheets.

Constructional materials are generally not critical because of the moderate temperatures and comparatively uniform drying conditions used. Plywood or asbestos-cement is suitable for sub-ceilings and fan shrouds. Walls and roof may be in masonry or concrete, or even insulated metal panels. Insulation requirements should be considered for each particular application, but are usually not important under Australian conditions.

Simple roller-track type hangers carrying light-weight doors without special seals are satisfactory since the kiln is practically at atmospheric pressure throughout the drying zone.

The high wet-bulb depression and moderate temperatures used cause little corrosion in fan joists, fans, and fan shafts, and an occasional coating with a corrosion resistant paint is all that is required.

Advantages of the commercial screen drier as compared with a mechanical roller or mesh belt drier are the low capital cost, ease of construction using untrained personnel, and the small number of moving parts with consequent ease of maintenance. Four kilns, are at present in operation, including two at the plant where the prototype was installed. The cost of a complete unit with best construction and materials, including kiln trucks and loading winch, is estimated to be £4,000. The charge capacity for a unit about 26 ft long internally is approximately 250 sheets. In the unit designed to dry sheets of 7 by 3 ft final size, 1/16-in. veneers can be dried in times varying from 30 to 60 min according to species. If a loading of full-length sheets is assumed, then at a drying time of a little under 40 min, about $1\frac{1}{2}$ charges an hour can be dried with an output of about 7500 sq. ft. On this basis the unit cost is a little over 10*s*. per sq. ft. of dried veneer output per hr. This figure is considerably below the price of imported mechanical driers ex-Germany or the United States, for which costs vary between £1 and £3, according to the size of installation.

The screen drier does not, however, possess special technical advantages compared with roller or mesh belt mechanical units, since in these the veneer movement compensates automatically for minor deficiencies in circulation and temperature distribution.

Loading the Kiln

Two different methods of loading and unloading have been used with screen driers.

The first method uses double width trucks, each measuring 8 by 4 ft, constructed of timber with steel bracing. Each truck is equipped with six full swivelling castor wheels and fitted with six sets of horizontal fingers in vertical alignment, approximately equidistantly spaced over a total height of 7 ft. Six trucks of green veneer are aligned on a guide track at the "green" end of the kiln. When the drying of the previous charge is complete the kiln doors are opened at both ends. The dry trucks are then coupled to the green charge behind them and the kiln is unloaded and reloaded in one operation with the aid of a winch. The dry trucks are then taken to an unloading bay, passed on for reloading and then re-aligned in the guide at the "green" end of the kiln. Eighteen trucks are usually provided to allow for six spares.

In the second method, two large trucks are used. These may be constructed of steel channels for chassis frame and uprights. The trucks are provided with sets of horizontal fingers in vertical alignment. A truck of this type with seven sets of fingers for 8 ft sheets is shown in Figure 2. Single sets of rails run through and extend on beyond the kiln at each end. The kiln trucks are coupled together in tandem and are pulled in and out of the kiln by a friction winch with reversible drive. In operation, the trucks are unloaded and re-loaded alternately, one being unloaded and re-loaded while the other is in the kiln. The actual choice of the type of truck must depend on the operating conditions of a particular installation.

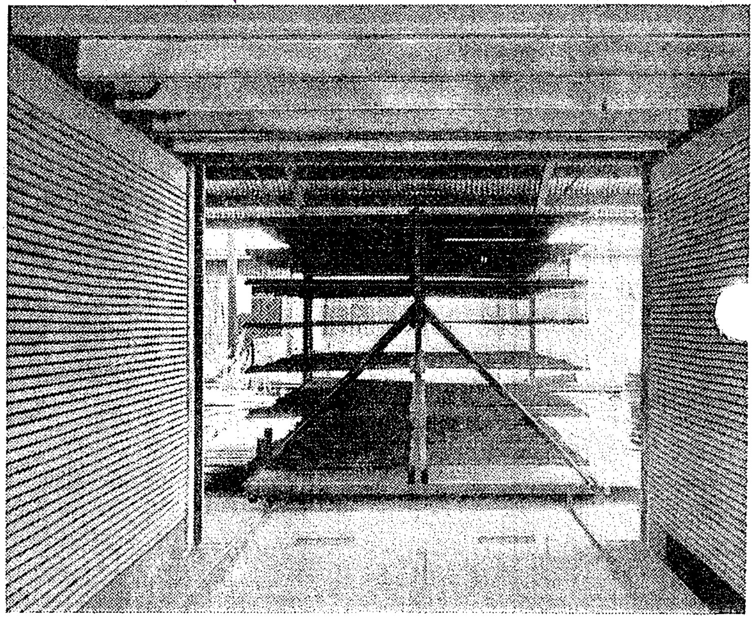


Fig. 2.—Screens inside drier for 8 by 4 ft veneers. Empty veneer trucks can be seen in the background.

Control

The dry-bulb temperature control needs little attention and can be set manually without difficulty, but automatic control is preferable when steam economy is important.

Wet-bulb temperatures are maintained fairly well by pre-determined manual setting of the vents but can be kept under automatic control if so desired. This will also result in additional steam economy where required and minimize necessary supervision.

The time required to kiln dry the veneer to slightly less than 8 per cent. was initially determined by experiment. Temperature differentials in the side ducts also gave a reasonably accurate indication. From data contained in Divisional laboratory records, it has been shown that for a given set of kiln conditions and a known species and thickness, the difference in temperature readings between thermometers placed in the ducts is related to the moisture content of the dried veneers. This method is being refined and an alarm has been built to indicate automatically when the veneer is dry.

Drawings and specifications, together with advice on installation and operation, are available on application to the Chief, Division of Forest Products, C.S.I.R.O., 69-77 Yarra Bank Road, South Melbourne.

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Forest Products Newsletter

1956##216

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NUMBER 216 MELBOURNE MARCH 1956

Recent Studies on "Ash" Type Hardwoods

Collapse Intensified by Heating while Green

By J. W. GOTTSTEIN and B. McCOMBE, Seasoning Section

IT IS well known that the prolonged drying of Australian "ash" type sawn eucalypts at elevated temperatures and high humidities frequently causes excessive, and sometimes non-removable, collapse. Furthermore, both field and laboratory experiments have indicated that temperature is a factor of major importance, independent of other drying conditions. Confirmation on these points was recently obtained in scout tests on the drying of "ash" eucalypt veneers. Even more importantly, however, attention was drawn to the extent to which collapse susceptibility and intensity is increased by heating while the timber is in the green condition.

Peeler blocks were prepared from a log of alpine ash (*Eucalyptus gigantea*) and preheated at two temperatures, approximately 110 °F and 150 °F respectively, the veneer obtained then being kiln dried. That from the blocks heated to the higher temperature invariably showed the greater gross shrinkage (normal shrinkage plus collapse), the average difference amounting to as much as 4 per cent. The general trend was found to be independent of the drying conditions.

This result was considered important, and a laboratory study followed in which a log of alpine ash and one of messmate stringybark (*E. obliqua*) were each divided into three peeler blocks. One block of each species was given no preheating, whereas the others were preheated to 100 °F and 135 °F respectively. Veneer was then peeled from each block in the usual way and dried in composite parcels under matched schedules. The gross shrinkage resulting again confirmed the temperature effect, as is shown in the table on page 2 (i.e. in all cases veneer from logs heated to the higher temperature showed much the greater gross shrinkage during subsequent drying).

Concurrently with the above work, short log lengths (cross sections) were taken from the two logs mentioned above, cut into segments, and subjected to several different preliminary heat treatments ranging from soaking in water at 70 °F to steaming at 212 °F for 48 hr. The segments were then air dried in the laboratory. In all cases the effect of preliminary heating in water, or steaming at 212 °F, was to produce a great increase in the severity of the gross shrinkage occurring during subsequent air drying; this is illustrated on page 2. In segments from the log showing the lesser collapse, the gross shrinkage was more than doubled by the heat treatment at 212 °F. The effect on segments treated in water at 100 °F and 140 °F was less obvious.

The wide difference in shrinkage behaviour caused by the preliminary treatment has led to scout tests aiming at evolving a simple method for testing the heat "sensitivity" of logs intended for veneer production. Preliminary results indicate that segments about $\frac{7}{8}$ in. thick, steamed for 48 hr and oven dried, can give a very good indication of subsequent shrinkage and drying behaviour. Other work concerned with these and other species is also proceeding in the laboratory, small specimens being used to determine temperature sensitivity over a wide range of temperatures and times.

Certain tentative conclusions can already be drawn from the work. These are:

(*a*) In preparing collapse-susceptible eucalypts of the "ash" type for peeling, temperatures and heating times must be held to a minimum compatible with good peeling quality; the temperature probably should not exceed about 110 °F.

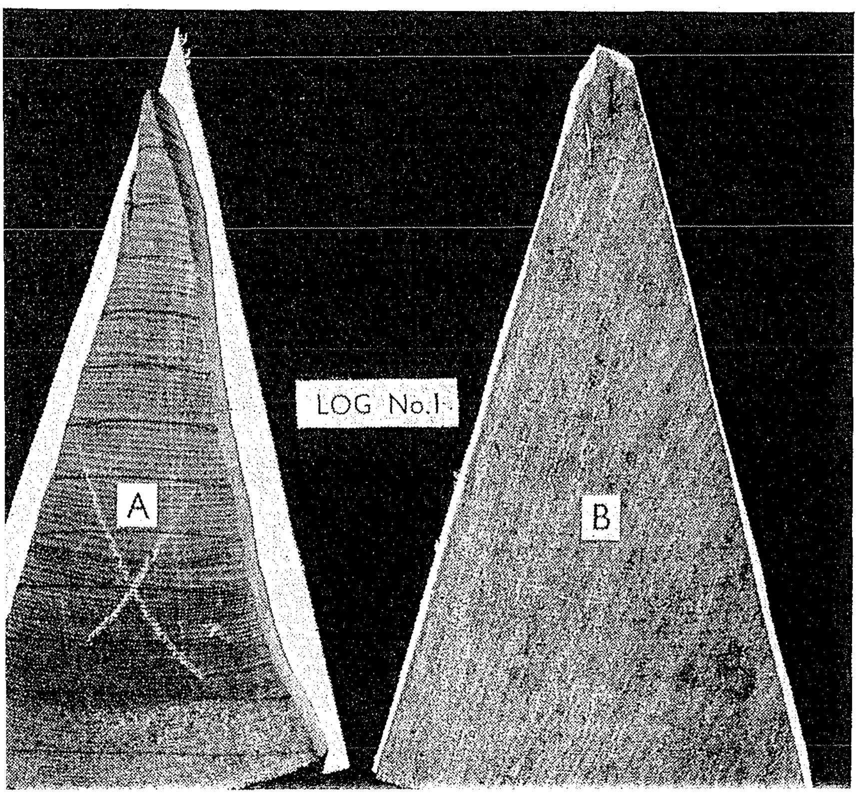
Gross Drying Shrinkage* of $\frac{1}{16}$ in. "Ash" Eucalypt Veneer in Drying to 12 per cent. Moisture Content

Timber	Peeling Temp. (°F)	Gross Shrinkage* (%)		
		Commercial Screen Drier 200 °F Dry-bulb 100–110 °F Wet-bulb Drying time: 25 min	Commercial Kiln 200 °F Dry-bulb (approx.) 110 °F Wet-bulb (approx.) Drying time: 30 min	Laboratory Kiln 170–180 °F Dry-bulb 100–110 °F Wet-bulb Drying time: 35 min
Log No. 1 (Alpine ash)	60	8·0	8·5	8·2
	100	8·5	9·0	9·2
	135	9·2	10·5	10·6
Log No. 2 (Messmate stringybark)	60	13·3	14·8	16·0
	100	14·6	16·5	16·1
	135	16·1	17·5	17·7

* Normal shrinkage plus collapse.

(*b*) Green sawn "ash" eucalypt timbers must not, under any circumstances, be given a heat treatment before drying. It is believed that attempts have been made recently to improve the drying of sawn "ash" boards by giving steam treatments prior to air drying; the effect of this can only be disastrous.

(*c*) Reconditioning should not be attempted until the moisture content is reduced to a value sufficiently low to ensure avoidance of temperature damage. Unpublished laboratory work indicates that it is not safe to recondition until "core" moisture content, as tested with a moisture meter and nails driven to the centre of the timber section, is below 30 per cent.



Effect of steaming at 212 °F for 48 hr on the subsequent drying behaviour of end-grain segments of ash eucalypt. (A) *Steamed for 48 hr and air dried, shrinkage in area:* 34%; (B) *Untreated and air dried, shrinkage in area:* 14%. (*The back-piece on each segment shows the outline of the segment at the commencement of drying, i.e. when green.*)

PROPERTIES OF AUSTRALIAN TIMBERS

Blackbutt

BLACKBUTT is the standard common name of the timber described botanically as *Eucalyptus pilularis* Sm. The common name, which is used throughout the range of its occurrence, is suggested by the charring by bush fires of the fibrous bark at the base of the trunk.

Habit and Distribution

This species is distributed along the coastal belt of eastern Australia from the Victorian–New South Wales border to Queensland as far north as Fraser Island. It is one of the most common trees in these coastal forests and flourishes best on well drained sites within the continuous rainfall belt.

The tree itself attains a height of up to 150 ft and has been recorded as attaining an extremely large butt diameter of 14 ft, although ordinarily its butt diameter is about 3 ft. It is a fast growing and sturdy tree. Its bark is coarse and fibrous at the butt, changing above this to smooth white gum type which then extends throughout the trunk and branches.

Timber

The timber is light brown to brown in colour, but when freshly cut sometimes has a pinkish tinge. It is of open texture and is usually straight grained, or sometimes slightly interlocked. Small gum veins are characteristic. It has no special figure. It is of medium density, ranging from 43·5 to 62, and averaging 54 lb/cu. ft. when dried to 12 per cent. moisture content. Seasoning may be carried out without much difficulty, although some checking of backsawn material is difficult to avoid. It may be kiln dried off the saw, but partial air drying followed by kiln drying is more economical. Collapse and warping occasionally occur, but this is not serious as the species responds to reconditioning. In drying from the green condition to 12 per cent. moisture content, its shrinkage averages 4·2 per cent. in the radial (quartersawn) direction, and 7·2 per cent. in the tangential (backsawn) direction. It is ranked about equal to spotted gum in durability. It is somewhat hard, strong, stiff, and tough, and is classified as a group B timber. It is readily worked with hand or machine tools.

Blackbutt. (Photo: Queensland Department of Forestry.)

Uses

Blackbutt is a most useful timber for general construction. It is largely used for bearers, joists, plates, studs, rafters and battens in dwelling construction. It is in good demand for flooring and weatherboards where a light coloured, durable timber is required. In tram cars or railway carriages it is used for body framing and pillars. It finds some market for bridge planking, sleepers, electric transmission poles and crossarms. It is sought after for splitting into posts, rails and palings. It has been used satisfactorily for paving blocks and wood-wool.

Availability

Blackbutt is one of four major hardwoods of New South Wales. It is available in a full range of scantling sizes, as boards, and as milled products.

Additional information on this timber is available from the forestry authorities in New South Wales and Queensland, and from the Chief, Division of Forest Products, C.S.I.R.O., 69–77 Yarra Bank Road, South Melbourne.

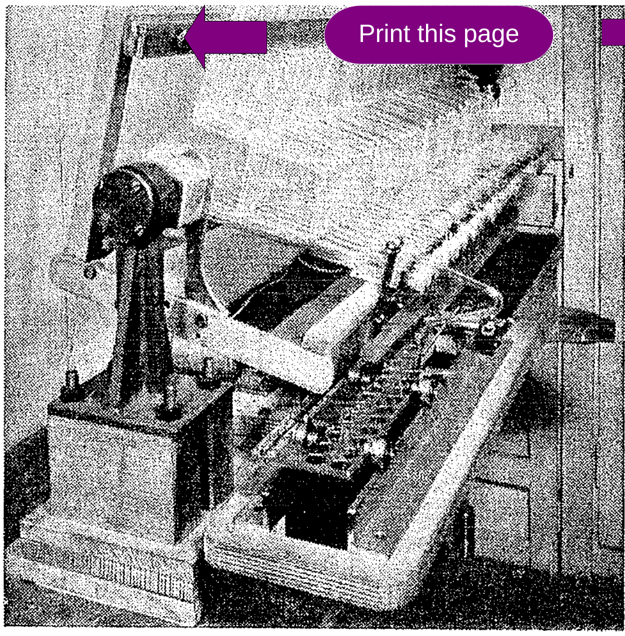
Interesting Equipment at the Division

Any large research laboratory such as the Division of Forest Products requires a range of highly specialized and often very costly equipment. Much of this may be purchased from manufacturers of scientific apparatus; some, however, must be designed for a specific purpose, hence it would not be available commercially. Some of this equipment has been designed and built by the Division and will be featured in future issues of the Newsletter.

A Robot Analyser: The Craig Machine

Lignin is an important constituent of wood, being the cementing material binding the fibres together. To produce paper pulp by chemical means, the lignin must be removed, leaving the fibres free to be formed into paper. Lignin is thus a waste product of the pulping industry, and normally is used as a fuel at the pulp mill, although small quantities have been used to produce other chemicals.

In the investigation of possible uses of lignin for the production of other useful chemicals, drugs, flavourings and similar compounds, it is necessary to separate the lignin from other chemically similar substances with which it is normally mixed, and the method of separation is based on the differing solubilities of these substances in different liquids. The method involves a considerable amount of shaking and decanting of the mixtures, and a piece of apparatus



The Craig machine showing the fifty transfer tubes and mechanical fraction collector.

known as the Craig machine was invented for this process. As this machine is not available commercially, a fully automatic Craig machine has been designed and built by the Division.

The machine, which contains 50 transfer tubes for shaking and decanting the solutions, is shown here. Behind the wall is the mechanical driving unit which imparts the shaking and transfer movements to the frame of tubes; also an electronic unit which controls all operations automatically. Thus, a separation which might take months if conducted manually, can be carried out in a matter of days. Moreover, the machine need not be limited to separations connected with the analysis of lignin, and takes its place among many general purpose items of laboratory equipment.

Pulp and Paper Research Conference

THE FIFTEENTH Pulp and Paper Cooperative Research Conference was held at the Division of Forest Products, January 23–27, and was attended by officers of the Division and representatives of Australian Paper Manufacturers Ltd., Associated Pulp and Paper Mills Ltd., Australian Newsprint Mills Ltd., and N.Z. Forest Products Ltd.

Dr. A. J. Stamm of the United States Forest Products Laboratory, Madison, Wis., who is visiting Australia as a Senior Fullbright Fellow, was also present.

Dr. S. H. Bastow, a member of the Executive of C.S.I.R.O., opened the Conference, and subjects discussed included the formation of reaction wood during growth, the chemistry and pulping of tension wood, growth and development of cells, cell wall structure, physico-chemical studies of cellulose and cellulose fibres, lignin, polysaccharides, wood and bark extractives, and pulping investigations.

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CREEP IN WOOD

By L. D. ARMSTRONG, Timber Physics Section

THE PERMISSIBLE load which a structural member can carry is calculated from data determined by testing a number of specimens in mechanical testing machines. The tests are referred to as short-term tests as their duration is only of a few minutes. In practice, however, structural members may carry loads for indefinite periods (dead loads), and may continue to deform for months or even years. This gradual increase in deformation with time under constant load is called creep, and is quite noticeable in some structures. In buildings it is particularly evident in roof and floor systems.

The most serious effect associated with creep in wood is a reduction in strength under continuous loading. In structural design allowance is made for the effect of such loading, but a better knowledge of creep in wood is required to obtain precise design data.

As a first stage in obtaining these data, a study of the effect of creep in green and air-dry mountain ash subjected to continuous loading in bending, compression, tension, and shear has been made at this laboratory over periods of up to several years. Although mountain ash is not primarily a structural timber it was chosen for the initial tests because it was readily available in large clear flitches reasonably close to the laboratory.

A large number of beams of square cross section were tested over various spans at stresses ranging from one-eighth to three times the working stress generally adopted for the species. In most cases they were set up out of doors, the temperatures and moisture contents of the material varying with climatic changes, but some were tested indoors under less variable conditions, or under controlled conditions of temperature and humidity.

Main effects evident in these tests were:

(*a*) The deflections of the beams continued to increase at a generally diminishing rate for at least a year, the magnitude and rate of increase depending upon the temperature and moisture content. The increases in the deflections of the initially green beams were about double those for the dry beams, and after 1 year the total deflections reached from three to five times those obtained immediately on loading. About one-half of the creep was found to be plastic in nature in that it remained as an irrecoverable deformation, the remainder of the creep disappearing slowly after removal of the loads.

(*b*) The increase in deflection occurring under constant load increased the tendency of the beams to buckle laterally.

(*c*) The strength of the material under continuous loading was less than that under short-term loading. A number of beams failed at stresses as low as 45 per cent. of the short-term ultimate stress in periods of up to 18 months.

In addition to this work on beams, tests have been carried out on specimens subjected to compressive and tensile stresses. These tests were done under controlled conditions of temperature and humidity, as the deformations were so small in magnitude that changes in the dimensions of the wood with varying temperatures and moisture contents would have obscured the deformation due to creep. The total deformations occurring in 2 years in both green and dry material under compressive and tensile loads were between two and three times those which occurred when the loads were first applied. A considerable reduction in strength was again evident.

A further type of test which has been carried out is the shear test. Experiments conducted on hoop pine and mountain ash under constant shear stress showed a similar general behaviour to the tests already described. Increases in deformation of from one-and-a-half to two times occurred within 2 months, at a diminishing rate. Part of the creep deformation was irrecoverable and this portion was affected most by temperature.

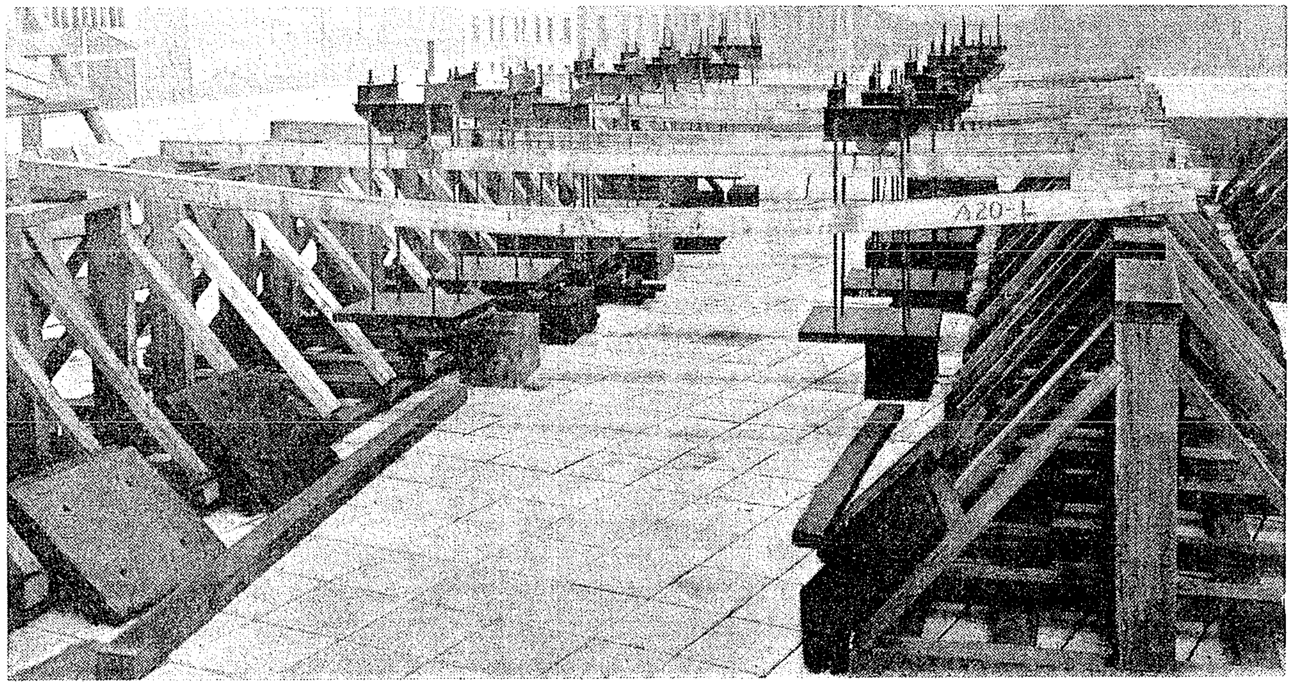
Temperature has a marked effect on creep, total deformation and rate of deformation increasing with increasing temperatures. This effect was evident from tests carried out under controlled conditions of temperature and humidity in shear and bending.

Beams tested out of doors showed marked increases in the rate of deformation during the summer, apparently due to increased temperature and the effect of direct solar radiation on the top surfaces of the beams. It is thus possible that in structural members loaded for long periods, excessive total deformation may ultimately result at stresses which appear satisfactory for a year or two. Tests have been commenced to study this aspect over periods approaching the economic life of timber structures.

As most of these tests have been on mountain ash, it was decided to carry out similar tests on a major structural species to determine if there were any difference in their creep properties. Accordingly, blackbutt was selected and similar tests on it have already been commenced.

Other experiments in progress are aimed at giving a better understanding of the mechanism of creep. Although the results may not be of direct practical value, they will serve to reduce testing time and the number of tests required to supply adequate information. It is hoped that they will also suggest measures to avoid, delay, or counteract the undesirable effects of creep.

Much research on creep in wood remains to be done but the knowledge already gained will help to bring about safer and more economical building practice.



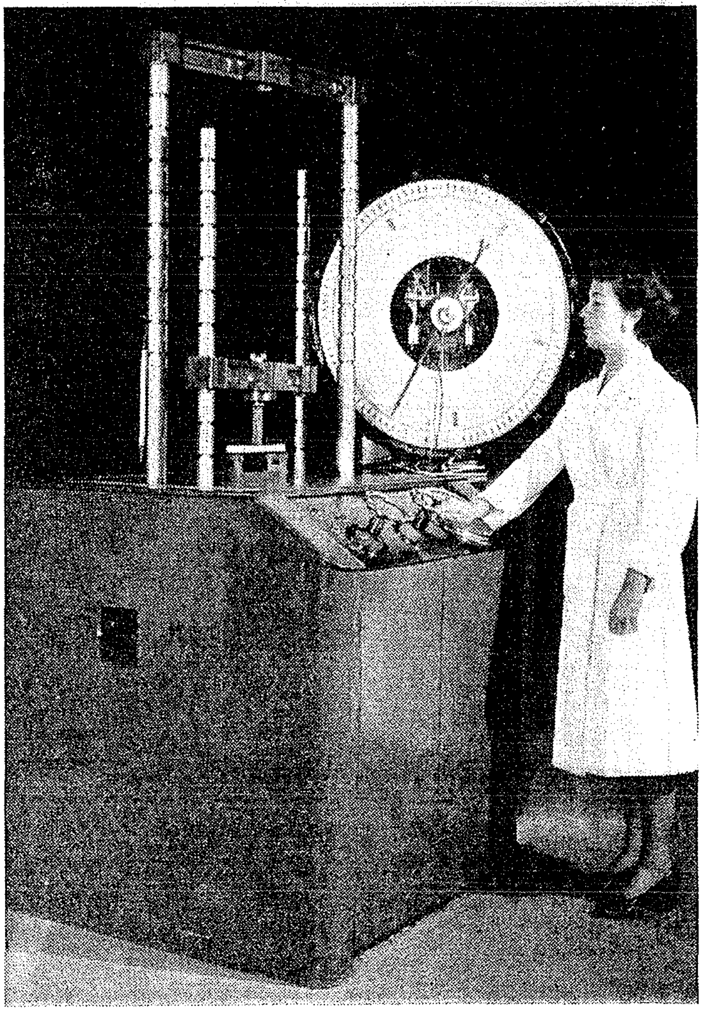
A group of beams under test. (The front beam is being allowed to recover.)

Interesting Equipment at the Division

500 lb Universal Testing Machine

To OBTAIN an understanding of the mechanical properties of a timber, it is necessary to subject it to a number of different types of test, such as bending, compression, tension, and shear tests, to mention a few. The loads required to break the specimens in these tests range from a few hundred to perhaps 20,000 or 30,000 lb. Generally such loads may be measured with acceptable accuracy in the better class of testing machine available on the market. Tests on small specimens of materials such as plywood, hardboard, and insulating board, however, require loads which may be only a few pounds or up to several hundred. Apart from the inconvenience of using a machine with a capacity of 60,000 lb to measure a load of say 60 lb, the higher-capacity machines are not capable of measuring such low loads with the necessary accuracy.

As a machine with the desirable characteristic of accuracy of load measurement at low values, and having adequate working area was not commercially available, the Division of Forest Products designed and built its own machine, illustrated here. It has a normal range of 0-500 lb, and this may be extended to 1000 lb if needed. Its working area is approximately 24 in. square, with a working height of up to 3 ft. Both the compression and tension heads may be hand-set at convenient testing positions, and the screw-driven loading head can apply the load over a distance of 12 in. at any selected testing speed within the range of from 1/200 in./min to $\frac{1}{2}$ in./min.



500 lb Universal Testing Machine.

The load-measuring system is a modified industrial-type platform scale coupled to a direct-reading dial graduated in $\frac{1}{2}$ lb increments. A maximum load indicator is fitted to the dial to provide a record of the maximum load reached during a test. The machine is sensitive to better than $\frac{1}{4}$ lb, and its accuracy is rated at $\pm\frac{1}{4}$ lb.

The machine has now been in use for $4\frac{1}{2}$ years for determining various properties of building boards, for nail holding tests, and bending tests on small specimens of wood, and has given very satisfactory service.

Preventing Kiln Heat Losses

A RECENT overseas study has shown that a forced circulation kiln without automatic vent control can release three to six times the minimum quantity of vent air required, and that compartment-type kilns without vent air control may consume twice as much steam as will maintain kilns with automatic vent control. These conclusions emphasize the importance of careful vent control by a kiln operator; for example, kiln operators should beware of too readily using the steam humidifying spray to hold humidity conditions. The golden rule is to resort to a spray only if the humidity conditions cannot be held after the dampers have been fully closed.

Timber Grading Conference in Sydney

A CONFERENCE on the selection and grading of timber was held in Sydney from February 27 to March 3. Special reference was made to the building timbers of New South Wales. The conference was sponsored by the Associated Sawmillers of New South Wales, the Forestry Commission of New South Wales, and the Division of Forest Products, C.S.I.R.O. The enrolments totalled 247, including sawmillers, timber merchants, timber inspectors, architects, builders, engineers, and wood technologists.

Seventeen addresses were given, some being followed by demonstrations of the application of grading rules to the hardwoods, brushwoods, and softwoods. Mr. E. L. S. Hudson, New South Wales Forestry Commissioner, discussed in the opening address the forestry resources and timber supply position in New South Wales. Mr. S. A. Clarke, Chief, Division of Forest Products, C.S.I.R.O., in the concluding address, dealt with the importance of proper utilization.

Mr. R. F. Turnbull, Officer-in-Charge, Utilization Section, Division of Forest Products, spoke on the pattern of timber utilization in Australia; trees, wood, and factors affecting quality; why and how timber is graded; timber specifications for dwellings; grades for hardwoods of south-eastern Australia; the grading of Monterey pine; and specifications for housing items. Mr. E. B. Huddleston, Chief, Division of Wood Technology, Forestry Commission, New South Wales, spoke on the occurrence and principal uses of New South Wales timbers; the preparation of specifications; grading of brushwoods and hardwoods of eastern Australia; and insect, fungi, and weathering control in building construction.

The subjects dealt with by Mr. G. W. Wright, Officer-in-Charge, Seasoning Section, Division of Forest Products, were the influence of moisture on the constructional uses of wood, and seasoning practices. Mr. H. E. Booth, Physics and Mechanics Officer, Division of Wood Technology, described methods of conversion and defect influence. Mr. F. F. Kraegen, Manager, Associated Country Sawmillers of New South Wales, discussed methods of marketing timber.

Throughout the conference attention was directed to the need for utilizing timber from New South Wales and other parts of Australia economically. Various Australian Standard grading rules and specifications published by the Standards Association of Australia were discussed in detail, and demonstrations given of their application in selecting timber for building and other purposes. They were shown to permit the sorting of industrial supplies of timber into grades suitable for specified uses, and to allow appropriate matching of the quality of timber with the requirements of service.

SCARF JOINTING OF VENEERS

A New Method for Better Utilization of Timber

THE SHORTAGE of peeler logs for production of plywood necessitates utmost economy in the utilization of timber available, and the increasing use of splicing equipment in Australian plywood mills shows that manufacturers are well aware of the fact that they must make maximum use of available resources.

A new method of effecting savings has been reported in Europe recently. This is the end scarfing of veneers. With suitable machinery and organization, labour costs of this process appear to be similar to the cost of splicing. Scarf jointing of veneers makes possible the use of materials coming from short bolts, round up off-cuts, and from peeled veneers found faulty in part of their length. Further particulars on current practice of this process can be obtained on application to the Chief, Division of Forest Products, C.S.I.R.O., 69-77 Yarra Bank Road, South Melbourne.

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1956##218

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NUMBER 218 MELBOURNE MAY 1956

Composite Timber-Concrete Construction

By R. G. PEARSON, Timber Mechanics Section

CONSIDERABLE success has been achieved overseas with a type of construction in which timber and concrete are bonded together to form a unified structural material. Essentially the construction is reinforced concrete, but instead of internal steel rods, the reinforcing is timber on the underside of the concrete.

Development of composite timber-concrete construction followed the preference for concrete floors and decks in such structures as warehouses, wharves, culverts, and road bridges. Concrete provides a smooth hard-wearing surface and readily withstands the high concentrated loads of modern mechanical equipment. However, it is heavy and expensive because of the extensive formwork required before it can be poured, and also because of the massive substructure needed to support its weight. Timber, on the other hand, is relatively light in weight, is easy to fabricate, rapidly damps out vibrations, and has high impact and tensile strength. Combining the two materials enables full advantage to be taken of the desirable characteristics of both materials; also, formwork is either eliminated or becomes very simple and relatively inexpensive. Furthermore, by keying the concrete deck to the supporting beams, the whole structure acts as a unit and a lighter and more efficient structure results. With preservative-treated timber, decay is virtually eliminated, and the life of the structure is limited only by obsolescence.

The usual type of composite timber-concrete structure comprises a timber sub-deck of preservative-treated planks on edge, spiked together side by side. The concrete deck is poured directly on the timber, thus obviating formwork. Alternate planks are of different widths, or are set at different heights, so that the sub-deck presents a grooved appearance, as shown in the illustration on page 2. Trapezoidal steel plates $\frac{3}{32}$ in. thick are driven into slots cut in the timber sub-deck at spacings calculated from the design shear stresses. The steel plates, called "shear developers", and spikes which also are driven into the deck at intervals, are embedded in the concrete layer and prevent relative movement between the two materials. The illustration shows a typical arrangement of spikes and shear developers in a sub-deck. Light reinforcing is added to take care of temperature and shrinkage stresses.

This type of structure is limited in overall thickness (and hence span) by the maximum width of plank available. Usually the total thickness is under 15 in. and the span under 30 ft. However, this limitation is not serious for many purposes for which composite timber-concrete construction is well suited, such as short-span road bridges, warehouse and mill floors, wharves, and sun decks.

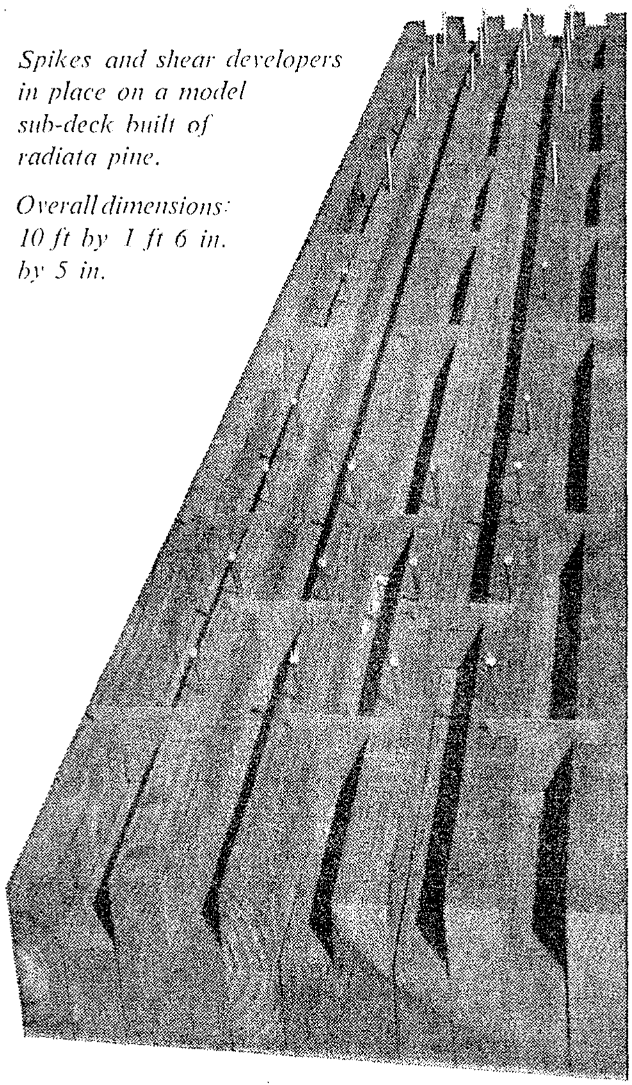
Numerous composite timber-concrete structures have been built. In the U.S.A., for example, Oregon State Highway Department began building composite timber-concrete road bridges in 1932, and by 1940 had built nearly 160 bridges of a total length of over 19,000 ft. The Department stated that the composite structure was in many cases more economical than the equivalent reinforced concrete one. Although the initial cost was more than that of the untreated timber trestle bridge, the composite structure was often preferred for medium and heavy traffic areas, owing to its lower maintenance and capitalized annual costs, superior deck surface, and better appearance.

An alternative to the sawn plank sub-deck is the use of round logs. Usually the logs are spaced several feet apart, but for long spans or heavy loads they may be in pairs, each pair comprising one log on top of the other. Formwork need be no more than wire mesh and building paper spread over the logs.

A very satisfactory structure should be possible with small logs, such as plantation thinnings, placed side by side. Such logs can be readily impregnated with preservatives, and so may enable a long life, high-class bridge to be built economically in certain localities.

At present some tests are being carried out at the Division of Forest Products on composite timber-concrete beams, using small round logs to determine suitable means of keying the concrete to the logs.

Considerable scope appears to exist for the development in Australia of composite timber-concrete construction. Enough experience has been gained overseas with the plank sub-deck type of structure for adequate design procedures to be established so that composite structures can be built with confidence.



Spikes and shear developers in place on a model sub-deck built of radiata pine.

Overall dimensions: 10 ft by 1 ft 6 in. by 5 in.

Forest Products Research Conference

The Eighth Forest Products Research Conference was held in Melbourne at the Division's laboratories from April 9 to 13.

The Conference was attended by representatives of all the State forest departments, the New Guinea Department of Forests, the Forestry and Timber Bureau, the New Zealand Forest Service, and the Division of Entomology, C.S.I.R.O., as well as by officers of the Division of Forest Products.

Two overseas visitors to the Division attended the Conference as guest delegates. They were Mr. R. Cortes, Head of the Timber Physics Section of the Philippines Forest Products Laboratory, and U Yin Pe, an officer of the Burmese Forest Department.

The discussions assumed a greater significance this year, owing to the fact that Australia will be the host country to the British Commonwealth Forestry Conference next year, and that the Forest Products Pre-Conference is to be held in Melbourne.

Training of Overseas Research Workers

DURING THE past 8 years 20 forest products research workers from other countries have come to the Division of Forest Products for training, or to widen their experience in forest products research. Most of these have come from Asian countries, usually under Colombo Plan or F.A.O. Fellowships, and in addition to one New Zealander and one American who were referred to in News-letter No. 205, two New Zealanders have made more recent visits.

Dr. R. Mirams, a wood technologist on the staff of New Zealand Forest Products Limited, spent from August 1955 to February 1956, widening his general background of forest products work. Mr. N. C. Clifton of New Zealand, who is studying the new Forest Technology Course at the Australian Forestry School, Canberra, spent January and February of this year at the Division, getting forest products research experience required for that course, and will be returning to the Division for further experience later in the year.

At the end of March two Colombo Plan Fellows completed their period with the Division. Mr. M. Husain, Assistant Engineer of Pakistan Railways, who is in Australia studying local use of timber in railway tracks, arrived at the beginning of December 1955, and has concentrated on the preservative treatment of railway sleepers and other railway compartment timbers. Mr. H. S. Martyn, a forest officer from North Borneo, is in Australia studying selected subjects at the Australian Forestry School, Canberra, and getting other related experience. He spent January to March this year at the Division gaining laboratory experience in several branches of forest products work.

At present with the Division are two other Colombo Plan Fellows, U Yin Pe, an officer of the Forest Department of Burma, who arrived in November 1955, and Mr. R. T. Cortes, Officer-in-Charge of the Timber Physics Section of the newly constituted Forest Products Laboratory of the Philippines, who arrived towards the end of March this year. Both are here for a twelve months' period, U Yin Pe to study veneer and plywood production, and Mr. Cortes to study the Australian approach to timber seasoning and investigation of the plywood properties of timber.

Seasoning Course for Perth

AT THE request of the Associated Sawmillers and Timber Merchants of Western Australia, the Division will conduct a five-day course in seasoning and kiln operation in Perth, during May this year.

Two highly successful seasoning courses were held during 1955 in Tumut (N.S.W.), and Adelaide, and the Perth course will provide an opportunity for Western Australians to become familiar with the latest practice in this important field.

As the dates for the course have not been finalized at the time of going to press, persons interested are advised to contact the Associated Sawmillers office in Manufacturers' Building, 29 Barrack Street, Perth, W.A.

OVERSEAS VISIT

MR. W. E. HILLIS, a Senior Research Officer of the Wood and Fibre Structure Section of the Division, left Melbourne on March 21 for 6 months to visit and carry out work in overseas laboratories engaged in activities allied to his. The bulk of his time will be spent in England, but he will also visit the Continent, and on his return journey will spend 3 weeks in U.S.A. and Canada, and 2 weeks in Japan.

Mr. Hillis's main investigations are in connexion with tannins and other extractives of wood.

DONATIONS

THE following donations were received by the Division during March:

Todd and Kerle Pty. Ltd., East Oakleigh, Vic.	£25 0 0
Criterion Construction Co., Dubbo, N.S.W.	£3 3 0
Burwood Timber Mills Pty. Ltd., Springvale, Vic.	£20 0 0
Burnie Board and Timber Pty. Ltd., Tas.	£100 0 0

A New Use for Round Poles

TRAVELLERS on the Hume Highway between Melbourne and Albury cannot fail to be impressed by the gigantic screen of the Skyline drive-in theatre near Wodonga.

One of the most interesting features of this screen is the use of large round poles for the supporting structure.

The screen, of hardboard on a timber frame, is roughly 84 ft wide by 38 ft high. It is supported by 6 poles rising 65 ft clear of the ground, and braced by 6 shorter buttress poles. The poles, of a durable species, came from the north coast of New South Wales.

The architects gave the following reasons for choosing the pole structure:

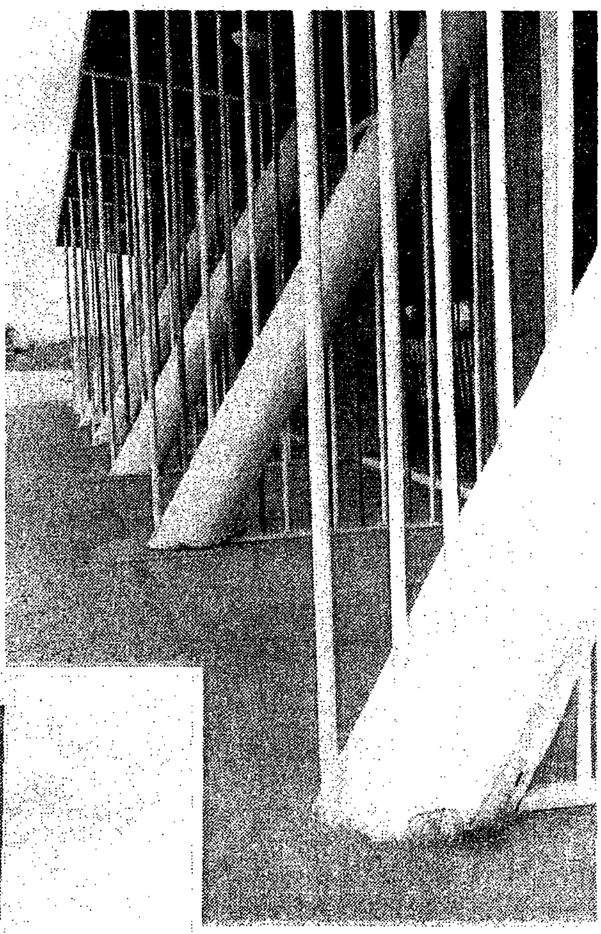
(*a*) The poles give a "cleaner" structure than a braced steel frame.

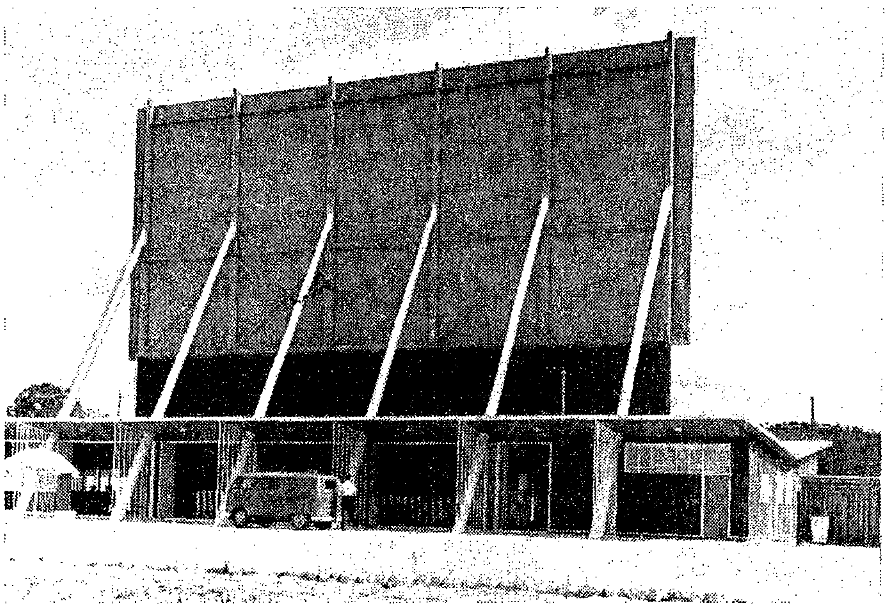
(*b*) The cost of the structure was about 15 per cent. less than that of a steel frame.

(*c*) Poles were available at a nearby depot at the time.

The tops of the poles and exposed timber of the screen have been painted dark brown, while the bases of the poles have been painted white to emphasize their position in the restaurant built beneath the screen. This building is mainly lined and covered with vertical cypress pine (*Callitris* sp.) boards, dressed and clear finished.

Round messmate stringybark (*Eucalyptus obliqua*) poles have been used by the architects for the screen at another drive-in theatre at Ballarat, Victoria, for the same owners.





Two views of the round poles supporting the structure of the Skyline drive-in theatre near Wodonga, Vic.

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C.S.I.R.O.

Forest Products Newsletter

1956##219

Registered in Australia for transmission by post as a periodical

NUMBER 219 MELBOURNE JUNE 1956

A Precision Frame Gang Saw Built in a Sawmill

AFTER breaking logs down on the twin circular machine it is usual to square the flitches up with facing cuts on the No. 1 bench before cutting out boards. This practice is wasteful and reduces the recovery obtained by the mill. Further, when stresses that cause spring are present in logs, the method of sawing practised with the twin circular and No. 1 combination is not entirely satisfactory, and waste occurs due to curvature in the material being sawn. In order to eliminate both these sources of waste and to improve the efficiency of the mill, a frame gang machine for breaking down logs was constructed by Ezard and Sons, of Swift's Creek, Victoria. The machine was constructed in the mill maintenance shop at Swift's Creek, and as this locality is remote from centres in which engineering facilities exist, the construction of this machine was an outstanding achievement.

The sawmill consists of three machines, the frame gang saw, a No. 1 breast bench, and a small table bench. Logs of alpine ash (*Eucalyptus gigantea*)—locally called woollybutt—come into the mill in long lengths and are hand barked in the log yard. Log diameters range from about 12 in. up to 4 ft, although an occasional butt end is greater than 4 ft across. The logs are cross-cut to lengths that suit the shape and curvature of the log, but the maximum length allowable is 20 ft. Log curvature causes very little difficulty in sawing. Cross-cut logs are fed to the frame saw without sorting for diameter. Two planks 2 in. thick (occasionally 1½ in.) are cut from the centre of the logs, and 6 in. flitches and side slabs are cut from outside the planks. The 2 in. material is transported to another mill where it is cut to width and small dimension material recovered, while the 6 in. flitches and side slabs are ripped into boards on the No. 1 bench. The small table bench is used only to prepare waste from the No. 1 for boiler fuel.

The frame gang machine (see Fig. 1, page 2) is fabricated of welded steel plate and has a sash width of 4 ft. The usual operating speed is 160 strokes/min (a stroke being the motion produced by a complete revolution of the crankshaft), and the feed speed is generally about 3 ft/min, but can be increased up to about 14 ft/min.

The reciprocating sash is supported on four rollers mounted on ball bearings and running in vertical channels. Each roller is automatically lubricated. Two connecting rods, one on either side, drive the sash. An interesting feature about the sash is that it has an oscillating motion, i.e. it comes forward into the cut on the down-stroke and backs away from the cut on the up-stroke.

The saw blades are mounted between the top and bottom cross beams of the sash by

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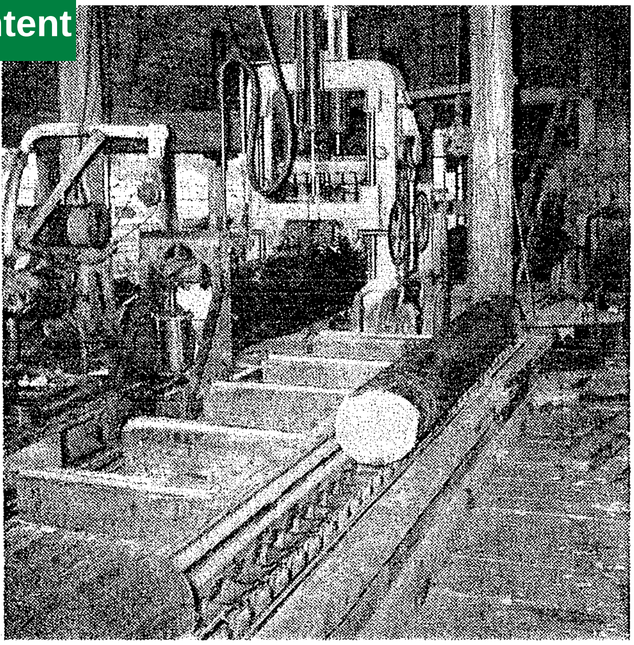


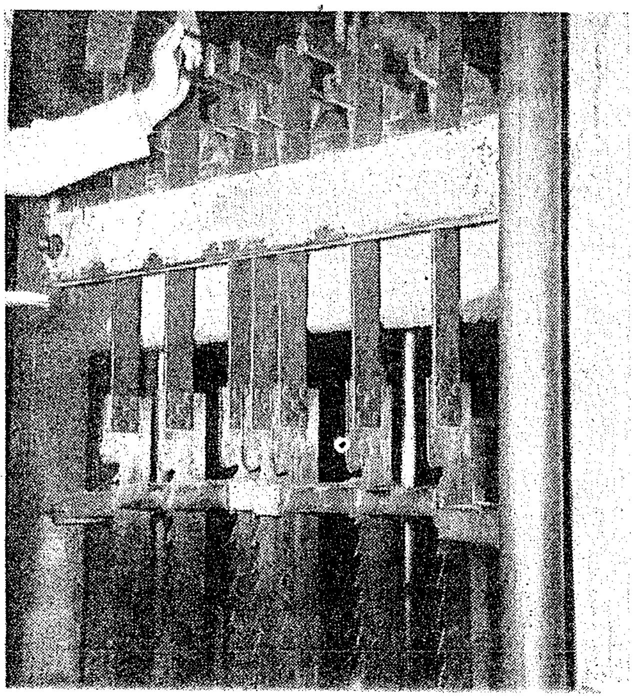
Fig. 1

using hangers riveted to the blades, and the blades are tensioned by driving wedges between the top hanger and a specially designed spring-loaded support (see Fig. 2). When inserted the blades are virtually spring-loaded, and therefore do not loosen during service. The blade spacings are fixed irrespective of log diameter, there being three blades in the centre at 2 in. spacings (occasionally 1½ in.), and two blades on either side of these at 6 in. spacings. The blades are spaced by inserting blocks between them at the top and bottom of the sash, as shown in Figure 2. The 6 in. blocks are steel and the 2 in. blocks aluminium, and they are hung on a cross-bar so that they remain conveniently in position when the blades are removed. The spacing blocks are tightened up by side tension bolts.

The blades used in this machine are 7 ft long by 6 in. wide by 13 gauge, and the teeth are swage set to approximately 8 gauge (0·035 in. on either side of tooth). Experience has shown that the best hook angle is 17°. For good swaging the sharpness angle must be as near as possible to 44°, so the clearance angle becomes about 29°. The blades are rolled similarly to bandsaw blades to eliminate "snaking" in the cut, and are sharpened on an automatic machine with a 19A 46 MV stone. Harder stones produce burning. New blades are inserted every 4 hr.

The feed mechanism of the frame saw consists of two pairs of fluted feed rollers, an infeed pair and an outfeed pair. The top roller of each pair can be pneumatically raised or lowered, and is used to apply downward pressure on the log during cutting. All four feed rollers are powered and the feed is continuous. In front of the bottom infeed roller is a 10 in. diameter two-knife planing head, to cut a narrow flat surface on the bottom of each log before it enters the saw. The cutter knives are changed each day and are sharpened on an automatic machine. Figure 3 is a close-up view of the top and bottom infeed rollers and also shows the planing head.

Fig. 2



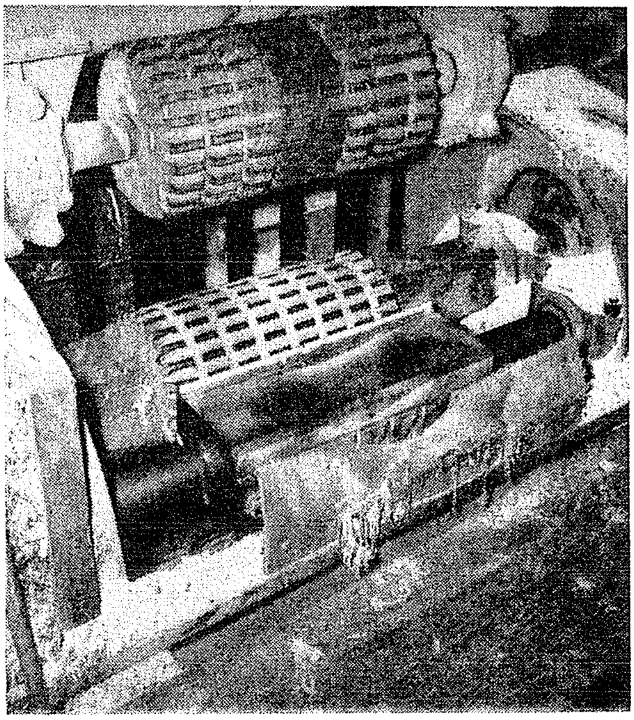


Fig. 3

(*This commentary by Mr. D. S. Jones, Utilization Section, will be concluded in the next issue of the Newsletter.*—Ed.)

Keruing

KERUING is the vernacular name used in Malaya, North Borneo, and Sarawak for both the trees and timber of the genus *Dipterocarpus*.

Distribution

There are many species of this genus widely distributed throughout Malaya and surrounding countries, but many individual species are rare. Other timbers that are the same or essentially similar to keruing are: apitong and bagac (Philippines), gurjun and eng (Burma and India), hora (Ceylon), yang Thailand) and keroeing (Indonesia).

Habitat

This genus is found over a wide range of soil conditions; some species grow in lowlying forest, while others are ridge forms growing at elevations up to 4000 ft above sea level. Mature trees usually attain a height of approximately 150 ft, often with more than 100 ft of straight cylindrical bole before the first branches. Girths of about 12 ft are common, the largest recorded so far being 26 ft 8 in. The bark is usually about an inch thick, brittle, and coloured grey to light brown.

Timber

Although the details of the structure of the timber of the different species grouped under the name keruing are so much alike that it is impracticable to distinguish them, between some species there are big differences in weight, strength, natural durability, and resin content. It would be possible to divide keruing into light, heavy, and medium weight groups, but there has been no demand commercially for this type of segregation, which would in any case be extremely difficult to arrange in practice. Requests are sometimes made for the more resinous species to be excluded.

The timber is moderately hard to hard, and moderately heavy to heavy, the average weight at 12 per cent. moisture content ranging from 40 to 57 lb per cu. ft., but the average for a commercial consignment of this timber would be about 46 lb. Grain is usually straight, an uncommon feature in tropical woods. Texture is rather coarse but even. The sapwood, when freshly cut, has an outer cream coloured zone, and an inner zone of purple-red brown; when dry the colour is grey-brown or purple-brown, and is generally distinguishable from the heartwood. The heartwood varies with the species from a light red to a dark brown, or more commonly a dark purple-red; the colour darkens on exposure. The timber is featureless except for an occasional "ribbon stripe".

Keruing can be obtained in large sizes in which knots are extremely rare, and brittle heart, cross-breaks, and borer holes are usually absent.

Seasoning

The timber shrinks considerably while seasoning, but provided care is taken when air seasoning to ensure that the boards are stacked correctly under cover, and a suitable end coating applied, serious degrade may be avoided. Shrinkage from green to 12 per cent. moisture content is of the order of 4·5 per cent. radially, and 8·5 per cent. tangentially.

There is considerable variation in the resistance of keruing to sawing, both between the species and even within the species, but generally speaking there is no serious difficulty in converting this timber. The wood works readily, but owing to its fibrous nature it usually requires considerable sanding to produce a good finish; for this reason it is not suitable for turning. Grain must be filled before varnishing or finishing. Keruing, containing relatively large amounts of resin, will hold paints well, provided four coats are applied with a good quality finishing coat.

Although there is a considerable variation in the resistance of the heartwood of different species to attack by fungus and termites, the most resistant of the species can only be classified in Australia as moderately durable, which class includes blackbutt (*Eucalyptus pilularis*) and spotted gum (*E. maculata*). No figures are available for Australian conditions, but in Malaya untreated keruing in contact with the ground can only be expected to last 2-5 years. In reasonably well ventilated positions not in contact with the ground, the heartwood will remain sound for several decades in the absence of termite attack. The sapwood is very rarely attacked by *Lyctus*, even in Malaya. Fortunately, keruing absorbs preservatives readily, and for most purposes adequate protection can be given by the open tank process.

The wood of some species contains a substantial volume of oleo-resin which is collected from the growing tree by cutting notches in it, and which is used for medicines and caulking of boats.

Uses

Keruing is a general purpose constructional timber and is used mainly for beams, joists, rafters, partitions, flooring, bridges and wharves (treated), poles and sleepers (treated), automobile framing, and boxes.

Additional or more detailed information regarding this species may be obtained from the Chief, Division of Forest Products, C.S.I.R.O., 69-77 Yarra Bank Road, South Melbourne.

Sorption Symposium

From May 14 to 16, the Division of Forest Products arranged an inter-Divisional Symposium on "The Sorption of Water by Porous Materials".

The inter-relation of wood and water is one of the most important aspects of wood technology, and the study of the many phases of this relationship, e.g. in growth, seasoning, and dimensional changes, forms a considerable part of the Division's research programme.

About fifty officers from different C.S.I.R.O. laboratories who are concerned in various ways with the retention of water in their particular products, met to exchange information and discuss common problems, and it is hoped that this will assist all the officers concerned, and lead to closer co-operation between the Divisions.

Dr. A. J. Stamm returning to U.S.A.

At the end of May, Dr. A. J. Stamm, Subject Matter Specialist on the staff of the U.S. Forest Products Laboratory, Madison, Wisconsin, completed a nine months' term as a Senior Fulbright Fellow at the Division of Forest Products.

A research worker of world-wide reputation, Dr. Stamm's stay in Australia has been of great value to his colleagues in the Division, and to research workers in industry, particularly in the field of paper chemistry.

During his stay Dr. Stamm carried out research work on the dimensional stability of paper and has written up his results for publication in A.P.P.I.T.A. proceedings.

MANGROVE TANNIN ADHESIVES

Since early 1955 this Division has been working with the Division of Industrial Chemistry in an endeavour to develop mangrove tannin extracts as plywood adhesives, and encouraging results have been obtained. In one series of experiments chemicals were added, and one of the most promising of these was commercial polyvinyl acetate, which in small proportions gave appreciable improvement to both dry and wet strengths.

Corrigendum

C.S.I.R.O. FOREST PRODUCTS NEWSLETTER

Number 215, February 1956

Page 5, Column 1: *In line 2 under "Details of Teeth for Cross-cutting", for* (mesh) *read* (max.).

DONATION

The following donation was received by the Division during April:

Burnie Board and Timber Pty. Ltd., Tas. £500 0 0

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C.S.I.R.O.

Forest Products Newsletter

1956##220 Registered in Australia for transmission by post as a periodical

NUMBER 220 MELBOURNE JULY 1956

Plywood Research in Australia

FOR SOME years past the Veneer and Gluing Section of the Division has been steadily declining. This has been due partly to transfers of staff to meet losses in other Sections of the Division, and partly to resignations. The position reached a climax with the departure of the Officer-in-Charge of the Section, Mr. Alan Gordon, to take up a post in New Zealand.

The Section is a well equipped one, and with other Sections of the Division has made a number of important contributions to the plywood industry. Two in particular might be mentioned; the design of veneer kilns, and the momentary dip treatment with boron compounds. It would have been a pity, therefore, if the Section had been allowed to die.

Over the last twelve months plywood research has been under discussion with the Australian Plywood Board. The possibility of setting up a Research Association on the one hand, or of restoring our Veneer and Gluing Section on the other, has been investigated.

At its meeting in Sydney last month the Australian Plywood Board agreed to make a grant of £8,000 per annum towards the funds of the Division to enable plywood investigations to proceed. The Board was no doubt influenced in reaching this decision by the fact that contributions towards plywood problems have come from all Sections of the Division, and to meet all aspects of plywood work a new Research Association, if formed, would have to duplicate many of the personnel and much of the equipment in the Division. The grant will be reviewed annually.

To assist in liaison between the Division and the Board a small technical committee of the Board has been set up. This technical committee will keep in touch with the Division's work, will make suggestions for lines of investigation, and will help to ensure the practical application of the results of research.

Probably one of the most pleasant features of the discussions between the Board and the Division has been the many appreciative remarks which have been made by the industry regarding the help it has received from the Division. A long and profitable association between the Division and the plywood industry is thus assured. The example of the plywood industry might well be followed by other branches of the wood-using industries of Australia.

A Precision Frame Gang Saw Built in a Sawmill. II

LOGS are fed into the machine using two rail-mounted trolleys. The front trolley carries the leading end of the log. A tail trolley, shown in Figure 4, is cable driven by an air motor and has air-operated dogs to grasp the end of the log and hold it firmly while the log is advanced over the planer and towards the saw. Logs are transferred from the log haul chain onto the two trolleys by an air-operated winch, and this winch is also used to rotate logs into the best cutting position (see Figs. 1 and 4). Just as the front of the log approaches the saw blades at the beginning of each cut, the front top feed roller is lowered and pressure is applied, and as soon as the front of the log is far enough out of the saw, pressure is also applied to the log with the back top feed roller. Logs are sawn with the wide end first so that short waste side slabs can be removed early in the cutting cycle. The occasional butt wider than 4 ft is cut down with the axe. Figure 5 shows a log nearly sawn. The front top feed roller has already been raised ready to receive the next log. The flat surface cut on the bottom of the log by the planer is shown.

Immediately the front of the log emerges from the machine the pieces are chained together. Behind the saw the log is first supported on cross-rails moving on a chain, and about 10 ft from the saw is a pair of vertical rollers that pneumatically press the sawn pieces together, and give added lateral

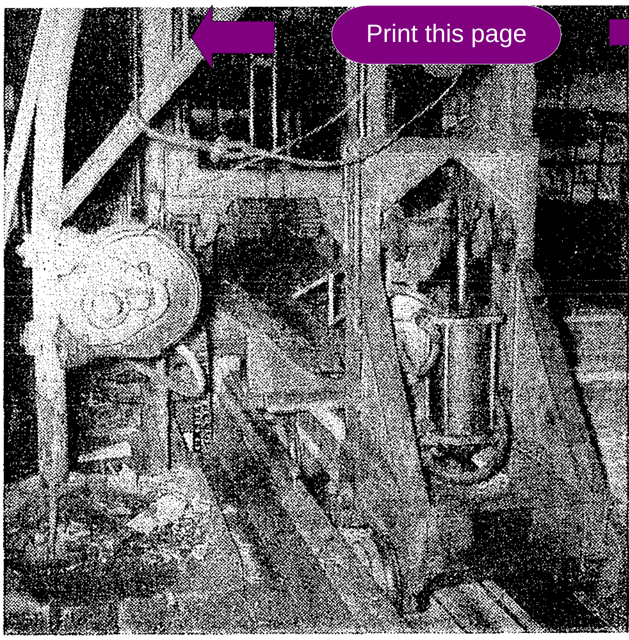


Fig. 4

support during the latter part of the cut. When the tail of the log leaves the back feed rollers, the vertical rollers are released and the sawn log, held together only by a chain at the front end, moves forward away from the machine, first on the moving cross-rails, and then on powered rollers (see Fig. 6).

The machine is steam driven by a 120 h.p. engine, and compressed air for the auxiliary equipment is supplied by a compressor driven by a separate steam engine.

Points of particular interest with this frame gang machine are:

- The connecting rods, mounted on either side of the sash, eliminate the large stresses set up when a single connecting rod is pivoted at the centre of the bottom cross-beam of the sash.
- The preparation of a flat bottom on the logs satisfactorily achieves cutting stability for logs of all sizes.
- Spring-mounting the blades is a unique

Fig. 5

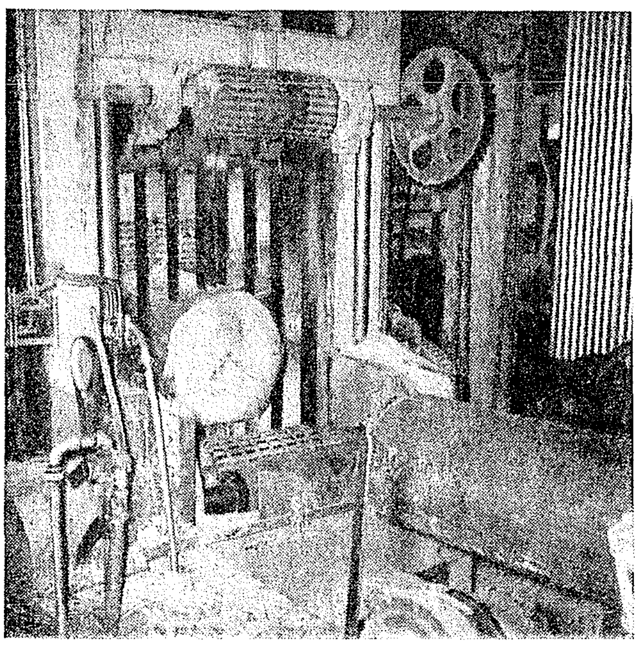
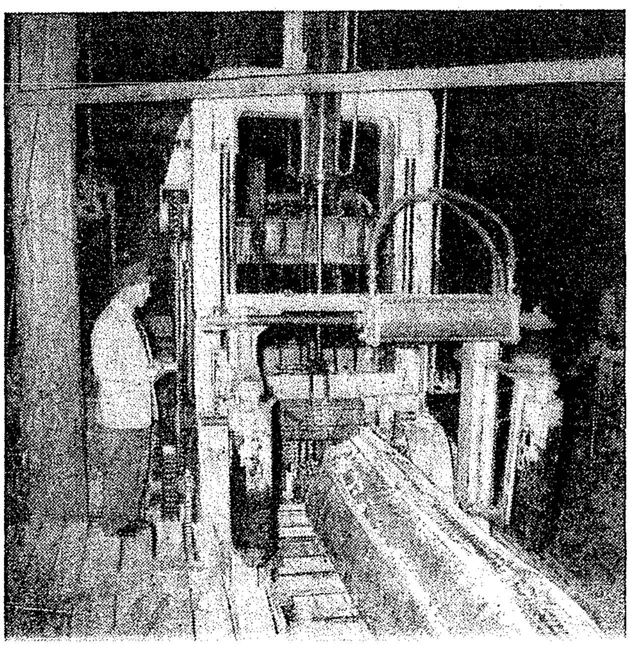


Fig. 6



idea, and solves the problem of the blades loosening and having to be re-tensioned during a shift.

- The simple idea of hanging the spacing blocks on cross-bars is an excellent labour and time saver.
- The oscillating motion of the sash is an elaborate method of providing clearance to the blades during their upward motion.
- Compressed air is used liberally for driving auxiliary equipment.

The sawmill in which this machine operates is producing 250-280,000 super ft of sawn timber per month, and attains an average recovery of 75 per cent. based on log hoppus volume, or 59 per cent. based on true log volume. This is a good recovery compared with other Australian hardwood sawmills, and indicates that when the frame saw can be used in place of the twin circular, at least two significant sources of waste in the Australian industry are eliminated.

(*This commentary was prepared by D. S. Jones, Utilization Section.*)

The Drying of Keruing (*Dipterocarpus* spp.)

By G. S. CAMPBELL, Seasoning Section

KERUING is one of the most common timbers of the Malayan Peninsula, and considerable quantities are imported annually into Australia.* Other timbers similar to keruing are: apitong and bagac from the Philippines, gurjun and eng from Burma and India, hora from Ceylon, and yang from Thailand.

Literature available on the seasoning of this species indicates that unless precautions are taken, particularly in the initial stages of drying, severe surface checking and end splitting are likely to occur. The timber is also described as prone to warping. The Forest Products Research Laboratory, Princes Risborough, England, recommends that keruing up to 1½ in. thick be dried under low temperatures and high relative humidities, until the moisture content has fallen below 30 per cent. The Malayan Forest Service reports that the timber shrinks considerably, that it should be properly stacked, and that the ends of boards be given suitable protective coatings. The shrinkage figures published in Malaya for drying from the green to an air dry condition (presumably 18 per cent.) are 3-3·5 per cent. radially, and 6-7 per cent. tangentially. When stacked under cover, the following are the approximate periods in Malaya for air drying from the green to equilibrium moisture content.

1-in. thick boards	3 months
1½-in. ,, ,,	3-5 months
2-in. ,, ,,	6-8 months
4-in. ,, planks	12 months

* A species description of keruing was given in last month's Newsletter.

The following schedule is tentatively recommended for drying 1-in. thick mixed sawn keruing.

Moisture Content Change Points (%)	Dry-bulb Temperature (°F)	Wet-bulb Depression (°F)	Relative Humidity (%)
Green	120	5	85
60	120	7	79
40	130	10	73
35	130	15	62
30	140	20	54
25	150	25	48
20 to final m.c. (12%)	160	30	43
At the final m.c. for 24 hr	180	10	79

Some limited experimental work carried out in this Division's kilns indicated that the schedule for red meranti, published in Newsletter No. 210, would be suitable for the drying of keruing. Timber with an initial moisture content of 43 per cent. took some 10 days (24 hr. per day) to kiln dry to 12 per cent. under this schedule. The dried condition of the timber was good, and although moisture gradients were occasionally steep after kiln drying, they were much improved by a final conditioning treatment. In one partly air dried run, some 4 days were required to kiln dry from a moisture content of 23 per cent. to 12 per cent.

It is reported that in Malaya keruing had not been exploited in the past because of its resinous nature, and because of slight difficulties with sawing. Evidence of the former was noted in test material and in a commercial charge, the resin exuding from the timber after standing in the sun for a few days on removal from the kiln. Appreciable resin exudation occurred during the final high humidity treatment of the laboratory runs, and it is suggested that such a treatment, or a short steaming treatment at saturated conditions, will bring sufficient resin to the surface during treatment to minimize risk of subsequent bleeding.

New Survey to Measure Moisture Content of Timber in Use

By R. FINIGHAN, Seasoning Section

IT IS very desirable that timber used in joinery, cabinet making, and for many other purposes, should not swell or shrink after manufacture, but as every craftsman knows, it is impossible to prevent such movement completely. Movement or "working" of wood, however, can be kept to a minimum by seasoning it to a moisture content suitable for the conditions under which it will be used.

The Division of Forest Products has some information on suitable moisture contents for indoor and protected outdoor positions for various timbers in different localities, but it is felt that a more detailed study is now necessary to cover most of the major timber uses.

As a consequence, work on this study has been commenced and permission obtained from several Government, semi-Government, and private bodies, to set up moisture measuring points in various timber structures and installations.

One section of this project is being carried out in cooperation with the Victorian Housing Commission, on its estate at Broadmeadows. Test points have been installed in eight of the dwellings on this estate. Four weatherboard and four brick veneer houses have been selected, the test points being installed in roof timbers, walls, and floors.

This survey will continue for about 2 years, and should give useful information on the conditions existing in this type of structure. Other structures now under test include bridges, piers, piles, poles, agricultural implements, and harbour installations.

Any suggestions for extensions to the survey would be welcomed by the Division.

DONATIONS

THE following donations were received by the Division during May:

Commonwealth New Guinea Timbers Ltd., Bulolo, New Guinea	£500 0 0
N.Z. Forest Products Ltd., Auckland, N.Z.	£125 0 0
State Electricity Commission, Vic.	£100 0 0
The Tasmanian Timber Association, Launceston, Tas.	£52 10 0
The Victorian Sawmillers' Association (Red Gum Section)	£100 0 0
The Associated Sawmillers and Timber Merchants of Western Australia	£100 0 0

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C.S.I.R.O.

Forest Products Newsletter

1956##221

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NUMBER 221 MELBOURNE AUGUST 1956

Current Research on Collapse*

By W. G. KAUMAN, Seasoning Section

"COLLAPSE" was first recognized by the pioneer of timber seasoning research, Harry D. Tiemann, in 1913. There are two approaches open for investigations of this phenomenon: examination of the collapse-inducing forces in their relation to the wood structure and to externally imposed physical variables, and study of the physical and chemical reaction of the wood substance to these forces.

Most workers today accept Tiemann's theory, proposed in 1915, that collapse is primarily induced by liquid-tension forces acting in the "free" water in completely filled fibres. This theory is at present being studied by experiments designed to vary the surface tension of the "free" water by using wetting agents or replacing water with other liquids. In another series of tests attempts are being made to vary the number of so-called "nuclei" or minute gas bubbles in the "free" water. One method consists of soaking specimens in air-free water, and then subjecting them to high pressures before drying.

Although drying stresses probably do not account for the primary collapse-inducing forces, they undoubtedly play a large part in determining collapse intensity. This has been investigated by cutting specimens of rectangular cross section with the long dimension alternatively in the tangential, radial, and longitudinal direction. It has been proved that "case-hardening" due to severe moisture gradients will reduce collapse in the width of rectangular samples because of its stiffening action. On the other hand, collapse is accentuated in thickness (away from the edges) under most drying conditions, irrespective of the direction of sawing.

The intensity of collapse under given external conditions depends, however, largely on the reaction of the wood substance. A recent experiment on the influence of temperature, humidity, drying time, and some minor variables, has shown that collapse intensity in mountain ash increases linearly with the temperature during drying, and is also affected by the length of drying time and the stress condition. Relative humidity in itself was of only minor importance.

High temperatures applied to moist wood prior to drying have been found to cause degradation and increase collapse during subsequent seasoning. The exposure time is important: a high temperature for a short time may not cause as much damage as a

* Collapse is an abnormal type of shrinkage due to caving-in of cell cavities during drying above fibre saturation point.

lower one for a longer time. Experiments are proceeding to investigate the reasons for this behaviour; preliminary results show that by chemically extracting certain cell wall constituents, normal wood can be made to approach tension wood in its composition and in its gross shrinkage during drying. Whether this change in behaviour is a direct consequence of the extraction, or of other effects such as breaking of chemical bonds or blocking of minute capillaries, remains to be seen.

The current research work is aimed ultimately to establish whether a method exists to prevent collapse from occurring altogether during drying.

In the absence of a method for preventing collapse, a prediction of collapse intensity in individual logs prior to drying would be most valuable. One method which has recently been successfully tested involves drying segments of logs, thus obtaining an indication of expected collapse behaviour from pith to bark (see Newsletter No. 216).

Research results are constantly being applied to practical timber seasoning and have been instrumental, for instance, in the development of the predrier and of low temperature veneer drying schedules with low wet-bulb temperature, designed to keep collapse to a minimum (Newsletter No. 182). Better understanding of the physical and chemical basis of collapse behaviour will undoubtedly result in progressive improvement of methods for the treatment of collapse-susceptible timber.

Western Australian Timber Seasoning Course

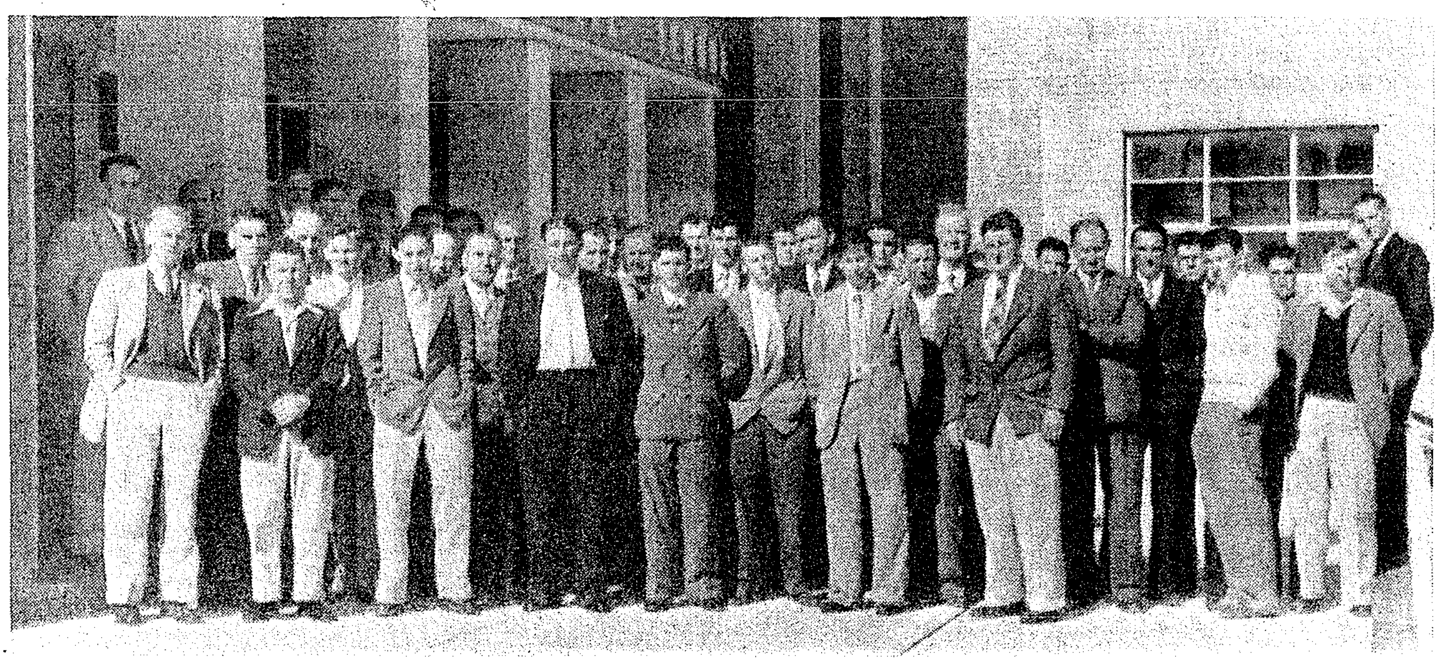
DESCRIBED by Mr. G. M. Bunning, acting president of the Associated Sawmillers and Timber Merchants of Western Australia, as a "course which will have far-reaching effects for the timber industry in Western Australia", a timber seasoning course of a week's duration was completed in Perth on May 18. It was planned in conjunction with the Association as part of a cooperative programme to improve technical standards and increase efficiency in the industry.

The course was attended by some 37 full-time and 20 part-time delegates from all levels of the Western Australian timber industry.

Among firms represented were: The Australian Lumber Co.; Bunning Bros.; Westralian Plywoods; Douglas Jones & Co.; Hearn Bros. and Stead; Millars Timber and Trading Co.; State Saw Mills; Swan Timber Co.; and Whittaker Bros.; all of whom had several members represented. Also attending were representatives of Government authorities from the Forests Department, the Technical Educational Branch, the Teachers' Training College, and the Manual Training Department.

Plant visits to Messrs. Bunning Bros. and Whittaker Bros. proved a valuable part of the course.

Delegates attending the Perth Timber Seasoning Course.



Pressure-treated Timber for Olympic Cycling Track

THE CYCLING track being built in Melbourne for the Olympic Games is notable for the novel and extensive use of timber in its construction.

The deck, which will be covered with a concrete or bitumen running surface, is laminated from 4 by 2 in. N.Z. *Pinus radiata*, laid on edge. This timber was pressure-treated in New Zealand with a water-borne preservative, and it represents the first major use of pressure-treated sawn timber in Australia.

Two hundred thousand lineal ft of 4 by 2 in. pine are being used in the deck, the laminations being fastened by nailing with staggered joints in adjacent members.

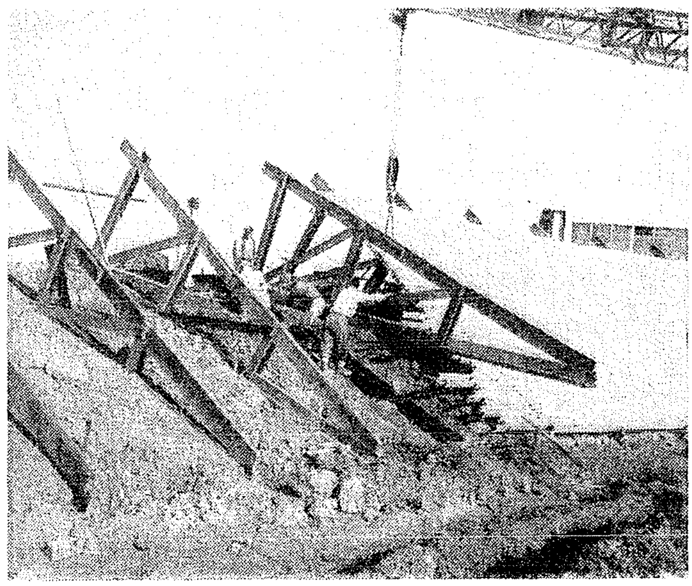
The deck is supported at about 8 ft centres by heavy hardwood frames, fastened with bolts and split-ring connectors.

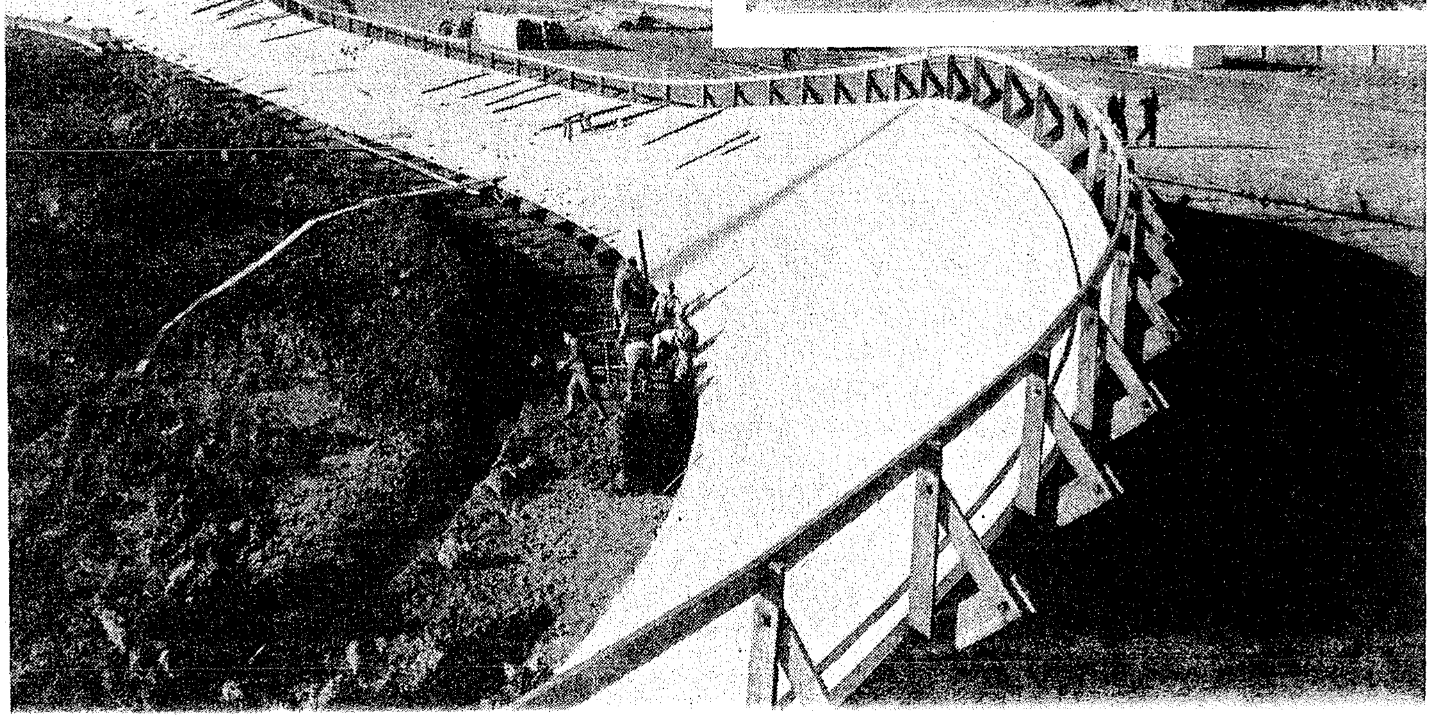
Besides simplicity and speed of erection, the structure has the great advantage that it can be dismantled after the Games and converted to an uncovered board track to meet local requirements.

The whole project is particularly interesting because it demonstrates how preservative treatment can greatly extend the use and value of a timber. Without preservative treatment, radiata pine could not have been used because of its low resistance to decay. Treated, it should last as long as the more durable of our eucalypts, with the advantage that it is much lighter in weight and easier to work and nail.

Right.—Placing supporting frames in position. (Note staggered joints in decking.)

Below.—View of the cycle track under construction.





Timber Seasoning Course for New South Wales

An Advanced course in timber seasoning has been planned by the Division of Wood Technology of the New South Wales Forestry Commission and the Division of Forest Products, C.S.I.R.O., to be held at Coff's Harbour, N.S.W., August 13-17, inclusive.

The course will comprise practical work and 16 lectures on subjects ranging from: stacking and handling, plant layout, kiln operation, warping and its prevention, collapse and reconditioning, modern kilns for sawn timber and veneer, kiln heating methods including the use of steam, flue gas, and electricity, to: anti-sapstain dips, immunization against borer, and kiln installation and drying costs.

Further details or advice on enrolment may be obtained from either the Chief, Division of Wood Technology, 96 Harrington Street, Sydney, or the Chief, Division of Forest Products, 69-77 Yarra Bank Road, South Melbourne, S.C.4.

OVERSEAS VISITS BY DIVISIONAL OFFICERS

Mr. W. G. Kauman, who is a Research Officer in the Timber Seasoning Section of the Division, is leaving this month for two years' experience overseas under a C.S.I.R.O. studentship. Mr. Kauman is particularly interested in the fundamental factors relating to the collapse of timber, and he has been accepted to undertake a two years' post-graduate course at the Free University of Brussels. He will carry out advanced studies there on the thermodynamics of irreversible processes.

Mr. P. U. A. Grossman, who is an officer of the Timber Physics Section of this Division, will be leaving for England during August to accept a research studentship offered by the United Kingdom Ministry of Supply. Mr. Grossman will be absent for two years, and will be working at Cambridge University during that period.

Dr. A. B. Wardrop, a Principal Research Officer of the Wood and Fibre Structure Section of the Division, will be leaving at the end of August for a three months' visit to the United States, England, and Europe.

In the United States he has been invited to present a paper on the nature of lignin deposition in wood fibres at the Third Lignin Round Table Conference, sponsored by the Institute of Paper Chemistry, Appleton, and the National Research Council of the United States. Dr. Wardrop will also be present at a conference on electron microscopy at Madison, and will make personal contact with a number of workers in his field in the U.S.A., England, and on the Continent.

DONATIONS

Firms and individuals who make donations to the funds of the Division are reminded that such donations are an allowable income tax deduction in Australia, under the heading "Gifts to approved research institutes for scientific research, etc.".

Donations to the Division are credited to a trust fund, which is used for special pieces of equipment, and for other expenditure to increase the efficiency of the Division and the service which it can give to the industry and the public.

The following donations were received during June:

Hancock Bros. Pty. Ltd., Ipswich. Q.	£105 0 0
Northern Veneers Pty. Ltd., Cairns, Q.	£105 0 0
Gibbs, Bright & Co., Melbourne	£105 0 0
Bright Pine Mills Pty. Ltd., Bright, Vic.	£100 0 0
A. A. Swallow Pty. Ltd., South Melbourne	£100 0 0
Central Timber Pty. Ltd., Frankston, Vic.	£5 5 0

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Forest Products Newsletter

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NUMBER 222 MELBOURNE SEPTEMBER 1956

Pole Strength Research

VERY little information is available on strength of poles for use in electricity distribution or telecommunication lines. Poles are, of course, essentially engineering structures which must be designed to carry the weight of conductors and, more important still, wind and other loads on conductors and poles. In many cases, too, considerable stresses result from the necessary anchoring of poles against overturning at bends in the line, and other severe out-of-balance loadings occurring at junctions and ends of lines. Lack of engineering design data on Australian pole strengths has resulted in widely varying design procedures by different authorities, and also in wasteful practices. Much more than the cost of the pole is involved; the cost of replacement and transfer of conductors is high, and the danger of failure may be serious.

With considerably reduced availability of the more durable species, and the consequent necessity of utilizing species having different growth and strength characteristics, the need for review of present design practices and of providing a better basis for future designs is clearly evident. The large economic advantage of preservative treatment of poles is another factor adding incentive to the investigation. From a preliminary review, it was obvious that considerable savings could result from more efficient design even on the basis of general timber research data available. It seemed likely that further research specific to Australian poles would indicate possibilities of even greater savings, and in addition would positively establish recommendations for improved design practice.

It was clear that the cost of this research programme, which would be spread over some three years, could be recouped many times in the first year after results became available. However, because of other demands on funds available for research, it was necessary to seek the assistance of pole-supply and pole-using authorities so that this work could be undertaken. A committee, representative of the major pole-supply and pole-using authorities throughout Australia, and the Division of Forest Products, was formed. Encouraged by the possibilities of this research, the committee sponsored the pole research programme and undertook the responsibility of seeking funds to finance it. The Division of Forest Products provided a working plan for the investigation and undertook full responsibility for testing, as well as in effect underwriting the cost of the project.

Some £8500 has already been donated in cash and a similar amount promised by interested authorities throughout Australia.

Several State forestry organizations also are cooperating by donating poles for testing. Details of the various donations will be included in a later issue of the Newsletter.

The project is now well under way. Green pole tests on one species, messmate stringybark, are already complete and a second species is now being tested. Though it is somewhat premature to draw conclusions from test results at present available, early indications are that information of considerable economic value will be forthcoming. Additional species sampling and testing is contemplated in the near future, and more details of this project will be published in the Newsletter at a later date.

Simplified Low-pressure Treatment

By P. J. MOGLIA and F. A. DALE, Preservation Section

THE low-pressure soaking process for the preservative treatment of round timbers was briefly described in Forest Products Newsletter No. 200, and in C.S.I.R.O. Leaflet No. 12, "Round Fence Posts: Preservative Oil Treatment".

The portable plant which was built to demonstrate the process has now successfully treated over 3000 fence posts of various eucalypts and radiata pine with creosote oil, and a number with a water-borne preservative.

These treatments showed that eucalypts can be adequately treated by low-pressure soaking in 12–24 hours, and pine in 2–4 hours, provided that they are properly dried beforehand.

Although the portable plant can be operated by unskilled labour with complete safety, it requires a definite sequence of valve operations to bring the charge up to pressure, and it is necessary for the operator to wait and watch the air bleed while the cylinder is filling. The temptation to go on with another job rather than wait is usually too great to be ignored, and on some occasions the operator has returned hurriedly to the plant to find the cylinder full and overflowing.

Also, with a portable unit there are definite restrictions with regard to pipe sizes, and it is not easy to arrange that the bulk storage is at a lower level than the cylinder. However, providing this latter condition can be met, it is possible to arrange a simple fixed plant so that the filling, pressurizing, and pressure regulation are completely automatic. In fact, after putting the posts in place and closing the door, the operator should be able to close a valve, press a button and walk away. Such a plant is shown

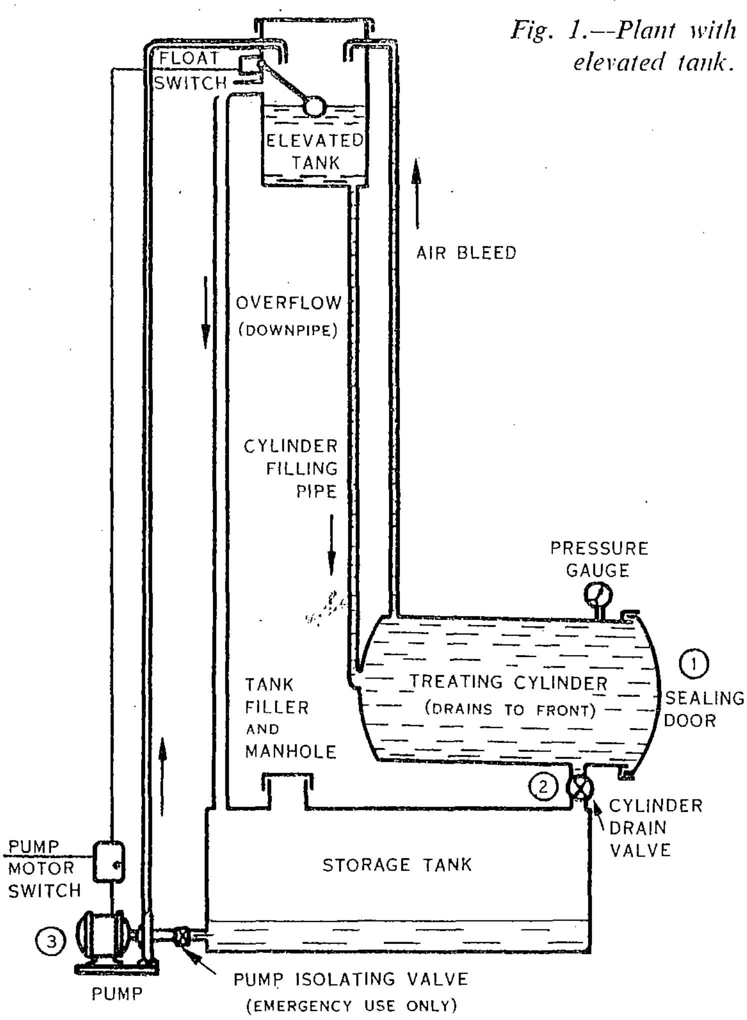

Fig. 1.—Plant with elevated tank.

diagrammatically in Figure 1. It consists of a treating cylinder similar to that in the portable plant, a storage tank at a lower level, an elevated tank to provide the necessary pressure, and a motor driven pump with the piping shown. Only *one* large drain valve or cock is used, between the cylinder and the storage tank. The only other *manual* control is the master switch on the pump motor.

The elevated tank is placed high enough (20–40 ft) above the cylinder to maintain a pressure of 10–20 lb/sq. in. in the latter.

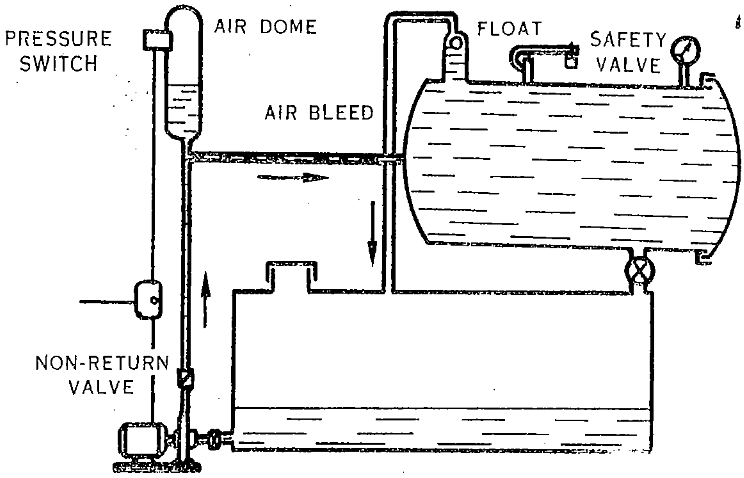

Fig. 2.—Plant with automatic pressure system.

Once the cylinder has been filled with posts, the operating procedure is as follows:

(1) Close and seal the door

(2) Close the valve

(3) Switch on the pump motor

Preservative is then drawn from the storage tank by the pump and discharged into the elevated tank, whence it flows into the cylinder, filling it and finally rising up in the air bleed until the elevated tank is full, when the float switch shuts off the pump motor. A large overflow (downpipe would suffice) from the elevated tank to the storage prevents overfilling, if the float switch fails to operate.

After treatment the valve is opened, emptying the cylinder into the storage, then the cylinder can be opened and unloaded.

An alternative arrangement which dispenses with the elevated tank is shown in Figure 2. Here an automatic pressure system is used to provide the treating pressure. These systems are readily available for such purposes as providing water under pressure on farms, and are cheap and reliable. A large float which closes the air bleed from the cylinder when it has filled can be used in place of a standpipe to do away with any elevated pipework.

With this arrangement there is no restriction on the treating pressure, provided the plant is designed to withstand it.

Wheaten Flour Extender for U.F. Glues

WHEATEN FLOUR is generally used in the plywood industry for extending urea formaldehyde resin glues in order to keep glue line costs at a minimum and, at the same time, maintain the joint strength and water resistance appropriate to the end usage.

Some glue manufacturers recommend particular makes of flour, having found that satisfactory behaviour is obtained with these makes. The flours used are generally selected for their low protein content, and in the United States special flour blends have been produced as glue extenders. This is not done at the present time in Australia, however, and the flour is usually one of the baking types.

Work recently carried out at this Division has shown that there is a very considerable difference in the qualities of these flours from year to year, and also that there is an even greater difference in the viscosity behaviour of baking flours from different States. The lowest viscosities of the flours tested were found in Victorian specimens, while New South Wales and Queensland flours showed very considerably higher viscosities. On this behaviour it would appear that Victorian flours would be more suitable for glue extension than those from either New South Wales or Queensland, although it is possible that in many applications the cost of transporting the more suitable types would be scarcely warranted.

PROPERTIES OF AUSTRALIAN TIMBERS

Queensland Maple

QUEENSLAND MAPLE is the accepted standard trade name for the timbers known botanically as *Flindersia brayleyana* and *F. pimenteliana*. It is, however, no relation to the maple of Europe or America, and was originally named silkwood. In Queensland it is still called maple silkwood or red beech.

Habit and Distribution

The mature tree, although it does not often exceed 100 ft in height, is massive trunked and may reach 14 ft in girth, with an average of about 7–8 ft. The two species are associated in the mixed rain forests of the highlands of north-eastern Queensland, principally on the Atherton Tableland. In this area only does Queensland maple find the combination of deep red loam, heavy rainfall of from 50 to 100 in. and a warm equable temperature range of 60–80°F.

Timber

The heartwood is an even brownish-pink to pink while the narrow sapwood band is grey. The grain is somewhat interlocked, often wavy or curly, and the texture medium and uniform. The quartercut boards show a variety of figure such as waterwave, riband, and birdseye. The butt is especially well figured and is usually sliced for veneer. The timber is strong, tough and non-fissile without being hard or heavy, but is not used structurally. Its density at 12 per cent. moisture content ranges from 28 to 41 lb/cu. ft. averaging 34·7 lb/cu. ft. before reconditioning, and 33·9 lb/cu. ft. after. The heartwood is not durable when in contact with the ground, but the sapwood is regarded as immune from *Lyctus* borer attack.

Queensland maple has excellent working qualities, although the interlocked grain tends to lift slightly. It peels and slices readily and glues well, making excellent veneers and plywood. It stains readily, takes a lustrous finish and is easily and successfully fumed or bleached.

Seasoning

This species seasons with almost no degrade, although twisting and warping may occur in dense, heavily interlocked boards. Cupping may also occur in wide boards other than quartersawn stock. Kiln drying from green to 12 per cent. moisture content usually takes 10 days for inch boards, and from 30 to 35 days for 3 in. stock. In drying from green to 12 per cent. moisture content the timber shrinks 6·7 per cent. in the backsawn (tangential) direction, and 2·8 per cent. in the quartersawn (radial) direction. Reconditioning improves these figures but is rarely necessary.

Uses

Queensland maple ranks among the world's finest cabinet timbers. It is used for all types of fittings and furnishings in ships, public buildings, shops, railcoaches, and very extensively for furniture construction. In boat building it has proved entirely satisfactory for planking, and in the aircraft industry it is used for propeller blades. It is obtainable as high class veneer and plywood, and may be attractively figured.

Availability

Although over 5 million super ft (sawn) was milled in 1954–55, it is always in short supply because of the keen demand.

DONATIONS

THE following donations were received by the Division during July:

G. N. Raymond Ltd., Collingwood, Vic.	£100 0 0
R. G. Williams and Co., Collingwood, Vic.	£50 0 0

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Forest Products Newsletter

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NUMBER 223 MELBOURNE OCTOBER 1956

Preservative Treatment of Building Timbers by a Simplified Diffusion Process

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

A SIMPLE diffusion process for the preservative treatment of green building timbers has been developed recently by the Division of Forest Products and applied without difficulty to the treatment of klinki pine for the construction of 50 houses in New Guinea. The new method and its advantages may be explained best by comparison with boron diffusion treatments which are in wide commercial use here for immunization of Lyctus-susceptible timbers.

For sawn timber, the present method of Lyctus immunization is to treat the green or semi-dry material in a solution of boric acid or borax until all susceptible sapwood is completely penetrated. Heat is usually applied either by steaming the timber and then "quenching" in cold preservative solution or by heating the whole stack in the solution and allowing to cool while still immersed. Where heat is applied, one treatment in 24 hr is usually made, but with cold solutions steeping for several days may be necessary.

For green veneer, a simplified treatment was developed by the Division in 1949, of a momentary dip in a cold solution of boric acid or borax, followed by block stacking the wet sheets for a few hours to permit diffusion of chemical into the wood before drying. This process is now used commercially in many Australian plywood plants, and has superseded the original hot steeping process introduced by the Division in 1938.

The new process for building timber seeks to apply the simple and successful method of treating green veneer to the preservation of *green* sawn timber of scantling size. The advantages of such a treatment are that large and costly tanks are eliminated, and no steam is required. There is also the important technical advantage that frequent chemical analysis of the preservative solution, essential in tank diffusion processes, is not necessary. In total, these advantages give a very cheap and simple treatment requiring minimum equipment and technical control even where complex preservatives are used.

In developing the process for application to sawn timber, the main requirements were:

- To formulate a preservative which would dissolve readily in water to give a highly concentrated cold solution, so that green timber of scantling size, given a momentary dip, would retain enough preservative on the surface for subsequent diffusion to a depth of at least one-half in.

- If possible, to retain boron compounds in the basic formula but to be able to add other preservatives, including an arsenical compound, particularly where increased resistance to decay or termites was required.

- To determine the practicability of preventing drying during the block stacking periods of several weeks necessary for deep diffusion into the wood.

These requirements have been reasonably attained, and it is believed that the new process has important application where building timbers require treatment against decay, termites, and other insects. Being a diffusion process, the timber is treated while completely green and penetration occurs in the heartwood as well as in the sapwood. As yet little work has been done to compare rates of penetration, but, in general, light weight timbers are penetrated faster than heavier species and sapwood faster than heartwood.

The basic preservative formula contains a boron and a fluorine compound in proportions which permit greatly enhanced solubility of both compounds—due to the formation of highly soluble borofluorides and pentaborates. Where control of *Lyctus* or *Anobium* borers is required this basic formula may be used without additives, as it will retain more than 30 per cent. boric acid equivalent in cold solution (w/w basis). For most purposes, however, the addition of an arsenic and a chromium compound is recommended both to increase toxicity and to increase the total quantity of preservative in solution. The formula containing all four compounds will retain over 80 per cent. of salts in solution at room temperature, and is thus suitable for the dip diffusion treatment of large section timbers.

Timber treated by the above process should not be used in contact with the ground or where frequent leaching is likely to occur, unless a second diffusion treatment with a copper or other heavy metal salt is given to fix the preservatives in the wood. The single treatment is, however, very suitable for protected building timbers, including painted weatherboards, where it should remain permanently effective.

To prevent its misuse, the Division has applied for a patent covering the use of this process in Australia, and will be glad to answer inquiries regarding specific applications.

Let's Discuss Sawing

with D. S. JONES, Utilization Section

Caking Sawdust

Many sawmillers and saw doctors have been troubled more than normally this winter by sawdust caking against the sawn surfaces. Most sawmillers consider that the unusually wet season in southern Australia this year has saturated the sapwood of logs and this excessive moisture causes the caking. They are resigned to tolerating the trouble in the hope that it will disappear when normal, drier conditions return. A wider appreciation of some of the causes of sawdust caking against the sawn surfaces may, however, assist in finding a remedy.

It is a general rule that the finer and dustier the sawdust, the greater will be its tendency to cake. Coarser sawdust can be produced by saws with fewer teeth used *at the same speed as the standard saw*. An alternative is to decrease the saw speed *but retain the same feed speeds*. If the bench can be conveniently modified, this is the better choice, because it also improves the life of the saw between sharpenings. Both these modifications, however, adversely affect the quality of the sawn surface. Caking of sawdust has also, under some circumstances, been eliminated by reducing the tooth bevel angle. If hemp packing is employed, freer clearing of the sawdust is effected by confining the length of the packing to a few inches near the rim of the saw. It should also be remembered that spacious well-curved gullets considerably reduce sawdust spillage and make for cleaner sawn surfaces.

The perforated bandsaw recently introduced is claimed to clear sawdust remarkably well and to leave very clean sawn surfaces. The perforations apparently carry away quite a lot of sawdust.

COMMON BORERS IN BUILDING TIMBERS

Part I. Recognition of the Commoner Types of Borer

By J. BEESLEY, Wood Preservation Section

AS MANY Australian building and joinery timbers are susceptible to attack by one or more of the wood borers, timber merchants or wood users are often faced with the problem of determining the maximum extent to which timber might be damaged or degraded by such attack and then deciding what, if any, remedial measures are necessary. Both these questions are easy to answer if the user has a little knowledge of the habits of borers.

The purpose of this series of articles is to explain the more important characteristics of the commoner types of timber borer, and to suggest treatments which the individual builder or householder may apply with a minimum of equipment and at little cost. Where doubt exists as to the type of borer present, or the treatment which would be most suitable for a particular set of conditions, further advice may be obtained from C.S.I.R.O. or from State Departments of Forestry or Agriculture.

In Australia most of the borer damage of economic importance occurs in the sapwood of the timbers attacked. In northern Australia, borer attack is generally more rapid and its consequences are often more serious, because the timbers of the warm rain forests usually have a much wider band of borer-susceptible sapwood than the eucalypt timbers of the south. In Queensland and New South Wales, special legislation obliges the sawmiller to accept responsibility for the amount of borer damage occurring in the timber he produces, and compels him to segregate and either treat or sell separately, timber susceptible to attack by the Lyctus borer. Elsewhere, sawmillers and timber merchants are becoming increasingly aware of their obligations in this regard, and many of them are now taking considerable trouble to limit the amount of borer-susceptible sapwood present in the timber they sell.

The term "timber borer" is reserved for those beetles (or their larvae) which tunnel in wood either for food or shelter. Most of these fall into one of two major groups, namely, the borers which normally attack growing trees, freshly felled logs, and green sawn timber, and the borers which commonly attack seasoned wood. A third group are the borers which invade decayed, or partially decayed wood. These are of little economic importance as they are not primary destroyers of sound wood, and their attack usually ceases when the conditions conducive to decay are remedied.

Fortunately, *few of the borers which normally attack green timber are able to extend their attack in dry wood*, although they are sometimes able to complete their life-cycle in timber which has dried naturally and emerge from apparently dry wood. Provided the timber attacked by these insects has not been materially weakened before use, it can be safely used without any treatment, as there is no risk of these borers re-infesting the dry wood. Correct recognition of the damage caused by green wood borers can therefore save the householder from much needless worry, and the builder from wasting much useful timber.

Borers which are able to initiate or extend their attack in seasoned wood are generally a more serious pest than the borers which attack only green timber. Unless eradicated these pests may cause complete destruction of the wood they infest. Fortunately, this does not always result in material structural weakening, as the damage caused by Lyctus, one of the commonest of these pests, *is restricted to the sapwood* of the timbers it attacks. Hence it is important to be able to recognize Lyctus attack and to be able to distinguish it from the attack of the borers which live in green timber.

The most characteristic differences between these groups of borers have been tabulated overleaf.

RECOGNITION OF BORER ATTACK COMMONLY FOUND IN BUILDING TIMBERS

	Borers attacking green timber. Attack usually ceases when timber dries, although emergence may take place from apparently dry wood		Borers attacking timber after it has dried. Attack will continue and may be extended in dry wood, whether air dried or kiln dried	
	Pinhole Borers	Longicorn and Jewel Beetles	Lyctus (Powder post) Borers and the Auger Beetles	Anobid Borers
Appearance of surface holes	Numerous round holes; small, $\frac{1}{16}$ in. or less in diameter. Margins frequently discoloured	Few scattered oval holes; large, $\frac{1}{4}$–$\frac{3}{8}$ in. diameter. Margins unstained	Numerous round holes $\frac{1}{16}$–$\frac{3}{16}$ in. diameter. Margins unstained	Numerous round holes, $\frac{1}{16}$–$\frac{1}{8}$ in. diameter. Margins unstained
Direction of galleries	Fairly straight, across the grain	Mainly across the grain	Along the grain. In advanced stages of attack, infested wood may be reduced to a powder	Mainly along the grain, but may honeycomb wood in advanced stages of attack
Frass (borer dust)	Usually absent	If present, coarse and stringy	Abundant, tightly packed, smooth and floury feel	Abundant, loose and gritty; feels like fine table salt
Timber attacked	Mainly hardwoods,* not confined to sapwood. Seldom emerge from dry wood	Mainly hardwoods,* not confined to sapwood. Will emerge through most lining materials	Confined to sapwood of certain hardwoods.* May emerge through face veneers and lining materials	Mainly in coniferous timbers.* Only in sapwood at first, later extending into heartwood
Duration of attack	Cannot survive in seasoned timber	Usually emerge from air dry timber in first few months of service, but may not emerge for years	Seldom emerges before timber has been sawn for a summer. Attack may continue for several years	Only found in timber several years old. Attack spreads slowly
Treatment by builder or householder	Unnecessary. Reject pieces showing obvious weakening	Unnecessary. Emergence holes which have punctured lining materials should be filled, and surface finish restored	1.—Ignore attack in structural timbers with only a limited amount of sapwood 2.—Avoid the use of untreated sapwood in finishing timbers 3.—Treat or replace damaged finishing timbers	Always necessary. Treat by injection or liberal flood spraying, or else replace infested wood

* It is most important to distinguish between the coniferous timbers, such as the pines, firs, and spruces, and the hardwoods, such as the eucalypts, and including the lightweight soft brushwoods of the rain forests.

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Forest Products Newsletter

1956##224

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Some Sawbench Test Results

By R. L. COWLING, Utilization Section

POWER studies on the No. 1 breast benches of various Victorian sawmills have yielded some results of interest to sawmillers, and perhaps to the sawing industry in general. The work was undertaken as part of a much wider study being conducted in the industry and also in the laboratory.

A bench employing a hydraulically operated drive to the feed rollers enabled observations to be made over a much wider range of feed speeds than is usually obtained with the more common friction feed drive, where the roller speed is usually in the vicinity of 200 ft/min. This may be regarded as too fast for deep cutting, and too slow for many cuts in small depths.

By contrast, the hydraulic drive appeared to allow better control of the feed during deep cutting in heavy flitches, whilst feeds in the smaller depths were much faster. For example, a feed speed as great as 385 ft/min was measured in a 4 in. cut.

Continued feeding at such fast rates may be undesirable, but it is important to note that the capacity of the saw was not exceeded, also that less electrical energy was consumed. Moreover, more timber can be sawn before the saw needs sharpening when the feed speed matches the capacity of the saw.

In Figure 1, page 2, the power at the bench employing the hydraulic drive is plotted against the range of feed speeds encountered during several days of sawing. The various depths of cut shown were made chiefly in messmate stringybark. The feed rollers were operated, forward and reverse, by the usual lever. Details of the saw are given with the figure.

It is necessary to stress that the *average* power only is indicated, and that an increase in power of as much as 25 per cent. above these values can be expected. This is of importance when designing the drive for saws. The usual squirrel cage motor will sustain some repetition of 100 per cent. short-term overloads, hence the rated horse-power of driving motors should be about one-half of the anticipated maximum load, calculated with due regard to the frequency of occurrence.

For example, Figure 1 shows that the maximum power occurred in 12 in. deep cuts and was approximately 110 h.p. The 25 per cent. increase which can be expected raises this maximum to 140 h.p. approximately. On the assumption that the demand for this power would frequently occur, a 70 h.p. motor would be selected for this particular set of conditions. The motor size would be increased for deeper sawing, or where a saw of greater thickness or greater diameter was used.

If sawbenches are under-powered, stalling inevitably occurs in the deeper cuts. This is more likely to happen with a normal friction feed drive than when the feed is controlled more sensitively through a hydraulic drive. Even though heavy flitches are initially held back, they appear to approach the speed of the rollers before completion of the cut, and for friction drives this speed is usually too high for deep cutting. Better control of the feed appears possible with a hydraulic drive, which offers an added advantage of faster feeding in the smaller depths of cut.

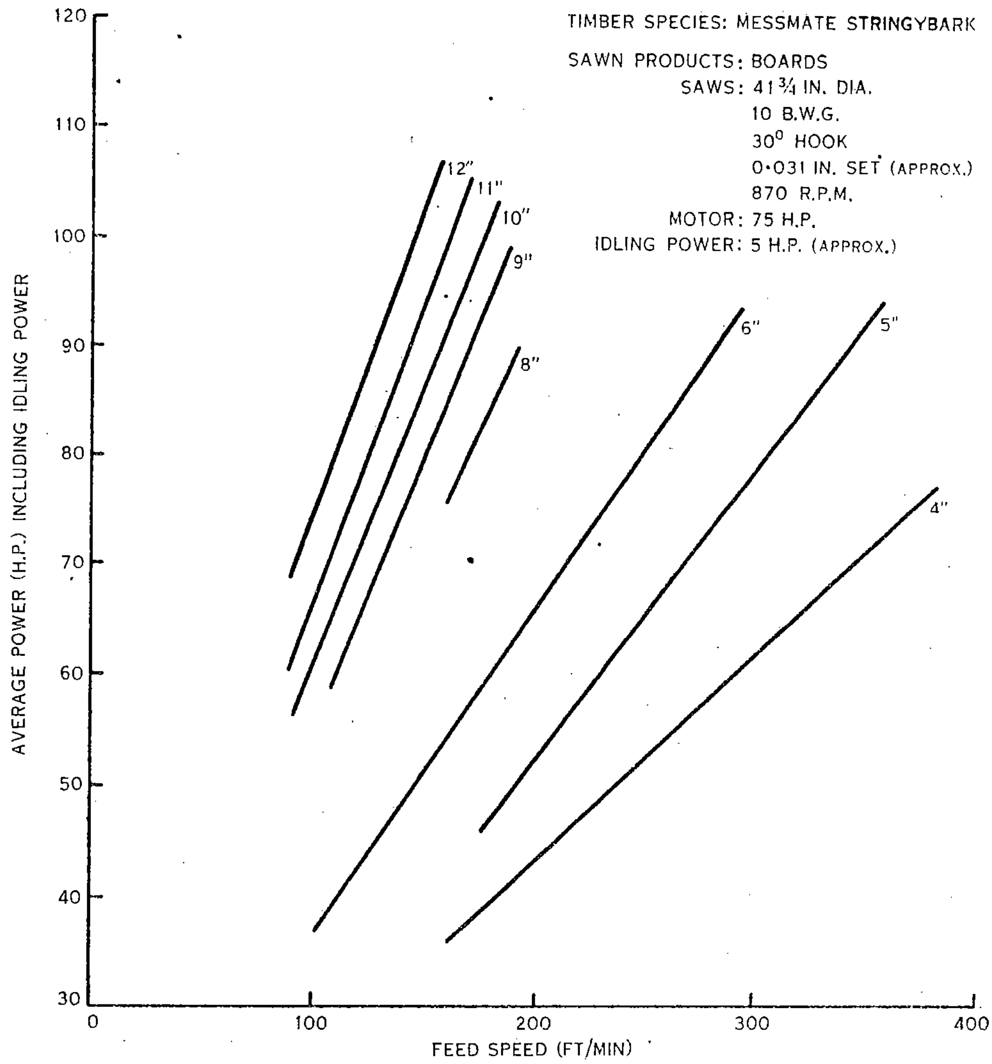

Fig. 1.—Relation of power to feed speed for various depths of cut.

Grading Conference in Canberra

DURING the week commencing October 8, the Associated Country Sawmillers of N.S.W., the Forestry Commission of N.S.W., and the Division of Forest Products, C.S.I.R.O., collaborated in conducting a Conference at Canberra on the selection and grading of N.S.W. building timbers.

In afternoon and evening sessions speakers dealt with topics of special interest to builders and architects.

Domestic Flat Roof Construction

ENQUIRIES have been received from time to time for information on the thickness of boards to be used as sheathing under the waterproof membrane for domestic flat roofs. The following table gives the *maximum* rafter spacing permissible with the usual thicknesses of dressed boards.

Direction of Decking	Thickness (in.)	Type of Boards	Maximum Rafter Spacing (in.)
Diagonal	1/2	Softwood	14
	1/2	Hardwood	18
	3/4	,,	27
	13/16	Softwood	24
Across or down the slope	1/2	Softwood	18
	1/2	Hardwood	24
	3/4	,,	36
	13/16	Softwood	33

Notes

- In determining the above table of thicknesses and spacings it has been assumed that the waterproofing membrane will be of bituminous felt laid in accordance with the recommendations of the C.S.I.R.O. Division of Building Research, and as set out in their leaflet on Domestic Flat Roof Construction.
- If the waterproofing membrane is properly laid and maintained, and adequate ventilation or other provision renders excessive moisture condensation on the timber unlikely, no provision need be made for decay. Where decay hazard exists, only durable or appropriately preservative-treated timber should be used.
- In no case should timber susceptible to Lyctus borer attack be used, except after appropriate preservative treatment.
- The above table refers only to roofs not available for recreation or traffic.
- All boards must be well seasoned, dressed to uniform thickness, and tongued and grooved.
- Hardwood boards should not be wider than 4¼ in. to reduce likelihood and amount of cupping. It is desirable that boards should only be laid across the slope when the latter exceeds 1 in 8 to ensure water will still be shed even if cupping occurs.
- When boards are laid parallel to the rafters, 3 by 1½ in. nogging between the rafters or 2 by 1½ in. (minimum) battens over the rafters must be provided at spacings not exceeding those given in the last column for decking across or down the slope.
- Decking placed diagonally is superior to decking placed across or along the rafters, as it provides much greater stiffness against racking loads due to wind.
- Enquiries directly concerning timber, including rafter spacing and thickness of boards, should be referred to the Division of Forest Products; all others to the Division of Building Research, Highett, Victoria.

New Handbook

MOST people engaged in designing or building timber structures are familiar with the Handbook of Structural Timber Design, published by the Division of Forest Products.

Supplies of the last edition have now run out, and to meet the continued demand for an up-to-date Australian reference, officers of the Timber Mechanics Section are now preparing a new timber engineering design handbook. This will be based on the latest research and practice and will include considerable additional information, particularly on the design of joints, plywood structures, and glued laminated construction.

It is hoped that the new handbook will be available early in 1957.

DONATIONS

THE following donations were received by the Division during August and September:

H. Beecham and Co., Melbourne	£100 0 0
Risby Ltd., Hobart	£50 0 0
Furness Ltd., Edwardstown, S.A.	£26 5 0
Riverside Timbers Pty. Ltd., Devonport, Tas.	£25 0 0
Gatic (Aust.) Pty. Ltd., Melbourne	£12 12 0
Davies Coop & Co., Melbourne	£10 0 0

PROPERTIES OF AUSTRALIAN TIMBERS

Forest Red Gum

FOREST RED GUM is the standard trade common name of a small number of timbers given the standard trade reference name of *Eucalyptus tereticornis*. In Queensland it is known as blue gum because of the colour of the bark.

Distribution

The species occurs in Victoria, New South Wales, and Queensland, mainly in open forest of the inland districts of moderate rainfall, but also in coastal areas as scattered trees. It is found also on the Atherton Tableland of North Queensland. The bark is mainly smooth but often has a persistent roughness at the base. The tree may attain a height of 100 ft and a diameter at breast height of 3–4 ft.

Timber

This is light to dark-red in colour with a greyish or cream coloured sapwood. It is hard and heavy, and is classified as a group B timber. The texture is uniform but the grain is interlocked, which makes it fairly difficult to machine and finish smoothly. It is similar in many respects to *E. rostrata*, but is generally denser. It is among the durable Australian hardwoods, being placed in Class 2. The sapwood is susceptible to Lyctus borer attack. The heartwood is resistant, to a certain extent, to marine organisms.

The wood, when green, has an average density of 74 lb/cu. ft., and when dried to 12 per cent. moisture content, has an average of 61 lb/cu. ft. In drying from the green condition to 12 per cent. moisture content, its shrinkage averages 5·0 per cent. in the radial (quartersawn) direction, and 7·9 per cent. in the tangential (backsawn) direction.

Forest red gum can be air- or kiln-dried from the green condition in 1 in. stock, although a preliminary air drying period before kiln drying may give a greater recovery. As the timber has some tendency to warp, weighting of stacks during drying is an advantage.

Uses

Because of its durability, the timber is used for piles, mining timbers, posts, paving blocks, stumps, and sole plates. Other uses are for steps, sills and flooring, but sapwood should be excluded. It is also used in ship-building and for mallets.

Availability

The species is available in round, hewn or sawn form, chiefly as scantlings and squares. Long lengths are not readily obtained.

Additional information on this timber is available from the Chief, Division of Forest Products, C.S.I.R.O., 69–77 Yarra Bank Road, South Melbourne.

REVIEW

Ripsaw Teeth for Exotic Pines

AN EXCELLENT little book recently came to our notice entitled "Ripsaw Teeth for Exotic Pines", by J. S. Kerr, formerly of the New Zealand Forest Service, and now of the Tasman Company. This book reviews recommended ripsaw design for cutting the exotic pines of New Zealand and deals with circular, band, and gang frame saws. It gives recommended tooth designs and discusses such problems as sharpening and setting, saw speeds, feed speeds, power requirements, etc. There is a wealth of practical information contained in tables. Pine sawmillers in Australia will find valuable information in this book, and copies can be obtained from the New Zealand Forest Service, C.P.O. Box 894, Wellington, N.Z., price 3*s*. 6*d*. (N.Z. currency) post free.

This Newsletter, prepared for general circulation by the Division of Forest Products, C.S.I.R.O., P.O. Box 18, South Melbourne, S.C.5, is issued free on request to members of the timber trade and timber users. Its contents may be reprinted without special permission.

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Forest Products Newsletter

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Service Tests of Preservative Treated Rail Sleepers

By E. A. BOWERS, Preservation Section

Introduction

Although preservative treated rail sleepers have been used extensively in America and Europe since last century, the practice of sleeper preservation has not been adopted in Australia for many reasons, chief of which is that until recently there has been a plentiful supply of timbers of high natural durability. However, with an increasing shortage of durable timbers in some States, the preservative treatment of rail sleepers has today become one of the most urgent problems in the field of wood preservation.

Sleepers of box, ironbark, and river red gum have often given service lives in excess of 20 years. Many other species also give equally long service lives. It is estimated that many of the species now being used, (e.g. peppermint, silvertop ash, manna gum) will have a service life of only 6–15 years.

Although other influences may slightly effect the comparison, the effect of the shorter sleeper lives being obtained from species currently used is illustrated by the fact that the rail sleeper usage in Australia has risen from an estimated 2,634,300, including new constructions and replacements in 1938-39, to 3,756,000 for replacements only in 1955. With approximately 71 million sleepers in use throughout Australia, the average service life now being obtained has already fallen to about 19 years. As the durable timbers now in service fail and are replaced by less durable species, the average service life of all sleepers in service will fall still further, and the cost of track maintenance will rise steadily.

Any treatment which increases the service life of the less durable sleepers now being used will tend to decrease the cost of track maintenance.

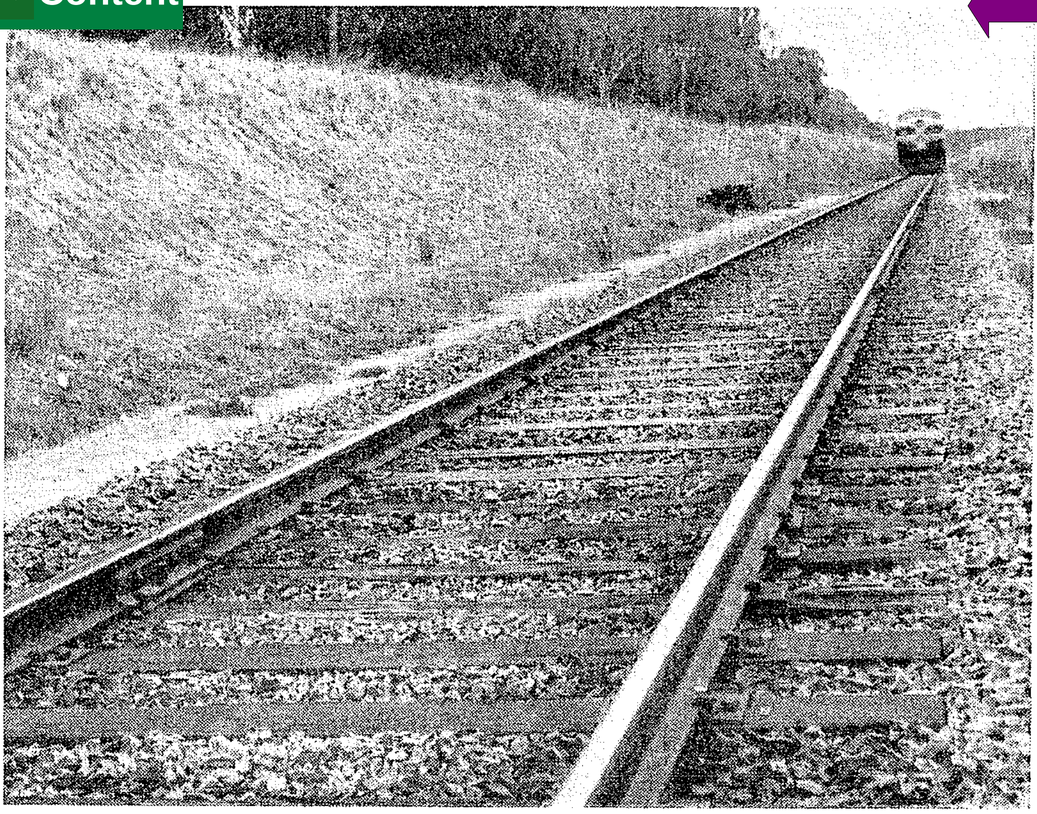
Causes of Rail Sleeper Failure

Primary causes of failure in the service life of sleepers can be placed in two categories:

(*a*) Biological (which includes decay and termite attack).

(*b*) Mechanical (which includes end splitting, loss of spike holding power, rail cut etc.).

This Division has already carried out a survey of condemned railway sleepers in Victoria and Tasmania to determine the relative importance of primary causes of failure.



High pressure treated Victorian hardwood sleepers on a main line track.

In Victoria, the majority of the sleepers inspected had been condemned primarily because of mechanical failure. Decay and termite attack together accounted for less than 10 per cent. of the failures.

In Tasmania, the majority of sleepers had failed from mechanical deterioration which was often associated with decay. In most cases, this condition was most serious in the vicinity of the rail seat.

The conclusions drawn from the survey were that any preservative treatment to be adopted would not only have to provide protection against decay, but also give maximum protection against mechanical failure.

Early Tests

Unlike the majority of softwoods, the heartwood of most eucalypts is very resistant to treatment, but may be penetrated either by the use of very high pressures, or by the slow diffusion of water-soluble salts into the green timber.

The Powellizing process, originally used in Western Australia during the period 1906–26, was considered unsatisfactory and was replaced by the fluarizing process in the early 1930's. These treatments were essentially hot diffusion treatments and were only partially effective. In one test, fluarized sleepers were found to have an average service life of 13 years, which is nearly double that obtained with Powellized sleepers. However, the weakness of these treatments lies in the susceptibility to splitting of the treated sleepers, and hence exposure of the inner untreated wood to attack by decay and termites.

Until 1936 *Pinus radiata* had never been used for sleepers in Australia, though softwoods are used extensively overseas. In 1935–36, low-pressure treatments were carried out by the Division on *P. radiata* and various eucalypt species. Service tests of these sleepers were installed in various localities in South Australia, and at Ballarat, Victoria. Both the hot and cold bath process and low pressure treatment were represented in these tests. After 20 years service of the preservatives, tested creosote, or a mixture of creosote and oil, has given the most satisfactory results. By way of comparison, untreated *P. radiata* sleepers failed in about 2–3 years.

A large test to determine the practicability of surface treatments was installed by the Division in 1941, in Victoria. Over 1800 sleepers, representing 9 species, were installed in two localities. About half the sleepers were surface coated with creosote and oil, followed by oil spraying of the

(*Concluded on page 7.*)

COMMON BORERS IN BUILDING TIMBERS

Part II. The Lyctus (or Powder Post) Borer

By J. BEESLEY, Wood Preservation Section

ONE OF the commonest borers found attacking seasoned hardwood timbers is Lyctus, which has a world-wide distribution and is so common in Australia that little unprotected susceptible timber escapes attack within the first year or two of service. Fortunately, Lyctus attack does not always result in significant damage and realization of this fact can save much needless worry.

FACTS WORTH KNOWING

● *Lyctus attacks only the sapwood of certain hardwood timbers.*—Softwood timbers such as the true pines, firs and spruce are never attacked by Lyctus.

Two conditions which govern the susceptibility of any timber (or log) to attack by Lyctus are the starch content of its sapwood, and the size of its pores.

Starch is essential for the nutrition of this borer, and timbers with a high starch content usually suffer most damage. The sapwood of many eucalypts, such as blackbutt, jarrah, mountain ash and the ironbarks, is rarely attacked because it usually lacks sufficient starch for the development of the insect.

Starch is normally produced during the growth of green plants and may be stored in the sapwood (i.e. the outermost layers of wood immediately under the bark) of some trees. Sapwood containing starch may be detected by a simple chemical test. When a few drops of a testing solution* are sprinkled onto a freshly split radial face of the timber, starch-containing sapwood changes from a pale yellowish colour to anything between a light greyish colour and a dark blue-black stain. In cases of doubt a hand lens should be used to examine the stain.

Pore size. Only hardwood timbers have pores, coarse-grained timbers having larger pores than fine-grained timbers. Lyctus can infest only timbers in which the pores are large enough to allow the female beetle to insert her eggs into the pores themselves. For this reason, the sapwood of certain brushwood timbers, such as coachwood and southern sassafras, is immune from Lyctus attack, and the sapwood of myrtle beech, despite its usually high starch content, is attacked only occasionally.

● *Lyctus does not necessarily cause the complete destruction of a timber member.*—The heartwood of hardwood timbers is never attacked by Lyctus, but it may completely destroy all the sapwood on a piece of hardwood timber.

In most eucalypts the sapwood seldom exceeds an inch in thickness. Consequently, when a eucalypt log is sawn into building scantlings sapwood is usually present only as small strips and edges on a few of the pieces. The amount of sapwood normally present on eucalypt framing timbers is so small that even its complete destruction by Lyctus is unlikely to cause any material structural weakening. On the other hand, eucalypt tiling battens, cupboard framings and mouldings containing a high proportion of sapwood may be so extensively damaged by Lyctus as to necessitate some treatment or replacement.

Some of the brushwoods (non-eucalypt hardwoods), such as brown tulip oak, white birch, and yellow walnut, of the rainforests of Queensland and New South Wales have a band of sapwood many inches in thickness which may be susceptible to Lyctus attack. If attacked, timber cut from these species may be seriously weakened or completely destroyed, consequently *the sapwood of these timbers should never be used in any permanent*

* The testing solution is prepared by dissolving ½ oz of POTASSIUM IODIDE crystals in about 2 tablespoons of water, and then dissolving into this ¼ oz of IODINE crystals. When the crystals have quite dissolved the solution should be made up to 1 quart. The solution keeps quite well in a glass-stoppered bottle if stored in a cool dark place. Both chemicals are reasonably cheap and readily obtainable from chemists.

construction unless it has been completely impregnated with boric acid, borax, or other chemical which will permanently prevent Lyctus attack.

● *Lyctus attack is easily recognized.*—Its most typical characteristic is the abundant frass (or dust) which is tightly packed into the borer tunnels, and which often forms little heaps beneath or around the flight holes made by beetles leaving the wood. The frass is smooth and floury (not gritty) when rubbed between the fingers. The flight holes are round, with no staining around their margins, and about $\frac{1}{16}$–$\frac{1}{8}$ in. in diameter. The fact that only the sapwood of hardwood timbers is susceptible to Lyctus attack is a useful diagnostic feature.

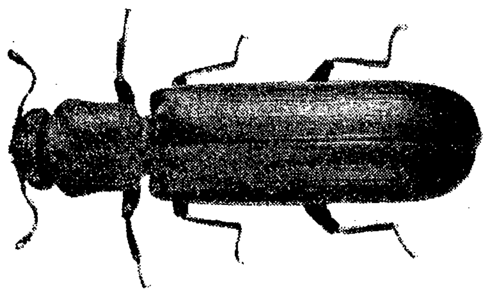


Fig. 1.—*Lyctus brunneus* (Steph.). *The Common Powder post Borer—Adult, magnified.*

● *Lyctus attack in one part of a building will not inevitably spread to other parts of the building.*—Lyctus attack is limited to the sapwood of those hardwood timbers which both store starch in their sapwood and have pores large enough for the female beetle to lay her eggs in. If Lyctus damage is present in several different parts of a building, the infestations may have originated from a single source or from a number of separate sources, *and it is practically impossible to establish which was the case.*

Lyctus cannot initiate attack in timber after the surfaces and ends have been sealed with paint, polish, or preservative, but adult borers might emerge from such timber if infestation had occurred before the surface was sealed. Once the surface seal has been broken the borers may re-infest such timber through the old emergence or flight holes, and may continue to do so until all the susceptible sapwood has been destroyed.

● *Kiln-drying does not prevent Lyctus attack.*—Kiln-drying only reduces the moisture content of the timber, and does not affect its starch content or pore size. Hence kiln-drying cannot affect its susceptibility to Lyctus attack. *No insect can survive the normal kiln-drying process, but Lyctus may infest or re-infest kiln-dried timber almost as soon as it leaves the kiln.*

LIFE HISTORY OF THE LYCTUS BORER

In its development the Lyctus borer passes through four distinct stages, namely the egg, the larval or grub stage, the pupal stage, and the adult beetle.

Throughout the year in tropical climates, and during spring and summer in more temperate regions, the adult female beetle searches actively, by crawling and flying (usually after dusk), for starch-containing sapwood in which to lay her eggs. When suitable sapwood is found the beetle lays her eggs, which may number several score, into the pores of the wood.

Within 14 days or so the eggs hatch out into small, creamy coloured *larvae* (grubs) which feed upon the starch contained in the sapwood, through which they bore a network of connected tunnels tightly packed with a fine powdery frass (hence the name "powder post" borers). The feeding period, during which the bulk of the damage is done, is as short as 2 or 3 months in warm climates and heated buildings, but may extend over 12 or 18 months under adverse conditions. When fully fed, the larvae pupate, and after a short pupal period emerge as mature beetles. The adult beetles seldom live more than a few weeks.

In their efforts to emerge from the timber in which they developed and to reach the open, the mature beetles sometimes bore through plaster sheeting, hardboards, and other lining materials. Flight holes in these materials indicate that the beetles have completed a life-cycle in the timber framing behind them. The flight holes, and frass ejected from them, are usually the first external evidence of the presence of Lyctus-infested timber and are an indication that the borer has completed its life-cycle. Upon emerging the mature beetles mate and begin laying fertile eggs. It is not uncommon for them to re-infest the timber from which they first emerged.

The beetles themselves are small, rather shiny dark brown insects, about $\frac{3}{16}$ in. long (see Fig. 1). When closely examined from above they have a distinct head, thorax or chest and abdomen (including the wings). In some species of borer the head is drawn back under the thorax (chest) and is not visible from above. The terminal segments of their antennae (feelers) are enlarged, giving them a "clubbed" appearance. The insects move quite actively.

builder or householder, who requires simple treatments which can be effected with a minimum of equipment.

Structural Timbers and Building Frames

(*a*) *Eucalypt Timbers.*—As most eucalypt logs have only a narrow sapwood band, only a few of the scantlings cut from them are likely to contain sapwood (see Fig. 2). When present, the sapwood usually occurs as a strip along one edge and represents only a

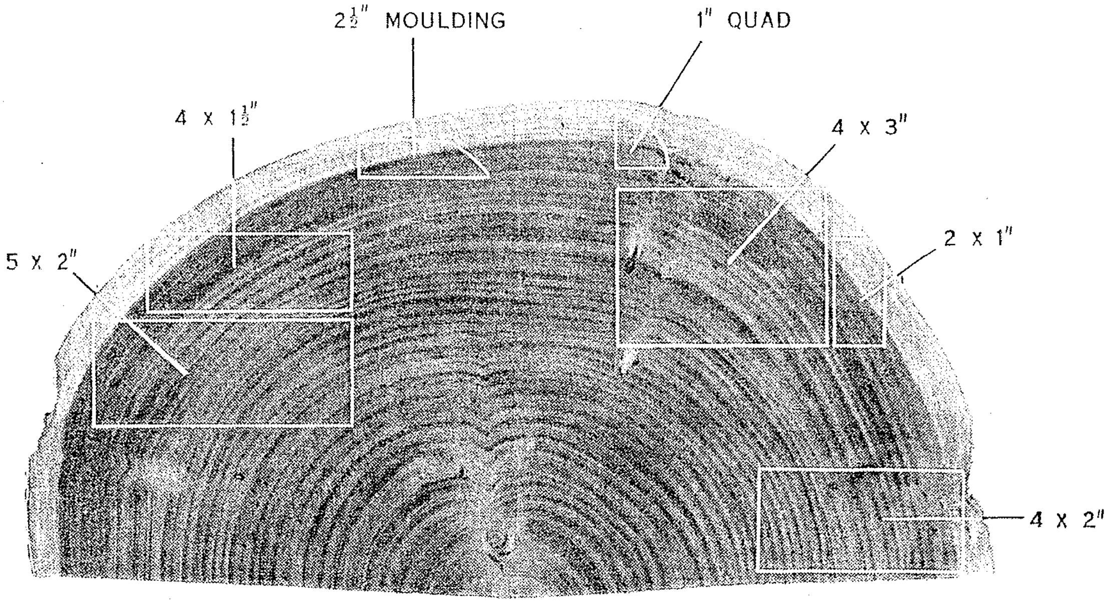


Fig. 2.—Section through a typical eucalypt log with a narrow sapwood band. The amount of sapwood which might occur in mouldings and scantlings is shown.

PREVENTION AND CONTROL OF LYCTUS ATTACK

In Queensland and New South Wales special legislation regulates the sale of timber susceptible to attack by the Lyctus borer, and controls the type of treatment which may be used to immunize such timber from attack. The only treatments given a general approval under either the *Timber Users Protection Act* of Queensland, or the *Timber Marketing Act* of New South Wales, are those which will completely penetrate the susceptible wood and give permanent immunity from Lyctus attack. Provided it is kept dry, timber treated by a process approved under either of these Acts should never be attacked by Lyctus.

The preventive treatments approved under the abovementioned legislation are not suitable for application by the individual

small fraction of the total cross section, and in building scantlings destruction of this sapwood edge by Lyctus is unlikely to cause material structural weakening. If the appearance of this damage is immaterial *no treatment is required.*

(*b*) *Brushwood Timbers.*—In some parts of Queensland and New South Wales brushwoods are used for building purposes. Many of these timbers have a wide band of Lyctus-susceptible sapwood which, if destroyed by Lyctus could cause serious weakening of the member. *Unless these timbers have been treated by an approved process the State laws of Queensland and New South Wales limit the amount of sapwood present at any cross section to* ***one-quarter of the perimeter*** *of the piece.* This rule could well be given general application in other States.

(*c*) *Battens.*—Generally battens are cut from the outer parts of the log and usually contain a high proportion of sapwood. Ideally these should be segregated and treated by a reliable process before use. However, when this is not done an attempt should be made to use only battens having a limited amount of sapwood.

If the presence of Lyctus attack is likely to be unsightly without causing serious weakening, it may sometimes be concealed by placing the sapwood edge away from lining materials so that the emerging beetles do not bore through the linings, or else by placing a lining material beneath the infested wood to catch the dust.

Finishing Timbers, Flooring and Furniture

Lyctus attack in finishing timbers, flooring or furniture seldom causes serious structural weakening but may completely spoil a decorative effect. During construction, the risk of later damage can be greatly reduced by rejecting finishing timbers with sapwood edges.

Frequently the presence of Lyctus in decorative woodwork and furniture is not apparent until a new building has been occupied for several months and little heaps of frass begin to appear on or under polished or painted surfaces. If treatment is started almost as soon as these appear, and repeated whenever fresh holes occur, the attack can be completely eradicated before much real damage is done. In most cases the following treatment with a liquid insecticide will be found to be entirely satisfactory.

(*a*) *Method of Treatment.*—Use a syringe, oil can, or eye dropper with a small outlet to force the preservative into the borer flight holes, so as to completely penetrate the infested wood. Penetration is assisted by removing loose dust from the borer tunnels with a vacuum cleaner before treatment.

After the preservative has had time to dry, fill the borer flight holes and restore the surface finish.

Treat any fresh holes which appear later as soon as they are noticed.

If the flight holes are numerous, or the infested wood can be placed flat, several liberal coats of preservative applied with a brush will penetrate well into the wood and give effective control.

(*b*) *Insecticides to Use.*—Almost any reliable insecticide dissolved in a clean, light mineral oil solvent (kerosene, mineral turpentine, etc.) may be used to control Lyctus in seasoned timber. Hardware stores and Stock and Station agents in most towns now stock at least one proprietary brand of preservative for the treatment of borer-infested wood. Satisfactory preservatives contain one or more of the following insecticides in the proportions given:

Insecticide	Concentration	
	Percentage	Oz/Gal (approx.)
Dieldrin	0·5	1
Chlordane	2·0	4
Lindane	0·5*	1
Gammexane	0·5*	1
DDT	3·0	5

* Gamma-isomer content only.

If only small quantities of preservatives are needed, it is usually more economical to purchase a proprietary brand of prepared preservative than to mix the chemicals. If larger quantities are needed, the above-mentioned chemicals may be purchased as concentrates and mixed with an appropriate amount of a suitable solvent. For example, 1 oz of Lindane (which is almost pure gamma-isomer of benzene hexachloride) may be dissolved in 1 gallon of kerosene, but approximately 8 oz of Gammexane (containing only 13 per cent. gamma-isomer) would be required to give the same effective concentration.

Oily preservatives with a strong or persistent odour, such as creosote oil, and waterborne preservatives which may cause seasoned timber to swell or warp, should not be used for the treatment of seasoned timbers used indoors. Special care should be taken to avoid tainting in timber food storage cupboards.

Special Cases

Advice on treatments to meet special cases may be obtained from State Forest Services or from the Division of Forest Products, C.S.I.R.O., P.O. Box 18, South Melbourne, S.C.5.

<< Content

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Service Tests of Preservative Treated Rail Sleepers

(*Continued from page* 2.)

road bed. It was found that while the surface application of an oily preservative gave some protection against surface deterioration, little or no protection was obtained against mechanical breakdown, particularly end splitting.

These early service tests definitely established the superiority of impregnation treatments and oily preservatives for the protection of sleepers. In areas where decay hazard is high, a relatively large proportion of creosote in a creosote mineral oil mixture is desirable to combat fungal attack. In areas where biological attack is not important, higher percentages of mineral oil are desirable in order to counter mechanical deterioration.

Recent Tests

From the early tests it was apparent that satisfactory preservative treatment of most of the Australian hardwoods could not be obtained with the usual treating pressures and schedules used overseas.

Following the installation at this Division of an experimental high pressure treating cylinder and an incising machine, treatments were carried out on both incised and non-incised material using pressures up to 1000 p.s.i. It was found that many of the timbers of low durability at present being accepted for sleeper use could be treated fairly readily. Deeper penetration and higher preservative loadings were obtained with the high pressures, while incising afforded a more uniform pattern of penetration.

Early in the 1950's, treatments were begun in the high pressure cylinder on the most comprehensive service test of sleepers ever conducted in Australia. This test, in co-operation with the Victorian Railways, was made to demonstrate the feasibility of high pressure commercial treatment of Australian hardwoods, and to obtain the maximum information on the following factors: type of treatment, preservatives and necessary retentions, species of timber, pretreatments (e.g. incising, preboring), and location (environment, traffic, and type of track).

Four species of eucalypt, together with Australian and New Zealand grown *P. radiata*, are under test in four localities in Victoria. Ten different treatments, including creosote alone, creosote and oil mixtures, pentachlorphenol in oil, napthenic acid, waterborne preservatives, and surface coatings, are under test.*

Since 1953, service tests of treated sleepers using both high and low pressures, have also been installed in Western Australia, Tasmania and South Australia.

For the Tasmanian test 150 sleepers, representing three species of Tasmanian hardwood, were treated, using two different treatments and preservatives.

The South Australian test was made on *P. radiata* only. Over 540 sleepers were treated with the following preservatives: two mixtures of creosote and oil, pentachlorphenol in oil, and a waterborne salt. All the treatments were carried out at 200 p.s.i.

In 1954, over 400 sleepers, representing three species of Western Australian hardwood (jarrah, karri, marri) were treated for service test in Western Australia with a creosote/oil mixture, pentachlorphenol in oil, and straight furnace oil.

Except for the treatment of the South Australian pine sleepers, at least half of the test sleepers installed since high pressure treatments began have been incised.

Although it is too early to assess the benefits of treatment in any of the tests recently installed, after only 12 months service those sleepers treated with oily preservatives in the Victorian test are already showing less weathering then preservative salt treated or untreated sleepers.

Service tests have already given much information on the relative merits of preservatives and treatments, and further tests, particularly on Queensland and New South Wales timbers, are scheduled for the near future. Meanwhile, work is continuing to improve on the evaluation of preservatives and improved methods of treatment.

The Division is confident that, as preservative practice becomes more generally adopted, the increased service life of treated sleepers will result in economic advantage both to the railways and the nation.

* A table showing all sleeper treatments will be published in Newsletter 226 (January 1957).

Let's Discuss Sawing

with D. S. JONES, Utilization Section

Perforated Bandsaws

The perforated bandsaw blades recently developed overseas are beginning to appear in this country, and a discussion of the advantages and disadvantages of these blades will probably be of interest to sawmillers using bandsaws.

The perforated bandsaw blade has holes punched along its length, the centre line of the holes lying slightly closer to the back edge of the saw than to the cutting edge. The holes can be of various shapes and can form different patterns, but the simplest type of perforation consists of circular or oval holes about one-third the blade width in diameter, and spaced along the blade at a centre distance approximately equal to the blade width.

The advantages claimed for these blades are that the perforations eliminate the necessity for rolling the blades and thus cut down maintenance time, and also that they saw smoother, and that sawdust is discharged more efficiently and does not adhere to the sawn surfaces. This type of blade however, has a serious disadvantage. The presence of the holes severely limits the extent to which the blade can be ground down. Solid blades are frequently still in use when they have been ground to half their original width, but a perforated blade must be discarded long before this stage is reached, hence, the sawmiller must weigh up the advantages claimed for the blade against this disadvantage. For example, before these blades can compete economically with solid blades, the savings in maintenance costs over a fixed period must be such that they outweigh the extra cost involved in having to discard the blades earlier. Also, the sawmiller might reasonably require that the higher proportion of working time compared to idle time with a perforated blade would allow fewer blades to be kept on hand at any one time.

Opinions differ overseas regarding the acceptability of the perforated blade, but it is interesting to note that the prevailing opinion in the United Kingdom among those who have observed these blades in use is that the disadvantage of the limited useful life outweighs the advantages. Observers in Australia, however, might reach a different conclusion.

OVERSEAS VISITS

MR. S. A. CLARKE, Chief of Division, was one of the official Australian delegates at the World Eucalyptus Conference held in Rome in October. He was leader of the Utilization Section of the Conference. Mr. G. J. Rodger, Director-General of the Forestry and Timber Bureau was appointed chairman of the Conference.

Mr. J. D. BOYD, Officer-in-Charge of the Timber Mechanics Section, is at present overseas studying developments in timber mechanics, with particular reference to the design and testing of timber structures. He will return to the Division next March.

DONATIONS

THE following donations were received by the Division during the month of October:

Victorian Sawmillers Assn., Melbourne	£25 0 0
Rutherglen Timber Co., Rutherglen, Vic.	£20 0 0
F. Straker and Sons, Cooroy, N.Q.	£20 0 0
E. Wilkinson and Sons Pty. Ltd., Yandina, N.Q.	£20 0 0
Timber Industries Pty. Ltd., Oberon, N.S.W.	£10 10 0
W. R. Henry and Son, Geelong, Vic.	£5 5 0

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