

UNIT 3

TIMBER

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CLASSIFICATION OF TREES

Trees are classified as endogenous and exogenous according to the mode of growth.

ENDOGENOUS TREES

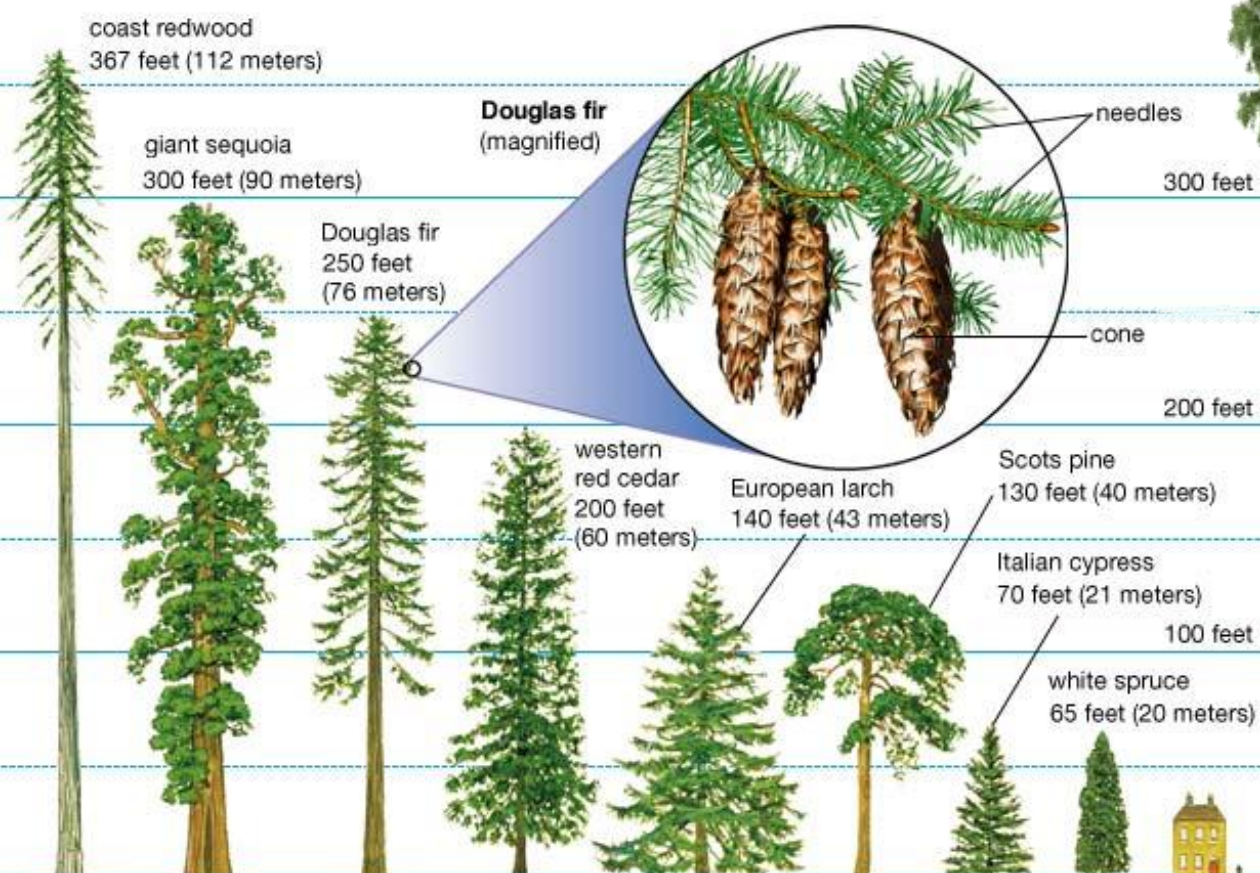
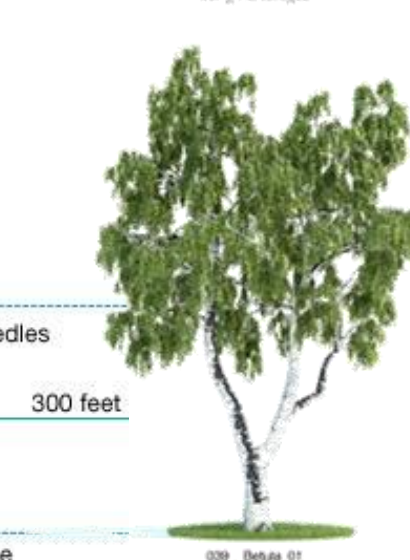
Trees grow end wards, e.g. palm, bamboo, etc.

EXOGENOUS TREES

Trees grow outwards and are used for making structural elements. They are further subdivided as conifers and deciduous.

Conifers are evergreen trees having pointed needle like leaves, e.g. deodar, chir, fir, kail, pine and larch. They show distinct annual rings, have straight fibres and are soft with pine as an exception, light in colour, resinous and light weight.

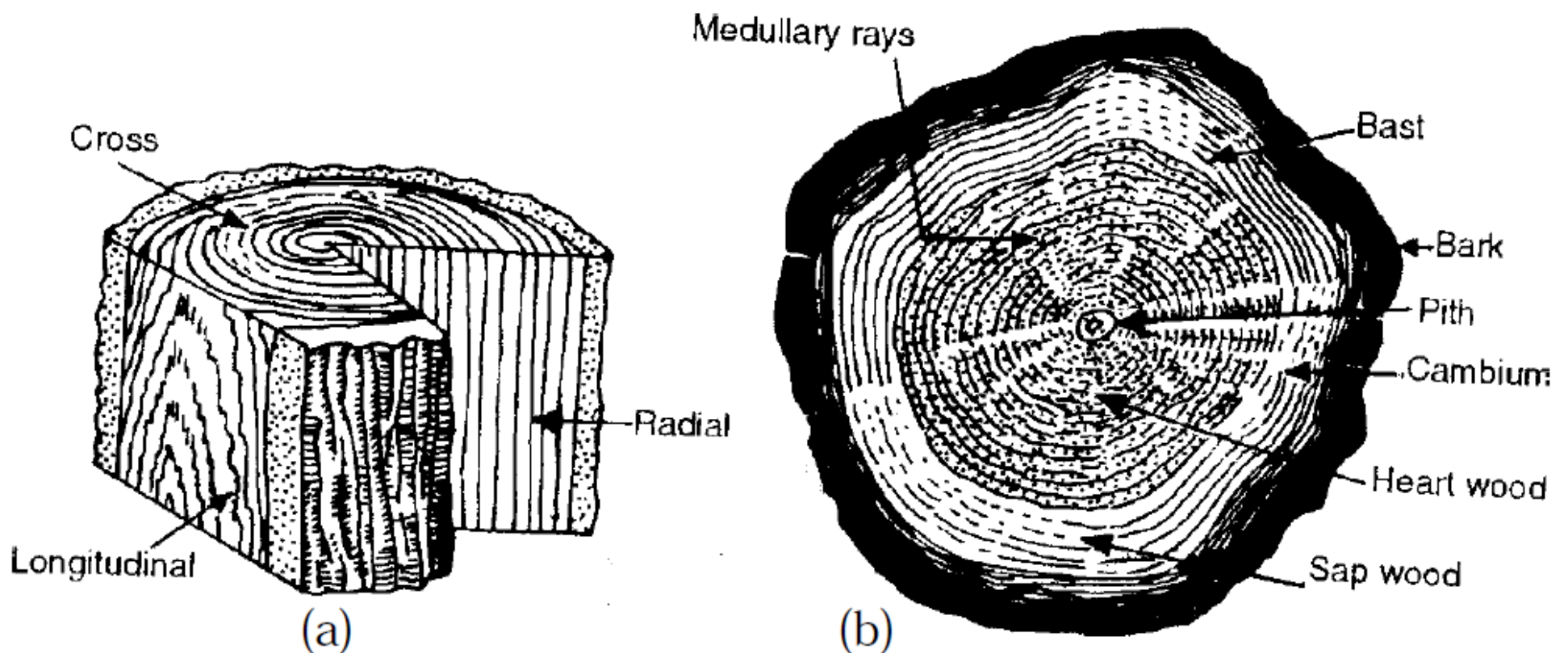
Deciduous trees have flat board leaves, e.g. oak, teak, shishum, poplar and maple. The annual rings are indistinct with exception of poplar and bass wood, they yield hard wood and are nonresinous, dark in colour and heavy weight.



STRUCTURE OF TIMBER

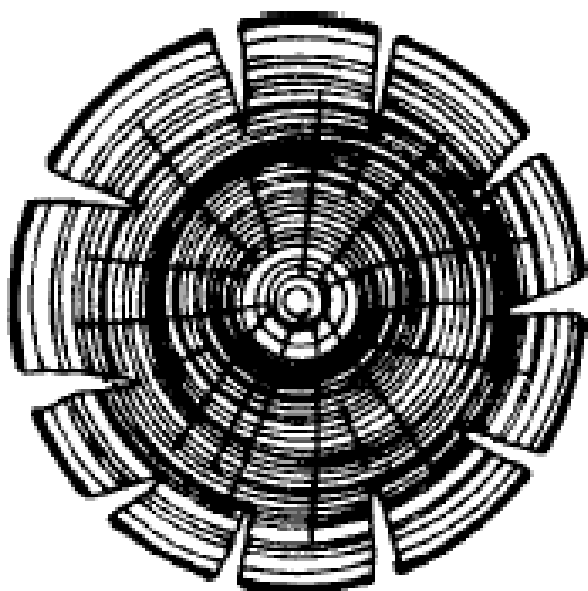
A tree can be divided into three portions, crown—composed of branches and leaves, trunk, and roots. The trunk accounts for about 80 per cent of the total bulk of wood.

Figure 1 shows the structure of well grown timber from trunk of the exogenous tree. The structure of timber visible to naked eye or at a small magnification is called *macro structure*, and that apparent only at great magnifications, the *micro structure*. Macro structure of the timber can be studied by cutting the trunk in three directions (Fig. 1 (a)). In the cross-sectional and radial ducts, the following main parts of a tree, e.g. bark, cambium, sap wood, heart wood and pith, become readily apparent (Fig. 1(b)).

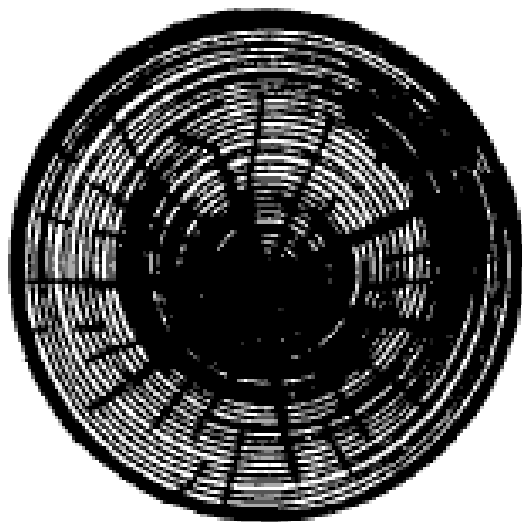


DEFECTS IN TIMBER

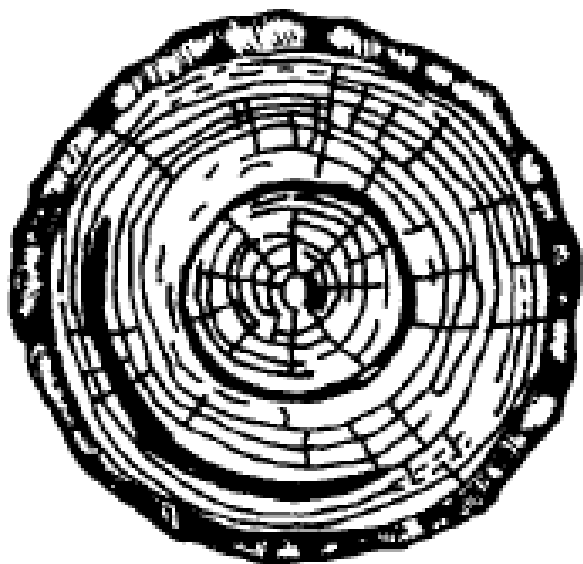
Defects can occur in timber at various stages, principally during the growing period and during the conversion and seasoning process. The defects in the wood as shown in Fig. 2 are due to irregularities in the character of grains.



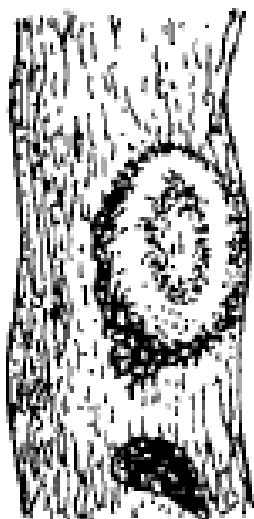
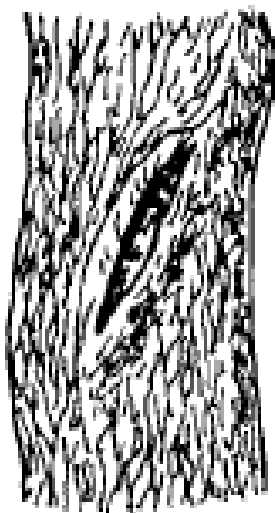
Star shake



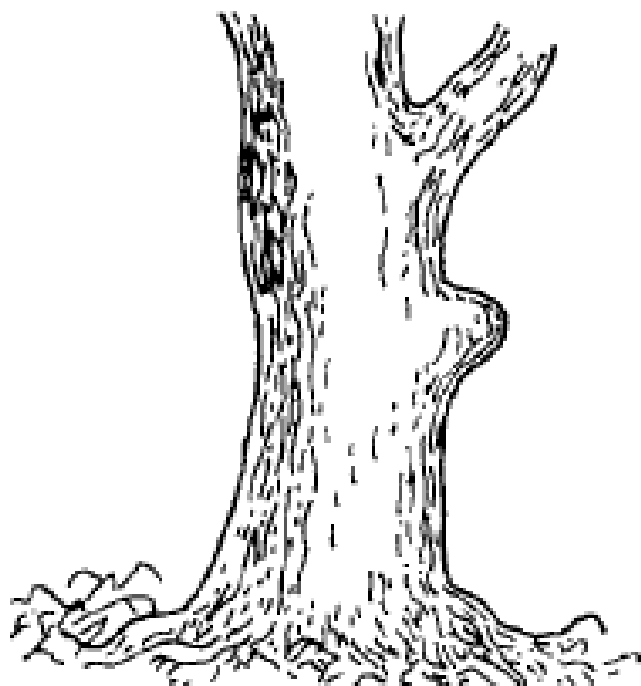
Heart shake



Cup shake



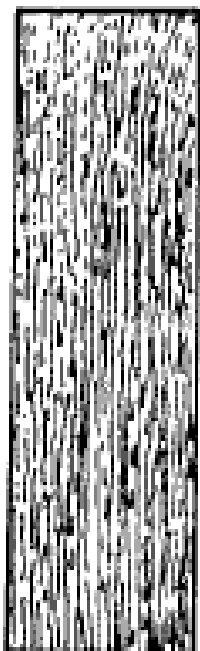
Knots



Rindgall



Twisted fibres



Upsets

STORAGE OF TIMBER

Timber should be stored in an enclosed building space that is well ventilated.

- Storage area should be clean and dry.
- Timber should be stacked on pallet to maintain its flatness. There should be adequate room space for good air circulation around stacks of timber.
- For kiln dried timber, packaging of timber should only be removed before installation. For air dried timber, if site condition allows, remove the packaging of timber in the environment where it will be installed to allow for proper acclimation of the timber for at least two weeks.

CHARACTERISTICS OF GOOD TIMBER

The principal characteristics of timber of concern are strength, durability and finished appearance.

1. Narrow annual rings, closer the rings greater is the strength.
2. Compact medullary rays.
3. Dark colour.
4. Uniform texture.
5. Sweet smell and a shining fresh cut surface.
6. When struck sonorous sound is produced.
7. Free from the defects in timber.
8. Heavy weight.
9. No woolliness at fresh cut surface.

SEASONING OF TIMBER

Timber contains water. Timber does require a definite percentage of water in it, in order to retain its fibers strongly adhered to each other.

Timber releases a part of this moisture in dry and hot atmosphere. And absorbs moisture in cold and humid conditions. This absorption and release, makes the timber bent, warped, shrunk or swollen etc. This change in the shape of a member can endanger the structure of which it is a part of.

Water percentage in timber to an extent that least moisture transfers take place between timber and environment, for the given ambient conditions', is called as 'Seasoning'.

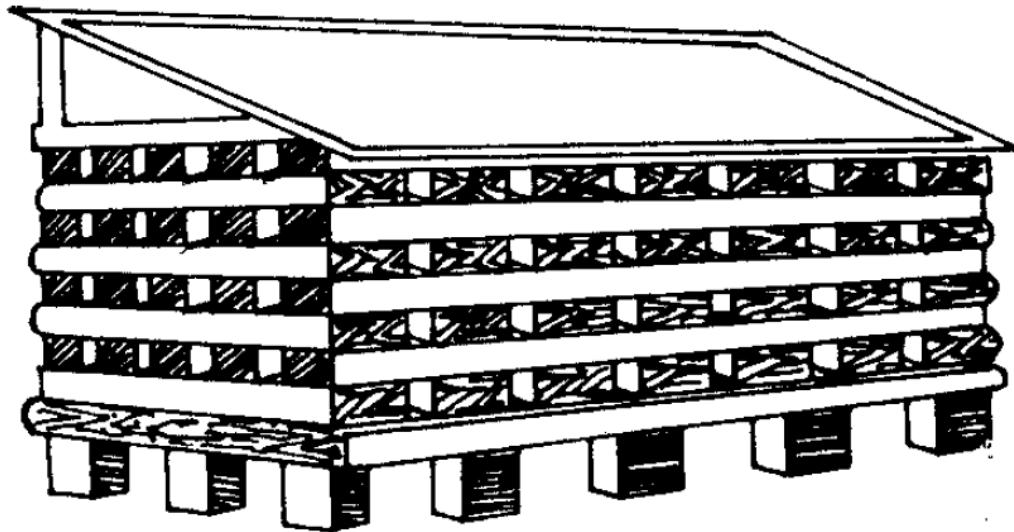
$$\text{Moisture content} = \frac{\text{Weight of water in timber.}}{\text{Weight of dry timber.}}$$

In order to control moisture in sawn timber sections, there are two methods:

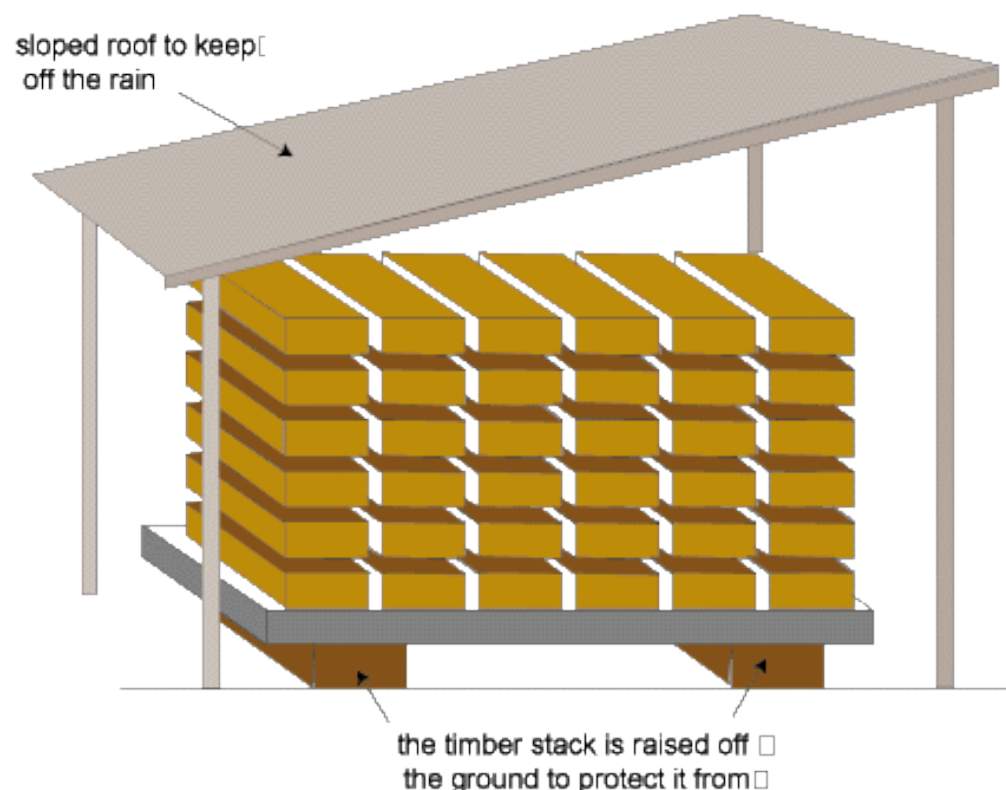
1. Natural / air seasoning method.
2. Artificial seasoning methods.

1. NATURAL / AIR SEASONING METHOD.

Swan timber sections are stacked horizontally on a 30cm raised platform as shown. These are arranged in layers one above other. The layers are separated by sound dry wood spacers. Gap of about 50cm is kept between two adjoining members for free air circulation. Roof covers the stack and the timber is not exposed to direct sunlight or dew. The process of seasoning is very slow & takes even upto 2 years. Capital cost and operating costs are least in this method.



Air Drying/Natural Seasoning



2) ARTIFICIAL SEASONING:

There are various methods of artificial seasoning as follows:

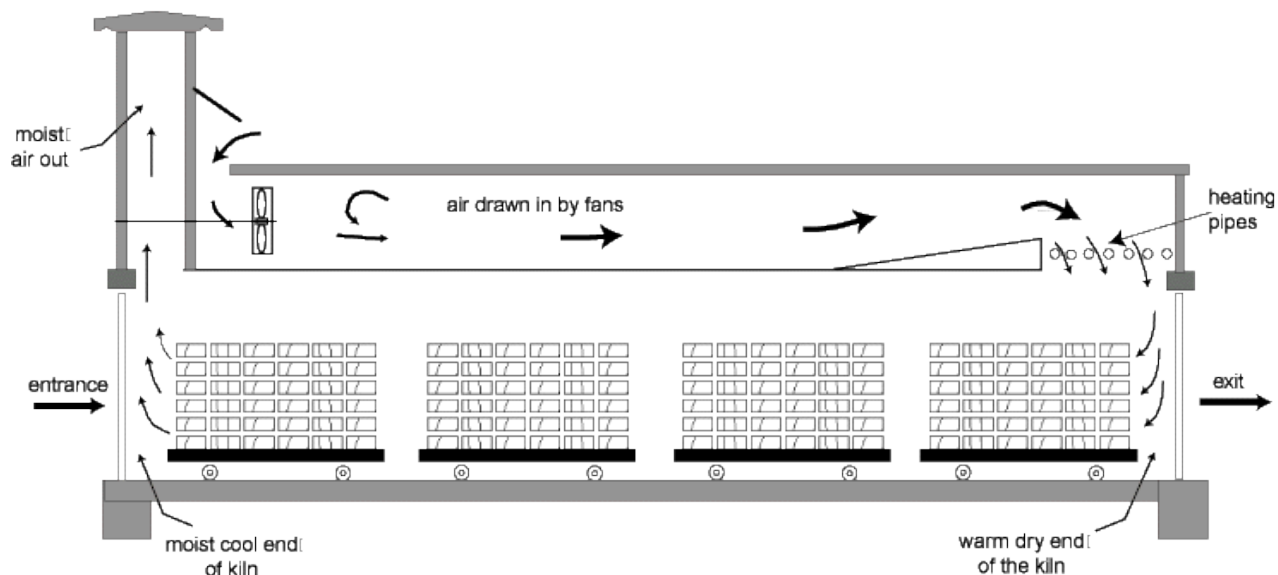
- a) Kiln seasoning
- b) Chemical seasoning
- c) Electrical seasoning
- d) Water seasoning
- e) Boiling

Brief information of above methods is as under:

a) Kiln seasoning:

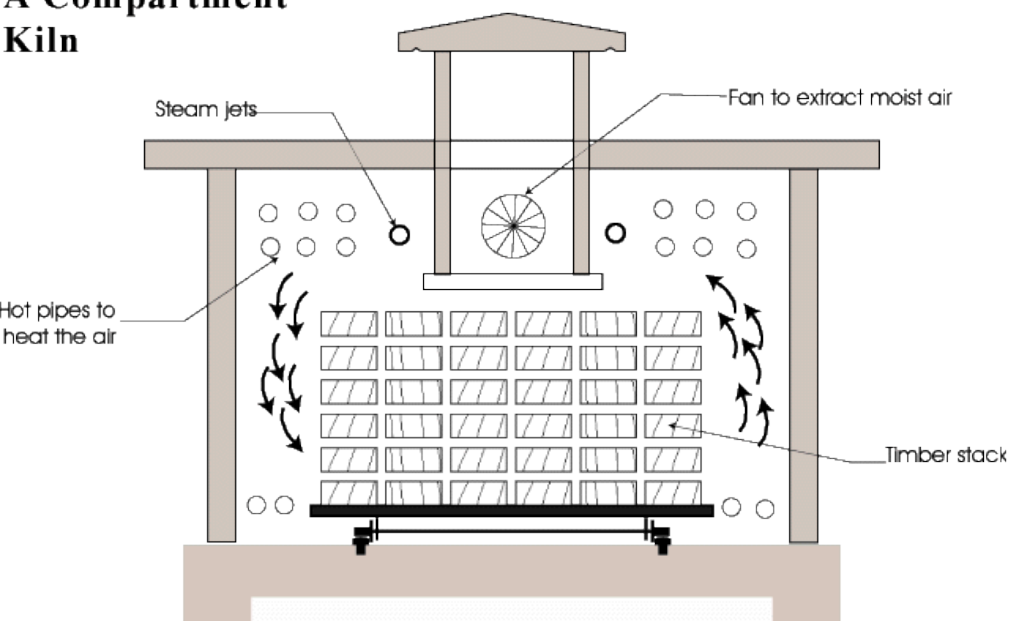
In this method, the drying of timber is carried-out inside an airtight chamber or oven. Timber is placed in such a way that free air circulates around. The steam is first forced inside in order to control the termites. Then the temperature is raised and maintained till the desired degree of moisture content is attained. The kiln seasoning, though costly, gives well seasoned timber as it controls three important conditions, namely, circulating air, humidity and temperature.

A Progressive Kiln



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A Compartment Kiln



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b) Chemical seasoning: This is also known as the salt seasoning. In this the timber is immersed in a solution of suitable salt. The salt is hygroscopic in nature and attracts the water content of timber. This water is then wiped out by cloth. But this method affects the elasticity and strength of wood.

c) Electrical seasoning: In this method, the use is made of high frequency alternating currents. The timber, when it is green, offers less resistance to the flow of electric current. The resistance increases as the wood dries internally which also results in the production of heat. This is the most rapid method of seasoning. But the initial and maintenance costs are so high that it becomes uneconomical to season timber on commercial base by this method.



WATER SEASONING



d) Water seasoning: In this method the timber is cut in suitable sizes and immersed wholly in water, preferably in running water. The timber is taken out after 2 to 4 weeks. During this period the sap contained in wood is washed away. Then the timber is allowed to dry under a shed having free circulation of air. And the timber is seasoned.

e] Boiling: In this method the timber is immersed in water and then it is boiled. This is a very quick method. The timber is boiled for three to four hours. Then it is dried very slowly in shed. The periods of seasoning and shrinkage are reduced by this method, but it affects the elasticity and Strength of wood. This method is costly as compared to others.

DISEASES IN TIMBER

DRY ROT



WET ROT



PRESERVATION IN TIMBER

Unprotected wood can easily decay by swelling (when it gets wet), fungi, insects, fire, etc. The rapidly with which it decays depends on external conditions, the species of the wood, its preliminary conditioning, and its structure.

One of the basic approaches to protect it is to create conditions unfavourable to fungi. Low humidity, heat and water insulation, etc. help to maintain the timber dry and thus make it insusceptible to damage by fungi. Water absorption, decay and other undesirable effects can be minimized by coating the surface of wood with polymer films or drying oils, oil base paints, varnishes and synthetic enamels.

Some of the methods used to poison the food supply to fungus are as below.

OIL TYPE PRESERVATIVE :

applied over outside of exposed timber, give unpleasant smell and are not suitable when timber is to be painted.

ORGANIC SOLVENT PRESERVATIVE :

(Preservatives Insoluble in Water) consists of toxic chemical compounds, e.g. pentachlorophenol, benzene-hexa-chloride, dichlorodiphenyl, trichloro-ethane (D.D.T) and copper naphthenate. These are dissolved in suitable organic solvents like naphtha, or in petroleum products such as kerosene, spirit, etc. The treated timber can be painted, waxed or polished.

WATER SOLUBLE PRESERVATIVE :

These are odourless organic or inorganic salts and are adopted for inside locations only. If applied over outside surfaces, the salts can be leached by rainwater.

VARIOUS TREATMENT PROCESSES

SURFACE APPLICATION

SOAKING TREATMENT

HOT AND COLD PROCESS

BOUCHERIE PROCESS

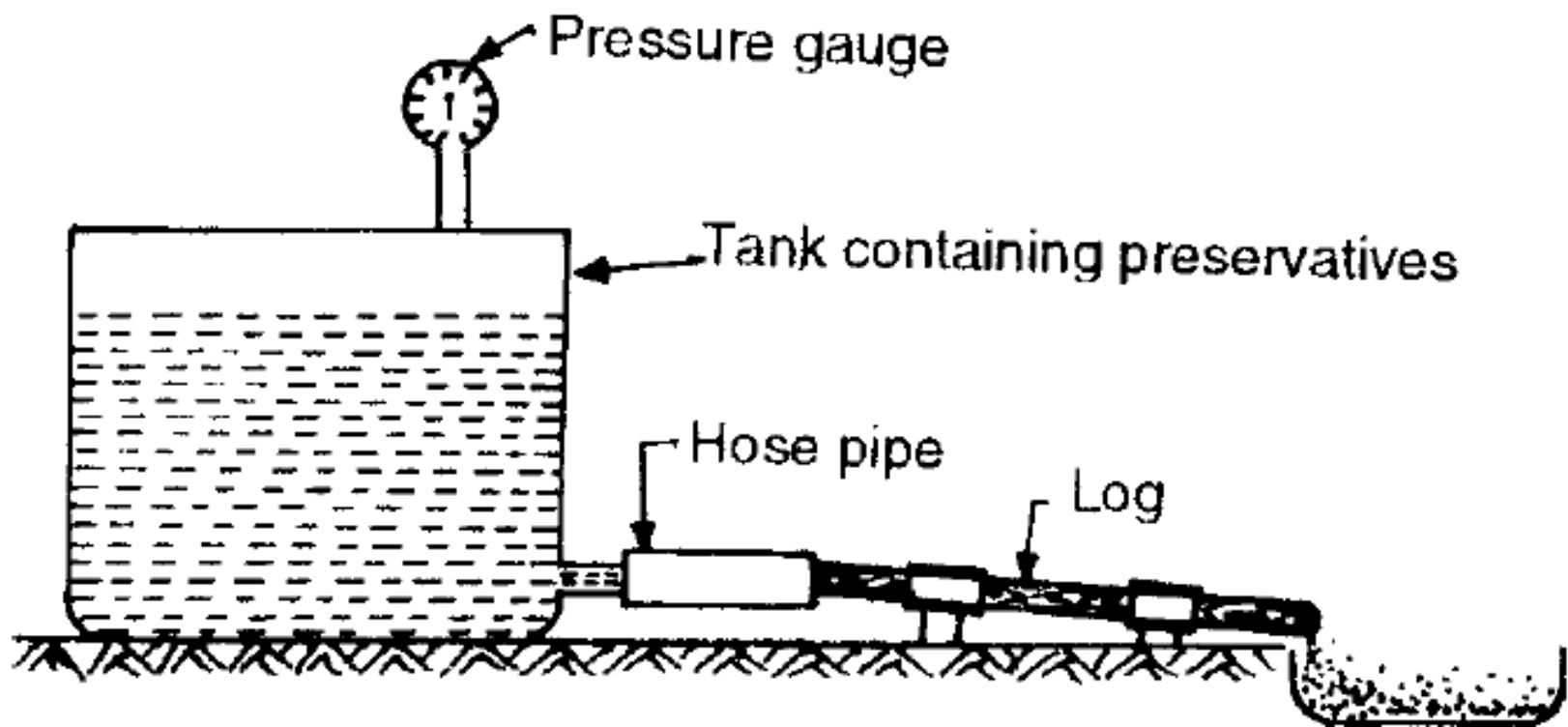


Fig. 4.6 Boucherie Process

FULL CELL PROCESS

EMPTY CELL PROCESS

DIFFUSION PROCESS

FIRE RESISTANCE IN TIMBER

Timber is very inflammable. The fire hazard of timber structures is, however, often overemphasized. As the temperature builds up, the evolution of gases is more rapid and the surface of the timber begins to char. Finally, the point is reached at which the wood itself begins to glow and to ignite (220–390°C). Until this point is reached, the woody portion does not support its own combustion. Quick ignition of inflammable gases and glowing of charcoal occur at about 390–530°C.

Fire proofing makes timber resistant to fire to a degree that it is difficult to ignite and support its own combustion. The fire resistance of wood can be enhanced either by impregnating it with chemicals like phosphates of ammonia, mixture of ammonium phosphate and ammonium sulphate, borax and boric acid, sodium arsenate, sodium tetra-borate or by designing wood to provide slow burning construction.

CHEMICAL METHOD

Impregnating with chemicals

Surface coating method

STRUCTURE METHOD

There is considerable difference between the burning of thin wooden members and that of large timbers. Timber of substantial dimension offers high resistance to fire. Heavy timber on burning form a protective coating of charcoal, which being a heat insulator retards the penetration of heat to the interior. On the contrary, thin members quickly reach the ignition point and burn rapidly. Once the fire is started, flames rise upward in case of wood and hence, wood which is in vertical direction catches fire easily. That is why windows and doors burn more rapidly as compared to beams and floors.