

supplies of timber; but in those countries that have been using steel ties, notably Germany, the rate of increase in the percentage of metal sleepers has been very small, and there appears to be no tendency to further replace wood by steel, unless unavoidable, since the wooden tie has proved to be the best. In many other fields the special suitability of timber is well known to all, and it is apparent, therefore, that wood is required in increasing quantities for those purposes for which it has been used in the past, and also to meet ever-increasing new uses, whilst at the same time it must be well realised that the available supplies are being rapidly and prodigally depleted.

Amongst the most valuable of the world's timbers are the hardwoods of Australasia, chiefly consisting of various members of the *Eucalyptus* family.

The late Mr. Ednie Brown has estimated the total forest-area in Australasia to be about forty-five million acres, of which nearly half lies in Western Australia—calculating only those areas upon which the timber is matured and ready for cutting. Of this amount many million acres are at present leased for timber-getting, but a very large percentage is still untouched.

Many timber-users believe that timber is always better and stronger with the sap in it. Their usual manner of expressing it is that "the nature" is gone from the wood after the sap is removed. It is also frequently stated that timber decays more rapidly when dry than when green. Both these beliefs are entirely erroneous. Timber when seasoned is stronger, stiffer, more resilient, and much less likely to decay when green or partly seasoned.

Reverting to the construction of wood itself, and first considering internal agencies, it has been definitely determined that the pure lignified cellulose of seasoned timber is practically imperishable. Neither air nor moisture have of themselves any effect upon it. It is, however, liable to be redissolved or digested by the fermentative action of the natural solvent contained within the cells. This fermentable nitrogenous matter in the green or partly seasoned timber is contained in the sap, and in order to eliminate the possibility of decay from this source it is absolutely essential to, as far as possible, remove the sap, or render it chemically inert. The removal of the sap without replacement, or, in other words, the process of natural seasoning, may not of itself be sufficient, for if such seasoned timber is used in unventilated positions, or in damp places, the same fermentative action and consequent decay may still take place through the action of some other plant, such as fungus or mould, or through the cellulose bacteria of the soil. Some woods rich in gums and resins, such as the heartwood of many coniferous timbers, and of some of our eucalypti, such as ironbark and jarrah, contain in these gums and resins ingredients of an antiseptic nature which will for long periods resist decay.

Australia undoubtedly possesses many varieties of hardwood which equal in strength and durability anything procurable in other parts of the world, and which would therefore be so treated as to give them the longest possible life. A few of these timbers will resist decay for long periods, whereas others, whilst possessing great strength, are peculiarly liable to attack by dry-rot and other diseases, and are also attacked by the majority of the insect pests. The strength of all the timbers is in every way greatly increased by seasoning, the increase in some cases being considerably over 100 per cent.

The natural or artificial seasoning of timber, whilst increasing the strength, will not of itself prevent decay, nor is it in any way a protection against the attacks of insects. It appears, therefore, that some artificial means must be adopted to satisfy the required conditions. The various processes at present in use may now be briefly considered, to determine their relative efficiencies in lengthening the life of timbers.

1. *Water seasoning* consists in its best form in entirely immersing the logs of timber in running water, with their butt end up stream. With soft woods, in about a month or six weeks the sap is more or less washed out, being replaced by pure water. The timber can then be fairly easily seasoned by natural or hot-air processes. Timber treated in this way gives fairly satisfactory results, being much less likely to be attacked by dry-rot and other similar forms of decay. It is, however, in no wise protected against the ravages of insects, and the process would be an extremely lengthy one when applied to the eucalyptus.

2. *Kyanising* was patented by Mr. Kyan in 1832, and consists in steeping the timber in a solution of corrosive sublimate (1 part of bichloride of mercury to 15 parts of water). The immersion is continued for at least seven days, or until the solution has thoroughly penetrated to all parts, the timber being then removed and dried. The results obtained have been somewhat contradictory, the wood in some cases resisting decay, whilst in others the subsequent rotting has been apparently expedited. The ingredient used is in no wise incorporated into the structure of the timber, and is washed out in time.

3. *Creosoting* was a system patented by Mr. John Bethell in 1838, and has been and is being very successfully used on various classes of wood in different parts of the world. Up to recent years the process was conducted as follows: The timber to be treated is naturally seasoned to as great an extent as conditions will allow, and is also further artificially dried for at least thirty-six hours. It is then placed in a cylinder, which in the larger plants frequently has a diameter from 8 ft. to 10 ft., and a length anything between 100 ft. and 200 ft. This cylinder is then sealed, steam at a high pressure is admitted, and the pressure maintained for some hours. This softens and "opens" the timber, and, when complete, the pressure is cut off, and a vacuum created in the cylinder, thus drawing off air and moisture from the softened timber. Of recent years certain modifications of this process, notably the "Rueping" and "open-tank creosoting" have been introduced. (Note: *Vide* special article by Mr. H. Lightband on page 78.)

4. *Burnettising* was invented by Sir William Burnett in 1840, and consists of the injection of a solution of chloride of zinc into timber at a pressure of about 150 lb. per square inch. The series of operations very closely agrees with that of creosoting, but the cost is considerably less, being about 9d. to 1s. per sleeper. It is not so efficacious as creosote.