COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.
DIVISION OF FOREST PRODUCTS.
1941##108 MONTHLY NEWS LETTER No. 108.
1st January, 1941.

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WHAT DO YOU KNOW OF SALT SEASONING?

Most of us are familiar with the opinion of 'old-timers' that sea-rafted or -stored timber appears to season much better than that which has never seen the sea, but most of us (until recent times) also thought little more about it; or if we did, tended to dismiss it as of little economic importance. Over the last few years however, work in the laboratory and in the commercial field has shown that the 'old-timers' did have something, and that the seasoning of refractory timbers is facilitated by treating these timbers in a solution of one of the chemical salts prior to their being dried. In fact, the pre-treatment of certain timbers, large sizes, and sections for special work is now an everyday matter, and is normal procedure in some plants.

Now almost universally referred to as chemical or 'salt-' seasoning, the process consists primarily of holding the green timber in an aqueous solution of one (or several) of a number of suitable chemicals. The latter include most of the chemical salts, such as sodium chloride, potassium chloride, ammonium phosphate and others, and also several organic derivatives such as urea and invert sugar. Varying degrees of concentration of solution may be used to achieve certain results, and after the timber has remained in the solution for periods which may range from two or three days to eleven days or so, (depending principally on the species and thickness) it is removed, and either kiln- or air-dried in the usual manner.

No actual chemical reaction between the chemical and the timber is involved, the process depending for its success on a simple penetration or diffusion of the chemical into the outer layers of the timber for distances up to ½-inch. This has the effect (owing to the 'affinity' between salt and water - as will be remembered from our annoyance with the salt cellar at the dining table on humid days) of preventing excessively rapid drying of the outer layers of planks or sections, by keeping them at a somewhat higher moisture content than they would be if the salt were not present. This, in turn, prevents excessive differential shrinkage between the outer layers and the centre of the planks (because normally the outer layers become very much drier than the centre during seasoning) which, of course, is the immediate cause of checking in timber.

The effectiveness of the treatment can be gauged from the fact that, after 11 days in a chemical solution, 12" x 12" and 8" x 16" Douglas fir has been air dried, free from checks, under summer conditions. With untreated timber, one would expect checks to develop 2-inches or so deep. In Australia the process has found commercial application in the 'salt' seasoning of wooden bearings, shoe and boot lasts, rollers, certain sporting goods - and even match-boxes.

Almost all the experimental work done in Australia to date has been with sodium chloride as the hygroscopic chemical. Although possessing certain advantages such as cheapness and availability it has, unfortunately, certain disadvantages of which the most serious is that it is a corrosive salt, particularly when associated with ferrous metals, e.g., iron fastenings or nails. On the other hand urea, and particularly a combination of urea and invert sugar, have been found to be particularly useful for the reasons that, not only are no corrosion hazards introduced, but the chemicals in addition have high anti-shrink values, i.e., they appreciably reduce the shrinkage in the wood. For this reason further work has been planned with these two chemicals, and no doubt a wide range of application will be found.

THE PROPERTIES OF AUSTRALIAN TIMBERS.

HICKORY ASH.

Hickory ash is the Standard Trade Common Name for the species known botanically as Flindersia ifflaiana F.v.M. Other names are Cairns hickory and hickory. The species is one of the many belonging to the genus Flindersia from which genus a number of commercial timbers may be derived. The best known of these is Flindersia brayleyana F.v.M., Queensland maple.

Habit and Distribution: Hickory ash reaches its best development in the hill forests of North Queensland in the Mount Molloy, Kuranda, and Daintree districts where it is associated with numerous other species including red and yellow siris, yellow walnut, Queensland walnut and North Queensland kauri, but forms the major constituent. It is a medium to large tree attaining a height of 120 ft. and a diameter breast high of 2-3 ft.

Properties: The timber is yellowish-brown in colour, with interlocked to straight grain. It possesses no pronounced figure; is hard, heavy and slightly greasy although this feature is not as pronounced as in Crow's ash (Flindersia australis); and is of medium texture. The density of the timber when dried to 12% moisture content is approximately 62 lb./cu.ft. with a 95% probability range of 57-66.5 lb./cu.ft. Collapse during drying is almost negligible and the shrinkage is also low, being on the average 4½% across backsawn widths and 3% across quartersawn widths Match size splinters from sound truewood of this timber burn to a full white or buff coloured ash and this fact is of assistance in identification work.

The timber has the reputation of being fairly durable, it is also a fair bending timber, and has a comparatively high impact and static strength.

Uses: Owing to its strength and durability this timber is eminently suited for heavy construction. It has been used for stumps and posts, bottom plates, studs, wall braces and bearers in house construction; railings and gates. It is also suitable for flooring and to a certain extent for boat decking. Other uses are for tool handles, and general vehicle construction.

Availability: It is available mainly in structural sizes in the localities of occurrence and also in short lengths for the manufacture of tool handles.

Further information on this or any other timber may be obtained from the Chief, Division of Forest Products, 69 Yarra Bank Road, South Melbourne, or from the various State Forestry Departments.

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GLUED LAMINATED TIMBER ARCHES.

A type of structure that has been used in Europe for many years and which has recently become popular in America, is the timber arch built up of comparatively thin boards glued together, thus permitting any desired shape to be obtained. So far as is known, no glued laminated arches have been built in Australia, but there is no reason why they should not be constructed here, as local timbers are quite suitable for the purpose.

The design and construction of glued laminated arches is thoroughly dealt with in a recent publication of the U.S. Forest Products Laboratory (U.S.D.A. Technical Bulletin No. 691).

In this bulletin it is pointed out that the advantages of this type of structure include:-

Arches to span large unobstructed areas with superior architectural effect are made available.

Material of the sizes used in laminated construction (up to 1" thickness) can be dried in a short time. (This is of particular importance in this country where it is very difficult to obtain dry timber in large sizes).

Members can be built up to larger cross section and greater length than are otherwise available. Members can be built up from material that is too small to be structurally useful otherwise.

Laminations can be placed in accordance with their quality, the highest quality pieces being placed at points of maximum stress.

Members can be tapered to give a graceful appearance and to save material.

In building glued laminated arches, the boards are coated with a moisture resistant casein glue and are assembled against a continuous convex form, pressure being applied by mechanical screw clamps or hydraulic or pneumatic jacks.

European experience has shown that so long as the arches are protected from the weather, their life is indefinite, and recent developments with completely water-resistant glues lead to the hope that in the near future it will be possible to use this form of construction even for exposed situations.

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WARPING IN PLYWOOD AND VENEERED PRODUCTS.

Don Brouse of the Forest Products Laboratory, Madison, Wisconsin, U.S.A. recently published a succinct article dealing with the above subject. The summary in a slightly expanded form is given hereunder.

Summary.

The following outline summarises the different factors that may contribute to warping and is offered as an aid in determining the probable causes from an examination of warped plywood panels.

Twisting:

1. Grain direction - Crossbands in 5-ply and face and back veneer in 3-ply not parallel.

2. End drying without drying at the centre.

3. Method of fastening - Twisting results when plywood panel are fastened rigidly to supporting members whose shrinkage characteristics differ from those of the plywood panels.

Cupping:

A. Defects in construction.

1. Thicker crossbands on one side than on the other.

2. Cross-grained crossbands on one side and straight grained on the other.

3. Doty crossband on one side and sound crossband on the oth

4. Compression wood in one crossband and normal wood in the other.

5. Species of widely different shrinkage characteristics used as crossbanding.

6. Widely varying moisture contents at the time of gluing.

B. Improper handling.

1. Drying more rapidly from one side than the other.

2. Highly resistant finish (to the movement of moisture) on one side with a finish of lower resistance on the other.

3. Method of fastening.

General:

1. Moisture content at the time of gluing. The moisture content of the different plies should be adjusted immediately prior to gluing so that the average moisture content when the glue sets is as nearly as possible equal to the average moisture content the stock may be expected to reach in service.

2. Density of the species. Warping of panels when subjected to varying moisture conditions is less when low density species are used.

3. Ratio of core thickness to total panel thickness. In general, the core should comprise 5/10ths to 7/10ths of the total thickness of panel where flatness is an important consideration.

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AUSTRALIAN TIMBERS FOR MATCHES.

Considerable interest has recently been aroused on the question of the use of Australian timbers for matches and match boxes. Prior to the war the match industry could obtain and was content to rely entirely on aspen (poplar) for its match splints which were imported from Latvia and the Baltic countries. Needless to say, supplies of splints have been cut off and there is now a rather frenzied search for suitable Australian substitutes, a search that should have been made and completed many years back.

What exactly are the requirements of a timber for match splints that it is so essential to use an imported species? As far as can be gathered in first-hand observation of the problem the main requirements are straight grain and fine and uniform texture. Stress is also laid on the light colour of the timber, but the need for this has always been doubted and the public could advisedly cease to expect whiteness in matches in these days. Furthermore, the log for the preparation of the 1/12" veneer from which the splints are prepared must be of first quality without knots, bumps, buttresses or any marked eccentricity. These requirements can be met the more readily because the actual length of the log for veneering is only 18". Thus many defective parts can be eliminated provided good straight grained material remains.

There should be a large number of Australian timbers that will meet all these requirements. However it is essential in the first place that logs with irregular, interlocked or wavy grain, external irregularities or otherwise misshapen should be rigidly excluded. Any grain distortion will be revealed in the finished match and how many of us have cursed when the head of the match flies off.

Such timbers as pink poplar (*Euroschinus falcatus*), sassafras (*Doryphora sassafras*), bollywood (*Litsea reticulata*), yellow carabeen (*Sloanea woollsii*), white birch (*Schizomeria ovata*), white basswood (*Panax murrayi*), candlenut (*Aleurites moluccana*), silver quandong (*Elaeocarpus grandis*), kauri (*Agathis spp.*), brown pine (*Podocarpus elata*) are all promising and well worth trial. Huon pine and radiata pine have been used. The peeling qualities of most of these are well known. There are many others whose potentialities in this connection need to be explored. A systematic investigation is essential before any timber can be condemned.

There is no doubt that hoop and bunya pines would prove equally satisfactory in this regard, but it is essential to conserve supplies of these timbers for other more important uses.

Match box skillets have been made from Australian timbers including hoop pine, kauri, radiata pine and others, but here again the question of supply enters the picture. It is highly probable however that some or all of the above listed timbers would also be suitable for this purpose.

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BREVITIES.

Mr. I. H. Boas, Chief, Division of Forest Products and Assistant Controller of Timber, Department of Supply and Development has just returned from a visit to Tasmania in connection with Timber Control.

Mr. A. Gordon of the Utilisation Section, Division of Forest Products has returned to Melbourne after spending several months in North Queensland collecting timber for testing in the Division's laboratories and carrying out special work for the Department of Supply and Development.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

MONTHLY NEWS LETTER No. 109.

1st February, 1941.

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FIRE-PROOFING CHEMICALS.

In a recent issue of "The Industrial and Engineering Chemistry" (November 1940) appears an interesting article on the relative effectiveness of certain chemicals in decreasing the combustibility of sawdust. The work which was carried out at the University of Idaho, U.S.A., refers to the action of those chemicals which, when impregnated in woody tissue, may induce fire resistance. This property results from one of the following causes:-

(a) The chemicals evolve gases such as ammonia which largely exclude oxygen from the combustion area;

(b) The chemicals (such as borax) fuse over the surface of the combustible material and thereby shield it from oxygen;

(c) The chemicals undergo endothermic reactions (such as vapourisation of water) and thus remove a portion of the heat of combustion. That these several types of protective reactions occur is well established.

In examining the relative efficiencies of a number of chemicals in decreasing the combustibility of sawdust a modified fire-tube apparatus was used. This apparatus proved extremely satisfactory in that the fire resistance of the various sawdust samples could be reproducibly and rapidly determined.

The decreasing order of effectiveness of the chemicals studied (based on loss in weight of the sample during the test) proved to be as follows:-

diammonium phosphate.
borax
monoammonium phosphate
zinc chloride
ammonium sulphate
ammonium chloride
magnesium chloride.

The first four of these were effective in moderately small amounts (8-10%) and may be used to fire-proof sawdust. Larger amounts of ammonium sulphate and ammonium chloride are required while magnesium chloride is not suitable as a fire retardant. Whereas borax proved to be a relatively good fire-proofing agent, when impregnated into sawdust, it was without effect when simply mixed in the dry form in sawdust.

Because of the possible value of sawdust for insulation and other uses, a study of the fire-proofing of sawdust is of definite immediate interest. The chemicals used in this work with sawdust have also been used for impregnating into solid wood and certain of them, including the ammonium phosphates and borax, have been shown to be efficient in the fire-proofing of timber.

AUSTRALIAN SAWDUST FOR MOSQUITO COILS.

Our attention has been drawn by the Queensland Forest Service to the manufacture in Australia of mosquito coils and sticks using wood-flour prepared from Queensland timbers. These are designed to replace the coils and sticks previously imported from the Orient for the same purpose.

THE USE OF BORAX AND BORIC ACID FOR THE PREVENTION OF LYCTUS ATTACK IN VENEER AND SOLID TIMBER.

The Division of Forest Products, after an extensive series of tests, has been successful in developing a simple method for the treatment of green veneer with boric acid in order to render it immune to the attack of the Lyctus or powder post borer. This treatment has been commercially applied with excellent results.

Further experiments have now been carried out with the object of providing protection for solid timber. A satisfactory immersion treatment has been developed and schedules for such treatment are now available. The equipment required is very simple, viz:- a vat with steam coils and necessary handling gear for the immersion and removal of the timber. However, further experiments are planned in order to obtain information regarding the most suitable material for the construction of the treatment vats and on the costs of treatment. When such information is available, it is hoped that the treatment of solid timber up to 2" in thickness will be established on an economic basis.

Full data concerning the treatment process and its application to such timbers as red tulip oak and white birch (crab-apple) can be obtained from the Division of Forest Products, as well as from the Queensland Sub-Department of Forestry and the New South Wales Forestry Commission.

The treated timber can be air dried or kiln dried as desired after treatment and can then be dressed or sawn without affecting its borer-proof properties. It will take polish and paint as well as untreated timber.

For temporary protection from borer attack freshly sawn timber can be given a dip treatment in a hot borax solution. Such treatment has given satisfactory results in America. At present, the method has had only a limited trial in this country, but the effects have been encouraging.

As a result of these boric acid and borax treatments, Lyctus attack in veneer and solid timber may now be easily and cheaply controlled and in future, it is not too much to expect that in all commercial timbers with perhaps the exception of hardwood scantling, where treatment is not justified, borer damage will be reduced to a minimum.

WOOD BENDING SIMPLIFIED BY NEW DISCOVERY.

In a recent issue of the 'Southern Lumberman', there appears an article which refers to the discovery of a new wood treatment which apparently greatly simplifies bending. This treatment was accidentally discovered by a member of the United States Forest Products Laboratory staff during experiments on the chemical treatment of wood with urea. It was accidentally found that wood treated with this substance bent very easily when heated.

Urea has been used in experiments connected with the seasoning of various timbers. Reference has been made in this News Letter to the use of common salt in a process known as salt seasoning. In some cases, salt is somewhat detrimental on account of corrosion of metal and nails used in the timber so treated and, therefore, experiments were carried out with other materials which would not attract moisture. In this way, it was found that urea was very effective and in addition, that timber treated with this substance was fire retardant.

It was during these tests for fire resistance that it was accidentally discovered that the test samples when heated to about 175°F. bent very easily. In fact, they could be twisted, bent and distorted with amazing ease. On cooling, the pieces seemed to retain their new shapes without any apparent fractures or other injury.

In this new process, it seemed that any wood could be used. The treatment consists of immersing the green timber in a saturated solution consisting of 1 lb. of urea to 1 pint of water. The timber is allowed to soak at room temperature for a period of one week per inch of thickness. After this treatment the timber may, if necessary, be stacked for some time and the necessary bending can be accomplished any time or anywhere afterwards by merely heating to a temperature of 175°F. The cost of the urea in the United States is reported to be about 85 dollars per ton (the cost in Australia will be approximately £43 per ton). It is claimed that there is little or no waste of the urea in the treatment and so the treatment is comparatively inexpensive.

It has been suggested that the principle of the treatment lies in the chemical reaction of the urea with lignin, one of the substances of which wood is composed. With these two combined, a thermo-plastic results which, as the name indicates, is plastic only when heated. It is claimed that the urea treated timber is more resistant to decay than untreated material, and in drying, the urea definitely reduces the tendency to check or split.

It is planned to carry out experiments using this treatment on Australian woods in the laboratories of the Division of Forest Products, and the results obtained will be reported in a future News Letter.

EXPERIMENTS WITH SLEEPER TIMBERS.

The Victorian Department of Railways is co-operating with the Division of Forest Products in a large scale project in which it is planned to investigate the lasting qualities of sleepers cut from timbers reputedly of low durability. The object is to conserve the diminishing supplies of more durable timber upon which the annual sleeper requirements make heavy demands. The timbers reputedly of low durability which are under examination consist of mountain ash, manna gum, white stringybark, messmate stringybark, silvertop ash and mountain grey gum. In the experiments planned, sleepers cut from each of these timbers will be compared with sleepers cut from reputedly more durable timbers, including yellow stringybark, coast grey box and red gum. Two test sections of track have been selected for this experiment, and these will represent both wet and dry localities. The traffic on both sections is fairly heavy with heavy loading. In one section of the experiment, some of the sleepers and the ballast will be treated with a preservative oil.

It is proposed to inspect these test sections at regular intervals and to obtain comparative figures for the life of each type of sleeper as well as some estimate of the effect of the preservative applied. It is not expected that all the timbers will prove satisfactory even with the treatment mentioned, but it is hoped that the results will enable a scheme for better sleeper utilisation to be developed. In such a scheme, it is hoped that timbers hitherto unused will find a place and so relieve the drain on the more durable species. The less durable timbers, if at all satisfactory, could probably be profitably substituted in those tracks where traffic is infrequent, thus leaving the better quality timbers for tracks where the conditions are much more severe.

PROPERTIES OF AUSTRALIAN TIMBERS.

KING WILLIAM PINE.

King William pine is the standard trade common name for the species known botanically as Athrotaxis selaginoides D. Don. This species is the only timber representative in the Southern Hemisphere of the order Taxodiaceae, of which family the best known species in the Northern Hemisphere is Californian red-wood (Sequoia sempervirens). The timber of King William pine is very similar in structure and properties to red-wood.

Habit and Distribution. This species is found in Tasmania only, being confined chiefly to the western part of the island at higher elevations, 1700 to 3000', and also in the central highlands. The tree attains a maximum height of 100' and a girth breast height of over 12'; the average milling tree has a girth breast height of 6' to 10' and a merchantable bole of 20' to 40'.

Properties. The timber is light pink to a yellowish pink in colour; pale red when freshly cut but fading on drying. The grain is straight and the texture fine and relatively uniform; growth rings are prominent and the bands of late wood are fairly conspicuous. The timber is light in weight, having an average density of 24 lb/cu.ft. when dried to 12% moisture content. The density range in which 95% of the material at this moisture content can be expected to fall is 21 to 28 lb/cu.ft. The timber is easy to season and in drying from the green condition to 12% moisture content, the shrinkage to be expected is 3.8% across back-sawn boards and 1.6% across quarter-sawn boards. Longitudinal shrinkage in this species may be high due to the presence of compression wood. This reaction wood is not easy to detect in the timber, but any material with dense bands of late wood extending practically throughout the growth ring should be eliminated, when selecting for specialty purposes. Strength properties are normal for the weight of the timber except that it is lower than would be expected in modulus of elasticity. It has been shown to be a very good bending timber and it has a high reputation for durability.

Uses. This species finds its greatest use in joinery, in the form of doors, window frames and sills, etc.; it is also used for the manufacture of oars and sculls, more recently for pattern making, for bent work, weatherboards, wood pipes, vats, slats for Venetian blinds, and sounding boards in violins and pianos. It has also been tried for battery separators and for match splints and skillets.

Availability. Supplies of the timber are fairly scarce, owing partly to its inaccessibility. However, it is possible to obtain material in a range of boards and manufacturing sizes in short and medium lengths.

Further information on this timber can be obtained from the Chief of the Division of Forest Products, Yarra Bank Road, South Melbourne, or from the Conservator of Forests, Forestry Department, Hobart.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

MONTHLY NEWS LETTER No. 110.

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WHAT NAME DID YOU SAY?

"Don't be silly, it's a sort of yellow!"

"I'm not silly! If any timber's red, blue gum is! Why, we used to get tons of it from Sydney for waggons. Do you think I'm colour blind?"

"Why did you get it from Sydney when it grows here?"

"No it doesn't!"

"Course it does and in Tassie too!"

"Oh! You're talking about Tassie blue gum."

"Yes that's right! What are you talking about?"

and so on.

How many times have you heard an argument like that?

Too many! That is what Australian timber men have thought for years and now thanks to the Standards Association of Australia we may hope that someday such misunderstandings will no longer occur. The foundation for hope lies in the recent issue of their technical standard A.S. O.2 - "Nomenclature of Australian Timbers" which sponsors for the first time a single common name for each of the principal timbers in Australia.

In the past and at present anyone interested in timber on a Commonwealth or even a State wide basis is faced with a perplexing array of names. One name is applied to several entirely different timbers and some timbers have as many names as a cat has lives.

It is easy to understand how this came about. Australia is a big country and especially in the early days, communities developed their commerce without much reference to the activities of their neighbours. In 1900 it probably did not matter much if Eucalyptus acmenioides was called yellow stringybark in Queensland and white mahogany in New South Wales. In 1941 it does matter. Improved transportation now brings products from different States and districts to common markets and timber men are scattered far and wide from where they learnt their local names.

Everyone agrees with the principle of one name, one timber. Jarrah is a splendid example of the advantages of this. By contrast consider the confusion with a species like Eucalyptus regnans which is a very important timber yet it is known as mountain ash, swamp gum, stringy gum, Tasmanian oak, Victorian oak, Australian oak and even blackbutt. Take a lot of cases like this and thousands of men on defence work in places far away from their home locality and names they have known and the result must be confusion. The matter will never right itself. Only deliberate action will bring results and such action is urgent for, in war-time especially, every source of confusion, misunderstanding, delay and inefficiency must be eliminated.

In choosing the names which they are sponsoring the Standards Association gave careful consideration to the opinions of every person who submitted suggestions. Where a timber had several names and one was chosen and the rest rejected, it is inevitable that the whole effort will be wasted unless the supporters of the

rejected names accept the decision with good grace and fall into line at least to the extent of using the standard name as an alternative to the one they ordinarily use. Even with wholehearted co-operation many years may pass before standard names are used universally and other names have fallen into complete disuse, but the life of the timber industry and of the nation is long and the sooner we start the sooner will the desirable benefits of standardisation be realised. For a little while there may be more confusion than ever but if we all keep steadfastly to a definite course we should pass through this inevitable stage in a surprisingly short time.

The last stronghold of the minor names will be the bush and it is asking too much to expect these names to disappear quickly. However, bush workers learn rapidly and any new names will soon be understood as well as the old and probably be used interchangeably. Forestry officers and timber buyers can exert influence in this sphere and their co-operation is assured.

The list of Standard names has also been issued in the form of a Trade Circular of the Division of Forest Products, namely, Trade Circular No. 47. While supplies last, copies may be obtained on application to the Chief, Division of Forest Products, 69 Yarra Bank Road, South Melbourne, S.C.4.

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AGAIN WOOD versus STEEL.

The relative advantages of steel and timber roof trusses were well demonstrated in a severe fire that recently occurred in a large Perth hardware store.

The building consisted of a saw-tooth roof with welded steel girders and trusses, supported on brick walls. The purlins were of timber (jarrah) and the partitions were mainly of 3 x 2 jarrah.

The fire gutted the store and ruined the steel roof, which completely collapsed causing the brick walls to be so badly damaged that they will have to be re-built. The interesting part is, however, that the majority of the purlins, although severely charred, were not burnt through, while the 3 x 2 partition studs also were not completely burnt. The lesson is that, in a fire, steel roof trusses will collapse and cause costly damage to supporting walls, as well as being expensive to remove, due to the necessity of cutting them up with the oxy-acetylene torch.

If the trusses had been of timber, they would have withstood the fire very much longer than the steel trusses (as evidenced by the condition of the timber purlins and partitions) and even if the timbers had burnt through eventually, they would not have ruined the brick walls in falling.

The lesson has not been lost on the management of the store and in re-building, the steel trusses will be replaced with modern timber trusses using split-ring connectors.

This is merely one of innumerable examples of the superiority of timber over steel for such purposes as roof trusses, especially for such buildings as warehouses, garages, hangars, etc. which house highly inflammable contents.

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THE USES OF TIMBER.

With a few notable exceptions the information on timber utilization is prepared in the form of notes on individual timbers, and a person seeking information on timbers suitable for a certain purpose usually has to assemble for himself the relevant information.

In due course the Division of Forest Products plans to issue a publication dealing with the major uses for timber. This cannot be done at present, so in the meantime it is proposed to include in each News Letter a brief article on some use for timber.

Flooring is discussed in this issue.

FLOORING.

Wood is unequalled as a material for flooring for many purposes, especially for homes and places where pedestrian traffic is heavy.

Let us consider why wood should be so widely used for flooring by enquiring first "What are the attributes which make timber so pre-eminent for flooring construction?" Undoubtedly its ability to withstand the continuous traffic of years, accompanied by its cheapness, ease of working, handling and laying, its adaptability to designs, beauty, combined lightness and strength, insulating properties and comfort, all contribute to its popularity. There is definite evidence that a covered wooden floor produces much less fatigue in workers than a concrete floor.

Timber, to be satisfactory for any kind of floor, must conform with the following fundamental requirements. The dimensions must be great enough to ensure the floor will be sufficiently strong and stiff to meet with the anticipated conditions of service. Timber should be inspected to ensure that no major weakening defects are present. It should be seasoned to a moisture content in equilibrium with the atmospheric conditions of service. This properly seasoned timber should be machined accurately to the desired profile. In addition to these fundamentals additional specific requirements will be necessary in flooring for different purposes.

According to the function for which flooring timbers will be used there are two chief classes of wood floors - structural and non-structural, best represented by strip floors and block floors respectively.

Strip floors may comprise one or more layers fixed over joists or battens, and are of considerable structural importance in supporting floor loads.

Block floors, including end-grain and side-grain block and parquetry floors, are laid over some structural material which provides a rigid even base. Structural concrete and plywood or wood strip sub-floors are common bases used for block floors.

The choice of timbers for internal floors is governed primarily by the purpose which the floors are intended to serve. In houses, offices and other buildings subject chiefly to pedestrian traffic the appearance of floors to be covered is of minor importance provided the timber used is sufficiently strong and the floor provides an even base for the laying of linoleum, carpet or other material, but where such floors will be exposed, good appearance, durable finish, resistance to wear and easy maintenance are necessary. For warehouses and factories both strip and block floors are common. Strip floors have the great advantage of cheap installation, but in many instances such floors are found unsatisfactory because the boards used are not strong enough to support without undesirable deflection between joists the heavy loads concentrated on small areas when small diameter steel wheeled trucks are used. Consequently tongues frequently shear off and excessive wear occurs by slivering from edges of boards as the wheels pass from one board to the next. The nails fixing the boards to the joists are also

liable to be sprung. The provision over joists of a sub-floor on which the finish floor is subsequently laid has many advantages over the alternative method of using thicker flooring where heavy loads are moved about and wear is excessive. The top layer of such a floor may be replaced with a minimum of inconvenience.

Wood block floors for industrial purposes are generally set in a bitumastic compound and are commonly laid over a screeded concrete base. They are comfortable to work on and effectively cushion the abrasive effects of the impact of heavy sharp cornered articles dropped on them. Badly worn sections are replaced fairly easily.

End-grain blocks provide floors which serve particularly well under all kinds of wear.

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AUSTRALIAN FLOORING TIMBERS.

The following Table shows under headings for various types of floors the timbers which are suitable. This has been done by placing in the appropriate place the initial of the States where the timber is used, namely, N for New South Wales, Q for Queensland, S for South Australia, T for Tasmania, V for Victoria and W for Western Australia. If the timber is commonly used the initial has been underlined. If not underlined, the timber is technically suitable but economic factors such as high cost, limit its use. Some timbers have been marked Ø. These should be free from sapwood.

Attention is directed to the 1940 revised standard A.S. No. 0.3 - "Grading Rules for Milled Flooring" and to A.S. Nos. 26-30, 32 - "Grading Rules for Jarrah Flooring" published by the Standards Association. Milled flooring should be ordered under these standards according to the grade required. For exposed floors of almost perfect appearance, select grade should be specified, but for all other floors, merchantable grade is usually good enough.

TYPE OF FLOOR

TIMBER	EX-TERNAL	INDUSTRIAL			HOMES, PUBLIC BLDGS. etc.
		Sub-floors	Top Floors & Side Grain Blocks	End Grain Blocks	Strip Floor, Side Grain Block, Parquetry
alder, rose		Q,			Q,
ash, alpine		N,S,T,V,	N,S,T,V	N,T,V,	N,S,T,V,
ash, crow's Ø	N,Q,	N,			N,Q,
ash, hickory Ø	Q,	Q,	Q,		Q,
ash, mountain		S,T,V,	S,T,V,	T,V,	S,T,V,
ashes, silver Ø	Q,				Q,
ash, silvertop		N,V,			N,V,
beech, myrtle		T,V,	T,V,		T,V,
beech, white	N,Q,	N,Q,		N,Q,	N,Q,
blackbutt		N,Q,	N,Q,	N,Q,	N,Q,
box, brush		N,Q,	N,Q,	N,Q,	N,Q,
cadaga	Q,	Q,	Q,	Q,	Q,
carbeen Ø	Q,	Q,	Q,	Q,	Q,
cheesewood Ø		Q,			Q,
gum, blue, southern Ø	T,	T,V,	T,V,	T,	T,V,
gum, blue, Sydney Ø		N,	N,	N,	N,
gum, grey		N,Q,	Q,	N,Q,	Q,
gum, manna Ø		T,V,			T,V,
gum, mountain Ø		N,			N,
gums, red Ø	V,	N,Q,V,		N,Q,V,	N,Q,V,
gum, rose Ø		N,Q,			N,Q,
gum, spotted Ø	N,Q,	N,Q,	N,Q,	N,Q,	N,Q,
ironbarks	N,Q,	N,Q,	N,Q,	N,Q,	N,Q,
jarrah	S,V,W,	S,V,W,	S,V,W,	S,V,W,	S,V,W,
karri		S,W,	S,W,		S,W,
kauri *		Q,			Q,
luster	N,Q,	N,Q,	N,Q,	N,Q,	N,Q,
mahogany, brush		N,			N,
mahogany, red Ø	Q,	N,Q,	N,Q,	Q,	N,Q,
mahogany, rose Ø		N,Q,	N,Q,		N,Q,
mahogany, white	Q,	N,Q,	N,Q,	Q,	N,Q,
maple, Queensland		Q,			Q,
maple, scented		Q,	Q,		Q,
messmate, Gympie	Q,	Q,	Q,	Q,	Q,
oak, tulip Ø		Q,	Q,		Q,
pendas	Q,				Q,
peppermints Ø		T,V,			T,V,
pine, black		Q,			Q,
pine, bunya *		Q,			Q,
pine, celery-top	T,	T,			T,
pines, cypress		N,Q,V,		N,Q,	N,Q,V,
pine, hoop *		N,Q,			N,Q,
pine, radiata		S,V,		S,(if creo-soted)	S,V,
quandongs Ø		Q,			Q,
sassafras		N,Q,			N,Q,
satinashes Ø		N,Q,			N,Q,
satinay		Q,			Q,
sheoak, rose		N,			N,
silkwood, bolly Ø		Q,			Q,
silkwood, silver Ø		Q,			Q,
silkwood, red Ø		Q,			Q,
siris, red Ø	Q,	Q,		Q,	Q,
siris, yellow Ø	Q,	Q,		Q,	Q,
stringybark, brown		N,V,	N,V,	N,V,	N,V,
" messmate Ø	T,V,	S,T,V,	S,T,V,		S,T,V,
" white	Q,	N,Q,V,	N,Q,V,	Q,	N,Q,V,
" yellow	N,V,	N,V,	N,V,	N,V,	N,V,
sycamore, satin		Q,	Q,		Q,
sycamore, silver		N,			N,
tallowwood Ø	N,Q,	N,Q,	N,Q,	N,Q,	N,Q,
turpentine	N,Q,	N,Q,	N,Q,	N,Q,	N,Q,
walnut, yellow Ø		Q,			Q,
wandoo	W,	W,	W,	W,	W,

* Should not be used. Required for defence purposes.

THE PROPERTIES OF AUSTRALIAN TIMBERS.

FOREST RED GUM.

Forest red gum is the standard trade common name given to the species known botanically as Eucalyptus tereticornis Sm. syn. E. umbellata (Gaertn.) Domin. It is known in Queensland as blue gum owing to the bluish caste of the smooth bark.

Distribution and Habit: This species occurs in Victoria, New South Wales and Queensland, chiefly in open forest in the undulating country of the inland districts of moderate rainfall, but also in coastal districts as scattered trees in association with grey iron-bark and bloodwood; it also occurs on the Atherton Tableland of North Queensland. The bark is smooth and often with a persistent rough bark at the base. The tree may attain a height of 100 ft. and a girth breast high of 9-12 ft.

Properties: The timber of this species is light to dark red in colour with a greyish or cream coloured sap; it is hard and heavy having an average density of 61 lb./cu.ft. and a range of 54 - 67 lb./cu.ft. when dried to 12% moisture content. The texture is uniform but the grain interlocked which makes it a difficult timber to dress and finish. The shrinkage is high, being in the nature of 9.1% across backsawn widths and 5.7% across quartersawn. There is little information available on the drying of authentic material of this species, but it seems to be somewhat easier to dry and less subject to collapse than river red gum, particularly when the latter has been grown in areas subject to flooding. Forest red gum is similar in many respects to river red gum (E. rostrata), but is, on the average, denser.

Uses: This timber is durable and has been used for piles, mine timber, paving blocks, posts, etc.; it is also somewhat fire-resistant. The sapwood is susceptible to attack by Lyctus borers and should be discarded from timber intended for such purposes as flooring. The truewood is resistant to white ants (termites) and to a certain extent to marine borers. Chief uses are in heavy construction work, and building scantling in the form of sole plates stumps, joists, etc. Additional uses are in flooring, steps, sills etc. on account of its durability, hardness and wearing qualities. In the ship-building field it is used for stem and stern posts and for hewn knees in small boats. It can also be used for wood carving as it finishes with a good sheen. Its interlocked grain and hardnes make it a very good timber for such things as mauls.

Availability: The timber is available in round, hewn, or sawn form, chiefly as scantling and squares. Long lengths are not readily obtained.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

MONTHLY NEWS LETTER No. 111.

1941##111 1st April, 1941.

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HOW TIMBER LOSES CUSTOMERS.

The Division of Forest Products has endeavoured by means of publications, lectures and personal contacts to dispel the exaggerated fears which are aroused by the word 'borer'. On numerous occasions it has pointed out that the householder has little to fear from the presence of a few narrow strips of sapwood in the timber used in the roof of his house. While the powder post borer might make its presence known, the fact that only narrow strips of sapwood are available soon limits its depradations. It is hoped that the campaign has been to a large extent successful and that as a result the Australian timber trade has been assisted in marketing Australian timbers more readily, but the trade must also assist. Indiscriminate sales of parcels of building scantling containing large proportions of sapwood have never been commended by this Division and the effect of such a practice can only react disadvantageously to the timber interests.

The following example will clearly show how such an action is not in the best interests of the timber trade. A large group of small wooden bungalows was recently erected at a holiday resort. Before the interior linings could be placed in position, it was observed that about half of the bungalows already erected were showing copious amounts of the borer dust or frass typical of the workings of the powder post borer. In a central building of larger size so much dust was produced in the rafters that the dining tables had to be cleaned off every morning. All this resulted from the use of timber containing considerable amounts of sapwood, and the effect has been that the owner will erect the remainder of the bungalows (still a considerable number) in concrete - not timber. A case such as this is excellent advertising material for suppliers of timber substitutes.

The annoying thing is that with a little care the offending sapwood could have been eliminated to a large extent and the timber would not have suffered so unnecessarily. It is true that probably only a small proportion of the trade is involved in cases of this nature, but unfortunately the effect of this kind of news on the consumer is out of proportion to the intrinsic damage caused by the borer. Let us hope that good sense will be applied more widely in the future in the sale of building materials. Should any doubts exist or should information be required in regard to these matters, the Division of Forest Products is happy to assist any person who makes application.

TIMBERS FOR OARS.

For many years the only oars that were considered to be any good were those made out of American ash - for straight oars - and sitka spruce - for spoon oars. From 1923 onwards numerous Australian timbers were given extended trials, but the reaction was in no case very favourable and the local products were rejected on one of the following grounds:-

(a) Low strength values compared with imported oars.
(b) Too heavy.
(c) Tendency to warp and twist after manufacture.
(d) Bad balance.
(e) Poor workmanship.

Of these causes for rejection the last three could be placed at the doors of the manufacturers rather than against the timbers themselves. The question of low strength values and weight in comparison with overseas timbers are more serious, but as, there appears little reason why with correct selection Australian timbers could not be obtained with the required weight and strength properties. The oars made from spruce were particularly used for racing and this timber was selected because of its high strength/weight ratio. However, Australian timbers have been proved to be satisfactory for this purpose and silver quandong is now recognised as a particularly suitable timber for racing oars. A specification has been drawn up in which this, as well as bollywood, bunya pine and hoop pine are permitted for spoon blade oars. In this specification the quality of the timber is of prime importance and it is set out that it shall be sound, straight grained truewood free from all defects and imperfections other than the following:-

(i) sloping grain: not exceeding 1 in 16 ($\frac{3}{4}$ in. in 1 ft.).
(ii) spring: not exceeding 1 in 576 ($\frac{1}{2}$ inch in 12 ft.).
(iii) sound intergrown knots: not larger than $\frac{1}{2}$ in. diameter, not more than one per square foot of the face on which it occurs.
(iv) holes: not larger than 1/16 in. diameter, not more than 3 in any 16 sq.in., not more than one per square foot of any face or edge.
(v) surface checks: not exceeding 6 in. long or 1/16 in. wide.
(vi) sapwood in bunya pine and hoop pine.

For straight oars a number of Australian timbers has been used, alpine ash being the most common. Others include such species as rose gum, silver quandong, silver ash, hoop pine, yellowwood, tulip oak and broad-leaved teatree. These timbers compare favourably with the imported American white ash and provided care is taken in selection and manufacture, there is no reason to expect that they will be replaced when the present restriction on timber imports has been lifted.

Oar Manufacture in Australia.

Alpine ash (Eucalyptus gigantea). Produced on a large scale in New South Wales, also in Tasmania.

Rose gum (Eucalyptus grandis). Manufactured in Queensland and along the north coast of New South Wales.

Silver quandong (Elaeocarpus grandis). Used by manufacturers in Queensland, New South Wales and Victoria. Specially suitable for racing oars.

Silver ash (Flindersia pubescens, F. bourjotiana and F.schottiana). Used by the largest Queensland manufacturers and also used in Victoria and New South Wales.

Hoop pine (Araucaria cunninghamii). Used to a certain extent in New South Wales and Queensland.

Yellowwood (Flindersia oxleyana).

Tulip oak (Tarrietia sp.).

Broad-leaved teatree (Melaleuca leucadendron). Used along the coast of New South Wales.

King William pine (Athrotaxis selaginoides). Used for racing oars in Tasmania.

PROPERTIES OF AUSTRALIAN TIMBERS.

SASSAFRAS.

Sassafras is the Standard Trade Common name given to the timber derived from two botanical species, viz: Doryphora sassafras Endl. and Daphnandra micrantha Benth. The timber from the former has also been known in New South Wales as golden deal or yellow sassafras, and the timber from the latter has been known as canary sassafras. Both these timbers have been used together indiscriminately for various purposes and have, therefore, been included under the one name 'sassafras' in the "Nomenclature of Australian Timbers" (S.A.A. No. O-2).

Habit and Distribution: Doryphora sassafras Endl. A tree attaining a maximum height of 150 ft. and a diameter breast high of 4 ft., with a slightly buttressed base; the bark is greyish brown in colour; both bark and sapwood have an aromatic odour. The species is distributed in New South Wales from near the Victorian border along the coastal slopes to north of Brisbane, Queensland. In Queensland it is found chiefly in the MacPherson Ranges, the Killarney and Tambourine districts, in the south east.

Daphnandra micrantha, Benth. This tree reaches a height equal to that of Doryphora sassafras, but not such a large diameter. Its distribution, though similar, is more northern, extending from the Hunter River district in New South Wales to the Mary Valley district in Queensland.

Properties: Both timbers are of a yellowish grey or brown colour, darkening to brownish on exposure; and they possess a faintly aromatic odour when freshly cut. Both timbers are very even in texture and for this reason, as well as because of their comparatively light weight, they have been termed 'softwoods' in New South Wales. However, they are typical "pored" timbers. The grain of the timber in both cases is usually straight, although the timber is not very fissile because of its tendency to brittleness; both timbers work well with tools and take an even finish. In density, Doryphora sassafras ranges from 31 to 45 lbs/cu.ft. and averages 38 lbs/cu.ft. at 12% moisture content. The timber of Daphnandra micrantha is slightly denser with an average of 41 lbs/cu.ft. at 12% moisture content and a range of 35-47 lbs/cu.ft. at the same moisture content. While the durability of the timbers is not high, they are resistant to borer and white ant attack and are extremely suitable for any interior work. The seasoning can be carried out readily and satisfactorily. The shrinkage of back-sawn boards when dried to 12% moisture content is 6% in the case of Doryphora sassafras and 7% in the case of Daphnandra micrantha, while the shrinkage of quarter-sawn boards is 2% for both timbers.

Uses: Both timbers have a fairly wide range of uses being employed in the cabinet trade in drawer sides, etc., and also in the manufacture of brushware, small tool handles (where strength is un-important) and turnery. Both peel well and the veneer is used considerably for corestock. The easy working, good finish and excellent turning properties of the timbers make them extremely suitable for various purposes.

Availability: In narrow to medium widths in the usual lengths, in scantling sizes and in the form of logs for peeling.

Any further information on this timber can be obtained from the Chief, Division of Forest Products, 69 Yarra Bank Road, South Melbourne; the Forestry Commission of New South Wales, Box 2667 EE, G.P.O., Sydney; and the Sub-Department of Forestry, Box 1150 P, G.P.O., Brisbane.

WHAT IS MEANT BY THE TERMS "FIRE RESISTANCE, INCOMBUSTIBILITY AND FIREPROOF?"

Alfred H. Barnes, F.R.I.B.A., M.I. Struct. E., in several of the recent issues of the English journal "Wood", has drawn attention to the results of muddled thinking and muddled expression in the very loose usage of such terms as Fire resistance, Incombustibility, and Fireproof. As he states in his first article, "Wood burns. Steel does not. And upon that has been built a woolly, erroneous idea that steel is fire resisting and wood is highly inflammable. But materials subject to fire may fail in other ways than by burning, and clearer thinking is needed on this matter."

It is now authoritatively recognised that while "incombustibility" means the one essential quality of a material that will not burn (to express it simply), "fire resistance" is the sum of the qualities possessed by a part of a building enabling it to continue in the performance of its functions for a given period despite the attack of fire.

Too frequently incombustible materials are regarded as being "fireproof". A little thought or an examination of the results of fire in any modern building will clarify the relationship between the two terms. It is said that nothing is "fireproof" - everything is vulnerable to heat influence in some way - steel, by becoming plastic and losing strength or by transmitting the heat to some other part of the structure; concrete by dehydration of the cement or disintegration of the particles of the aggregate, and if reinforced, by the expansion of the metal as well. Such materials are incombustible and may be fire resistant to a certain degree, but they are definitely not fire-proof.

Wood is not incombustible. Some species are definitely fire resistant, others can be made fire resistant. Little information is available, however, on the behaviour of timber under the influence of heat. It is well known that it does not become plastic under relatively low temperatures as does iron and steel, it does not disintegrate in the same way as concrete, nor does disruption take place owing to expansion in one part and contraction in another as in the case of reinforced concrete. More information is needed, however, on its fire resistant properties and use in fire resistant structures as compared with other materials of construction.

ROTARY CUTTING OF VENEER AT THE DIVISION OF FOREST PRODUCTS.

During the last quarter, the Division's lathe has been working full time in connection with research being carried out on local substitutes for birch aircraft plywood. Over 70 logs of 10 different species were peeled into 1/100", 1/48", 3/100" and 1/16" veneer. Each log is cross-cut into two 3'6" lengths, one length being peeled into alternating 1" bands of 1/100" and 3/100" veneer, while the other is peeled similarly to 1/48" and 1/16" veneer. After clipping, each sheet is numbered and dried to 8-10% moisture content in frames in a C.S.I.R. type internal fan kiln. This method of drying has been found to produce a very high quality veneer free from splits and buckling. Records are also kept of the amount of shrinkage which occurs in drying from green to 8-10% moisture content.

After drying, sheets of each thickness are selected from each inch class and bonded up using Tego glue film. After conditioning, these sheets are tested for conformity with the Australian Standard Specification for Aircraft Material (Emergency Series) - Plywood No. (E) D. 804-1940.

The various species tested to date include leatherwood, Queensland silver ash, Northern silver ash, yellowwood, myrtle beech, rose alder, sassafras, yellow walnut and white birch. Very little trouble was experienced in peeling any of these species. It was observed, however, that care had to be taken in the heating of the myrtle beech prior to peeling. The logs were heated in water and it

was found that temperatures in excess of about 130°F. tended to cause excessive splitting. A longer heating period at a lower temperature gave satisfactory results. Care was also necessary to ensure that the myrtle beech veneer was dried evenly to 8% moisture content prior to bonding-up, otherwise blisters formed in the hot press due to the spasmodic appearance of wet spots.

Leatherwood has given very promising results and it is intended that this species will be investigated further to determine its exact possibilities for the manufacture of aircraft plywood.

BREVITIES.

E. A. Hanson, Ph.D., of the University of Leyden, Holland, has been appointed to the Division of Forest Products as an Assistant Research Officer in the Section of Wood Chemistry. He has specialised in Biochemistry and was on the staff of the "Laboratory for Research on Starch, Cellulose and Rubber" and of the "Children's Hospital" in Leyden. He has spent two years in Adelaide where he was a guest of the "Waite Agricultural Research Institute" and afterwards Research Assistant at the School of Botany of the Adelaide University.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

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BENT WOOD FOR FURNITURE.

For centuries wood has been used almost universally for furniture in practically every country of the world. This is still the case and likely to remain so although a certain amount of specialised furniture is now made of metal. In the first place wood was used because it was readily available in almost every inhabited region of the world and also because of its ease of working and its beauty of figure and grain with no two pieces exactly alike. Added to this are such other advantages as its poor heat conductivity which renders it neither hot nor cold to the touch, and the absence of noise under impact.

Costs of production, together with a taste for simplicity, have greatly reduced the amount of carving used, but the beauty of a curve in furniture is always appreciated. Such curves can be produced at a reasonable cost by using bent wood and they are very much in evidence in modern furniture design. Bent wood has the advantage over built-up curves in both strength and cost. Some types of bent wood furniture require elaborate form work and must be mass produced to bring the cost to a reasonable figure. An example of this kind is the Austrian chair. However, in chairs more suitable for the home, in tables and beds, the bends required can be produced simply and cheaply and are rarely very severe. If the required bend is too severe for solid timber, plywood glued and bent simultaneously can be used very effectively. For example, quite a comfortable armchair can be made relatively inexpensively in one piece from a single sheet of plywood. The main item of cost is in the form and provided such a cost is distributed over a number of chairs the proportion on each is quite small.

The main essential for bent wood furniture is to choose wood of suitable quality. In the first place it must work and finish readily - a requirement for any furniture timber - and in the second place it must bend well, although within limits this is perhaps less important than the selection of the right grade of material. Suitable material is generally known as 'bending quality' which implies straightness of grain, relative freedom from interlock, and in general, freedom from knots, decay and gum. The presence of knots is less important in some timbers than in others. One particular timber tested in the laboratories of the Division of Forest Products, viz: horizontal from Tasmania, has been bent quite well at a radius of only 6" with a thickness of 1", even when knots up to 1" diameter were present on either face and local sloping grain was as bad as 1 in 1. It is very unfortunate that at present this remarkable bending timber cannot be marketed on account of its inaccessibility and small sizes available.

Although no Australian timber has yet been found to compare with such timbers as English ash (or American ash) in bending properties, there is a number of timbers which bend reasonably well and are suitable except for the sharpest bends which, as mentioned earlier, can always be made of laminated material in the manner that tennis racquets are made. In view of this there is no reason why any imported timber should be necessary in the manufacture of bent wood furniture.

In all but the easiest bends, strapping is required on the outside face to reduce the stretch. The wood should be steamed for about 45 minutes to an hour per inch of thickness before bending

and bent as soon as possible after removal from the steaming vessel. Even hot timber, although it can be compressed much more than cold, would stand little additional stress without fracture, hence the need for the support of the metal strap which should be left on until the bend has cooled.

Most woods bend better when partly green. The bends should be tied in position on completion and the timber allowed to dry down to equilibrium moisture content in order to prevent their opening. Even then an allowance should be made by bending slightly more than is required for the finished article. Whilst a timber for bending should be selected for its bending quality it need not be the same as the rest of the piece of furniture, provided it is a wood of similar grain and figure. Colour is no obstacle to matching, but difference of grain can never be overcome. The following Australian timbers are suitable for use in the bent parts of furniture:-

Alpine ash (N.S.W., Tas., Vic.)
Blackwood (Tas.)
Colery Top pine (Tas.)
Leatherwood (Tas.)
Mountain ash (Tas., Vic.)
Myrtle beech (Tas.)
Radiata pine (Plantation)
Red tulip oak (Q.)
Rose mahogany (Q.)
Sassafras (N.S.W., Tas.)
Silky oak (Q.)
Silver ash (Q.)
Silver quandong (Q.)
Spur mahogany (Q.)
Yellow siris (Q.)

There may be other suitable species. A complete survey of the bending of Australian timbers has not yet been made, the various species being tested as they were received from the different State Forestry Departments. Alpine ash and mountain ash are suitable only for fairly easy bends. Red tulip oak is very free splitting and fractures very readily on the outside of the bend if the strapping has been inadequate. In this species sapwood should be avoided owing to its vulnerability to attack by Lyctus. Most of the timbers listed above can be readily obtained, although some of the Queensland species would have to be indented through suppliers in that State. In the case of Western Australia the only local timber which is suitable for bending is karri which bends easily and well except for severe bends. It is unfortunately somewhat heavy for furniture. In New South Wales spotted gum and tallowwood also bend easily provided the bend attempted is not unduly severe. They also are rather heavy; on the other hand, both take a beautiful finish.

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PROPERTIES OF AUSTRALIAN TIMBERS.

WHITE STRINGYBARK.

White stringybark is the Standard Trade Common Name for the timbers known botanically as Eucalyptus eugenioides Sieb. syn. Eucalyptus scabra Dum-Cours. and Eucalyptus globoidea Blakely. This timber is also known as pink blackbutt in Queensland.

Habit and Distribution: E. eugenioides is a small to medium sized tree with a height of 40-100 ft. and a diameter up to 2 ft. breast high; the bark is stringy and fibrous and persistent to the ends of the branches. It occurs in the coastal districts of New South Wales extending north into southern coastal Queensland and south into eastern Victoria. E. globoidea occurs in the central tableland area of New South Wales.

Properties: White stringybark is brown to pale pink in colour, and the wood is generally straight grained, fairly fissile and fairly hard. In density it averages 51.5 lb./cu.ft. at 12% moisture content with a possible range from 44.5 to 58.5 lb./cu.ft. In the "Handbook of Structural Timber Design" it is classed as moderately durable, being placed in groups 2 and 3. In this respect it may be considered slightly less durable than yellow stringybark although in the same strength group. The seasoning of the timber should present no difficulties although it is somewhat prone to collapse. In drying from the green condition to 12% moisture content, backsawn boards shrink 10% in width and quartersawn boards 5.5%.

Uses: White stringybark is mainly a structural timber, very little being used for building scantling. Its chief uses are for poles, telephone and electric transmission, sleepers, cross-arms and general construction. In Victoria there is a feeling that white stringybark is inferior for many purposes to yellow stringybark (Eucalyptus muelleriana). This has been accentuated by the unconscious comparison of the best yellow stringybark with the poorest white stringybark. As mentioned above, the two species have been placed in the same strength group and there appears to be only a slight advantage in favour of yellow stringybark in regard to durability. It would appear that with careful selection and grading, there is little reason to prefer one to the other. The Division of Forest Products has been asked in many cases to identify these two timbers. Examination of the anatomical features shows that they are very much alike and in many cases it is impossible to make a certain identification. Botanically also there seems to be a grading of one species into the other so that at times it is extremely difficult to say which species is which, therefore they could be regarded as equivalent in value for many purposes.

Availability: White stringybark is available in moderate quantities in the larger sizes and in pole form.

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WHAT TIMBER SHALL I USE?

It is not infrequently that the Division of Forest Products is confronted by a problem, the occurrence of which could have been avoided in whole or in part by the enquirer if he had selected an appropriate timber for the particular task in hand. A recent case well illustrates this point. A manufacturer purchased a timber on price basis alone for his particular purpose because of the similarity between the name of this timber and that of another more costly but more suitable.

The Division of Forest Products maintains a highly trained staff whose services are at the disposal of the timber trade, and wherever possible advice is given to bona-fide enquirers. During the 12 years of its existence the Division has not only built up this highly trained staff, but has assembled a valuable collection of information concerning practically every Australian timber of possible commercial value and the manufacturing processes in which they may be best used. This information is disseminated principally through the Utilisation Section of the Division. Manufacturers and other timber consumers would save themselves unnecessary expense and would solve their problems more readily if they approached the Division before embarking on any new process or adopting the use of a strange timber. Such a step would be preferable to waiting until some unforeseen development is revealed when the timber or the price, or both, are unsuitable for the purpose required.

Under the present emergency conditions the necessity for the elimination of waste in time and material is evident to all and the Division of Forest Products will be glad to assist any timber user who is faced with a difficulty.

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HOW TO MAKE A LAMINATED DIVING BOARD.

The Forest Products Laboratory, Madison, Wisconsin, U.S.A. recently announced details of the construction of two types of laminated diving boards. One of these types should be of interest to Australians as it can be readily fabricated in any wood-working shop. The other, which is bonded-up with special types of artificial resin glues requires no protection from moisture but is more difficult to construct owing to the special types of adhesives used. The first mentioned type, however, is quite satisfactory in use providing that the joints are protected by rubber matting. A board of this type has given five years service under conditions where it was found necessary to replace the conventional type of board every year.

The board is 1'8" wide with a length of 14'. It is built up of laminations dressed from 2" thick stock tapering in width from 3" at the inshore end of the board to 1⅜" at the outboard end. The laminations are bonded together using a good grade of water resistant casein glue and a pressure of approximately 150 lb./sq.in. applied evenly over the length of the board. Care should be taken in the assembly of the laminations and the application of pressure to prevent misalignment or bowing of the board.

A low grade of rubber matting which is characterised by a high percentage of fibre and tar should be casein glued to the board. This type of matting is more satisfactory in use than high quality mattings containing a high percentage of rubber which are difficult to glue without the appearance of 'blisters'. The function of the matting is to keep moisture from the board and protect the glue joints from water. Failure to protect the board in this way will result in opening-up of the glue joints. In many instances rubber covered boards have been used without further covering, but

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a more satisfactory service is obtained when the usual type of coco-matting is applied over the rubber.

A broad (9" wide) slightly rounded fulcrum which is recommended to replace the usual 2" pipe as a fulcrum, contributes largely to the length of service of the diving board. The 2" pipe offers a line of bearing for the board which is practically a knife edge and applies concentrated shock loads to an extremely limited area of wood fibre. The broad fulcrum distributes the load over a much wider area and is a safeguard against failure of the board at the fulcrum. The entire board can be shifted with respect to the location of the fulcrum to suit the desires of users.

Diagrams illustrating the construction of the board are available and can be obtained by application to the Chief, Division of Forest Products, 69-77 Yarra Bank Road, South Melbourne. S.C.4.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

MONTHLY NEWS LETTER No. 113.

1941##113 1st June, 1941.

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PRESERVATIVE TREATMENT OF MINING TIMBERS.

The Division of Forest Products has just completed an investigation undertaken as a result of a request for a simple and economical treatment of round, green, mining timbers. Experience abroad and results of experiments in Australia have indicated that chemicals such as zinc chloride and copper sulphate will increase the service life of timber if a sufficient quantity has been absorbed by the timber. As a result of the recent experiments in which careful analyses of the freshly treated wood were undertaken, it has been shown that the required concentrations of the preservatives can be readily and cheaply obtained by means of a diffusion process. No elaborate or expensive equipment is necessary and the treatment does not require much attention or supervision. Cost of the chemicals alone for a 6 ft. mine prop would probably range from 2d. to 4d. Labour costs should be low. To suit varying conditions and length of the service life required, a certain amount of control can be exercised over the absorption of the preservative by varying the strength of the treating solution and the time of treatment. Timber is clean to handle and the fire risk is not increased in any way - it even may be slightly decreased. It should be noted, however, that the preservatives mentioned above can only be applied with mining timbers used in dry mines. The leaching which would occur in some mines where water is abundant would seriously reduce the concentration of chemicals in the treated wood and so reduce the service life of the wood.

Further details of the method of treatment used and of the equipment required can be obtained by application to the Chief, Division of Forest Products, 69 Yarra Bank Road, South Melbourne.

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CONSERVATION OF VALUABLE AUSTRALIAN TIMBERS.

Australian forests supply the railways, electricity departments, Postmaster-General's Department and maritime services with a variety of durable timbers such as the ironbarks, turpentine, the red gums, grey box, jarrah, wandoo and a number of others. All of these are noted for their durability in service under severe conditions of exposure. The demand for durable timber of this nature is met in Europe and in America by the use of material treated with preservatives. Such a practice has hitherto been unnecessary in Australia where it has been comparatively simple to obtain naturally durable timbers. Under present conditions, however, it is apparent that our supplies of the more valuable durable timbers should be conserved to the utmost. This may be done by the substitution where possible of cheaper, more readily obtainable, although somewhat inferior, timbers. It may even be advisable in the near future to consider very seriously the various forms of preservative treatment which can be applied to these inferior timbers and so bring their service life up to that at present obtained by the use of our first-class durable timbers.

With these possibilities in view a number of tests have recently been initiated to determine the most suitable preservative method for use under certain Australian conditions. Two such tests are of particular interest. In the first the Victorian Railways Department is in co-operation with the Division of Forest Products investigating the possibility of using such timbers as white stringybark, mountain grey gum, silvertop ash, and others for sleepers. About 2,000 test sleepers are being installed in addition to a number which has already been tried out by the Department in various localities.

The second test is rather different. The Melbourne Harbour Trust in co-operation with the Victorian Forests Commission and the Division of Forest Products will instal a number of piles in waters where marine borer attack is severe. Half of these piles will be impregnated with creosote oil and the other half left as controls. The piles used will be the standard ones for wharf construction. Tests of this nature have been carried out in America but with the exception of some experimental tests using small pieces of timber this will be the first instance that creosote impregnated timber has been tested for piling in Australia. The test piles will not be loaded but will be exposed to severe marine borer attack and the results of such exposure observed by careful inspections at regular intervals. If the above described experiments prove successful, there should be some relief on the drain of the valuable durable species.

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ELECTRICAL MOISTURE METERS.

The demand for electrical moisture meters for use in the timber industry has been greatly stimulated as a result of increased activity in timber production in Australia coupled with an increase in kiln drying. Electrical moisture meters offer a rapid and reliable answer to the question "How dry is this timber?" Most types depend for their operation on the fact that the electrical resistance of timber changes with its moisture content.

The "Blinker" type of electrical moisture meter is well known as it has been marketed in this country for over nine years. It receives its name from the flashing of neon tubes which indicate the moisture content. Since the war, supplies of these neon tubes, which are not manufactured in Australia, have been discontinued and one firm previously manufacturing "blinkers" has now developed a new instrument of which every part is made in Australia. The instrument measures the electrical resistance of the wood by means of a thermionic valve bridge and records it as moisture content. Either batteries or power mains can be used to supply the current. One of these instruments has now been in use in the Division of Forest Products for some months and it has proved entirely satisfactory.

Further information regarding electrical moisture meters will be furnished gladly on application to the Chief, Division of Forest Products, 69 Yarra Bank Road, South Melbourne, S.C.4.

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TRAINING KILN OPERATORS.

In view of the difficulty that is being experienced in obtaining trained kiln operators to meet the increased demand for kiln dried timber, the Division of Forest Products draws attention to the fact that it is prepared to assist the industry in the following ways:-

(1) by a correspondence course in kiln operation,

(2) by providing individual experience and instruction at the laboratory followed by a short term of experience at a commercial plant, for a limited number of bona fide trainees in kiln operation. This course includes the correspondence course lessons.

There is a nominal fee of One Guinea for the correspondence course and no additional fee for the personal attention given at the laboratory.

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THE PROPERTIES OF AUSTRALIAN TIMBERS.

WHITE BIRCH.

White birch is the standard trade common name of the species known botanically as Schizomeria ovata D.Don. This name has only recently been adopted and the timber is perhaps more widely known as crabapple or New South Wales white ash.

Habit: The tree is somewhat variable in size, but may reach an over-all height of 120 ft. and a diameter breast height of 5 ft. although it does not usually reach these dimensions.

Distribution: It occurs in coastal areas of New South Wales, in the brush forests from the Illawarra district to southern Queensland on the McPherson and Killarney Ranges and on Fraser Island.

Properties: Timber is off-white to light brown in colour, generally with some pinkish tints. There is no very distinct line of demarcation between the sapwood and truewood and the sapwood may be up to 4" - 6" in width. The weight of the timber air-dried averages 39.5 lb./cu.ft. with a possible range of 33-46 lb./cu.ft. The texture is fine and uniform; the grain, while in many trees is straight, is often interlocked in others. A rather subdued figure is noticeable on backsawn surfaces or in rotary cut veneer. The sapwood is particularly susceptible to the attack by Powder Post borers and therefore should be either excluded from use or treated before use with a preservative solution (boric acid). Backsawn boards have an average shrinkage of 6-7% and quartersawn boards an average of 3%. The seasoning of this timber presents no difficulties.

Uses: The uses of this timber have been somewhat impeded because of the difficulties of distinguishing sapwood from truewood and the trouble resulting from the attack of the Powder Post borer. In the past, therefore, its use has been confined to such things as shelving, coffin boards, boxes, pegs and small turned articles. It is readily peeled and veneers from it are being utilised for plywood. At the present time rotary cut veneer including sapwood may be treated by immersion in a hot 8% boric acid solution which will prevent the attack of the Powder Post borer. The veneers are also being used for match boxes and splints and if selection of the log has been carried out carefully so that straight grain material is obtained on peeling, there is little difficulty in the preparation of match splints and these are satisfactory. Because of its fine uniform texture and comparatively light weight, this timber should, in the future, be more extensively used, especially as methods have been developed for the treatment of the sapwood against borer attack. There is no doubt that many speciality uses will be found for such a timber.

Availability: It is moderately readily available in log form, [illegible] in sawn lengths up to 24 ft. and as plywood. Naturally it is more readily available in New South Wales than in other States.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

MONTHLY NEWS LETTER No. 114.

1941##114 1st July, 1941.

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THE USE OF AUSTRALIAN TIMBERS FOR AIRCRAFT PRODUCTION.

Work done at the Division of Forest Products:

At a recent General Meeting of the Victorian Branch of the Australian Chemical Institute, Mr. I. Langlands, Officer-in-Charge of the Section of Timber Mechanics of the Division of Forest Products gave an address on the above subject. In this address Mr. Langlands summarised the work carried out by the Division of Forest Products during the past 2½ years and it has been considered of interest to record portions of his address.

At the beginning of 1939 the Division of Forest Products, in conjunction with the Division of Aeronautical Research, initiated work on the use of Australian timbers for aircraft. Australian woods had been used in previous experiments with considerable success, but an insufficient knowledge of the properties of the timbers so used did not permit of the most economical design. In selecting the timbers for experimental work, it was decided to give priority to those light to medium in weight and produced in large quantities. The importance of using timbers available in fairly large quantities may be estimated from the fact that approximately 5% only of sitka spruce - a species most widely used overseas for aircraft - is of aircraft quality. It is therefore reasonable to expect that in a case of any Australian timbers, the percentage of aircraft quality timber that may be derived would be as low as 5% or even lower.

For the systematic work for the determination of properties of any particular timber, at least 30 trees covering the range in size and habitat should be selected. To obtain the necessary information the services of a special collector in the field are necessary. The logs on arrival at the Division of Forest Products laboratories are cut into 2½" square test specimens. These are carefully kiln dried at a temperature known to be safe, after which they are conditioned to a m.c. of approximately 15% before testing. Sticks are cut up into 13 different types of test specimens and all the tests - tension, compression, bending, etc. are carried out under standardised conditions. For every timber thus investigated, a total of approximately 3,000 tests are made. The results are analysed and the necessary design stresses tabulated. In addition, microscopic examinations are made on the wood from every stick in order to detect the presence of "reaction" wood or brittle heart and to record such details as rate of growth, etc.

As a result of the work to date, it has been found that hoop pine is about 20% heavier than spruce and has an equal or better strength/weight ratio. It is, however, more brittle than spruce and unless carefully selected, has a tendency to warp due to the presence of compression wood. Bunya pine, which is very similar to hoop pine, is however about 10% lighter in weight with correspondingly lower properties.

Perhaps the most promising species are mountain ash and alpine ash, which have practically identical properties. They are among the most common Australian timbers. Their average weight is about 40% higher than spruce, but their strength/weight ratio is better and they also have considerable shock resistance. The tests already made on these two species have provided data to permit the conversion of the stainless steel wing of a certain type of aircraft to wooden construction.

Other timbers being tested are blackwood, northern and Queensland silver ash, silver quandong, sassafras, white birch and King William pine. King William pine has considerable promise for use in the many parts of aircraft where bulk rather than strength is required.

An important part of the work is the testing of timbers for use in aircraft plywood. Overseas, birch is the standard timber for this exacting use. In Australia, scented satinwood (coachwood) has been widely used but the supplies are limited. A number of other timbers has been tested, the logs being peeled in the Division's veneer lathe and test plywood specimens made up using a film resin glue in a specially designed hot press. The Tasmanian timber, leatherwood, has shown considerable promise. It appears to be superior to scented satinwood and only slightly inferior to birch. A commercial test is now being carried out.

Another line of research is the development of the variable pitch wooden airscrew from Australian material. In order to obtain the strength required at the root of the blade so-called "improved" wood is used. This improved wood is glued by means of scarf joints to the Queensland maple blade, thus giving the desirable combination of high strength (where required) and density. Wooden airscrews of this type have considerable advantages over duralumin airscrews as they are much lower in weight with a consequent increase in pay load and reduction in the gyroscopic and inertia forces on the aircraft.

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TIMBERS FOR MAULS AND MALLETS.

Mauls and mallets may be described briefly as wooden headed hammers.

Mauls are robustly constructed and are swung with both hands to deliver heavy blows.

Mallets are usually short handled so that they can be wielded effectively with one hand only to strike short sharp blows. Croquet mallets provide one of the few exceptions where the handle is long and two hands are used to wield the mallet.

Mauls: Since mauls are used for heavy work such as driving wedges, sturdy construction rather than fine appearance is necessary for satisfactory service. The head, which is best made from some seasoned dense timber that will not split readily and will strongly resist impact, is commonly shaped from a billet of wood using only axe and augur as tools. To make maul heads last longer wrought iron rings are frequently fitted to prevent splitting and excessive breaking away from the edges of the driving faces. Handles may be made of some resilient timber, or for heavy work iron piping may be used.

Bushmen throughout Australia have for many years recognised the value of heavy interlocked grained hardwoods for maul heads, and in different localities have definite preference for certain timbers. Timbers as boxes, coolabah, various gums, ironbarks, jarrah, penda, tallowwood, tuart and wandoo all give satisfactory service.

Mallets: Similar, but perhaps more particular properties are generally required for mallets which when new usually have a fine finish. They may be constructed in one piece only or with a heavy head on a light handle.

Resistance to splitting, hardness and moderate to high density are necessary whilst fine texture, ease of working and good turning properties are desirable.

Carvers' and stone masons' mallets, which are usually circular in cross section and often made in one piece from blackwood jarrah or other Australian timbers, have given satisfactory service.

Carpenters' mallets with heads of jarrah, myrtle, beech, red gum, ironbark etc., handles of spotted gum, hickory ash, leatherwood, alpine and mountain ash, southern blue gum and other timbers provide examples of the successful use of Australian timbers for this purpose.

On the other hand, many types of special mallets, as used by plumbers for sheet metalwork, bending lead pipes etc., and more recently in aircraft construction for bending aluminium sheet over forms have been made from boxwood and lignum-vitae which have been considered as ideal mallet timbers. Mallets from these timbers are sometimes prepared from small trunks and branches with the pith in the centre or may be sawn from timber which is free from pith. Since supplies of lignum-vitae and boxwood are practically cut off, Australian manufacturers are seeking Australian timbers and the possibility of using the dense interlocked grained hardwoods such as ironbark, grey box, grey gum, tallowwood, tuart and wandoo are worthy of exploration. For small mallets cut out of round timber, mangrove, yellow boxwood and satinbox should be reasonably good substitutes for lignum-vitae and boxwood.

The Division of Forest Products has in hand the testing of some dense Australian timbers for bending Alclad over bend bars for the aeroplane industry. Results will be available in due course.

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INSTRUCTION CLASS FOR POLE INSPECTORS.

A series of informal lectures, demonstrations and discussions on pole timbers, their preservation and their maintenance was held at the Division of Forest Products from Tuesday, 24th June to Friday, 27th June inclusive. The series was attended by 24 members of the staff of the Electricity Supply Department of the Victorian State Electricity Commission comprising pole inspectors, patrolmen and line foremen. Five members of the staff of the Division of Forest Products were engaged in delivering the lectures which dealt with the properties of pole timbers and sources of supply, decay and insect in poles, and pole preservation including methods of treatment and maintenance.

The lecture material was discussed later in detail during the inspection of various types of breakdown in a number of selected pole butts which were forwarded from the Commission's Darling pole-yard. The class terminated with an inspection of certain standing poles in the suburban area, and a demonstration of methods of treatment and their immediate results.

This course is part of the Commission's vigorous programme for the development of more economical methods of pole preservation and maintenance, and the establishment of a well trained staff will provide a basis for the gradual introduction of modern methods of pole treatment.

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THE PROPERTIES OF AUSTRALIAN TIMBERS.

BOLLYWOOD.

Bollywood is the Standard Trade Common Name of two botanical species, namely, Litsea reticulata Benth. and Litsea ferruginea Benth. and Hook. which belong to the family Lauraceae. Other common names are bolly gum, brown bollywood, brown beech.

Habit and Distribution: Litsea reticulata is a large and occasionally buttressed tree reaching a height of 120 ft. and a diameter breast high of 5 ft. It is found in the brush forests New South Wales and Southern Queensland, from the Hawkesbury River district in the south to Gympie in the north. Litsea ferruginea is a smaller tree and its range extends much further north to the Endeavour River, North Queensland. A variety, namely, Litsea ferruginea var. lanceolata is a somewhat larger tree found on Fraser Island and the mainland nearby.

Properties: The timber is usually a pale brown in colour but frequently shows some yellowish, pink or grey tones. It possesses a slight lustre similar to that of other members of the family; a lustre or sheen very probably due to the minute particles of oil present in the oil cells characteristic of the woods of this family. The grain is not always straight; some specimens are somewhat interlocked and not very fissile. The texture is fine or moderately coarse and uniform. The air-dry weight at 12% moisture content averages 33 lb./cu.ft. and the possible range at this moisture content is 25 - 41 lb./cu.ft. In seasoning the timber dries slowly; the average shrinkage of backsawn boards is 4.6% and that of quartersawn boards 1.9%. The sapwood is susceptible to the attack of the power-post borer and as it is often difficult to differentiate between sapwood and truewood, care must be taken in utilisation.

Uses: Bollywood, with its comparatively light weight and ease of working, should prove suitable for many purposes for which imported softwoods have been used. The main disadvantage is the susceptibility of the sapwood to borer attack, but this can be overcome by careful elimination of all sapwood or by the dipping of the sapwood in a suitable hot solution of boric acid (8%) before seasoning. In the past, bollywood has been used for small turned articles, wood carving, furniture, joinery, coffins, as a case timber, and for plywood. It veneers well and with the use of boric acid dipping treatment there is no danger of borers. There is little doubt that its uses will be extended rapidly in the near future.

Availability: It may be considered that this timber is available in New South Wales in commercial quantities both in log form for veneering and as sawn timber.

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NEW PLANT FOR PRESSURE IMPREGNATION OF TIMBER WITH PRESERVATIVES.

The recently formed N.Z. Forest Products Ltd. has undertaken the erection of a plant in New Zealand for the production of timber impregnated with preservative chemicals under pressure. The timber will consist principally of plantation grown Pinus radiata The plant will be similar in design to those which are in use in America and Europe for the preservation of sleepers, poles and large structural timbers. It will be equipped with two 70' pressure cylinders and will probably be used for the production of durable fence posts, poles, building stumps and other classes of round structural timber in which durability is a prime requisite.

Creosote oil will be the chief preservative employed although others may be adopted if the demand for special types of preserved timbers become sufficiently great. This is an important

development in wood preservation. There are no such pressure plants in Australia and the operations of this small plant in New Zealand will be keenly watched by interested parties in this country.

Large numbers of poles and piles are consumed each year in Australia and as these would be treatable by pressure methods the possibility of increasing their durability by impregnation with preservatives must be seriously considered. Small scale tests in this country with creosoted impregnated poles have been very satisfactory in regard to eucalypts, and tests are also in progress in South Australia with creosote impregnated Pinus radiata poles and sleepers. Should these prove reasonably successful the case for the establishment of a pressure impregnation plant for the treatment of suitable timber in Australia will be considerably strengthened.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

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1st August, 1941.

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In the September 1940 issue of this News Letter, reference was made to the appointment of Mr. I. H. Boas, Chief of the Division of Forest Products, as Assistant Controller of Timber in a part-time capacity. At that time the big question of timber control and supply was the satisfaction of demands for suitable Australian timbers for essential defence needs. It was essential to see that, wherever possible technically, Australian timbers were substituted for imported timbers. In this work, Mr. Boas was able to call upon the various specialists in the Division of Forest Products for advice and to make full use of the knowledge accumulated by the Division over a period of 12 years on the properties and uses of Australian timbers. In addition, Mr. Boas was able to utilise the goodwill of the State Forestry Departments, the Timber Merchants and the Sawmillers.

With the expanding needs of the munitions industry and the partial or complete prohibition of imports of certain timbers, considerable work has been necessary to see that supplies of Australian timbers suitable for various purposes are forthcoming. Gradually the question of timber supply has assumed greater and greater importance, and the need for a full-time controller was met by the appointment of Mr. S. L. Kessell. To assist Mr. Kessell in this work the Division of Forest Products has now made available the services of two officers of its Utilisation Section, Messrs. R. F. Turnbull and A. J. Thomas, both of whom have been connected with the work on Timber Control since its beginning in September, 1940. These two officers will carry with them an appreciation of the difficulties associated with the best utilisation of the timbers available. Mr. Boas will remain Assistant Controller of Timber directing the staff of the Division of Forest Products, which will carry on with the technical advice and experimental work associated with the best utilisation of Australian timbers.

A NEW PRESS FOR THE MANUFACTURE OF CORE-STOCK.

The May issue of the American journal, "Wood Products", carried a short note on the development of a new press built by the Plycor Company for rapidly bonding-up core-stock. This is a natural development from the machines which have found extensive use during the past 3 or 4 years for the tape-less joining of veneers.

It is claimed that the new press facilitates straight-line production methods, saves time and produces a higher quality core-stock with the danger of sunken joints virtually eliminated by the use of synthetic resin glues.

In actual operation, the strips that are to be glued together are spread with the special synthetic resin adhesive, then laid on the feed table of the core press and fed into it by an automatic pusher plate. Once inside the press the boards are subjected to tremendous edge pressure. This establishes and maintain a firm edge to edge contact while the pressure squeezes out the surplus glue. The boards continue to move forward through the press, and as they do so, controlled heat is applied to them from both sides

An endless ribbon of core emerges from the out-feed end of the machine to be sawn to any desired width by an automatic cross-cutting saw operated by an automatic, adjustable trigger on the out-feed table.

THE PERFECT SPECIFICATION.

There is no practical value in discussing perfect specifications; but it may be highly profitable to consider one or two imperfections that are met all too frequently in specifications under which timber is bought and sold today. One which was recently examined required the timber (for defence purposes) to be free from this and that "and all other defects", i.e., faultless. Quite apart from the sheer impossibility of achieving this end, it is absurd and wasteful to insist on such superlative material during the present crisis except for the most exacting purposes.

Under these circumstances, the properties of the timber required should be accurately described. Certain arbitrary standards which appear in the clauses of specifications appear to contribute to confusion and inconvenience rather than to the mutual benefit of the producer and consumer. Such clauses permit the presence of defects in a certain arbitrary percentage of boards in a batch, or over a certain arbitrary area on each board. While tolerance is to be encouraged these arbitrary percentages which have no relation, in some cases at least, to the producers' capabilities or the consumers' requirements, must remain a constant source of dissatisfaction to the timber trade. If the clauses do not agree with standard trade practices, they are more probably ignored than obeyed.

The timber specification should be a considered product in which due attention has been paid to the class of material available and to requirements to be satisfied (which it is called to satisfy). It should provide the miller with a standard which he can approach without undue inconvenience or too great a waste of material of varying quality, and should provide the consumer with a material which is good enough for his demands but not too good. And above all, the specification should be soundly based on the available information relating to the properties of the timber or timbers under consideration and the defects which are likely to occur in them.

With this co-operation between the miller, the technical worker, and the consumer, the specification stands upon a triple footing. With this basis, it has a reasonable chance of satisfying all parties.

THE PROPERTIES OF AUSTRALIAN TIMBERS.

SOUTHERN MAHOGANY.

This is the standard trade common name for the timber derived from the botanical species Eucalyptus botryoides Sm., which is common in the southern-eastern coastal areas of Australia. It has also been known as Bangalay, Gippsland mahogany, and mahogany. The timber bears no similarity to the true mahoganies, but is in many ways very like that of jarrah, once referred to as Western Australian mahogany, and red mahogany, another eucalypt common in northern coastal New South Wales and southern Queensland.

Habit and Distribution: The tree is usually of medium size, but reaches its best development in the South coastal areas of N.S.W. and the eastern parts of Gippsland, Victoria, where it may attain a height of 150 ft. and a diameter of 5-6 ft., with clear boles of 50 to 60 ft., but it more usually has a short stocky bole. Its range extends as far north as the Port Stephens district, N.S.W.

Properties: The wood is reddish brown in colour, is hard and strong and has a reputation for durability. The grain is interlocked and the texture coarse to medium. The average air-dry density recorded is 57 lb/cu.ft. at 12% moisture content with a probable range of 48-66 lb/cu.ft. It has been placed by the Division of Forest Products in Strength Group B and Durability Class 2, that is, second to such timbers as the ironbarks, grey box, grey gum, and equivalent to red box, yellow box, forest red gum and yellow stringybark. It is a fair bending timber. As the timber is commonly used in large sizes, seasoning is slow. Experimental work has shown that during drying to 12% moisture content, a shrinkage of 9% for back-sawn boards and 4.7% for quarter-sawn boards may be expected, and when reconditioned, the shrinkage is reduced to an average of 6.4% for back-sawn boards and 3.8% for quarter-sawn boards.

Uses: Southern mahogany is used in Victoria as a sleeper timber and also for general heavy constructional purposes. Other uses are for wagon-building, railway truck construction and fence posts. It is suitable for all kinds of building scantling, stumps and posts.

Availability: Available in split and hewn pieces for the purposes mentioned above and to a limited extent as sawn timber.

TIMBERS USED IN BOAT AND SHIP BUILDING IN AUSTRALIA.

A matter of vital importance in these days is the suitability of various Australian timbers for boat and ship building. It is probably not realised by the majority of people just how much timber is needed in the construction of any ship. It has been stated recently that in a 24,000 ton liner there may be as much as 60,000 cu.ft. of solid timber as well as large quantities of veneer and plywood; further in a modern battleship as much as 40,000 cu.ft. of timber of all kinds is used and even about 2,000 cu.ft. in a submarine. World famous ship building timbers are oregon, teak (for decking especially), Borneo whitewood (also for decking), pitch pine, oak, and mahogany. Australian timbers which can be used for specific purposes are listed below. Standard trade common names have been used and the States in which each timber occurs have been noted.

(a) Keels, Stem and Stern Posts, Under-water Bearings.

Spotted gum (*E. maculata*)	N.S.W. & Q.
Grey ironbark (*E. paniculata*)	" "
Crow's ash	" "
Red ironbark (*E. sideroxylon*)	" "
River red gum (*E. [illegible]*)	Q., N.S.W., Vic. & S.A.
Forest red gum (*E. tereticornis*)	" " " "
Tallowwood (*E. microcorys*)	N.S.W.
Jarrah (*E. marginata*)	W.A.
Southern blue gum (*E. globulus*)	Tas.
Huon pine	Tas.
Messmate stringybark (*E. obliqua*) (selected)	Tas.

Note - Spotted gum and ironbark may be obtained in selected quality up to 40 ft. long.

(b) Interior Framing, Girders, etc.

Spotted gum	N.S.W. & Q.
Grey ironbark	" "
Hoop pine	Queensland
Huon pine	Tasmania.

(c) Planking.

Kauri, New Zealand	N.Z.
Kauri, Vanikoro	From Solomon Islands.
Hoop pine	Q.
Bunya pine	Q.
Turpentine	N.S.W. & Q.
Spotted gum	N.S.W. & Q.
Sydney blue gum	N.S.W.
Huon pine	Tasmania
Red cedar (used for racing skiffs)	Q. & N.S.W.
Yellow siris	North Queensland
Various resin-bonded plywoods.	

(d) Decking.

Kauri, N.Z.	N.Z.
Kauri, Q.	Q.
White beech	Q.
Yellowwood	Q.
Hoop pine	Q.
Huon pine	Tas.
Silver ash	N.S.W. & Q.

(e) Knees, natural for small boats.

Tea tree Honeysuckle Mangrove	Various species represented in all States.

(f) Bent timbers.

Spotted gum	N.S.W. & Q.
Scented satinwood	N.S.W.
Blackwood	Tasmania
Yellowwood	Q.
Huon pine	Tasmania.

(g) Gunwales.

Spotted gum	N.S.W. & Q.
Sydney blue gum	N.S.W.
Southern blue gum	Tas. & Vic.
Alpine ash	N.S.W., Vic. & Tas.
Jarrah	W.A.

(h) Gratings.

Alpine ash	N.S.W., Vic. & Tas.
Mountain ash	Tas. & Vic.
White beech	N.S.W. & Q.

(i) Oars.

Alpine ash	N.S.W., Vic. & Tas.
Hoop pine	Q.
Silver quandong	N.S.W. & Q.

(j) Masts and Spars.

Hoop pine	Q.
Alpine ash	N.S.W., Vic. & Tas.

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DIVISION OF FOREST PRODUCTS.

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MEASUREMENT OF STACKS OF WOOD BILLETS.

Wood cut and sold in the form of billets is not generally measured according to the normal method of true volume as for sawn timber, but on an arbitrary basis according to the volume it occupies as determined by the exterior dimensions of a well made rectilinear stack. This method is used primarily because it is expedient, although not very accurate. Firewood, pulpwood and wood for charcoal manufacture or distillation are generally measured on such a basis.

In European countries, the unit is based on the stacked cubic metre, called the 'stère' in France, and 'Raummeter' in German

In Canada and U.S.A. the cord comprising a stack 4 ft. high and 8 ft. long of wood cut into 4 ft. lengths, i.e., 128 cubic ft., is the unit.

The Australian unit is a cord of 125 cubic feet, comprising a stack 5 ft. high and 5 ft. long of wood cut into 5 ft. lengths. Another unit employed in Australia for the measurement of stacked wood is the "ton", which commonly comprises 50 cub.ft stack measure, but in some transactions 40 cubic ft. is regarded as constituting a ton of wood. In certain municipalities, however, the by-laws provide that firewood shall be sold by weight, but one very important factor operates against the substitution of weight for stacked measure for fuelwood. This is the difference in weight between green and dry wood. When sold by weight, dealers tend to sell wood as green as possible. This is disadvantageous to the purchaser who is then paying for part water instead of all dry fuel. Furthermore, each pound of dry wood has to generate sufficient heat to vaporize all the water in the wood before any surplus heat is given off.

On drying, green cordwood shrinks approximately 10% and it is usual to build stacks about 10% higher than nominal to compensate for this shrinkage.

The solid content in a stack is dependent on the following factors which tend to reduce the percentage of wood:-

1. Presence of bark.
2. Long and thin billets.
3. Crooked and tapered billets.
4. Split billets.
5. Irregularities such as knots, branch stubs and swellings.

Generally speaking, conifers stack more closely than hardwoods.

The solid content of a stack of barked wood may vary from 30 to 80% according to the above factors. Where bark is left on, the percentage of solid wood may be reduced by a further 10-20%.

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USES OF AUSTRALIAN TIMBERS.

HANDLES.

Timber has been used for tool handles from the days of primitive man, and this choice has doubtless been due to its intrinsic properties of strength and shock resistance. However, not all timbers possess these properties to the same degree. Two timbers have been generally accepted for purposes where such properties are essential and both of these are Northern Hemisphere species, namely, hickory and ash. It should be realised that not all hickory and ash possess the desired properties; selection hasplayed an important part in obtaining the best material. Numerous Australian timbers have been tried out for various tool handles and while none seem to come up to the requirements of the best hickory and ash, certain of them have proved quite satisfactory, and are superior to some low grades of hickory sometimes on the market.

In the following lists, the Australian timbers that have been used have been set out under various headings. It should be understood that only first-grade material with straight grain and free from obvious defects should be selected. Particular care should be taken to eliminate "brittle heart" from material selected for conversion to handles where shock resistance is an important factor.

(a) Axe, hammer and adze handles.

Spotted gum	N.S.W. & Q.
Southern blue gum	Tas. & Vic.
Yellowwood	Q. & N.S.W.
White handlewood) Grey handlewood)	Q. & N.S.W.
Hickory ash	Q.
Leatherwood	Tas.
Wirewood	Tas.

(b) Spade, shovel, fork, rake and hoe handles.

Spotted gum	N.S.W. & Q.
Alpine ash	Vic.,N.S.W.,Tas.
Shining gum	Vic.
Silvertop ash	Vic.,N.S.W.,Tas.
Mountain ash	Vic. & Tas.
Silver ash	Q. & N.S.W.
Southern blue gum	Vic. & Tas.
Yellowwood	Q. & N.S.W.
Hickory ash	Q.
Leatherwood	Tas.

(c) Pick and mattock handles.

Karri	W.A.
Wandoo	W.A.
Alpine ash	N.S.W.,Vic.,Tas.
Silvertop ash	Vic.,N.S.W.,Tas.
Spotted gum	N.S.W., Q.
Mountain ash and others	Vic., Tas.

(d) Brooms, mops and other household implements.

Hoop pine	Q. & N.S.W.
Alpine ash	N.S.W.,Vic.,Tas.
Mountain ash	Vic., Tas.
Shining gum	Vic.
Karri and others	W.A.

(e) Chisel, screw-driver and file handles.

Scented satinwood (coachwood)	N.S.W.
Myrtle beech	Tas. & Vic.
Blackwood	Tas.
Sassafras	N.S.W., Q., Tas.
Grey handlewood	N.S.W., Q.
White handlewood	N.S.W., Q.
Wirewood and others.	Tas.

(f) Saw and plane handles.

Scented satinwood (coachwood)	N.S.W.
Myrtle beech	Vic. & Tas.
Queensland maple	Q.
Blackwood and others.	Tas.

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THE PROPERTIES OF AUSTRALIAN TIMBERS.

WHITE CHEESEWOOD.

White cheesewood is the standard trade common name given to the timber known botanically as Alstonia scholaris R.Br. It is commonly known in Queensland as milky pine or milkwood owing to the exudation of a milky white substance, latex, occurring from the bark of the tree when chopped.

Habit and Distribution: White cheesewood is a tree sometimes reaching a height of 100-120 feet and a girth breast high of 8'-10'; the trunk is slightly buttressed and may be fluted for some distance up the bole. It is found in association with other species occurring in the higher rainfall areas in the Cairns, Mackay, Atherton and Cooktown districts, where in certain areas, chiefly along the coast, it is sometimes fairly plentiful. This species also occurs in India and Burma where its habit is more occasional and also in the Dutch East Indies, Philippines and New Guinea.

Properties: The timber is creamy to yellowish white in colour, and the sapwood, being wide, is scarcely distinguishable from the truewood. It saws and dresses readily by machine tools and by hand, and can be peeled for plywood and used for carving, finishing to a good smooth surface. The wood is light in weight, having an average density of 25.5 lb/cu.ft. at 12% moisture content. Subsequent to felling, the timber, if left in log form, is very subject to blue-stain, borer attack and decay, and should be converted and seasoned without delay to prevent these. When seasoned, the sapwood is also definitely susceptible to attack by powder-post borers (Lyctus sp.). The presence of elongated radial pockets from $\frac{1}{4}$ to 2 in. long and up to $\frac{1}{8}$ in. wide is a characteristic of this timber, but the frequency of occurrence varies considerably. These latex canals, as they are called, mar the appearance of the timber, as they become loose in seasoning and leave apertures in the wood. The truewood is not durable but should be amenable to preservative treatments.

Uses: The timber has been used for casing, flooring and interior work and for pattern making on account of its ease of working. It has been used to a limited extent for plywood. In India and Burma and the Philippines it has been used for casing and tea boxes, furniture, coffins, blackboards and for carving. It has been peeled for match splints, but provides inferior material in that field.

Availability: Though not plentiful, in some small areas it occurs as almost a pure species; at other times scattered. Available in log form and as sawn timber in various sizes.

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TIMBER INDOOR AIR RAID SHELTERS.

In a recent number of the English journal "Wood", there is some very interesting information on the construction of timber indoor shelters. Considerable prominence has been given in the press to the use of heavy steel tables for indoor shelters, but there is no reason why equally effective shelters should not be constructed from timber, which is cheaper, more readily available and, for the same weight, as strong or stronger than steel. It is pointed out that these indoor shelters afford no protection against a direct hit, but English experience has shown that the number of people killed or injured by direct hits is very small in proportion to those killed or injured by falling debris or by blast. A house gives some protection against blast and the chief danger inside a house is by injury by falling debris.

The wooden shelters described in "Wood" are essentially strong timber boxes of various types, large enough to provide sleeping accommodation for at least two people and sufficiently strong to prevent injury from falling debris. They may be used in any convenient part of the house, care being taken to place them in such a position that the effect of blast coming through windows is minimised.

Experience in England shows that increasing numbers of people are using these indoor shelters, which are much more convenient and comfortable than outdoor shelters, which have to be placed at an inconvenient distance from sleeping and living quarters and cannot easily be made comfortable and hygienic. Also, while avoiding bombs in outdoor shelters, it is easy to contract colds and other ailments.

Further details on the wooden shelters may be obtained on application to the Chief, Division of Forest Products, 69 Yarra Bank Road, South Melbourne, S.C.4.

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THE TWO-COAT SYSTEM OF HOUSE-PAINTING.

Labour cost bulks large in the total cost of house painting. The traditional method of painting an Australian home is on the three-coat system, requiring three separate painting operations. Experience has shown that this three-coat system is trustworthy and efficient. But it has been found possible by suitable modifications in the paint and the painting practice to eliminate one of the three coats. The method is not new, but it has taken considerable time to gain ground in America where it is becoming firmly established as a sound and economical method of applying paint.

Paint manufacturers recognize it by printing directions for "two coat" work and consumers and contractors find that in skilled hands the method effects a valuable saving in labour.

Two coat painting relies for its success upon the established fact that the thickness of a paint coat determines its durability withi wide limits, no matter whether the coat is made up of two layers or three. It is important, however, to ensure that the coats are firmly bound to each other and do not show the phenomena lumped together under the term 'incompatibility'. Some paints may be applied successfully and remain durable over others. These combinations are said to be compatible. There are, however, combinations of paints (an extreme example is ordinary house paint over clear varnish) which are not durable. The surface coat in these cases usually cracks badly and tends to separate from the paint coat beneath. Paints which tend to produce coatings of low durability when placed one over the other are said to be incompatible.

It has been found necessary to develop new paint types which, while permitting the painter to produce thick films, brush out well, and do not sag or wrinkle. The under or first coat may be of the same paint as the outer or finish coat in which case the first coat is virtually a self-primer. Progress is being made in the development of special primers for two-coat work. These developments are of particular interest to Australia, for these special primers have been found especially valuable on timbers that do not hold paint well such as oregon (Douglas fir). Our Australian hardwoods are not without their painting problems, and any expansion in timber house building, coupled with the modern trend towards bright colours and light shades, will probably be accompanied by a crop of questions in regard to painting technique.

Although under our climatic conditions and on our timbers the two-coat system may not prove to be a reliable substitute of the traditional three-coat method, its obvious advantages will cause its development to be watched with interest.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

MONTHLY NEWS LETTER No. 117.

1941##117 1st October, 1941.

A NEW FIRE-RETARDANT PAINT.

Fire-retardant paints have been the subject of considerable investigation, particularly in recent years, and a number of these paints has been produced commercially. Most of them have contained water as the vehicle or a fluid in which the fire-retardant substances can be dissolved or suspended. Compared with ordinary house paints these fire-retardant types possess some disadvantages. They are frequently more difficult to brush and in many cases produce coatings of poor appearance and short life, that is, the coatings lose their fire-retardant efficiency after a fairly short period.

The United States Forest Products Laboratory has carried out a series of experiments with fire-retafdant coatings and has just released details of a paint with a linseed oil base which appears to combine the good features of oil paints with a very high fire resistance. The paint has the following composition by weight:-

White lead	41.0 per cent.
Borax	32.0 " "
Linseed oil	22.8 " "
Turpentine	3.6 " "
Japan drier	0.6 " "

This paint does not stand up to exterior exposure as well as ordinary household paint of good quality, but for interior use it seems to be superior to most of the other coatings tested. If it is finely ground as in ordinary paint manufacture, it possesses good brushing qualities and produces a good surface. Home made preparations using this formula will, however, be as effective in resisting fire, although the appearance of the coat will probably be rougher if the pigments are lumpy. For maximum effect, this paint should be applied in 3 or 4 coats with a total coverage (all coats considered together) of about 150 square feet to the gallon. This finished coat should be about twice as thick as the ordinary coat of paint. Thinner coats would probably be effective enough in preventing the rapid spread of small fires.

This borax paint is a welcome addition to the list of fire-retardant materials now available and should find a use in the protection of interior woodwork. It should be capable of production in any tint so that it can be made to blend with any colour scheme. The paint does not deteriorate during storage in the can.

Fire-retardant coatings of proved value can do great service in lowering the fire hazard where this is high. By reducing the inflammability of wood surfaces, they make ignition much more difficult and prevent small fires from spreading rapidly. This is the limit of their powers and a coat of fire-retardant paint should never be expected to withstand long exposure to a fire of major proportions.

PLYWOOD AS SHEATHING FOR RACING SHELLS.

The Plywood Section of the "Timberman" recently featured the new racing shells constructed by the rowing coach at Oregon State College, U.S.A. These shells are described as being of the four oar type (plus coxswain), 46' long. Eight oar boats are to be built in the near future. The most radical departure from standard practice is

the use of plywood instead of the conventional cedar planking. The total cost of materials for each boat was approximately 50 dollars. Plywood sheathing was chosen for several reasons. Firstly, boats were needed that would stand severe usage. Plywood filled the bill as it will withstand the hardest knocks, and if punctured, can be readily patched. The 200 lb. boats possess adequate strength and can be easily handled by two men. Secondly, only simple hand tools and no elaborate forms were required. Thirdly, the lower cost was a very important factor.

Eight pieces of $\frac{1}{8}$" 3-ply Douglas fir (oregon) plywood (cut from 4' x 12' panels) - presumably bonded with an artificial resin glue of the Tego film type - were used to cover the hull. Two pieces were cut from each panel, soaked in water and clamped in place over the internal framework. An ordinary hand iron was used to "iron" the sheet in position while pressure was applied by pulling on large rubber bands. After each sheet was formed, it was glued and bradded to the ribs. Butt joints plus a waterproof glue were used. The only seams in the hull are the three around it and one down the centre. One shell was finished with three coats of gymnasium floor varnish; the other was given three coats of a sealer similar to varnish.

The "run" of the boats and their "feel" in the water has given rise to much favourable comment. Waterproof plywood has once again proved its usefulness and adaptability to a very specialised form of construction!

WAR-TIME USES OF WOOD.

In a recent issue of the American Journal, "Science", mention is made of a statement by G.W. Trayer of the U.S. Forest Service calling attention to the fact that wood wins wars in spite of the apparent primacy of metals. He pointed out that even in air-planes where aluminium and magnesium have replaced the spruce and fabric of earlier flying fighters, wood is staging a comeback. Plastic bonded plywood is coming to the aid of an industry harassed by a shortage of light metals. Smaller planes have been manufactured using this new construction with laminated wooden propellers, and these have proved entirely practicable for training purposes. The modern army's need for wood is almost beyond calculation. It ranges from timber for barracks and for bridges to wooden poles for holding camouflage nets and wooden boxes for the transport of ammunition. Chemical uses of wood are also important. Wood pulp supplies cellulose for nitrating purposes and charcoal derived from wood is an essential ingredient of many gun powders. Compressed wood charcoal is also being used in the canisters of gas masks. The usefulness of the U.S. Forest Products Laboratory for defence assistance particularly in relation to the use of wood in aircraft has been recognised by the United States Congress in that its appropriation for the year has been increased from $782,500 to $932,500.

The Division of Forest Products, which is the Australian counterpart of the U.S. Forest Products Laboratory has, as is well known to readers of this News Letter, been actively engaged in the study of Australian timbers with respect to their use in aircraft construction since before the outbreak of hostilities. It is perhaps not so well known that the Division has been constantly assisting the Service Departments in all their timber problems. One specific example is the work done in connection with the construction of all types of ammunition boxes.

THE PROPERTIES OF AUSTRALIAN TIMBERS.

YELLOW CARABEEN.

Yellow carabeen is the standard trade common name of the species known botanically as Sloanea woollsii F.v.M. This timber is also known in Queensland as grey carrobean.

Habit and Distribution: This species occurs as a large tree up to 140 ft. in height, with a stem diameter above the buttressed base of 4' and a merchantable bole of 35' - 45'. The base of the trunk is invariably buttressed, except in very young trees; the buttresses are plank-like and extend from 12-16 ft. up the trunk while above this is cylindrical. The species is found in coastal scrubs of northern New South Wales, Dorrigo and the Macpherson Range, and in south eastern Queensland in the Killarney and Tambourine districts in areas of steady rainfall. It is found in mixture with other typical scrub forest timbers, such as scented satinwood (coachwood), sassafras, white beech, etc.

Physical Properties: The wood is yellowish in colour when first cut, drying to a light brown. The log has a dark-brown heart zone distinct from the outer wood and this may vary in extent from a small 2" - 3" core to as much as two thirds the cross-section of the log. The large 'heart' is mainly associated with older trees and those having a thicker and rougher bark. This latter condition is possibly due to unfavourable growth conditions. The sapwood is rather indefinable as although there is a narrow outer ring of white sapwood, the yellowish wood between this and the 'heart', irrespective of its size, gives a starch reaction with iodine. This wood is not durable and is definitely susceptible to Lyctus attack. Thus, some means of giving this timber immunity from Lyctus attack, such as heating in solutions of boric acid varying in strength from 1.25% to 10% depending on whether veneer for solid timber is being treated is vital, since the 'black heart' is not well regarded even for case stock. The wood is of uniform fine texture, moderately soft, and finishes to a fairly good surface with hand and machine tools. The density ranges from 28-45 lb/cu.ft. and averages air-dry 36 lb/cu.ft. In seasoning, the timber has a high tangential shrinkage; on drying from the green condition to 12% moisture content, back-sawn boards shrink 7.3% and quarter-sawn 3%. After reconditioning, however, this high value is reduced to 3.7% and 1.8% respectively. It has mechanical properties appropriate to its density.

Uses: The chief use to which yellow carabeen is now put is in the manufacture of cases, fruit cases, cheese crates, etc. It has also been used to a small extent for interior fitting of railway carriages and for baseblocks for electric light switches. The timber turns fairly well and can be used for small wooden articles such as brush-backs, toys, etc. Yellow carabeen has veneering possibilities if selected logs are used and veneers are adequately treated to remove any danger of Lyctus attack. It may prove a suitable species for match splint manufacture, if suitable logs are selected.

Availability: The species is fairly plentiful in most localities within its range. Large sizes are usually cut. 10 x 4, etc., to be resawn for case stock.

THE USES OF TIMBER.

RIFLE FURNITURE.

Relatively few people realize the full importance of the timber parts of a service rifle. The functions of rifle furniture, the group name covering the individual portions known as fore-ends (stocks), butts and handguards respectively, may be summarized briefly as follows:-

They provide a suitable grip and balance to the rifle, protect the barrel from mechanical damage and while arranged so that the barrel may vibrate during firing, the magnitude of the vibration is restricted. The fore-end supports the bayonet when fixed and must therefore be strong and stiff enough to prevent the wood from bearing on the barrel. The recoil is partly absorbed by the fore-end and butt and is transmitted by the butt to the shoulder. The fore-end and handguards provide a suitable grip and insulate the hands against burning by the barrel when the rifle is used for rapid fire. The butt must be sufficiently strong to resist breakage when used as a club.

It was formerly traditional in Europe and America to use walnut for furniture for service rifles, but a recent survey indicates that the following timbers are now in use:-

	Overseas	Australia
Walnut	- Juglans species	Scented satinwood (coachwood) -
Birch	- Betula species	Ceratopetalum apetalum
Beech	- Fagus species	
Plane	- Platanus orientalis	Queensland maple -
Sugar maple	- Acer saccharum	Flindersia brayleyana

It is interesting to note that in Australia recent investigations indicate that brown alder - Ackama muelleri - and brush mahogany (red carrotean) - Geissois benthami - are also suitable for the manufacture of rifle furniture.

Since several timbers have been accepted for rifle furniture it is apparent that the qualities necessary are not confined to walnut as was formerly believed, although walnut will probably continue to be regarded as the standard when solid blanks are used for its production. From examination of the properties of the timbers accepted and consideration of the probable severe conditions liable to be encountered by rifle furniture in service, it appears that any timber with properties and characteristics similar to walnut should be suitable. The general requirements are:-

1. Average density at 12% moisture content 35-48 lb/cub.ft., so that weight and balance will be maintained as now recognized.

2. Mechanical properties necessary to absorb the recoil, support the bayonet, and enable the rifle to be used as a club.

3. Absence of brittleness or tendency to split.

4. Relative ease of seasoning to a stress-free condition at the final moisture content.

5. Freedom from warping and relative freedom from working when exposed to climatic extremes in service.

6. Fine uniform texture and good machinability so that it may be finished accurately to delicate shapes and provide smooth surfaces which after finishing, will not roughen on exposure or splinter when knocked against stones, etc. In addition to providing a good finish on machining, it is desirable that the wood shall not unduly wear the cutting tools. Modern developments in cutting tool steels have overcome many difficulties such as this.

7. Natural dark colour appears to be preferred, and some woods may be stained to produce the desired effect.

While the above properties limit the species of timber suitable for rifle furniture, proper selection within each approved species is essential to ensure compliance with the individual requirements, particularly those of strength and freedom from warping.

Timber selected should be straight grained sound wood free from defects such as decay, brittle heart, knots other than pin knots, and, prior to manufacture from blanks, should be carefully seasoned to avoid checking, honeycombing and internal stresses.

In Germany the manufacture of rifle furniture from laminated boards of beech veneers bonded with waterproof adhesives of the synthetic resin type has been fully developed. This material has many advantages over solid timber, and it is probable that in the future similar methods will be adopted in other countries.

Sporting guns with butts moulded from synthetic resin plastics were featured recently by American plastics manufacturers. Although no information is available that moulded butts have been adapted for use in service rifles, it is possible that further investigations may lead to the use of plastics in rifle manufacture.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

DIVISION OF FOREST PRODUCTS.

MONTHLY NEWS LETTER No. 118.

1941##118 1st November, 1941.

IMPROVED WOOD AND ITS USE IN VARIABLE PITCH WOODEN AIRSCREWS.

"Improved" or "compregnated" wood is a product made from thin veneers impregnated or coated with a synthetic resin and bonded under considerable pressure at elevated temperatures. The pressures used range from a few hundred to several thousand pounds per square inch according to the density required and the product usually contains from 15-60% resin. Phenol or cresol formaldehyde resins of a bakelite type are almost exclusively used.

At low pressures and resin contents improved wood is comparable with ordinary resin bonded multi-plywood. However, with increasing pressure and resin content the product changes in appearance and assumes something of the properties of a wood-filled plastic. The mechanical properties are greatly enhanced and as the compressed fibres are locked in position by the water resistant resin, prolonged immersion in water causes only negligible absorption or change in volume.

Because it is laminated, improved wood is a much more homogeneous material than natural solid timber with its inherent inconsistencies due to vagaries of growth and to the occurrence of faults and defects. Also by varying the resin content, density and grain direction of the laminae, it is possible to manipulate the mechanical and physical properties of improved wood to produce materials for specialised purposes. As the properties and possibilities of improved wood became established, it was realised that this material was an attractive alternative to metal and natural wood for the hubs of airscrews.

In the early stages of aviation fixed pitch wooden airscrews were almost exclusively used but as high power engines were evolved, the variable pitch airscrew with magnesium or duralumin blades was developed. Wood proved unsuitable for variable pitch screws owing to its low shear strength which made it impossible to fix the blade root into the metal sleeve of the variable pitch hub.

A Russian inventor, Samsonov, is credited with the idea of improving the mechanical properties of the natural wood by treating with a synthetic resin and compressing to high density. After much experimental and developmental work the variable pitch wooden airscrew with a high density improved wood root and a light wooden blade is today a commercial possibility. This type of airscrew is now being manufactured in Europe and America and has been made experimentally in Australia by the Division of Forest Products in co-operation with an Australian airscrew company.

As a material for airscrew blades, wood possesses certain advantages not possessed by metal. Its high damping capacity makes it an ideal material for smooth operation on an internal combustion engine with its periodic torque variations. The wooden blade with improved wood root is very much lighter than the magnesium or duralumin blade. On large aircraft this weight saving may amount to 200 lb. per engine and in addition to this, the lighter blade considerably reduces the centrifugal load, thus permitting the hub itself to be made slightly lighter.

The high density improved wood root may be obtained by two methods. In the first method the improved wood is manufactured as boards ¾"-1" thick with a uniform density of 80-85 lb. per cubic foot. After manufacture these boards are scarf jointed and glued to wooden planks (spruce, maple, etc), and the composite planks then glued together to form a solid blank from which the blade with its improved wood root is shaped. This method has been used successfully by the

Weybridge Airscrew Co. in England and has been followed in the manufacture of the Australian blades.

In the second method the planks are made entirely of veneer, the high density root being obtained by inserting extra veneers of different lengths near one end of the board which is then compressed to a uniform thickness. The planks are then glued together to form the blank. In this case the density varies continuously from root to tip. This method is used by Jablo Propellers Ltd. in England, and has been further developed by Decat of the Airsealand Research Corporation where the finished blade is moulded from the resin impregnated veneer in one operation. In this latter case, the heat is supplied by an ultra high frequency unit which cures the resin and effects the bonding in about 10 minutes.

After manufacture of the blank by either method, the improved wood root is turned and threaded with a coarse, usually buttressed thread by which it is attached to the metal ferrule of the hub. A cement is forced between the threads as the blade is screwed in.

Before going into service the blade must be covered by a durable skin which will resist abrasion and also waterproof the wood. The Schwartz and Rayoid processes have been developed for this purpose. In the well known Schwartz process the blade is covered with a layer of fabric or high tensile steel gauze which is then covered with a sheet of cellulose acetate applied in plastic condition. The necessary adhesion to the wood is obtained by placing the airscrew, while its covering is still plastic, in an autoclave and forcing the plastic cellulose into the pores of the wood.

Investigations into the manufacture of improved wood from various Australian timbers have been carried out over the past 18 months in the laboratories of the Division of Forest Products. As mentioned earlier, the work has reached the stage where experimental blades have been made and tested. Fundamental investigations relating to various problems associated with the production of improved wood and its use are being continued.

WHY NOT KILN DRY YOUR CASE STOCK?

Seasoned hardwood case stock is, as all case-makers know, in very great demand these days. In fact, the demand so far exceeds supply that the relaxation of moisture content clauses in specifications - a move which is made only as a last resource - was recently found necessary so as to permit the use of case timber at moisture contents above the upper limit of what has been found by experience to be the safe range. In other words, official sanction has been given for the acceptance of timber for cases at moisture contents which may cause some deterioration of the contents of the cases.

Such a state of affairs must only be temporary and steps are being taken with the object of remedying this position. For success, the co-operation of all case-makers is essential to ensure that the remedy considered most practicable - the installation and use of kilns for kiln-drying the case stock - is a satisfactory one.

For an appreciation of the benefits of kiln drying it should be realised that hardwood case stock can be dried green from the saw rapidly and economically. For stock $\frac{1}{4}$-inch to $\frac{3}{8}$-inch thick, the time required to kiln dry from the green condition to a moisture content of 14% should not be much more than 36 hrs. For this stock a temperature of 180°F. may be used right from the commencement of drying. Similarly, provided material for case ends, which is usually about $\frac{3}{4}$-inch thick, is quartersawn, it may also be rapidly kiln dried from the green condition (within 5 days), an initial temperature of 180°F. again being used.

Investigations are being made to develop a kiln design which will permit the construction of a modern, forced circulation kiln suitable for case stock, at a cost of no more than £250. Each unit should be capable of an output of at least 16,000 super feet of ½-inch or ⅜-inch hardwood case material per week. It is hoped to provide economical heating which, in city areas, will obviate the necessity of installing steam boilers or employing firemen. This Division would be glad to discuss this matter further with those interested.

PROPERTIES OF AUSTRALIAN TIMBERS.

BRUSH MAHOGANY.

Brush mahogany is the standard trade common name for the timber derived from the species Geissois benthami F.v.M. (syn. Weinmannia benthami F.M. Bail.). It is perhaps better known as red carrobean or red bean, and it has also been referred to as mountain cedar, leatherjacket, or marara.

Habit and Distribution: The tree is of medium size but attaining a height of 100-120 ft. and a diameter breast high of 3 ft. The butt is sometimes flanged and the barrel may be somewhat irregular. It is found in the brush forests of north coastal New South Wales from the Manning River northwards to southern Queensland.

Properties: The timber is light to dark pinkish brown in colour with a narrow white or yellowish white sapwood (up to one inch). The texture is fine and uniform and the grain straight or somewhat interlocked. There is little or no distinctive figure, although the fine ray fleck on dressed quarter-sawn boards is very pleasing to the eye. The average air-dry density at 12% moisture content is 39 lb/cu.ft. with a 95% probability range of 31-48 lb/cu.ft. In seasoning to 12% moisture content, back-sawn boards may be expected to shrink 6% on the average and quarter-sawn boards 3.4%. This shrinkage is comparatively high, but may be reduced slightly if the timber is reconditioned, although collapse is not serious. The timber has the reputation of being fairly easy to work and turns well, although the presence of crystals in the cells is somewhat hard on tools. Large crystals or "stones" are often encountered and care should therefore be taken in veneering the timber. The timber is not durable and should not therefore be used in exposed positions. This timber is similar in properties and uses to scented satinwood (coachwood) to which it is closely related botanically. In fact, it has been mixed indiscriminately with scented satinwood for many purposes. The identification of rough sawn boards of these two species is very difficult without resort to the use of a lens. In general, scented satinwood may be distinguished on its distinctive odour and fine figuring on dressed back-sawn veneers or rotary cut plywood. For the uses to which both timbers are put, there seems little sense in trying to separate them. The only problems that may be encountered are a different drying rate and blunting of cutting tools by the included crystals.

Uses: Brush mahogany has been used, like scented satinwood, in cabinet work, joinery, for turnery purposes as in brush-stocks and small utensils, and for general interior building work. It is a timber suitable for veneers and considerable quantities have been marketed in the form of plywood.

Availability: The timber is available in wide boards and in the form of veneer logs.

THE USES OF TIMBER.

LARGE TIMBER STRUCTURES.

The use of timber for large structures, particularly roofs, is rapidly increasing, due mainly to the revolution in design and construction methods consequent on the use of timber connectors, and at the present time, some very large timber and composite brick and timber buildings are in course of construction. As engineers and architects gather experience in the new technique, more efficient and economical designs are being prepared and contractors are rapidly becoming familiar with the radically new methods of construction required. All this is resulting in greater economy and more efficient utilisation of the timber available. As an example, a timber roof covering 120,000 sq.ft. of floor area, with clear spans of 75", has recently been built using 130,000 super feet of timber, the approximate erected cost being £4 per 100 sq.ft. (exclusive of galvanised iron covering) which is very low for a roof of such span.

For a time, tender prices were too high mainly because of the lack of experience with timber connectors, but on recent jobs it has been found that the cost of cutting, fabricating and assembling timber roofs is about 12/- to 15/- per 100 super feet of timber for large repetition jobs, and about £1 per 100 super feet for smaller jobs where complete mechanisation would not be economically justifiable.

All the more common Australian structural timbers have been and are being used in these structures and are giving satisfaction. However, experience has shown that more care should be given to grading. With the publication in the near future of A.S. No. 0.54, "Australian Standard Grading Rules for Structural Timbers", grading of structural timber into Select and Standard grades as defined in that specification should become standard practice. This will result in still further economies, as at the present time, the designer has to play safe and use working stresses suitable for the lower grade timber, especially in such States as Victoria, where the general quality of structural timber is low.

One point that should not be overlooked in the design of timber structures, particularly roofs, is that they deflect more than steel structures of the same strength and that the deflection goes on increasing for some years. It is recommended by the Division of Forest Products that an initial camber of at least 1/240th of the span should be provided in timber roof trusses to permit deflection to take place, without causing unsightly sagging. For large and important structures, the deflection should be calculated, and the fact that the ultimate deflection under dead loads will be about 3 times the initial deflection should be taken into account.

Further information on timber structures may be obtained from the Chief, Division of Forest Products, 69-77 Yarra Bank Road, South Melbourne.

BREVITIES.

According to the News Edition published by the American Chemical Society, the U.S. Army will substitute wood and wood products wherever possible for critical and strategic materials. The Office of the Quartermaster General has created a new Wood and Wood Products Unit in the Supply Division to organise such a procedure. This Unit will try to broaden the base of wood specifications to permit use of all suitable species of domestic timber. In charge of the programme is a one-time member of the United States Forest Products Laboratory.

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

DIVISION OF FOREST PRODUCTS.

MONTHLY NEWS LETTER No. 119.

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RESIN-IMPREGNATED WOOD FOR TRUCK WHEELS.

As the properties of improved wood have been further investigated, it has been realised that this material possesses to an enhanced degree all the desirable mechanical properties of wood while many undesirable qualities such as lack of uniformity, occurrence of defects, etc. are suppressed.

Some months ago, the Division of Forest Products was approached regarding a suitable material for the manufacture of small truck wheels. The conditions of service in this case were particularly severe, the trucks being required to carry loads up to one ton over a concrete floor which could not be kept free from nails and wire cuttings.

A number of materials had been tried. These included a rubber tread which remained in service for a fortnight to treads machined from solid bakelite impregnated canvas sheet which gave a service life of 4-5 months. The increase of life in the latter case was not considered sufficient to warrant the greatly increased cost of the wheel. As an experiment, two solid improved wood discs 6-inches in diameter and 2½-inches wide were made in the Division under the following conditions -

Timber Used - Schizomeria ovata, white birch.
Original Veneer Thickness - 1/16-inch. Eighty laminations were used and the grain direction of each successive lamination was displaced 20° to obtain a uniform wearing wheel with a high percentage of end grain at the periphery.
Resin Impregnation - The veneer was vacuum impregnated with a thermo-setting cresol-formaldehyde resin to give a resin content of 30% calculated as solid resin and based on the O.D. untreated weight of the wood. The veneers were pressed at 2,000 lb. per sq.in. at a temperature of 300°F. to give a product with a density of 1.39. The discs were then turned, fitted over suitably modified wheel hubs and placed in service. They have been examined periodically and have already equalled the service life of the expensive bakelite canvas type.

CORROSION OF METALS - AND WOOD.

This question has exercised the minds of many at the present time when so much machinery, munitions, guns, turned goods of all types, etc. is being shipped from one country to another and from one locality to another. It is of interest therefore to consider what has been published by the Forest Products Laboratory, Princes Risborough, England, on the subject and their comments follow.

It has been recognised for some time that under certain conditions wood can corrode certain metals that are close to it or in contact with it. This effect of the wood is due to the presence of certain volatile acids. These acids are to be found in the vapours given off by all green woods during drying and they may also be set free when seasoned wood is moistened. For this reason the use of incompletely seasoned wood in contact with metals must be avoided and wood used near metals should not be allowed to become damp. To avoid all trouble, wood for use in this manner should be seasoned to approximately 12% moisture content.

Metals most liable to corrosion in contact with wood are (i) lead and some of its alloys, (ii) iron and steel and (iii) aluminium and some of its alloys. Brass and copper are not ordinarily corroded by contact with wood but examples of such corrosion are known. Corrosion is most liable to occur under warm moist conditions.

Aluminium is subject to an electrolytic type of corrosion at pressure points in a pack where wood or other porous material is in contact with the metal.

This Division has in the past few months had numerous enquiries on the question and it has been apparent in the majority of cases that green timber used for packing has been the primary cause of the trouble. Naturally at the present time when supplies of dry case timber are short there is a great tendency to use anything for packing, even timber that has had little or no air seasoning. Manufacturers packing important goods or machinery should realise the risk they are taking in so doing. This risk is especially great if the wooden container is completely closed. On the other hand, where it is possible to use open crates, partially dry timber may be used, provided that the metal parts of the machinery or articles that are to be crated are sufficiently protected from the weather and from the wood where they are likely to come in contact with it.

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BREVITIES.

In a recent issue of the Timber Trades Journal attention was drawn to the formation in Britain of a company to manufacture matches which would strike at each end. This proposal resulted from a suggestion put forward half in earnest and half in jest that as a war-time economy measure, double-headed matches might be considered. Mr. Stanley Tompkins of Queen's Gate, London, the inventor, has indicated that double-headed matches would probably be on the market within six months and would be sold at very little higher price than ordinary matches. If this idea could be adopted in Australia, periodical shortages of matches as experienced during the past 12 months might be somewhat alleviated.

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Hoop Pine Sawdust for Cleaning, Drying and Polishing Metal Work.

Experiments conducted recently using dry hoop pine sawdust passed through a 20-mesh sieve were so satisfactory for the drying and polishing of safety-pins in a heated rumbler, that a manufacturer is seeking further supplies for this purpose. He considers the finish obtained to be far superior to that on imported safety-pins.

In the past, imported boxwood sawdust has been used by jellewers for similar purposes, and brass workers and electroplating firms have used considerable quantities of Douglas fir (oregon) and hemlock sawdust for cleaning various metal articles. Supplies of pure dry sawdust from any of these timbers are now very difficult to obtain and the prices ruling for boxwood sawdust are high. It appears, therefore, that a fairly large potential market could be developed for hoop pine sawdust properly graded for various purposes. Enquiries from timber-using firms in Melbourne reveal the practical impossibility of obtaining large quantities of dry hoop pine sawdust free from shavings or sawdust from other timbers. Further enquiries in Queensland indicate that no regular supply of hoop pine sawdust is available there. The organisation of supplies for this purpose would be a valuable asset to Australia and especially the munitions industry which requires considerable quantities of dry sawdust of various sizes for drying, cleaning and polishing all manner of metal components of ammunition, guns, etc.

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MEASUREMENT OF STACKS OF WOOD BILLETS - A CORRECTION.

In the September issue of this News Letter 125 cubic ft. comprising a stack 5 ft. high and 5 ft. long of wood cut into 5 ft. lengths was stated to be the Australian unit cord. This should have referred to a Victorian modification of the standard cord of 128 cub.ft., which is used as an approximation for wood cut in 5 ft. lengths. A stack of 128 cub.ft. of wood billets is generally accepted throughout Australia as a cord.

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THE USES OF TIMBER.

BATTERY SEPARATORS.

In a storage battery the positive and negative metal plates must be kept apart from one another to prevent internal short circuiting resulting in a "flat" battery. Battery separators, as the plates used for this purpose are called, are commonly made of wood although other materials such as latex, cotton fibres set in rubber, and glass wool are also employed for this purpose. Because wooden separators are cheaper than these alternative materials and usually outlive the useful life of the metal plates (about 2 years) they are considered more economical. As at all times these separators are subject to the action of the strong battery acid, and during service to considerable mechanical stresses, it is not surprising that only few timbers have been found satisfactory. For many years the American timber, Port Orford cedar, has been considered the species par excellence for separators. However, the large scale production of Douglas fir separators recently embarked upon in America indicates that this timber, too, has been found satisfactory. Others including cypress, redwood, basswood, spruce and cherry have been used in that country, but with less success.

The annual separator veneer or stock requirements of the Australian and New Zealand markets is between five and six million square feet ranging in thickness from 1/24 - 1/4-inch, or about 500,000 super feet of selected timber. Port Orford cedar comprises the majority of this, and as the limited quantity of local timber used is not commonly considered suitable for first-grade batteries, it is desirable to explore the suitability of further Australian species and of improving existing methods of preparation.

This question was raised in about 1916 when, at the suggestion of the Forestry Commission of N.S.W., more than a dozen samples of Australian timbers were sent to England. However, the report on these was unfavourable in all cases. Since that time experiments have met with very little success or inconclusive results.

In estimating the suitability of a species for this purpose, the ultimate criteria are good recovery from logs and long, efficient battery life under service conditions.

The first factor depends on freedom from defects such as knots, decay, and irregularities in shape and grain. However, these can be eliminated to a large extent by the careful selection of logs. Small pin knots such as occur in rotary peeled hoop pine are considered a defect as these may come out during pre-treatment and leave holes through which short-circuits may occur. This defect is minimised in stock sliced on the quarter.

The second criterion, the length of battery life as affected by separators, depends on the resistance of these to destruction by acid and abrasion due to contact with the battery plates, and on their freedom from resins etc. which produce substances harmful to the latter. Acid resistance seems to be a major problem and is a point in favour of Port Orford cedar.

The electrical efficiency of a battery is affected by the resistance of the separators to current flow. To minimise loss of energy the resistance should be kept as low as possible. This depends on thickness, species, pre-treatment, and whether rotary or quarter cut. It is generally accepted that quarter cut material is less resistant than rotary peeled. As the resistance of a separator is directly proportional to its thickness, it should be possible to utilise some of our timbers having either mechanical strength or low resistance. For example, King William pine has the latter property and should therefore prove successful in batteries requiring thicker separators.

With these criteria in mind, a series of tests has been developed by this Division. At the moment Queensland kauri, celery-top pine, and King William pine are being examined beside Port Orford cedar as a standard of comparison. Electrically, these Australian species are satisfactory, but the indication is that they do not stand up to battery acid as well as the cedar. However, tests are under way to ascertain whether these lesser strength values are still sufficient to give a satisfactory battery life under service conditions. For this purpose test batteries have been installed in this Division's vehicles.

Now that a routine set of tests has been developed it is proposed to try out other species such as hoop pine, black pine, and some soft hardwoods. Softwoods were considered first as these are believed to be more acid resisting than hardwoods. On the other hand, the latter are said to have been used earlier because of their better electrical properties. These points have yet to be settled by investigation of individual species.

At the moment, hoop pine is the only Australian species used to any extent. This has been all rotary cut veneer, and only recently has a slicing plant been installed in Queensland for the production of quartercut separator stock. In accordance with previous remarks it is probable that this stock may prove entirely satisfactory, and with the availability of quartercut material, other species may also prove suitable. It is unlikely that sufficient of any one suitable species will be available.

However, by finding a number of these which could be used under conditions to which each is most suited, sufficient material may be made available to meet the requirements of the battery trade in Australia.

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THE PROPERTIES OF AUSTRALIAN TIMBERS.

SILVER QUANDONG.

Silver quandong is the standard trade common name for the timber derived from the species Elaeocarpus grandis F.v.M. and Elaeocarpus kirtonii F.v.M.; the timber is also commonly known as blue fig and blueberry ash in New South Wales.

Habit and Distribution: Both species are large trees, E. grandis attaining a maximum height of 120 ft. and a steam diameter at breast height of 4 ft. The average clear bole rises to 60 ft. with a mid girth of 6-7 ft. but the base of the trunk is frequently buttressed as high as 15 ft.

The species is found in the rain forests of coastal areas from the Nambucca River in New South Wales to the Endeavour River in North Queensland.

Properties: The timber of these species is light coloured, white, pale straw or brown, often pinkish in colour when freshly cut; soft and uniform in texture, though somewhat coarse, straight-grained and easy to work with hand or machine tools. The average air-dry density at 12% moisture content is 29 lb./cu.ft. and with a 95% probability range of 24-34 lb./cu.ft. The timber has a low shrinkage, as expected from its density, for in seasoning to 12% moisture content the average shrinkage of backsawn boards is 4% and for quartersawn boards 1.4% only. The sapwood is fairly wide, generally 2-4 inches and is subject to blue stain and therefore should be seasoned as soon as possible. The timber is easy to season and is not prone to warping or checking; the wood is not durable, however, and the sapwood is susceptible to attack by Lyctus.

Mechanical - The timber is strong for its weight and is a first-class bending timber ranking with silky oak.

Uses: Silver quandong is used for all types of interior trim, flooring, lining etc.; also for light coloured furniture. It is in demand as a substitute for spruce in racing oars, and at odd times has been employed in the construction of aircraft for civil use.

Availability: The supply is fairly limited but can be obtained as sawn timber in wide boards.

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