C.S.I.R.O.

FOREST PRODUCTS NEWSLETTER

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

No. 189 — 1952##189 — January - February, 1952

IDENTIFICATION OF EUCALYPT TIMBERS -- Part 1

By H. E. DADSWELL, Officer-in-Charge, Wood Structure Section

In recent issues of this News Letter there has been published a series of articles relating to methods used for timber identification. These methods can, of course, be applied to the identification of eucalypt timbers but it must be understood that, in the case of one genus embracing a large number of species, such as the genus *Eucalyptus*, correct identification of the wood of one or other of these species is extremely difficult. On the basis of the examination of the structure of the wood following the procedures outlined in the earlier articles, it is generally fairly easy to place an unknown timber correctly in its genus, but it is not always possible to place a timber in its correct species. In general wood identification work it is often quite satisfactory to determine only the genus of an unknown timber. For example, most people are satisfied if a statement is made that the unknown is a pine (*Pinus spp.*), a spruce, an oak, a hickory, or an ash (*Fraxinus spp.*). No one in Australia is satisfied if the timber identification expert says that a particular sample is a eucalypt; the immediate reaction is "what eucalypt?"

According to Blakely's "Key to the Eucalypts", a book dealing with the botanical characteristics of the various species, there are listed over 600 species and varieties. These species and varieties have been named over the years by many botanists working on specimens of leaves, fruits and flowers. Unfortunately the variations between species that may be obvious in the examination of such botanical material are not always reflected in the structure of the wood. Basically, the timbers of the many species of the genus have many structural features in common. This is, of course, to be expected when dealing with the close relatives of the one genus. There is a certain degree of overlapping between closely related species, there is known hybridization between species, and there is still a lack of accurate botanical information regarding a number of species. All these factors make the correct identification of the timber very difficult and at times impossible. At the present time approximately 100 of the timbers of the genus are of some commercial importance; many of these timbers have developed a reputation in some field of utilization and the timber user is therefore acutely conscious of his need for a specific timber for a specific purpose. Hence his great interest in correct identification.

From its inception the Division of Forest Products has paid continual attention to this problem and much work has been carried out with the object of discovering just how a eucalypt timber can be identified to its correct species. However, as the work has progressed no simple solution of the problem has been found; indeed, the factors of species overlapping and hybridization, and the utilization of a wider range of the timbers of the genus under present conditions have revealed the many difficulties. The object of this article is to indicate just what can be accomplished in the field and in the laboratory in the identification of eucalypt timbers and what the limitations are.

In identification work there are two methods of approach — (i) using macroscopic methods, including the examination of the structure of the timber by means of a hand lens (giving at least 10 magnifications), and (ii) examining at high magnification the detailed structure of the timber in the form of cross, tangential and radial sections. The former method is within the reach of most people interested in timber identification and will therefore be treated in greater detail here; the latter method is for use only in the well-equipped wood technology laboratory.

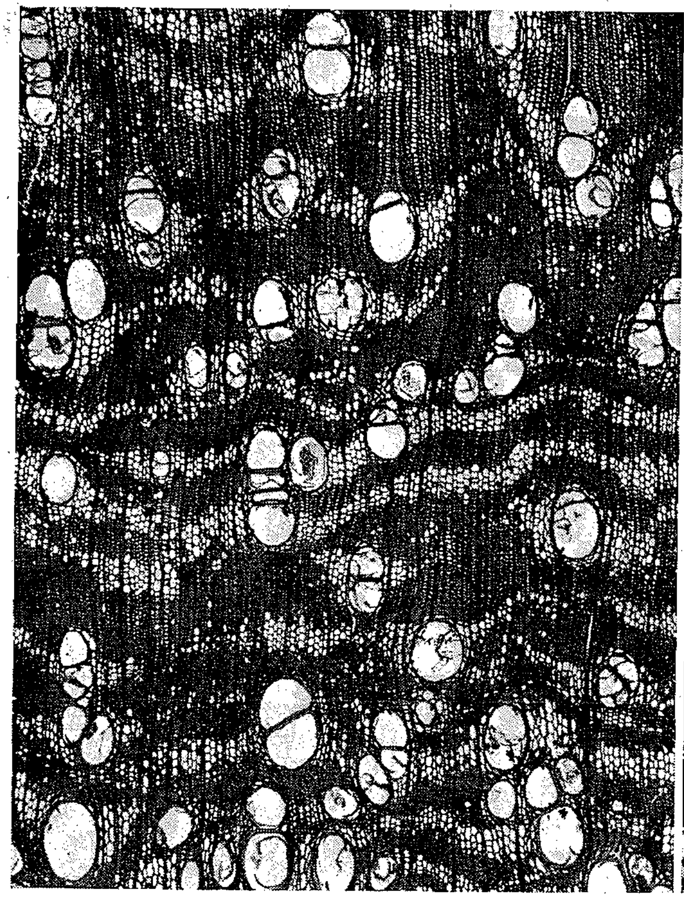
There are a number of macroscopic timber characteristics that can help in eucalypt identification and do lead to the grouping of the timbers. They are general appearance, colour, weight, appearance of structure on cross section under a lens, and the results of the burning splinter test.

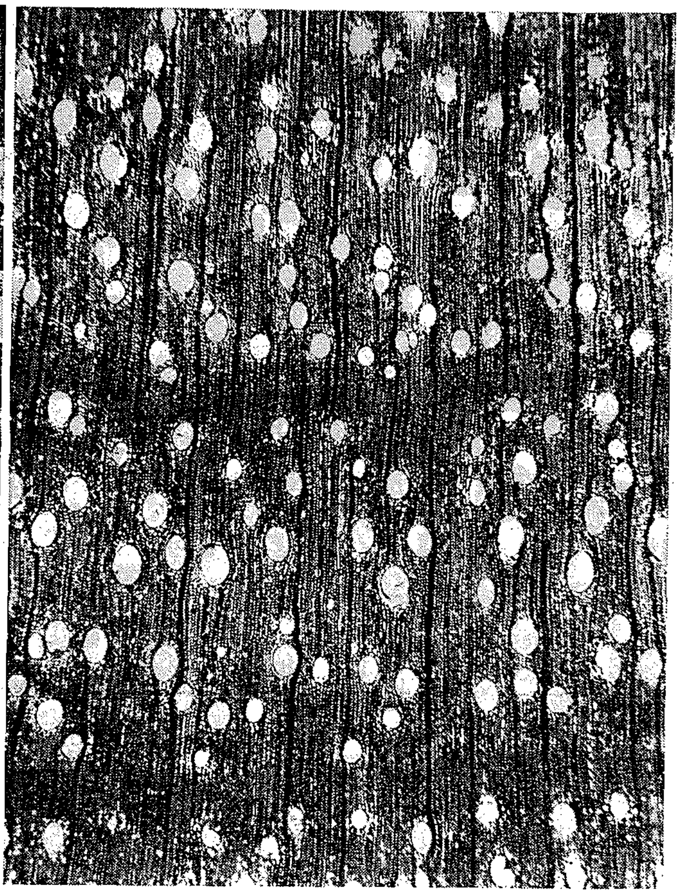
(a) **General appearance**: Other than variations in colour and texture, the eucalypts are very similar in general appearance. One particular feature, however, is the distinct greasiness or oiliness of the wood of tallowwood (*E. microcorys*) and, to a less marked degree, of spotted gum (*E. maculata*) and southern blue gum (*E. globulus*). The fineness of the texture of the ironbarks, some boxes and gums, and certain Western Australian species such as gimlet (*E. salubris*) is also an important feature associated with the size of the pores (see later).

(b) **Colour**: Roughly speaking, the eucalypt timbers can be divided into two main groups — (i) those which are definitely coloured, being red, red-brown, or dark brown to chocolate brown; (ii) those which are not so definitely coloured, being pale straw, light-brown to brown. Some of the timbers falling into the second group often have pink tints, especially when freshly sawn; but they should not be confused with the red or red-brown timbers of the first group.

It should be emphasized here that the colour of the material must be determined from a longitudinal surface, preferably a dry surface. Small specimens of green timber freshly cut from the tree can always be dried quickly by exposure in the sun or by placing near a stove or other source of heat.

(c) **Density**: The air-dry weight of the various eucalypt timbers differs considerably, the lightest being the ashes, of which *E. regnans* is the best known example. At the extreme other end of the scale we have *E. microtheca*, the coolibah of north-west and north Australia, the timber of which is dark chocolate brown in colour and weighs approximately 85 lb./cu. ft. air-dry. The most commonly encountered dense timbers of the genus are the ironbarks and certain of the boxes, grey ironbark and grey box being two well-known examples. Thus, on the basis of weight alone, there would be no difficulty in distinguishing between, say, grey ironbark and mountain ash. However, the





many other commercial timbers of the genus fall between mountain ash and grey ironbark in weight, and, as would be expected, weight is of no assistance in separating between closely related species, for example, members of the stringybark group.

It should be stressed that any differences in weight show up only in air dried material; all eucalypt timbers when green are heavier than water. The air-dry weight is also influenced by collapse which, when severe, makes the timber harder and heavier. For example, the average air-dry weight of mountain ash *(E. regnans)* before reconditioning is approximately 44 lb./cu.ft. compared with the average figure of 39 lb./cu.ft. for reconditioned material (see Pamphlet 92, C.S.I.R.). A practical method of assessing wood density is to place a small specimen in a container of water. If it sinks it is more than 62.4 lb./cu.ft. in weight; if it floats the approximate density may be gauged from the amount of the piece not submerged.

(d) **Structural Features:** Macroscopically, in the case of the timbers of the genus *Eucalyptus* only the cross-section reveals structural features helpful in identification. A very cleanly cut surface is essential and, with timbers as hard as many of the eucalypts, to get such a cleanly cut surface an exceptionally sharp knife is required. The details of the structure can then be examined by means of a hand lens and such examination is assisted if a drop of water is placed on the surface.

The two anatomical features of value in identification are (i) pores (vessels), and (ii) the parenchyma (soft tissue). The size of the pores varies considerably in the different eucalypts; the arrangement of the pores does not vary to any marked extent although one main group of the eucalypts — the bloodwood group — can always be separated because in this group the pores are arranged in short radial rows (refer to News Letter No. 183, "What Wood is This?" Part 2). In all the other groups of eucalypts the pores are solitary, that is, not in any radial or tangential rows, although at times some tendency to oblique arrangement is noticed (see "What Wood is This?" Part 2, Fig. 5). Thus, in addition to the separation of the bloodwood group on pore arrangement, the variation in size and number of pores may be used as an aid to identification. In *E. regnans* and others of the ash group, the pores are large, often clearly visible to the naked eye and not particularly numerous; on the other hand, in the case of timbers of the box group and the ironbark group, the pores are small, not visible to the naked eye, and much more numerous.

The parenchyma (soft tissue) arrangement should also be examined on the cleanly cut cross-section. Here again, the most distinctive group of timbers is the bloodwood group, in which the parenchyma is often arranged in bands spreading tangentially from the pores — see Figure 1. In all the other groups of the eucalypts the parenchyma is either surrounding the pores or diffuse, or both. (For parenchyma distribution, see News Letter, No. 185, "What Wood is This?", Part 3). The amount of parenchyma tissue varies from species to species and unfortunately within a species. Generally speaking, however, it may be said to be quite sparse and paratracheal (surrounding pores only) in the timbers of the stringybark group, and quite abundant, paratracheal and some diffuse in the various timbers of the gum group. In such timbers as river red gum *(E. rostrata)* and jarrah *(E. marginata)* diffuse parenchyma in quite a common feature, being very marked in the former. All close relatives of river red gum have the same type of parenchyma. Another timber with a lot of diffuse parenchyma which is characteristic is woollybutt *(E. longifolia)* — see Figure 2.

(e) **Burning splinter test:** This test is mainly of value in distinguishing between closely allied species. It has to be applied with caution and under certain prescribed conditions. For the test only **sound** heartwood of the timber being examined should be used. Sapwood, or wood that has been subjected to weathering or decay will not give true results for the species. From the sound heartwood splinters approximately the size of a match are split off and lighted. The lighted splinters are allowed to burn quietly, away from draughts. In certain timbers the splinter will burn to a definite ash; in other timbers the splinters will burn to a charcoal or to a fine thread of ash which slowly drifts away. Only in those cases where a definite and comparatively complete ash is obtained should it be recorded that the timber burns to a definite ash. Very few timbers burn in this way, the most outstanding example of course being karri *(E. diversicolor)*, which can be distinguished from jarrah *(E. marginata)*, splinters of which burn to charcoal. Grey ironbark is another timber which burns to a definite ash, often buff in colour. Other timbers like grey box *(E. hemiphloia)* and spotted gum *(E. maculata)* also burn to an ash.

Summing up, therefore, for the macroscopic examination of a eucalypt timber in the field or in the laboratory, cognisance should be taken of colour, weight, result of burning splinter test, and the result of examination of the cleanly cut cross-section by means of a hand lens. Such an examination will indicate quickly whether the unknown eucalypt timber belongs to the bloodwood group, which is characterized by radial arrangement of pores and abundant parenchyma often arranged in concentric bands. Such an examination should also pick out timbers of the ash group on the one hand, timbers of the ironbark group on the other hand, and timbers with special features such as tallowwood. One additional feature of value in detecting ironbarks is the fact that such timbers are hard and horny to cut across the grain with a knife. A timber which is at the lower end of the density range for the eucalypts, having small and fairly numerous pores with little or no parenchyma, and being light brown to brown in colour, is most probably a stringybark. A light brown timber in the moderately heavy class with medium sized pores surrounded by parenchyma quite easy to see under the hand lens, and with some diffuse parenchyma, most likely belongs to the gum group. To some degree, therefore, it is comparatively easy to place a eucalypt timber in a group, but to go past the grouping on the basis of macroscopic examination is impossible, and at times still impossible after examination of structural details by means of the microscope.

The actual grouping of various eucalypt timbers and the features used for such grouping will be discussed in the next article of this series.

SAWDUST AS A SOIL IMPROVER

by W. M. McKenzie, Utilization Section

Can great volumes of sawdust be saved from the rotting heap or the destructor, to the profit of both sawmiller and the primary producer? The technical possibilities are considered here. More work on both technical and economical aspects is necessary before a complete answer can be given. Meanwhile it can be said that where sawdust is on the spot, it can be used to improve the soil.

Possible methods of using sawdust as a soil improver

- Mixed raw with soil
- In compost heaps
- As a mulch
- Chemically treated, then mixed with soil

Use of raw sawdust

Attempts to use straight sawdust mixed with the soil in cropping have usually failed. At first these failures were put down to the presence of poisons in the wood (terpene, resin, etc), or produced by rotting (sulphur compounds) or to acidity produced by the decomposition of sawdust.

Experiments have shown that such failures are due to nitrogen deficiency. This is caused by the greatly increased activity of bacteria which break down the wood substance. Any organic material, such as straw, grass, or animal manure has this effect to greater or lesser degree. The bacteria compete with plants for the nitrogen available in the soil, and if this is not sufficient for both, both suffer. Thus nitrogen must be added with the sawdust. It may be in the form of animal waste (e.g. absorbed in sawdust bedding in cowyard or fowlyard) or of ammonium sulphate or potassium nitrate. Estimates of the necessary amount vary. It probably depends on the nature of the crop and soil; 1 per cent. of nitrogen added with the sawdust is an accepted rule of thumb. Some workers recommend 2 per cent. nitrogen and this is probably necessary for high production crops or poor soils.

Sawdust definitely improves the structure of a soil. It loosens a heavy soil and improves the water and fertiliser holding properties of a light soil. The problem is how to obtain these benefits while avoiding its bad effects.

One way is to make the decomposition very gradual so that there is never a great demand for nitrogen by the soil bacteria. This is discussed under mulching.

Another way is to break the sawdust down before working it into the soil. This can be done by composting in heaps, or chemically.

Mulching

Some of the beneficial effects of sawdust — water absorption and prevention of crusting — are obtained by using it as a mulch. A layer several inches thick is desirable. Since the nitrogen depression is less, on some soils with low demand or perennial crops, the harmful effects are not evident. In other cases a small amount of added nitrogen, about 50 lb. ammonium sulphate to the ton of sawdust, may be sufficient to relieve any deficiency. If the sawdust is finally dug in, more nitrogen may be necessary.

Composting

Sawdust may be used in the same way as garden rubbish to build compost heaps, adding animal manure, blood and bone or ammonium sulphate to provide nitrogen to supply to the decomposing bacteria and provide a surplus for the plants. The period of decomposition is about twice as long as that for straw or garden waste. Compost "accelerators" may speed the process. This compost, when incorporated in the soil, has the usual beneficial effects. These may not be immediate but accrue after a year or so.

Chemical decomposition

Composting is a slow method of breaking down sawdust, and nitrogen manures are required. In many cases these cannot be provided cheaply, as in cowyard or fowlyard bedding. Some quicker, cheaper way of breaking down sawdust seems desirable. Hydrolysing by acid treatment would appear to offer one method. Some claim good results with sawdust heated with acid at temperatures above 212°F., neutralized and restored to 15 per cent. moisture content. If the latter tests were to be confirmed, this would offer the best possibilities. Nitrogen and other fertilizers could be added to improve the nutriment value. Some such treatment may be possible at the sawmill, or at a group of sawmills.

Thus promising outlets for sawdust as a soil improver seem to be as follows :—

(1) As a mulch for low-demand or perennial crops, pastures and orchards. Small amounts of nitrogen and other fertilisers may be necessary.

(2) With large amounts of added nitrogen (2 per cent.) if to be mixed raw with soil. This is a good proposition where sawdust can be readily obtained for cowyard or fowlyard bedding.

(3) After composting, with lesser amounts of nitrogen added, and perhaps "accelerators" to shorten the period.

(4) After hydrolysing at or above 212°F with a cheap acid, neutralizing, and adding other fertilizers to extend the nutriment value.

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No. 190 1952##190 March - June, 1952

THE STRUCTURE OF EUCALYPT BARK

By MARGARET CHATTAWAY, Wood Structure Section

In the course of an investigation of the bark of various eucalypt species, it became clear that although from the days of Baron von Mueller, the genus *Eucalyptus*, has been classified according to the **appearance** of the bark, very little **anatomical** work had been done on bark generally, and practically none on that of the genus *Eucalyptus*, and it was therefore considered that some information on the subject would be of general interest.

A few botanical terms must be used in such an article; they are defined below :—

Epidermis —
the outermost protective layer of the young stem.

Cortex —
the outer layers of the young stem, forming the tissue between the phloem and the epidermis.

Phloem —
the product of cambial division towards the periphery of the tree, considered as conducting the manufactured foodstuffs from the crown of leaves.

Cuticle —
the waterproof outer layer of the epidermis.

Periderm —
the layers of cells which replace the epidermis in old stems; it consists of the **phellogen** or cork cambium, an actively dividing layer which cuts off layers of **phelloderm** on the inside and layers of **phellem** on the outside of the stem.

Rhytidome —
dead tissue which has been cut off by the periderm.

Suberin —
an impermeable substance which may be deposited within the wall structure of the cells, or secreted and accumulated as a covering layer outside them.

As the term "bark", which was originally applied only to the dead tissue covering the stem, is loosely used in the non-technical sense of "everything outside the cambium", the technical term "rhytidome" is preferred and will be used throughout this article for the dead tissue which has been cut off by the periderm.

The structural differences between xylem (wood) and phloem are due not only to the different functions the tissues fulfil, but also to their different positions in relation to cambial growth and the increase in girth of the stem. In an actively growing tree the cambium has a twofold function to perform. It not only contributes to the girth of the tree through tangential divisions which add new cells to the xylem and phloem respectively, but it also accommodates itself, and consequently the tissue it produces, to the increasing girth. As this increase is on the outside of the xylem, the tissue undergoes little extension after it has been formed, and secondary thickening of the cell walls soon fixes it into a mould that does not alter much throughout its life. Except for the formation of tyloses at the inner edge of the sapwood, the cell pattern of the wood is fixed within a few millimetres of the cambial layer, and no further growth of the wood cells occurs.

Such is not the case in the phloem. The cambial divisions, which are sufficient to keep pace with the increasing perimeter on the inner edge of the phloem, cannot have any effect at the point of greatest increase, which is in the oldest layers of the phloem, on the outside of the stem, at the farthest point from the actively growing cambium. The phloem is, therefore, under a constant tangential strain all its life. The cells of the parenchyma and rays in the phloem remain alive and can undergo division and enlargement until they are finally isolated by the formation of a periderm which cuts them off from the food supply and causes their death and the subsequent formation of rhytidome.

The structure of the young stem is very uniform throughout the eucalypts, the characteristic features of the mature trees developing either when the stem is four or five years old, or, in some species, the juvenile bark structure being retained throughout the life of the tree, except for a portion of variable height at the base of the tree.

The young phloem (Fig. 1) is a very regular tissue consisting of sieve tubes (a) and their companion cells (b), tanniniferous (c) and crystalliferous (d) parenchyma and bands or patches of fibres (e). The cortex consists of tanniniferous parenchyma and contains a variable number of oil glands towards the periphery. The epidermis, covered outside with a thick layer of cuticle, at first keeps pace with the expanding girth of the stem, the epidermal cells dividing by radial walls and the cuticle continuing to define the limits of the original cells (Fig. 2).

As soon as the epidermal layer is stretched to its uttermost, the first periderm forms, immediately underneath it, usually beginning under the lenticels. This periderm is the pattern for all the subsequent ones and consists of a phellogen (Fig. 3a) which produces a variable number of layers of thick walled lignified cells with all the thickening on the inner tangential wall (b) interspersed with a variable number of suberised layers, the cells of which are, at first, thin-walled, but which later acquire an inner lignified layer which may fill most of the cell (c). As the strain of growth becomes greater this layer ruptures, but the break is quickly made good by the secretion of suberin by the outer cortical layer (d). These deposits may be so great that they give the appearance in cross sections of a new epidermis, where the broken periderm has fallen away. The suberin seal is not sufficient as a permanent outer covering and new periderms form deeper and deeper into the cortex till the whole cortex has been cut off and the periderms form in the phloem itself. It is at this stage that the different types of rhytidome associated with the various groups of eucalypts begin to develop.

In the gums, which have smooth white or greyish trunks, the rhytidome is shed in the late summer and early autumn, leaving the stem always in the juvenile state, covered by only one periderm which is kept impermeable as the year goes on, by the development

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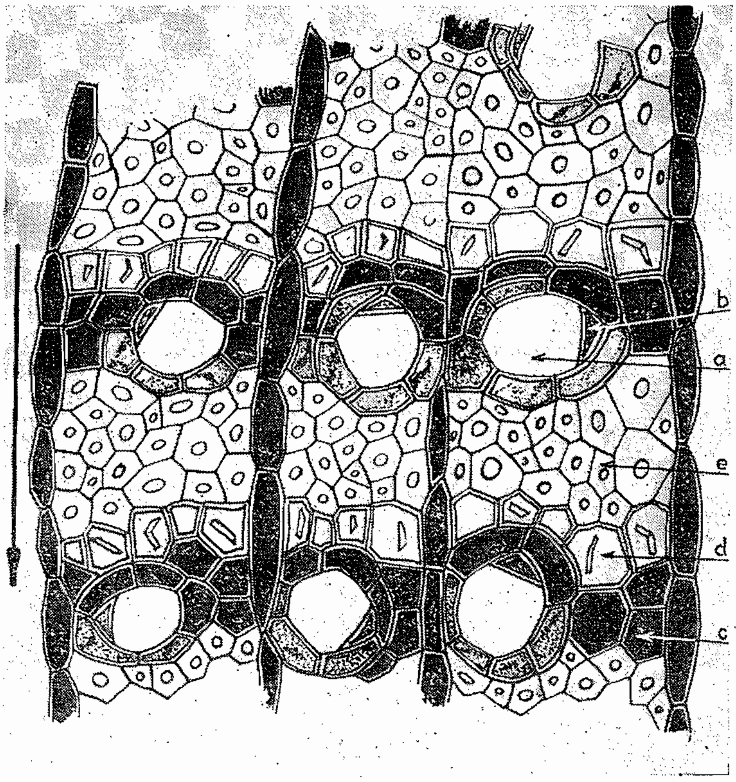

Figure 1 : Cross-section of phloem of *Eucalyptus obliqua* L'Herit (x 350). The arrow on the left points towards the cambium.

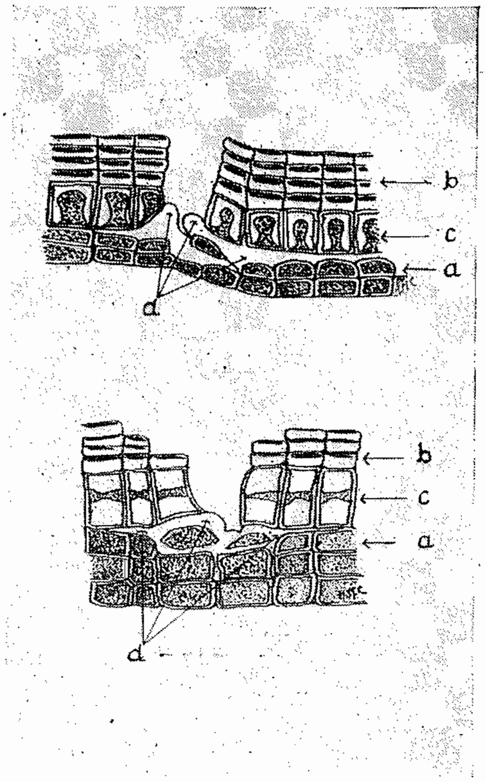

Figure 3 : Suberin deposits sealing cracks in the phellem of *E. Australiana* Bak. and Sm. and *E. regnans* F.v.M. (x 350).

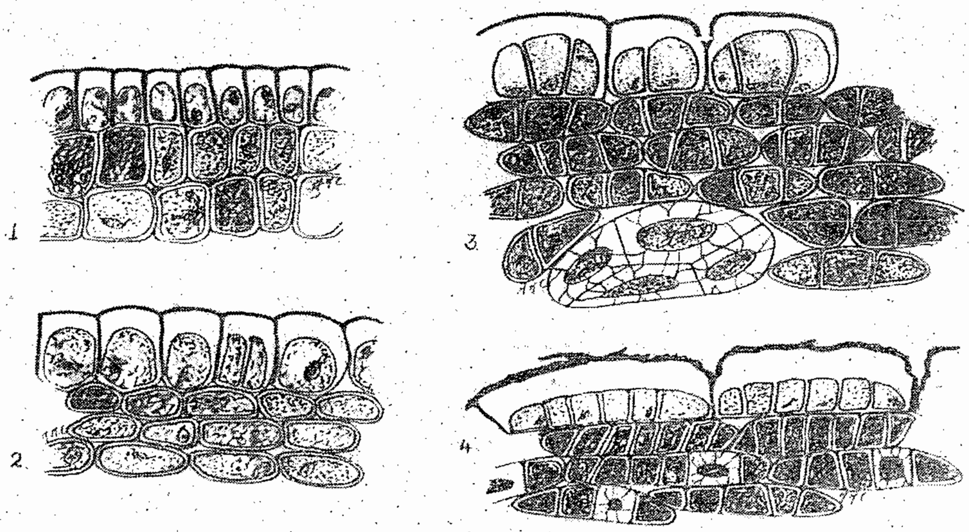

Figure 2: Cross-section of cortex of *Eucalyptus gigantea* Hook. 1-4 : Progressive stages in growth and division of the cells of the outer cortex and epidermis (x 350).

of suberin deposits under the newly formed cracks.

The stringybarks, which are covered by a very thick loose bark which is never shed, but only worn away gradually by abrasion, have a phelloderm five to six cells wide inside the phellogen. The phellem is in its early stages, very similar to that of the gums. The characteristic of these trees is the enlargement of the phloem parenchyma which takes place as each new periderm forms, causing the tissue between the new and old periderms to become very loose and spongy. At the same time a tangential band of radially elongated cells forms in the phelloderm. These cells may enlarge to many times their original size, they are usually thin-walled, but adhere strongly together so that they are a conspicuous feature of the torn and dry rhytidome on the very outside of the old tree. They can be seen with the naked eye as light tangential bands on cross surfaces of the bark.

In the boxes and peppermints the young stems still have the characteristic structure noted above. In older trees, however, the bark becomes rugose, that is to say, wrinkled, and is persistent on the whole tree except the young branches. The rhytidome is formed by the development of a number of closely spaced periderms which may be many cells wide and are usually without conspicuous thickenings on any of the cells. When the stem expands with the growth of the tree the stretching causes the phloem and ray parenchyma to expand, and the living cells divide so that the mature bark consists of alternating wedges of phloem and parenchyma. The phloem wedges taper towards the periderm and the parenchyma wedges towards the cambium. In peppermint and in the long-leaved box, oil glands develop in the parenchyma wedges.

Yet another type of bark is developed in red ironbark, the hard, black, furrowed rhytidome, differing from all the other barks examined, in the presence of large pockets of kino. As soon as the smooth twig begins to give place to the rough-barked stem, which in its turn grows into the flanged and furrowed trunk, the periderms begin to be discontinuous, becoming rugged and broken, interrupted by the development of extensive kino deposits which appear to come from the disintegration of the phloem tissue itself. In the young stems these cavities are bounded by many layered periderms, which are similar to those of the younger stems of this and other species of eucalypt. In still older bark the kino pockets are much more extensive and may burst the confines of the periderms, remains of which may be found here and there around their peripheries. The cohesion of the bark of red ironbark into a hard mass is due to this impregnation with kino, which hardens on exposure to the air. The deep furrows, which are such a feature of ironbarks, begin to form early, when the young stem expands, and the phloem parenchyma and ray cells divide to form wedges of large celled tissue. As the surrounding tissue becomes hard and rigid these wedges form weak places that give way very easily under the strain of expanding girth and consequently are the site of further cracking. These wedges of large-celled tissue are similar to those observed in the boxes and peppermints, but the greater rigidity and cohesion of the dead rhytidome in the ironbark ensures that the cracks always occur in the same place, and that little bark is lost through abrasion. In the boxes and peppermints there is a certain amount of "give" in the surrounding tissue, and the cracks are not always in the same place. The trunks of such trees are a network of small fissures instead of the fewer deep furrows of the ironbark.

It is possible that if more were known about the structure of bark another feature might be added to those which help in the identification of eucalypts. Bark is more accessible than wood and sufficient for examination can be taken off the outside of a tree without causing damage to the timber, or permanent disfigurement to the tree. Unfortunately the details of structure are not as easily seen with a penknife and hand lens as are those of the wood. It is often difficult to get a clean surface without embedding the bark in wax or celloidin, and even then the cutting requires a very sharp knife. But there is already some evidence that a survey of the barks of the different eucalypts is likely to help establish relationships and to assist in the separation of species which have very few distinguishing features in the wood.

MEASUREMENT OF STRAIN IN TIMBER

With Special Reference to the Use of Resistance Strain Gauges

By I. G. SCOTT and J. E. MORRIS, Timber Physics Section

Stress and Strain

In every day speech the words "stress" and "strain" appear synonymous, but when used as technical terms a clear distinction must be made. To make this distinction, it is necessary to gain a clear understanding of both these terms and how they arise physically.

When a wooden test specimen is loaded in tension, it is found to increase in length with increasing load. With load application, there are set up in the specimen internal resisting forces which oppose the stretching of the specimen, i.e., tend to balance the applied forces. In the absence of this resistance, the specimen would break under even the smallest load. The internal force which acts across unit area of a plane normal to the direction of loading is generally called the stress, and is generally measured in lb. per square inch.

The amount of stretch of a specimen under load will depend, in part, on the load on the specimen. To enable the stretch of specimens of differing lengths to be compared, the fractional change of length is considered, i.e. the change in length per unit length. This measure of the deformation of the specimen is known as the strain. Thus the difference between the two terms may be clearly seen, for while one is a load intensity, the other is a measure of stretch.

When a force is applied to a body, it is found that up to a certain load the strain is directly proportional to the stress, i.e. if the stress is doubled, so is the strain. The stress per unit strain under these conditions is therefore constant and is defined as the modulus of elasticity for the material of the body. The modulus of elasticity gives a measure of the rigidity of the specimen, for it can be seen that the greater the load required to produce the same strain, the greater is the resistance to deformation offered by the specimen.

These points may be further clarified by considering a practical example: a tension specimen of square cross section ($\frac{3}{8}$ in x $\frac{3}{8}$ in.) is cut from mountain ash (modulus of elasticity 2.6×10^6 lb. per sq. in.) and

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loaded with a 700 lb. weight. The stress, which is the load per unit area will be 700 ($\frac{3}{8}$ x $\frac{3}{8}$), very nearly 5,000 lb. per sq. in. As the modulus of elasticity is stress/strain the strain will be 5,000/2.6 x 10^6 or about 0.002. That is, if the initial length of the specimen is 10 in., the length under load will be 10.02 in.

Although this discussion has referred only to tensile strain, a very similar discussion would cover strains which deform the specimen in other ways.

Why Measure Strain ?

It is frequently impossible to calculate the stress in a member of, say, a wooden roof truss. Further, it is generally very difficult to measure this stress even in the laboratory. However, if the strain in the member is measured, the stress may be calculated and from a knowledge of the dimensions, the load and the elastic modulus. From such an actual determination, either on existing or experimental structures, the value of safe loading on the various members may be found. In addition, it is necessary to know the effect of the connecting devices (nails, bolts or timber connectors) on the strength of the member. This can only be determined when the variation in strain around the connecting device is known. Thus a knowledge of strain values assists in the improvement of design and, generally, in advancement in engineering and architecture.

Methods of Strain Measurement

The need for strain measuring devices in the field and laboratory is considerable, and because of the diversified requirements for particular purposes, there is a diversity of gauges, examples of which will now be discussed in considering various methods of strain measurement.

1. **Indirect Methods :** The use of large wooden beams for studying the effect of prolonged loading on wood is described in an earlier "News Letter" (No. 145), the deflection of the loaded beam which is directly related to the strain in the beam being measured with a surveyor's level and staff. If smaller deflections are to be measured in these or other tests (e.g. standard bending test, News Letter No. 152), the measurement may require the use of an engineer's dial indicator.

2. **Direct Measurement :** The direct observation of extensions, which are very small, generally requires a microscope or similar device to observe fine markings on the specimen, the distance between such markings being measured by the micrometer screw with which the position of the microscope is adjusted. The cathetometer and the toolmaker's microscope are good examples of devices which are used for strain measurement by measuring the change in a known length. A measuring microscope was used to study growth stresses in trees (News Letter No. 173). Where this instrument is applied to the measurement of creep in timber under a tensile load (illustrated in News Letter No. 151) a magnifying lever is attached by knife edges to the specimen and the magnified change in length is measured with a microscope and screw.

3. **Optical Methods :** The Tuckerman and Lamb's roller gauges use a beam of light to obtain sufficient amplification of the small movements of the specimen under strain. In both cases, the movement is transferred by knife edges which are in contact with the specimen. The Lamb gauge is used extensively in the laboratory, whilst the Tuckerman, although having a similar accuracy, may also be used in field work, e.g. the determination of stresses in wooden bridges due to dead loading.

4. **Mechanical Methods :** The engineer's dial gauge is extensively used to measure distances up to 1 in., the dial being graduated in thousandths of an inch. Indicators may be produced to measure more accurately but the travel is much smaller and their operation not so satisfactory. By measuring over comparatively great gauge lengths (about 10 in.), a moderate accuracy may be achieved, this being done for a number of routine laboratory tests. A number of extensometers are on the market in which a dial indicator is incorporated as the measuring device (e.g. Garrard, Whittemore extensometers).

5. **Special Methods :** The de Forest scratch gauge is a small device by which scratches made on a polished target can be used to estimate the strain, the target being examined under a microscope for this purpose. Despite its simplicity, the gauge has not been extensively used, one probable reason being that no indication is given of the time at which the strain occurred, thus presenting difficulties in correlation.

In cases where only a gross indication of strain is needed, recourse may be made to two other methods: (a) A transparent model may be made, and viewed with polarized light. Coloured light fringes which appear when the wood is strained indicate the existence and form of strain fields. (b) The surface of the specimen may be coated with a brittle lacquer which will show crazing under load. Provided a suitable lacquer is selected, this crazing will indicate the extent and magnitude of the various strains.

Despite the wide range of methods of strain measurement which have been covered and the uses for which they are suitable, there are other fields in which the use of a very small gauge is desirable, and which call for another method such as the use of electrical resistance strain gauges.

The Electrical Resistance Strain Gauge

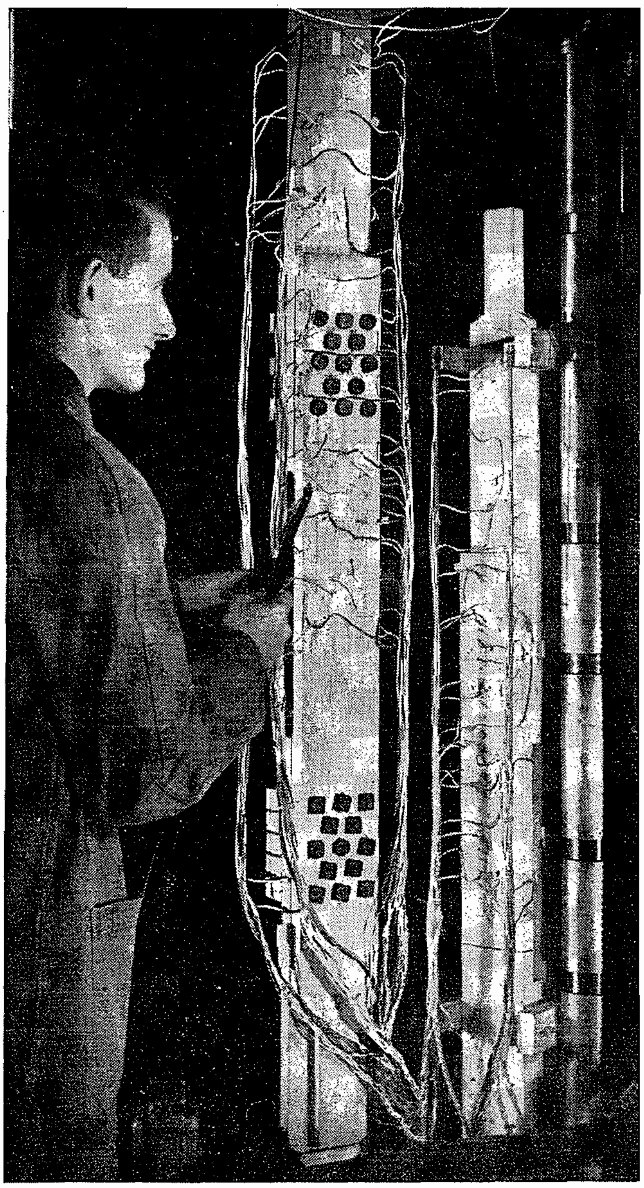
When a wire is stretched, its electrical resistance changes. The electrical resistance strain gauge is a length of fine wire, about the thickness of a human hair, glued to a fine rice paper and cemented to the surface in which strain is to be measured. It is essential that the wire be intimately bonded to the surface so that it becomes, as it were, part of the specimen and thus undergoes the same strain. When the length of the specimen and wire is changed, it is found that the fractional change of the electrical resistance of the wire gives a direct measure of the strain.

The most suitable wire is 0.001 inch diameter resistance wire (an alloy of copper and nickel). If the length of wire is not less than six inches, the complex electrical and electronic equipment required to measure resistance change may be simplified. However, although a satisfactory gauge would result, some of the advantages would be lost if this length of wire, together with leads, were simply attached to the specimen. Hence, the size of the gauges is about one-third of that of an ordinary postage stamp, the length of wire being wound on a cylindrical paper former, which is subsequently pressed flat, leads and covering paper being soldered and glued in place.

The Gauge in Use

To determine the suitability of electrical resistance strain gauges in creep measurement, two inch gauges are being compared with the optical-mechanical extensometers on tension specimens. These gauges afford the advantage that the time taken for each strain reading is about one hundredth of the time required for a trained operator to set up and read the measuring microscope.

The strains in the various members of a roof truss or in members of a wooden bridge have been found by using dial indicators or Tuckerman gauges. However, if simultaneous strain measurements at a number of points are required, the arrangement becomes either impossibly expensive or unnecessarily



Test on bolted lap joints using electrical strain gauges.

wasteful of manpower. By using electrical resistance gauges, all strain readings may be taken by the one operator at a central point some distance from the actual structure. In addition, small gauges (length one quarter inch) have been used to investigate the stresses in the vicinity of the nails or bolts used as connectors. Gauges have been attached to flooring joists to enable the effect of loading on the floor to be investigated.

Although attempts were made overseas to use the de Forest scratch gauge to determine stresses in rotating airscrews, electrical resistance gauges produced a far more satisfactory method of stress determination. With these, strain readings could be taken during progress of the test, whilst the results from the de Forest scratch gauges could only be interpreted when the test was completed. In aeronautical research, electrical resistance strain gauges are commonly used in what were once considered inaccessible positions. As a result, there has arisen a new method in aeronautical design, allowing considerable reduction in weights of various machine members. In some cases, strain readings have been made during flight tests of single seater fighter planes, the results being automatically transmitted by radio to the operator at the ground station, without any need of an air-borne observer.

During acceptance tests on a hydraulic pressure cylinder of novel design (see News Letter No. 184), water-proofed gauges were attached to the interior of the cylinder, which was filled with water at high pressure. It is doubtful whether any other gauge could have been used under these conditions.

Many more examples of the use of these gauges could be given but those above should prove sufficient to indicate their many advantages over more orthodox methods of measurement.

Advantages of Electrical Resistance Gauges

It must be emphasized that these gauges measure strain, unlike those described earlier which were essentially extensometers, which measure changes in length. Hence, the gauge size has no bearing on either the sensitivity or the accuracy of strain measurement, and gauges may be made of an appropriate size and shape to suit the requirements of the particular test. Because the gauges are electrical in operation and may be made small in size, they are available for use in positions which were formerly considered inaccessible to strain measurements. These small comparatively inexpensive gauges may be attached in large numbers to a structure or machine to allow simultaneous strain measurement, under load, to be taken. (Twenty-two gauges may be mounted on the specimen on the space normally occupied by a dial indicator.) Even when tests are carried out on a large structure, such as a bridge or an aeroplane hangar, all strain readings may be brought to one central location.

Since a large number of gauging points may be essential to the success of the particular test, the "setting up" time may be considerable. However, the time for reading the strain from each gauge is small, and there is probably no other method available by which such a test could be successfully carried out.

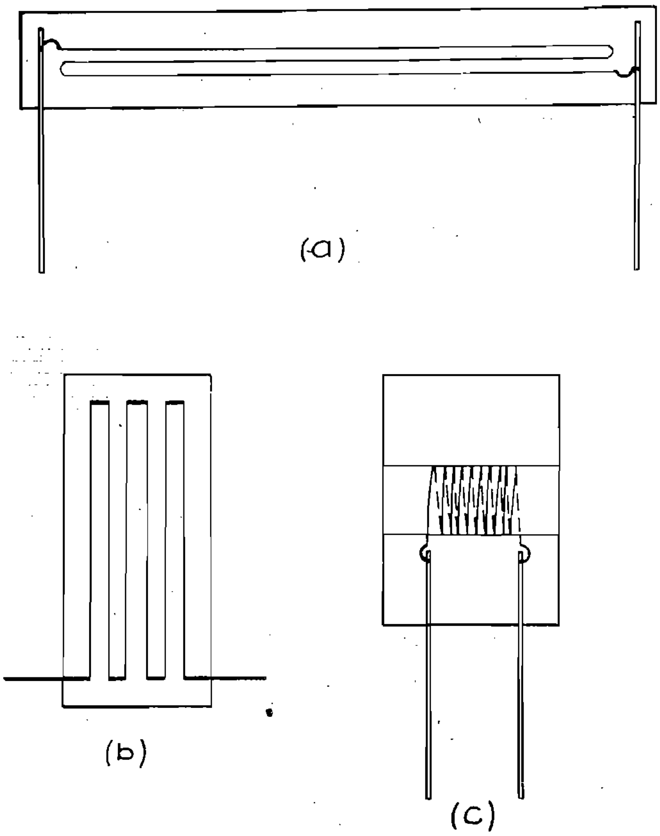
As the fractional resistance change of the gauge

Determining the strain distribution in a large laminated compression specimen by the use of electrical strain gauges.

is very small, changing atmospheric conditions may bring about resistance changes which indicate a spurious strain. To provide some measure of compensation, the gauges are generally used in pairs, which although doubling the number of gauges used, affords certain additional advantages. By combining the strain measured by two gauges, the effects of bending in compression specimens may be eliminated, i.e. strains may be averaged. In addition, shear and torsional stresses may be measured by similar combinations of gauges.

The Tuckerman extensometer possesses most of these advantages, but although accurate and moderately robust, is very expensive.

Finally, the ability of electrical strain gauges to measure rapidly changing strains, which may be recorded by use of an appropriate equipment, opens up an entirely new field for research.



Types of electrical resistance strain gauges —
(a) Two inch gauge
(b) One method of avoiding sensitivity to lateral stresses
(c) Method used for very short gauges

Concluding Remarks

Various types of electrical strain gauges are made in these laboratories to satisfy the requirements of a number of tests. Very small gauges are constructed using the earlier method described while larger gauges are made by one of two completely different methods. However, prospective users of these gauges are recommended to purchase gauges from a reputable firm, rather than attempt the hazardous task of home construction. A complete technique which has been acquired over a number of years is necessary to manufacture these gauges successfully. The knowledge gained in this respect has been invaluable when applied to the attachment of the gauges, which are affixed to a smoothed surface which has been thoroughly cleansed by a cellulose based cement (used also in manufacture). Thorough drying of the adhesive is necessary for good results — air drying for up to 48 hours being considered essential. The lengthy drying time is not a great disadvantage when work can be planned ahead, but for casual users, may be serious. For this reason, overseas laboratories are searching for a suitable cement which is quick drying.

Associated with the gauges is the electrical and electronic equipment which is required for measuring the resistance change. The use of an equipment which will automatically record the strains at various points is only justified when the number of gauging points is great and when the equipment is in almost continuous use. In these laboratories an equipment to allow the rapid switching to any of 48 gauge points has been constructed. The strain is not recorded but is read from a dial used for balancing a resistance sensitive bridge. Commercially available equipment generally comprises a strain measuring bridge for use with a single pair of gauges, the switching equipment necessary for multi-channel work being supplied as a separate unit.

The rapid development of electrical strain gauges in the last ten years has been due in no small measure to the interest shown in their application and the suggested improvements made by various users. Provided this interest is maintained in the future, this technique of strain measurement must be further advanced.

Although most of this discussion has referred to the use of electrical strain gauges on timber, their performance is equally good when used on metal. Further information regarding commercially available gauges, together with associated equipment, may be obtained on enquiry from the Chief, Division of Forest Products, P.O. Box 18, South Melbourne.

Personal

It was with regret that the Division said farewell to the four students from S.E. Asia who left after spending some time here studying the latest methods in forest products research, and investigating particular problems with the intention of extending or improving the utilization of forest products in their own countries.

Mr. Francisco Tamolang, a forester of the Philippines Department of Forestry, was chiefly concerned in investigating the properties of Philippine timbers, and also studying the background of operations of a large forest products laboratory with a view to incorporating some of the ideas in the new forest products laboratory in his own country.

Messrs. Sakdi Wattanakul and Karin Ingavata, two students from the Thailand Forestry Department, mainly concentrated on the study of veneer and plywood production, but also gathered information on general utilization, preservative treatment and seasoning of timber.

Mr. K. Kumarasamy, from the Timber Research Laboratory, Malaya, was also chiefly interested in veneer and plywood production, but he too spent some time in other sections of the Division.

These students deeply appreciated the co-operation of the Australian plywood industry in showing them over plants, helping them gain experience, and discussing their timber problems with them.

The Properties of Australian Timbers

HUON PINE

Name

Huon pine is the standard trade common name of the timber which botanically is known as *Dacrydium franklinii*. Hook. f. Other common names given to this species are white pine and Macquarie pine.

Distribution

The genus *Dacrydium* is found in Australia and New Zealand, New Caledonia, Malay Archipelago, Borneo and Chile, but this particular species *D. franklinii* is confined solely to Tasmania. Here it is restricted to river banks, occurring in many swampy localities extending from the upper Huon River around the south west coast and reaching the most northerly point in its range along the Stanley River, a tributary of the Pieman. From the west coast it extends up the Gordon River as far as the Serpentine River which is its eastern limit.

Habit

Under normal development the tree attains a medium height of 80 feet, with an average diameter at breast height of about 3 feet 6 inches.

Timber

The timber is pale yellow to yellowish-brown in colour. It is usually straight-grained with the growth rings fine and close. The figure is usually pronounced on account of the growth rings and sometimes exhibits a "bird's eye" appearance. The wood is smooth and oily to touch. It has a characteristic odour and when distilled yields an essential oil. It is moderately light in weight, ranging from 28 to 37 and averaging 32.6 lb./cu. ft. when dried to 12 per cent. moisture content. It is a very durable timber, being noted for its resistance to decay, borers and Toredo. It is a soft timber, fairly strong, not tough and fairly stiff.

Seasoning

Huon pine may be seasoned readily without degrade. A kiln drying schedule has been recommended for 1 inch green stock which would enable it to be dried in a commercial kiln in 5 to 6 days. In drying from the green condition to 12 per cent moisture content little shrinkage takes place, back-sawn material contracting only 3.2 per cent in width and quartersawn only 2.4 per cent.

General

Because the timber is soft it is very easily worked with hand or machine tools and it turns well. It is also a satisfactory bending timber. It has good nailing properties and holds screws firmly. It takes a good finish, staining and polishing particularly well.

Uses

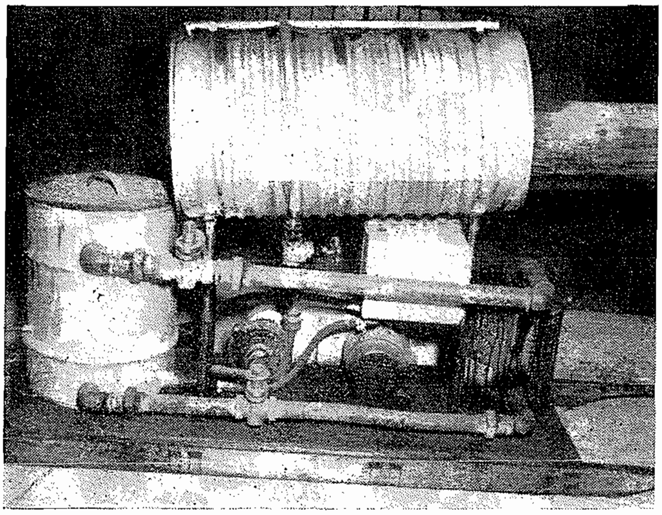
Huon pine is especially favoured for boat building, and for this purpose there is probably no wood superior to it. It is valued for cabinet work and also for doors, sashes and other house fittings. It is commonly used for drawing boards because of its softness and smooth surface finish. Wooden troughs in this timber have given years of satisfactory service. In the furniture trade it is widely used for drawer slides, and drawer sides, its popularity being specially due to its clean cutting. It makes attractive ornaments when adorned with poker work, to which it responds readily.

Additional information on this timber can be obtained from the Tasmanian Forestry Department, or from the Chief, Division of Forest Products, 69 Yarra Bank Road, South Melbourne, Victoria.

A New Form of Preservative Treatment for Round Poles

By F. A. DALE, Preservation Section

The best non-pressure preservative treatment for the sapwood of round timbers is the hot and cold bath, using an oily preservative such as creosote. In this process the timber is treated to about 200°F. in the preservative and then allowed to cool in the bath. Air is driven from the sapwood as it is heated and is replaced by preservative as it cools. Loadings of 10-20 lb. of preservative per cubic foot of sapwood are easily obtained provided the sapwood is dry before treatment. Details of the treatment are set out in D.F.P. Trade Circular No. 27 "The Preservation of Timber." Usually when power or telegraph poles are treated in this way the butts only are immersed in the bath because the high loading of preservative obtained is not needed in that part of the sapwood above the ground. Such butt-treatment entails up-ending the poles into a tank, and this may be very difficult if proper lifting gear is not available. The Preservation Section of the Division of Forest Products has been working on an alternative method, suggested by the State Electricity Commission of Victoria, in which the poles are laid horizontally and the butts are sprayed with hot preservative until they are thoroughly heated, when the heat is turned off and the spray continued until they have cooled.



A simple plant, as illustrated, has been made to test the process. The preservative is heated by electric elements in the tank and continuously circulated by the pump over the butt of the pole in the treating cylinder. With this plant, preservative loadings similar to those obtained in the hot and cold bath have been obtained.

Another advantage of this plant, particularly where only a small number of poles are to be treated, is that, compared with the hot and cold bath, much less preservative is needed for its operation. This fact, and the portability of the plant, suggest its possible use for the treatment of poles at or near the site of installation.

It is not implied that the treatment is superior to the hot and cold bath treatment for general pole treatment, but in certain cases the advantages cited may make its use attractive.

ECONOMICAL METHODS OF ESTIMATING QUANTITIES AND COSTS IN THE TIMBER INDUSTRY

By E. J. WILLIAMS, Section of Mathematical Statistics

One of the risks incidental to the timber industry, in common with most industries dealing with raw materials, is that quantities, quality and costs are not known with exactitude, but are subject to unknown errors. The volume of timber in a tree, or in a stand, can be estimated with, at best, limited accuracy. Likewise, the properties important in utilization, such as density, mechanical properties, decay resistance etc., are variable in timber of any species from piece to piece and from tree to tree. Again, because of the varying conditions under which the timber is felled, hauled and milled, the cost to be allocated to various products is determinable only to within a certain margin. All these figures are therefore surrounded by a certain penumbra of doubt, which it will be in the interests of the industry generally to make as narrow as possible.

While these inaccuracies can be allowed for, by taking conservative estimates of volume and liberal estimates of costs, and while such action would always be prudent even if the errors were known to be small, it would help considerably in the planning of operations if risks arising from these inaccuracies could be reduced to a minimum.

Fortunately, methods have been devised for firstly, estimating the extent of the errors to which such figures are subject, and secondly, reducing these errors to as small a range as possible consistent with practical needs. While these methods have not as yet found extended application in this country, they are, judging from the literature about them, in common use overseas. It therefore seems worth while to give some account here of the methods, and the results to be achieved by their use, in the belief that the local industry and State Forest Services will find them of value.

In volume estimation, either of standing timber or of logs, the basic tool is the volume table. The usual volume table relates volume to some measure of diameter and some measure of height. New variants of the volume table are always being devised in the hope of achieving increased accuracy, and it would be impossible, as well as unnecessary, to discuss any of them in detail here. It is, however, important to recognize that a volume table is most accurate when applied, not only to the species, but also under the conditions for which it was constructed. In fact, to reduce the risk of errors in volume estimation due to the use of an unsuitable volume table, it is desirable whenever possible to base the volume table, or at any rate adjustments to existing tables, on measurements of a small sample of trees from the area being studied. The size of the sample required will depend on the size of the stand and on the variation in size among the trees in it. An equation relating volume to diameter and height measurements is then determined from the results for the sample trees. The actual construction or adjustment of the volume table is based on this equation.

In a recent study carried out for the Queensland Forestry Department by the Section of Mathematical Statistics, figures were provided for diameter, pipe and length of a number of logs, together with the net solid sawn output and total milling cost of each. From these figures, formulae were calculated, giving estimates of output in relation to the three dimension measurements, and of cost in relation to dimensions and output. Such formulae would provide an objective basis for setting stumpage rates, for making allowances for pipe and such defects, and for deciding which trees can be economically felled.

Needless to say, the collection of records for individual logs on which to base the derivation of formulae for costs and other factors in a laborious and time-consuming business, although it does give valuable data for use in mill design and re-organization. However, for more specific investigations, interesting methods have been developed whereby only total figures, more easily ascertainable, are used. For instance, Day (Journal of Forestry 35 (1937) 69-71) has derived equations for estimating the cost of hauling logs, in terms of diameter and diameter-squared. Seventy truckloads of logs, for each of which the haulage cost was the same, were examined. For each, the number of logs, and the totals of diameters and diameters-squared, were recorded. A relationship for cost was determined by regression analysis. The success of the method is indicated by the fact that, using the empirical formula, the haulage cost of any truckload was estimated with a standard error of 10 per cent. (This figure is not given in the paper referred to, but can be calculated from the results supplied.)

In a similar way, Hasel (Journal of Forestry 44 (1946) 552-560) has derived an estimate for logging cost in terms of tree size and intensity of cutting. For his records he has used, not observations on individual trees, but daily totals of numbers of logs in each size-class and total daily cost: quantities which would normally be recorded in any case. He is thus able to derive information on costs without the labour of collecting individual records, and without upsetting the routine of the mill to undertake a special study.

This "daily total" method would have application also in sawmill studies, though up to the present only the more laborious and not necessarily more reliable methods of individual records have been used in this country. An example of sawmill studies conducted in this way is given by Schumacher and Jones (Journal of Forestry 38 (1940) 889-896).

Another incidental but nevertheless important advantage of the "daily total" method over the method of individual records as commonly practised is that, since the calculations are based on easily verifiable quantities, the errors to which the estimates are subject can be determined, and hence, the limits within which the true values are likely to lie can be found. This is generally not possible with mill studies conducted by other methods.

In conclusion, it should be added that the methods referred to above are not only applicable to volume and cost estimation. The estimation of fire weather conditions from temperature and relative humidity, of decay susceptibility from chemical composition, and many other useful relationships affecting the welfare of the timber industry, are all within the scope of these methods.

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C.S.I.R.O.

FOREST PRODUCTS NEWSLETTER

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

No. 191 1952##191 July-August, 1952

IDENTIFICATION OF EUCALYPT TIMBERS — Part 2

By H. E. DADSWELL, Officer-in-Charge, Wood Structure Section

In the previous article of this series reference was made to the grouping of eucalypt timbers. It has been found that, to some degree, grouping of the timber on anatomical features follows botanical groupings and also, to a lesser extent, the groupings based on bark characteristics. Therefore, some consideration of the common bark groupings is not out of place. The earliest classification of the eucalypts introduced by the first settlers in Australia developed from the varying bark appearances and this classification has persisted. In all the literature on eucalypts reference is made to bark characteristics and to the grouping of species in various bark classifications. Baron von Mueller divided the genus into six groups using this feature and his groupings were adopted with modifications by other workers. The late R. T. Baker in his well-known publication "The Hardwoods of Australia and their Economics" stated :—

> "In classifying the timbers of the eucalypts it would perhaps be as well to first consider the genus in groups, and for preference to arrange them according to the nature of their barks or cortically in their botanical sequence."

He therefore made eleven such groupings, namely: bloodwoods, mahoganies, boxes, tallowwoods, stringybarks, woollybutts, blackbutts, gums, peppermints, ashes, ironbarks. The distinction between some of these groups is not very apparent and in some cases, such as the mahoganies and ashes, the wood type is obviously referred to. However, there seems to be some general agreement on a number of groupings that a fairly characteristic, and these are :—*

- (i) *Gums:* The largest group of all, giving rise to the commonname for the trees of the genus—gums; the bark is smooth on trunk and limbs except for varying amount of rough bark at the butt.
- (ii) *Stringybarks:* Outer bark thick, brownish, fibrous and stringy, persistent on trunk and larger branches.
- (iii) *Ironbarks:* Bark thick, hard, brittle and deeply furrowed, persistent on trunk and larger branches, but the degree of roughness and corrugation varying considerably.
- (iv) *Boxes:* Rough bark of a sub-fibrous, interlaced character extending over varying length of the timber and branches; upper branches usually smooth.
- (v) *Peppermints:* Bark sub-fibrous, somewhat resembling the box bark, but more stringy and furrowed, the upper branches and sometimes a portion of the trunk are usually smooth.
- (vi) *Bloodwoods:* The bark is rough, rigid, reddish in colour, friable and more scaly and flaky than any other groups.
- (vii) *Miscellaneous rough barks,* including all rough bark species not included in other groups.

One important point to be remembered is that the man in the field can often place a species of eucalypt into its correct group on the basis of bark characteristics. This applies to the examination of logs or sawn timber on which the bark has remained attached. It must also be remembered that there is some degree of variation in the appearance of the bark at different periods of the year and with height in tree. A piece of timber without bark must of course be classified or grouped by other means. In the following discussion the above bark groupings have been followed as far as possible because it is convenient to consider the woods in these groupings. However, special mention has been made of variation either in the wood or the bark.

1. BLOODWOOD GROUP

The name "bloodwood" refers specifically to the common kino exudations from the bark and in certain cases to the rather commonly occurring gum veins in the wood. As mentioned in the first article in this series, the wood structure of the bloodwood group differs from that of the remainder of the members of the genus in that all the timbers falling into the group are characterized by pores (vessels) being arranged in short radial multiples and by abundant parenchyma commonly arranged in bands spread tangentially from the vessels. The species with this type of wood structure fall into two of the botanical series listed by Blakely in his "Key to the Eucalypts", namely, Series 4 — Corymbosae (non-peltatae) and Series 5 — Corymbosae (peltatae). Although most of the species in these series have the characteristic bloodwood bark, some do not. For example, spotted gum *(E. maculata)* and lemon-scented gum *(E. oitriodora)* have the smooth bark typical of the gums. Others also have a smooth bark and in these cases classification on bark alone would fall down. On the other hand, examination of the wood structure as revealed on cross section under a hand lens would place them correctly with others in the bloodwood group.

The common timbers of the group are spotted gum referred to above, red bloodwood (*E. corymbosa*) syn. (*E. gummifera*), white bloodwood (*E. trachyphloia*), carbeen bloodwood or Moreton Bay ash (*E. tessellaris*), yellow bloodwood (*E. eximia*), marri (*E. calophylla*), *E. papuana* from Northern Territory and New Guinea. The well-known red flowering gum (*E. ficifolia*) is also a member of the group.

The structure of the woods of this group is practically identical with that of the woods of the genus *Angophora*, and with no other evidence to hand it is difficult to determine whether an unknown timber is

* See, for example, R. H. Anderson — "The Trees of New South Wales." Government Printer, Sydney (1947).

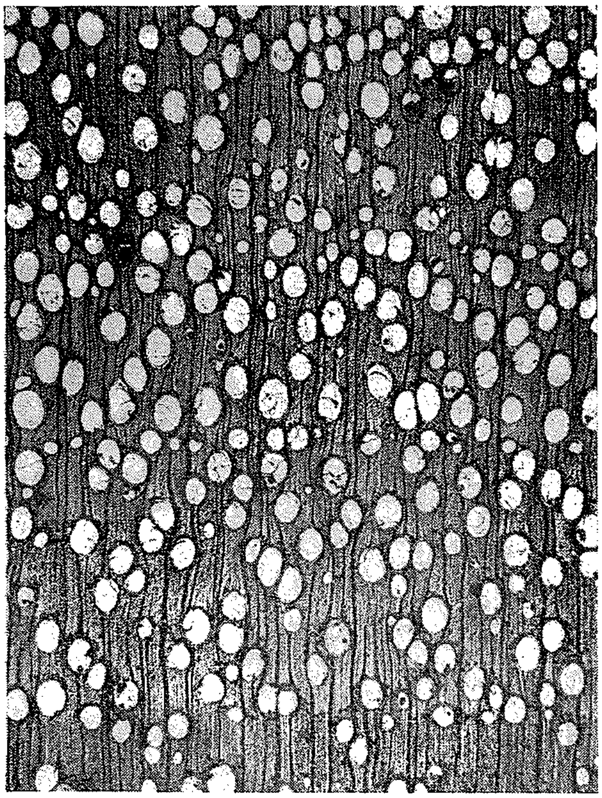


Figure 1 : Cross-section of a typical ironbark.

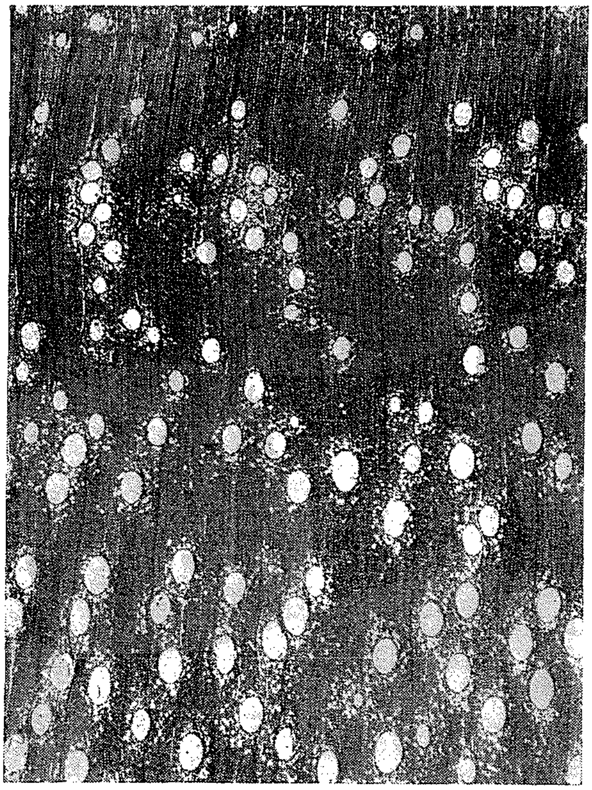


Figure 2 : Cross-section of *E. leucoxylon* (yellow gum).

a bloodwood or whether it belongs to the genus *Angophora*.

2. IRONBARK GROUP

The members of this group are probably the next most distinctive from the point of view of both bark appearance and wood structure. As indicated above, the bark is very characteristic and all the woods are extremely dense and very hard to cut across grain with a knife. They have what has been termed a hard, horny cut. Anatomically the timbers have numerous small pores and sparse paratracheal to sometimes diffuse parenchyma visible with difficulty under a lens. These features together with the hard horny cut usually serve to distinguish them from most other eucalypts.

The common ironbarks are grey ironbark (*E. paniculata*) (N.S.W. and Queensland), narrow-leaved red ironbark (*E. crebra* syn. *E. racemosa* (N.S.W. and Queensland), broad-leaved red ironbark (*E. siderophloia*) (N.S.W. and Queensland) and red ironbark (*E. sideroxylon*) (N.S.W. and Victoria). The timbers are dark brown to reddish brown in colour, grey ironbark being dark brown to chocolate brown and somewhat reddish brown, the others reddish brown. Grey ironbark can be readily distinguished from the others because match size splinters burn to a full ash, generally buff in colour. *E. crebra* sometimes burns to a partial ash white or buff in colour, and the others to a charcoal. Other members of the group are not so well known but they fit into the general pattern of wood structure.

The grey gums of New South Wales and Queensland (*E. propinqua* and *E. punctata*) may be confused with the ironbarks on the basis of timber colour, weight and hardness to cut across grain. Even microscopically these timbers are not easy to distinguish from the ironbarks, being only slightly coarser (large pores) but having more paratracheal parenchyma. They of course possess the smooth gum type bark in contrast to the thick deeply furrowed bark of the ironbarks.

Other species have been at various times given the name ironbark although not properly placed in this group. One of these is *E. sieberiana* now known as silver-top ash. Its bark is hard and deeply furrowed like an ironbark on the trunk, but smooth and white on branches. Its timber, however, is quite distinct from that of the various ironbarks, being pale in colour and more like that of the ash type or the stringybarks. On the other hand, *E. leucoxylon*, once called white ironbark but now known as yellow gum, is, botanically speaking, closely related to the ironbark group. Its bark, however, is more nearly the gum type and its wood structure is distinct from that of the ironbarks, being much more like that of the boxes.

In the first article of this series a photomicrograph of the cross-section of a member of the bloodwood group was included. With this article two additional photomicrographs of the same magnification (25X) are provided for reference. From these it can be readily seen that *E. leucoxylon* has much more parenchyma than the ironbark, and is somewhat less dense (fibres with thinner walls).

Australian Pulp and Paper Industry Technical Association Sixth General Conference

The Presidential address and a brief description of this Conference have been included in the "News Letter" because it is felt that they would be of interest to the timber industry generally. They indicate how industries can combine together and improve their status by co-operation and the exchange of technical information.—Ed.

The Sixth General Conference of APPITA was held at the University of Melbourne from March 3rd to 7th inclusive. It attracted a record number of 230 members, i.e. approximately 40 per cent. of the total membership, representative of all the south-eastern States of Australia, as well as of New Zealand and overseas.

At the Annual General Meeting J. D. Andrews, Operations Manager of Australian Paper Manufacturers Ltd., was elected President in succession to Dr. W. E. Cohen, Senior Principal Research Officer, Division of Forest Products, C.S.I.R.O. At a subsequent meeting of the new Committee, J. L. Somerville, Chief Chemist of Australian Newsprint Mills Ltd., was elected Vice President.

The highlight of the conference was the field day during which members, their wives, and friends were the guests of Australian Paper Manufacturers Ltd. and its subsidiary, A.P.M. Forests Pty. Ltd. A convoy of land liners and cars took the party to Gippsland where some spent the day at the Maryvale pulp mill while others inspected the afforestation operations at the Longford *Pinus radiata* plantations.

With regard to the technical sessions, the first, logically, was concerned with the industry's main raw material, viz., wood. The first paper, by J. D. Brookes, described the procurement and handling of foothill eucalypt species in lieu of fire-killed mountain ash which is no longer workable. The paper then proceeded with the description of the pine planting programme of A.P.M. Forests Pty. Ltd. and served as a fitting introduction to the field day which was to follow. After the paper a short film was shown illustrating the operations which had been described in the paper. The film portrayed a very important theme for the consumption of the public at large, viz., that the pulp and paper industry is very much alive to its national responsibilities in taking steps to replace the forest produce which it utilizes, i.e. by means of intensive re-afforestation. The second paper, by P. Bryce, in addition to describing methods used in procuring wood for the mills of Associated Pulp and Paper Mills Ltd., gave in some detail that Company's experience with German-made chippers which are claimed to be the only ones of their kind in the Southern Hemisphere. The third and last paper of the session by F. B. Smyth was concerned with the problem of handling and storing groundwood pulp being produced in excess of immediate requirements.

The Sustaining Members' night provided for varied interests. Those attending had the choice of viewing films dealing with pulverized fuel, the manufacture of machine tool steel, and the development of the modern paper machine with its influence on civilization; or of hearing lecturettes on chlorine production and a modern water treatment plant. In addition numerous interesting exhibits of instruments and equipment were on display.

In the second technical session L. W. Brasch discussed the effects of sodium chlorite bleaching on the molecular structure of the pulp. Machine room instrumentation was concerned first with photo-electric break detectors for paper and board machines. This was discussed by D. J. Williams, and he was followed by V. J. McConchie, who described a continuously recording moisture meter for measuring off-machine moisture contents. The former demonstrated the value of electronics in paper machine operation and in particular emphasized the great saving in production loss and in broke handling which may be gained by properly installed break detectors.

The third technical session really got down to some of the fundamental properties of our raw materials. Within a cross section of a tree there are great variations in both fibre length and micellar angle. A study of a cross section of *Pinus radiata* showed how these two intrinsic properties, working together, would affect the properties of the pulp. A paper describing this work was a contribution from the Division of Forest Products, the authors being A. B. Wardrop, A. J. Watson, W. E. Cohen and H. E. Dadswell. The reactivity of wood cellulose was discussed by D. H. Foster, who demonstrated by means of hydrolysis data and powder x-ray diffraction photographs that the rate of hydrolysis is a function of crystallite size. The soda pulping of *Eucalyptus gigantea* was discussed by C. H. Turner, and his paper was concerned with the question of the relationships between soda charge, cooking time and permanganate number. The final paper of the session was presented in summary by a visitor from the United Kingdom, Colonel Wm. Nash, Chairman of Directors of the Cellulose Development Corporation. It was entitled "Development in Straw and Bagasse Pulping" and was prepared by R. Duse' and C. B. Tabb. It outlined recent developments in the application of straw and bagasse pulping by the Celdecor process, a development of the Pomilio chlorine-sodium hydroxide process.

The fourth and fifth sessions on the fourth day of the conference were devoted to engineering subjects. T. A. Mellen discussed the conversion of a board machine drive at the Fairfield mill of Australian Paper Manufacturers Ltd. and then went on briefly to describe new electrical drives. R. L. Henry continued the symposium with an interesting dissertation on application and types of variable speed drives available. The third paper of the session by O. T. Dalley discussed the mechanism and rate of drying under constant conditions of insulating board varying in weight from 680 to 965 lb./1,000 sq. ft.

The fifth session was opened with a paper by C. E. Perry on the corrosion of sulphate mill digesters, a subject which is very much alive at the present time both in Australia and overseas. W. T. White, in discussing engineering materials for use in the pulp and paper industry, gave a brief summary of available materials of construction and then proceeded to describe in more detail some of the investigations which had been undertaken into problems associated with materials of construction. The final paper of the session was a theoretical one concerned with the mathematical treatment of the frictional losses due to flow of stock, by Z. J. Majewski. The formulae which he had derived should be of great benefit to the APPITA Stock Pumping Committee in lining up their experimental work.

In the final session of the conference, R. Kerslake discussed stock cleaning for board mills after describing modern methods and equipment for this purpose. The second paper of the session was concerned with titanium dioxide and its application to the paper industry and the final paper discussed the use of yacca or *Xanthorrhoea* resin as a paper sizing agent. It indicated that this resin could be used as a substitute for rosin, both in paper sizing and in fibre recovery.

The C.S.I.R.O. is an Honorary Company member of APPITA and is represented in the Association by members of the staff of the Division of Forest Products.

Presidential Address

By W. E. COHEN

On occasions such as this, it seems that one should be brief and not too technical in leaving with you a thought or two for future contemplation. With some of the aims of our Association in mind, I should therefore like to turn your thoughts to such vital questions as technical co-operation and technical assistance.

Within our industry and our Association, we have already achieved outstanding success and have gained a considerable amount of prestige in the fields of technical development, co-operation and mutual assistance. It is my personal opinion that much goodwill may be won and that our prestige might be enhanced even more if we were to extend our activities further afield, for instance, into the international sphere.

As an outsider looking into the Australian pulp and paper industry, which theoretically speaking I am, I cannot help but be deeply impressed not only by the vast amount of technical skill which has been concentrated within the industry, but also by the enlightened and progressive attitude of management and employee alike towards technical co-operation and technical interchange. One has only to review the past five conferences and this, the sixth, which is drawing to a close, to appreciate how much each has owed its outstanding success (i) to those at the management level who have tangibly sponsored the attendance of many of us and who have generously made available the fruits of technical experience and the results of research in the form of papers to be presented by us, their employees, (ii) to our individual members, who have entered into the spirit of the conferences with enthusiasm and vigour, (iii) to our Company members who have been such grand hosts on our field days, and (iv) to our Association which brings before a common rostrum men and women from a wide variety of professions and trades such as is not accomplished by any other organization within our country.

The formal presentation of papers and the discussions which follow are only two aspects of a technical conference. Perhaps more important is the direct contact between those of us having mutual technical, and maybe not so technical, interests.

I have yet to visit a mill outside a conference period without observing some visitor from another mill or company in the act of ferreting out the details of some operation or process with no uncertain vigour. It is a healthy sign of technical hospitality and arises from a deep and mature appreciation on the part of the management of the fact that, on the average, there is as much "take" as there is "give" on such occasions.

So far I may appear to have laid emphasis on co-operation at the production and operations levels. Let us now turn to research and development. No doubt most of you are aware that for many years we have had what is known as the Pulp and Paper Co-operative Research Conference. Quite distinct from APPITA, this conference arose out of the long-sighted view of management in appreciating the importance of building up a picture of the anatomy, chemistry and physics of our raw material, the eucalypt pulpwoods, and especially of those intrinsic properties which influence the behaviour of pulp and paper. This conference has frequently been cited as a fine example of true co-operation between industry and a government organization in the field of fundamental research.

At first the co-operation was between Australian Paper Manufacturers Ltd. and the Division of Forest Products, C.S.I.R. The Company not only subsidized the Division to enable the recruitment of additional staff but made available some of its own staff and facilities. In this way, the specialists in wood anatomy, wood chemistry, pulping and pulp evaluation were moulded into a team and were able to gain some appreciation of each other's viewpoints, difficulties and deficiencies in procedure and in equipment.

Before long the co-operative scheme was broadened to include Associated Pulp and Paper Mills Ltd. and Australian Newsprint Mills Ltd. on an equal basis, and later N.Z. Forest Products Limited was admitted on an observer basis. For years now the Division of Forest Products has reported the results of its investigations at round table conferences attended by research personnel from the industry. These conferences are completely informal; the reports of work are candidly discussed, suggestions are made as to the future course of it and these suggestions are gratefully received. There are various other co-operative ramifications which need not be discussed here. The proceedings of these conferences are mimeographed and with the consent of the companies are given a fairly wide distribution amongst kindred oversea institutions to which the results of our work are thus made freely available.

I mention this Pulp and Paper Co-operative Research Conference at some length because, apart from being the progenitor of APPITA, it is a somewhat unique example of technical co-operation. There are no restrictions on the course of the Division's projects, no accounting for expenditure of the subsidy and no limitation on the publication of results.

So far, I have confined my remarks to technical co-operation, and now I wish to refer briefly to the subject of technical assistance. Once again the Division finds itself serving as a public utility but at the international level — more especially because of such projects as the Colombo Plan and the United Nations' programme of technical assistance to underdeveloped countries.

Australia probably could claim to lead the world in hardwood pulping. It can definitely claim this leadership in the pulping of eucalypts. It is daily becoming more and more evident that other countries are looking to us for guidance and technical assistance in the hardwood pulping field. I am not sure that members of this Association fully appreciate that there is considerable interest beyond our shores in the cultivation and utilization of eucalypts. Naturally, because these countries are looking to Australia for advice and help, enquiries received by the Division of Forest Products are becoming more and more frequent. It has been my task to handle those which have been concerned with pulp and paper, and it is through this that I have come to realize that there are several gaps in our published information on pulping, bleaching, beating and papermaking. Even more obvious is the almost complete void of information on the properties of our eucalypt pulps and of the papers made from them. Consequently there are no yardsticks which one can use in appraising pulps prepared from eucalypt woods grown outside Australia or, for that matter, from other hardwoods.

Let us publish in our own Proceedings material which, when pieced together, will provide a valuable and up-to-date text book on the utilization of eucalypts in the pulp and paper industry.

S. R. Laing Print, Blackburn.

F.A.P.

C.S.I.R.O.

FOREST PRODUCTS NEWSLETTER

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

No. 192 1952##192 September-December, 1952

MORE ABOUT BARK

By M. MARGARET CHATTAWAY, Wood Structure Section

In Newsletter No. 190 some details were given about the structure of eucalypt bark. Since then a great number of species of *Eucalyptus* have been examined, and it has been found that the bark structure can sometimes be useful in elucidating hybrid species, and in providing an extra feature for distinguishing between species that cannot be separated on the wood anatomy.

Hybrids: *E. macrorrhyncha* F. Muell. × *E. rossii* Baker and Smith

Some material received recently purported to be a hybrid between *E. macrorrhyncha* and *E. rossii.* Five logs were received, one from trees of each of the parent species and three from suspected hybrid trees.

The parent species are distinctive in appearance, *E. macrorrhyncha* having a stringy bark and *E. rossii* a smooth deciduous one. The woods are, for all practical purposes, indistinguishable.

The barks of the two species are very distinct in structure as well as in appearance. *E. macrorrhyncha* has successive periderms* which cut off a very spongy rhytidome* in which the phloem parenchyma has undergone a great deal of expansion, causing the fibre bundles to become widely separated from one another. This expansion is outside the periderm.

Figure 1 (1 and 2) shows the phloem and rhytidome of *E. macrorrhyncha* as they appear in cross sections under a microscope. The phloem is a compact tissue consisting of fibre bundles, crystalliferous and tanniniferous parenchyma, sieve tubes, and rays. *E. rossii* (Fig. 1 (3 and 4)) has phloem of quite a different structure. The sieve tubes are fewer in number (none are shown in Figure 1 (4)) and the fibres vary considerably in diameter. A group of very wide fibres is shown at *a;* these occur at frequent intervals among the groups of fibres of smaller diameter. In *E. rossii* there is no rhytidome, the dead tissue is shed, as in other deciduous species, and the thick-walled cells of the lignified phellem*

* See Newsletter No. 190 for definitions of these terms.

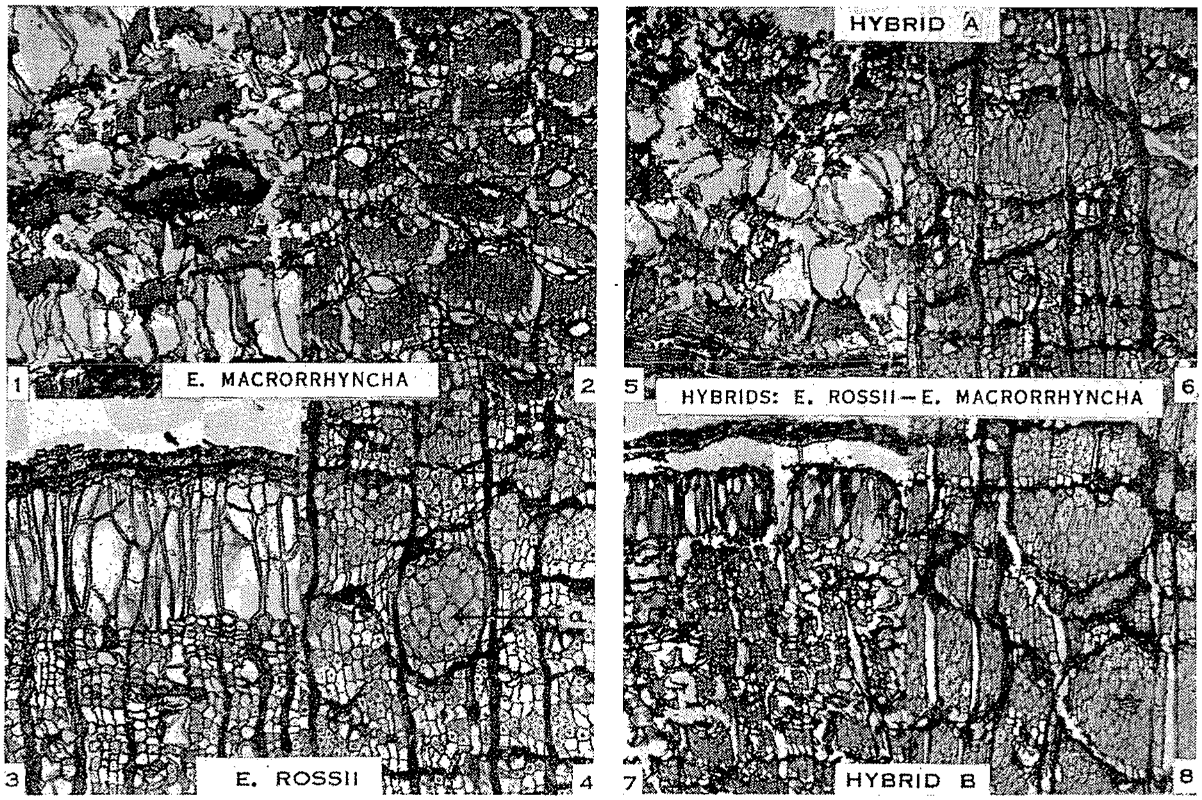


Fig. 1.—(1) and (2), rhytidome and phloem of *E. macrorrhyncha.* (3) and (4), outer and inner phloem of *E. rossii,* bundle of enlarged fibres at *a.* (5)-(8), rhytidome and phloem of two of the hybrids. (1), (3), (5), and (7) × approx. 50. (2), (4), (6), and (8) × approx. 65.

form the outer layer; these are gradually abraded as the periderm gets older.

Mention was made in the previous article of the radially elongated cells of the phelloderm*, which are a feature of some stringybarks. They have also been observed in some smooth-barked species and are a feature of the phelloderm of *E. rossii* and its allied species *E. haemostoma* Smith and *E. micrantha* DC., but are absent from *E. macrorrhyncha*. They are shown in Figure 1(3).

The three hybrid trees were all rough-barked species, the appearance of the trunks being very similar to the *E. macrorrhyncha* parent, but the minute structure of all three barks was of a truly hybrid nature, combining the features of the two parents. Cross sections of the hybrids are shown in Figure 1(5-8). In hybrid A, a portion of the rhytidome (Fig. 1(5)) shows expanded phloem parenchyma; the phloem contains bundles of large-diameter fibres (Fig. 1(6)). In hybrid B the rhytidome was again formed by successive periderms but showed little parenchyma expansion; the phelloderm, however, was of the type of *E. rossii,* with bands of radially elongated cells. The phloem contained many patches of fibres with large cross-sectional diameters (Figure 1(7 and 8)). The third hybrid, which is not illustrated, had, like the others, successive periderms, but there was little parenchyma expansion and no radially elongated phelloderm. The phloem was of the *E. rossii* type with many patches of enlarged fibres.

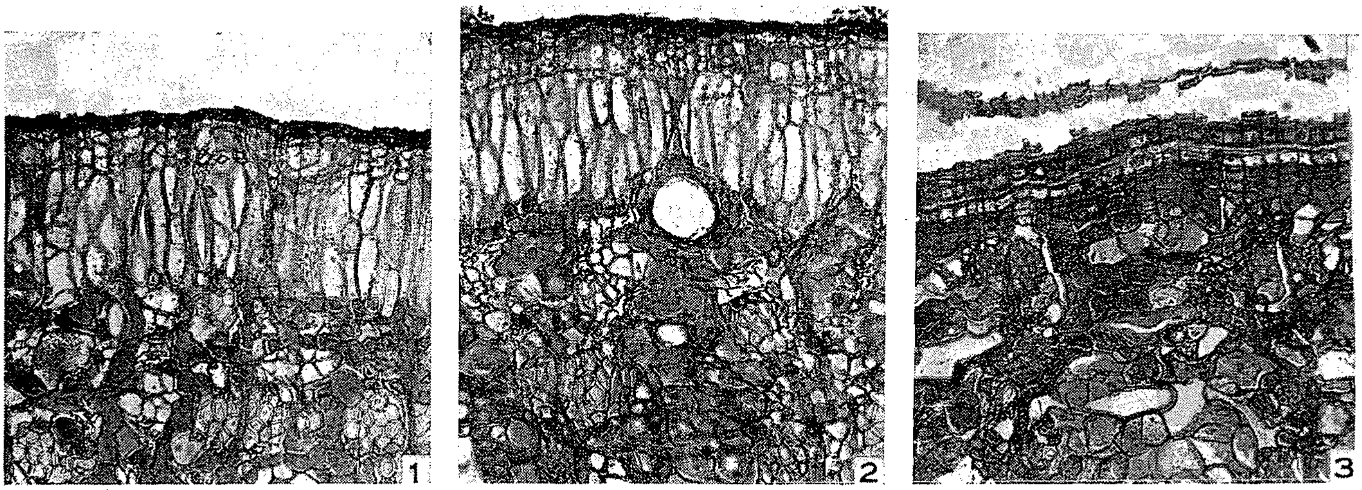
In these hybrids the *E. macrorrhyncha* features all occurred in the rhytidome, all the living tissue — which includes the phelloderm — being like *E. rossii.*

Species: *E. viminalis* Labill. and *E. rubida* Deane and Maiden

The habit, flowers, and fruit of *E. viminalis* and *E. rubida* are very similar, and the shape of the juvenile leaves is usually considered to be the only way of making a reliable distinction between the species. The barks of these two species, though similar in outward appearance, may be distinguished by some of the features of their structure as seen under a microscope.

The smooth bark of *E. viminalis* is bounded by a periderm which consists of thick-walled lignified and suberized cells. On its inner side is a wide phelloderm* of unthickened, more or less isodiametric cells in fairly regular rows. The chief feature of this bark is the wide parenchyma wedges of the outer phloem and their accompanying oil glands (Fig. 2(1 and 2)).

E. rubida differs from this only in its phelloderm. The parenchyma wedges are usually smaller than in *E. viminalis* and the oil glands fewer, but such differences are not of sufficient significance to distinguish between the species. In *E. rubida* there is also a considerable phelloderm development, with radial extension of the cells and the formation of a palisade of thick-walled cells (Fig. 2(3 and 4)). The extent to which the palisade phelloderm is developed is a little variable, but in no material has the phelloderm ever been composed of cells as nearly isodiametric as in *E. viminalis.*



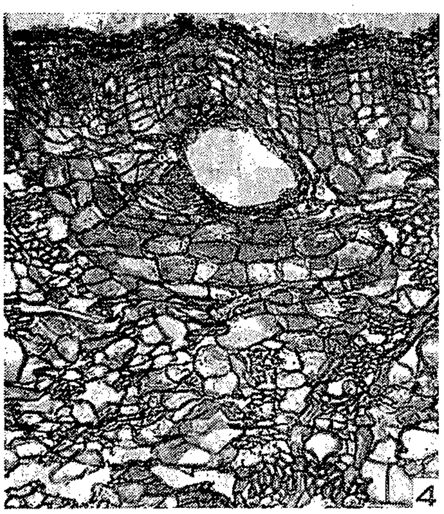


Fig. 2.—(1) and (2), phelloderm and outer phloem of *E. rubida* showing radially elongated cells and in (2) oil glands. (3) and (4), phelloderm and outer phloem of *E. viminalis;* in (4) a parenchyma wedge and oil glands. All × approx. 95.

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Sixth Forest Products Research Conference

This conference was held at the Division of Forest Products from November 17 to November 21 and was attended by delegates from the Forest Departments of all States and New Guinea, with the exception of Western Australia, in addition to representatives of the Commonwealth Forestry and Timber Bureau, Building Research Liaison Service, University of Melbourne, and Division of Entomology, C.S.I.R.O.

The first of these conferences was held in 1946 in order that research programmes and matters of common interest could be discussed by all concerned. They have led to a better understanding of the problems peculiar to the various States, and have prevented overlapping of work on major research projects.

The conference was opened by Dr. F. W. G. White, Chief Executive Officer of C.S.I.R.O. Papers were presented this year by officers of the New South Wales Forestry Commission, Queensland Department of Forestry, and Division of Forest Products. The major items discussed were preservatives and preservative treatments of timber, timber seasoning investigations, veneers, plywood, and adhesives, and collaboration and coordination of research projects.

With regard to preservation of timber, a report was made to the conference on the progress of work on high-pressure impregnation of rail sleepers. Some details of the work planned in connexion with this project were given in Newsletter No. 184. The pilot-scale high-pressure treatment plant has now been in operation for some time, and a test batch of 150 sleepers for the Western Australian Railways and 50 for the Commonwealth Railways has been treated. A start has now been made on the treatment of 3000 sleepers for the Victorian Railways, using a number of different preservatives. This large-scale test will provide a great deal of valuable information on the preservatives and the process as a whole.

Under the heading of seasoning investigations, the progress of work on the vapour drying of Australian native timbers was reported. This work was commenced some three years ago at the Division with the object of determining whether the process had technical application to Australian timbers, and whether it would be of value to the Australian timber industry. Experiments so far have indicated that good final quality can be obtained with impervious species (in particular the "ash" eucalypts) by this process, the drying time from green to 12 per cent. being 111 hours for stock 1 inch thick.

Victorian mountain ash was satisfactorily dried from 25 per cent. (partly air dry) to 10 per cent. in the very rapid time of 5 hours.

With regard to the pervious species, no difficulty whatever was found in vapour drying, free from degrade, 1-inch- or 2-inch-thick radiata pine from the green condition to a moisture content of 12 per cent. The 1-inch-thick stock was dried in 4½-5 hours and the 2-inch-thick stock in approximately 12 hours: these drying times are only some 5 to 10 per cent. of the time usually regarded as normal for kiln drying material of this nature. However, despite the attraction offered by the speed of drying, considerable further work on plant engineering, control, and operation is necessary to ensure fully efficient and economic performance.

Glued laminated structural members are being used increasingly in Australia, especially for large curved roofed factory or warehouse buildings. This form of construction is considerably cheaper than steel, because arches, trusses, etc., can be assembled on the ground and erected in one piece, thus saving on labour costs.

Developments in New South Wales in the field of bark utilization were reported to the conference.

Stringybark barks, after retting and teasing, are being successfully used in the manufacture of fibrous plaster sheets. Bark of the paper-barked tea-tree (*Melaleuca leucadendron*) is being exploited as a source of cork. This bark can be stripped without affecting the tree, and the cork, after separation from the fibrous material in the form of thin plates, is being used as an insulating material and a filling for pillows and mattresses.

Interstate delegates, while in Melbourne, took the opportunity of discussing specific research projects with officers of the Division. They included Messrs. J. Thomas (South Australia), F. A. Noar (Tasmania), E. B. Huddleston (New South Wales), V. Grenning, S. F. Jennings, K. V. Cokley, G. F. Littler (Queensland), J. B. McAdam (New Guinea), and F. J. Gay (Division of Entomology, C.S.I.R.O., Canberra).

Publications

The revised edition of Pamphlet 112, "Building Frames: Timbers and Sizes", is now available from the Division of Forest Products.

There has been a continuous and increasing demand for this pamphlet since it was first issued in 1941, not only from private architects and builders, but also from Government departments and municipal authorities in every State. This has been particularly so in Victoria, where the Uniform Building Regulations (1945) make specific reference to the pamphlet.

The chief addition made is a considerable extension of the tables to cover other spacings of members than the standard of 18 in. for joists and rafters which was in general use when the pamphlet was first written. Another extension is the recognition of two conditions for joists and bearers, namely, simply supported and continuous. This is regarded as important because of the widespread practice of partially cutting through long pieces over supports — a practice which destroys almost all continuity.

Copies of this revised edition may be obtained on application to the Chief, Division of Forest Products.

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The Trade Circular Series issued by the Division of Forest Products has been very popular with all connected with the timber trade, as well as being widely used by technical schools and similar bodies where authoritative information is required for the use of students.

The sustained demand for Trade Circular No. 13, "Cross, Diagonal and Spiral Grain in Timber", which No. 48 replaces, led to the selection of this subject as the first to be presented in an entirely new form. The page size has been increased, illustrations have been improved and increased in number, and an attractive cover has been added. Copies may be obtained on application to the Chief, Division of Forest Products.

<< Content
Print this page

DOUBLE-SIDED SAW BENCH GAUGE

By S. J. COLWELL, Wood Utilization Section

In recent months a new type of saw bench gauge which is capable of operating on both sides of the saw line has come to our notice. This gauge was designed and is being manufactured in Victoria.

The gauge consists primarily of two main assemblies, the notched bar assembly and the gauge proper, as can be seen from Figure 1. The two notched bars are pivoted at points *A* and are supported on screws, *B*, which give longitudinal adjustment of gauge either side of the sawline. This assembly is bolted to the saw bench in a transverse position through two holes, *C*, the outer ends of the bars being supported to remain in a horizontal plane by two hook-shaped supports on the saw bench frame. The notches are machined and are spaced at accurate inch intervals.

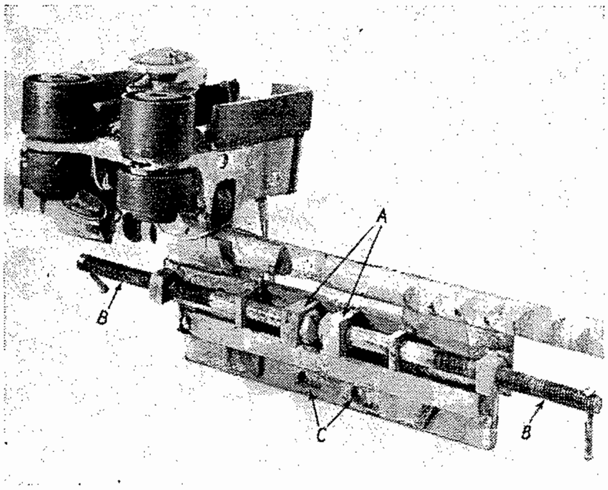

Fig. 1.—General view of the double-sided gauge.

The gauge proper, or carriage, rides on rollers on the two notched bars and is located by two curved guide plates. This carriage consists essentially of a pivoted member which engages with the notches in the bars to give the intervals either side of the sawline. This member has a self-locking manually operated cam mechanism which moves its position relative to the notches in the guide bar to give fractional intervals to left or right of the sawline. As can be seen from Figures 1 and 2, the fences consist of two pairs of rollers on the outer end of the carriage, followed by two adjustable plate fences. This adjustment enables the fence to be kept close to the saw as wear decreases the saw diameter or to be retracted to within three inches of the front edge of the bench.

The gauge has been studied in an operation on breast benches, and it is considered that it is particularly suitable for operation on a No. 1 bench. In this connexion it takes the place of the usual "set-up" in Victorian sawmills, which is normally a standard one-sided gauge plus the pin or peg type gauge on the opposite side of the bench. It enables timber to be gauged on either the left- or right-hand side of the bench; the gauge operator, of course, is situated on the side of the bench on which the

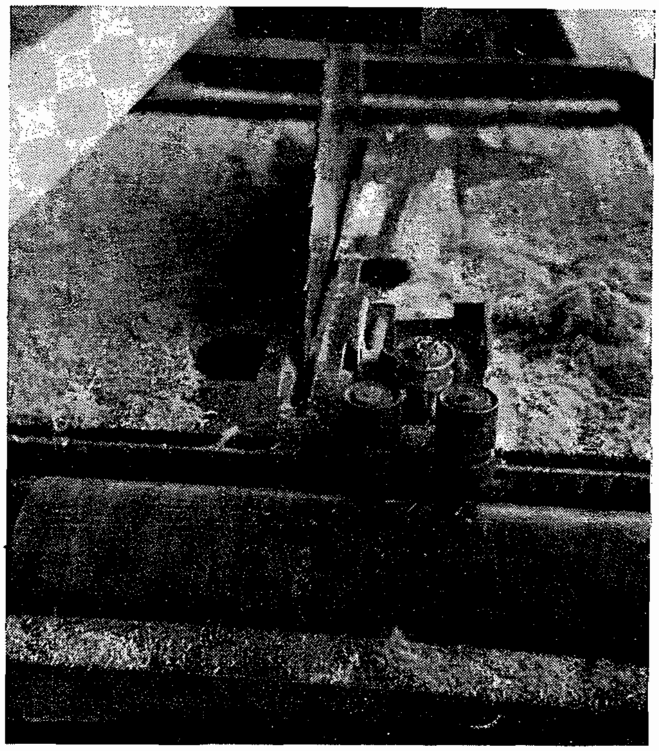

Fig. 2.—Typical gauge fitted to a breast bench.

largest amount of sawing is being done. Having a double-sided gauge of this nature enables large flitches to be sawn accurately into gauged dimensions without the flitch being turned by the sawyer.

There is little need to remove the gauge from the bench, but if it is necessary it can be removed from either side. This gauge, although slightly heavier than normal, is positioned without difficulty and moves readily from one guide bar to the other. It was found that the gauge could be "thrown" to the correct position by the gauge setter after a short time of practice.

It is claimed by the manufacturer and by sawmillers who have fitted the gauge to benches that it is possible to increase the capacity of any bench so fitted by 200 super. feet per 1000 super. feet sawn. This claim is based on the following advantages:

(i) The "puller out" does not need to lift pieces of timber around the tail of the saw. This is not only time-saving, but eliminates a hazardous operation.

(ii) With a gauge on either side of the saw line, advantage can be taken of a flat side, thus saving time in turning flitch or making extra unproductive cuts.

The Division has not had an opportunity of checking this claim, but it feels that the gauge is of sufficient merit to warrant the interest of the industry. In the gauges seen, the standard of manufacture was high. Further information on this gauge can be obtained from the Chief, Division of Forest Products.

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