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FOREST PRODUCTS LABORATORY

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A HUNDRED DEFINITIONS PERTAINING TO WOOD AND OTHER FOREST PRODUCTS

AIRPLANE SCHEDULE: A mild kiln drying schedule suited to the seasoning of wood to be used in aircraft.

ALBURNUM: Another name for sapwood, which see.

ANGIOSPERMS: The botanical name for a group of plants that includes the so-called hardwoods; literally the word means "having the seeds enclosed." Terms commonly applied to trees belonging to the angiosperm group: hardwoods, deciduous trees, porous woods, broad-leaved trees. Compare GYMNOSPERMS.

ANNUAL RING: In the case of wood, the growth layer put on in a single growth year.

BIRD PECK: A small hole or patch of distorted grain resulting from birds pecking through the growing cells in the tree. In shape bird peck usually resembles a carpet tack with the point toward the bark and it is usually accompanied by discoloration extending for a considerable distance along the grain and to a much lesser extent across the grain. The discoloration produced by the bird peck causes what is commonly known as *mineral streak*.

BLUE STAIN: A bluish or grayish discoloration of wood caused by the growth of certain mold-like fungi on the surface and in the interior of the wood; produced by the same conditions that favor the growth of other fungi.

BORDERED PIT: See PIT.

BOXED HEART: A timber is said to have boxed heart when the pith of the tree from which it is cut falls entirely within the four faces of the piece.

BRASHNESS: A condition in the wood characterized by a more or less abrupt failure across the grain, instead of a tendency to splintering, when broken.

BROAD-LEAVED TREES: See ANGIOSPERMS.

BROWN STAIN: A chemical discoloration of wood apparently due to oxidation and accumulation of extractives

under certain conditions during the air drying or kiln drying of various species.

CASEHARDENING: A state of compression in the outer layers of a board or timber accompanied by tension in the center or core, the result of too severe drying conditions.

CAMBIUM: The layer of tissue just beneath the bark of the tree from which the new wood and bark cells of each year's growth develop. On the inner side of the cambium the typical wood cells, springwood and summerwood are formed. On the outer side of the cambium the phloem or bast is formed. While new phloem is being formed, corky cells which subsequently become the main portion of the bark are being formed in the older phloem.

CELL: A term applied in a general sense to the minute units of wood structure, including wood fibers, vessel segments, and other elements of diverse structures and functions.

CELLULOSE: The carbohydrate ($C_6H_{10}O_5$) that is the principal constituent of wood and of parts of many plants. Cotton fabric, paper, and rayon are common forms of manufactured cellulose.

COLLAPSE: In drying, a defect in wood, characterized externally by a crushed and/or corrugated appearance, due to the flattening of individual cells or rows of cells in the heartwood. In wood preservation, flattening or collapse of wood is caused by the use of excessive treating pressures while the wood is hot and plastic.

COMPARTMENT KILN: A kiln in which all the truck loads of lumber are exposed to substantially the same drying conditions simultaneously. Compare PROGRESSIVE KILN.

COMPRESSION SET: A condition in which some of the outer fibers in a piece of wood are permanently compressed as a result of the piece being restrained from swelling while taking on moisture.

COMPRESSION WOOD: Abnormal wood formed on the lower side of branches and leaning trunks of softwood trees. Compression wood is identified by its relatively wide rings, usually eccentric, and its relatively large amount of summerwood, usually 50 per cent or more of the width of the annual rings in which it occurs. Compression wood shrinks excessively and irregularly lengthwise. It

breaks with a more or less brittle or brash failure.
CONIFER: A tree bearing seed cones; usually, an evergreen. A softwood. See GYMNOSPERMS.

CROOKING: A deviation edgewise from a straight line drawn from end to end of a piece of lumber.

CROSSBAND: In the construction of plywood, to place the grain of alternate layers (usually) at right angles to the grain of the faces in order to more nearly equalize the strength in the two principal directions, and to minimize shrinking and swelling: In plywood, layers of veneer at right angles to the face plies.

CROSS GRAIN: Cross-grained wood is that in which the fibers are not parallel to the axis of a piece. In U. S. Department of Agriculture Circular 296, "Standard Grading Specifications for Yard Lumber," slight cross grain is a slope of grain not over 1 inch in a length of 15 inches; medium cross grain is a slope of grain over 1 inch in a length of 15 inches but not more than 1 inch in a length of 10 inches; heavy cross grain is a slope of grain over 1 inch in a length of 10 inches.

DECAY: The disintegration (commonly called rot) of wood-cells by fungi. The fungi are usually characterized by mushroom, toad stool, or shelving fruiting bodies giving off microscopic spores or seedlike units which settle on wood and start new infections wherever there is sufficient warmth, moisture, and organic food material.

DIFFUSE-POROUS WOODS: Certain hardwoods in which the pores are practically uniform in size throughout each annual ring, or decrease slightly and gradually toward the outer border of the ring. Compare RING-POROUS WOODS.

DIAMONDING: A distortion in drying which causes a piece of wood, rectangular in section, in which the annual rings run diagonally across the piece, to become diamond-shaped. This is due to the fact that tangential shrinkage (shrinkage perpendicular to any radius of a log) is greater than shrinkage radially.

NOTE: "Dote", "doze", and "rot" are synonymous with "decay" and are any form of decay which may be evident as either a discoloration or a softening of the wood.

DRY ROT: A term loosely applied to any dry crumbly decay but correctly only to the decay produced by such

fungi as *Merulius lacrymans* and *Poria incrassata*. Wood in an advanced stage of disintegration due to the attack of these fungi can easily be crushed to a dry powder. But "dry rot" is actually a misnomer for any decay, inasmuch as all fungi require considerable moisture.

DURABILITY: A general term for permanence or lastingness. Frequently used to refer to the degree of resistance of a species of wood to attack by wood-destroying fungi under conditions that favor such attack. In this connection *resistance to decay* is a more specific term.

DURAMEN: Another name for heartwood.

EDGE-GRAIN: Vertical-grain (EDGE-GRAIN, rift-grain, comb-grain, or quarter-sawed) lumber is that which has been sawed so that the wide surfaces extend approximately at right angles to the annual layers or rings of growth. Material is considered vertical grain when the rings (so-called grain) form an angle of 45 to 90 degrees with the wide surface of the piece. Compare FLAT-GRAIN.

DIMENSION STOCK: Squares or flat stock, usually in pieces under the minimum sizes admitted in standard grades, rough or dressed, green or dry, cut to the approximate dimensions required for the products of woodworking factories. Dimension stock should be distinguished from "ready-cut stock," which is defined as material green or dry, sawed, turned, shaped, or otherwise machined to exact conditions and dimensions required for assembly into the various products of wood-using factories.

EMPTY-CELL PROCESS: Any process for impregnating wood with preservatives or chemicals in which air is imprisoned in the wood under pressure of the entering preservative and then expands when pressure is released and drives out part of the injected preservative or chemical. The air pressure in the wood may be built up by applying compressed air before admitting preservative, or dependence may be placed upon the air naturally in the wood. The distinguishing characteristic of the empty-cell process is that no vacuum is drawn before applying the preservative. The aim is to coat the cell walls with preservative and leave the cell cavities empty or only partially filled. Compare FULL-CELL PROCESS.

EXTRACTIVES: Materials in wood, that can be dissolved

out with hot or cold water, ether, benzene, or other relatively inert solvents.

EQUILIBRIUM MOISTURE CONTENT: The moisture content at which wood neither gains nor loses water when surrounded by air at a given relative humidity and temperature.

FALSE RING: An extra zone of growth in a cross section of wood produced by a cessation or decided retardation of growth followed by resumption of growth within a single season. It can result from defoliation and re-leafing of the tree or temporarily unfavorable conditions of moisture, temperature, or other growth factors.

FIBER-SATURATION POINT: The stage in the drying or wetting of wood (varying slightly with different woods but approximating 30 per cent) at which the cell walls are completely saturated, while the cell cavities are free of water.

FIBRIL: One of the major divisions of cell walls, consisting of elongated strands of cellulose extending more or less spirally around the cell.

FIREPROOFING: Making wood resistant to fire. Wood can not be treated chemically so that it will not char or decompose at 280 degrees Centigrade. What effective fireproofing does is to make wood difficult to ignite and keep it from supporting its own combustion.

FLAT-GRAIN: Flat-grain lumber is that which has been sawed in a plane approximately perpendicular to a radius of the log. Synonymous terms: slash-grain, "bastard" grain, plain-sawed, tangential cut. Lumber is considered flat-grain when the wide surface makes an angle of less than 45 degrees with the annual growth layers. Compare **EDGE-GRAIN**.

FLITCH: A thick piece of lumber with wane (bark) on one or more edges.

FULL-CELL PROCESS: A process for injecting preservatives or chemicals into wood in which a vacuum is drawn to remove air from the wood before admitting the preservative. This favors heavy absorption and retention of preservative in the treated portions. Compare **EMPTY-CELL PROCESS**.

FUSIFORM BODIES: Small spindle-shaped bodies into

which the fibril (which see) is resolved when chemically dissected.

GROUNDWOOD: Pulp produced by mechanical disintegration of wood on grinding stones. The main constituent of newsprint paper.

GYMNOSPERMS: The botanical name for the group of plants that includes the so-called softwoods; literally the word means "seeds not enclosed." Terms commonly applied to trees belonging to the gymnosperm group: softwoods, evergreens, nonporous woods, needle- or scale-leaved trees, conifers. Most, but not all, true gymnosperms are needle-leaved, evergreen, and cone-bearing. Compare **ANGIOSPERMS**.

HARDWOODS: Broad-leaved trees (See **ANGIOSPERMS**). The term refers to a botanical grouping and not to the actual hardness of the wood. Some of the so-called hardwoods are in reality very soft. All hardwoods contain pores or vessels, specialized water conducting elements not characteristic of softwoods.

HEARTWOOD: The wood in the interior of the tree, extending from the pith to the sapwood, in which the cells no longer participate in the life processes of the tree. Heartwood serves chiefly the mechanical function of support. Heartwood may be infiltrated with gums, resins, and other materials which usually make it darker and more decay resistant than sapwood. Compare **SAPWOOD**.

HEMICELLULOSE: A form of cellulose which is easily decomposable, as by dilute acid, yielding a mono-saccharide.

HONEYCOMBING: Checks that occur in the interior of a piece of lumber, often not visible at the surface. Honeycombing usually occurs along the rays.

INTERNAL SAPWOOD: A zone of wood within the heartwood that retains the light color of the sapwood.

INTERLOCKING GRAIN: Wood in which the fibers are inclined in one direction in a number of rings of annual growth, then gradually reverse and incline in an opposite direction in succeeding growth rings, then reverse again, etc.

LAMINATED WOOD: Wood built up of plies or laminae glued together or joined by nails, bolts, or other mechanical fastenings. The term is most frequently applied in cases

where the plies are too thick to be classified as veneer, and where the grain of all plies is parallel.

LIGNIN: The second most abundant constituent of wood, located principally in the middle lamella, which see. Lignin constitutes 20 to 35 per cent, by weight, of wood. Its chemical composition has not been definitely determined. Lignin may be isolated by treating wood with 72 per cent sulphuric acid to remove the cellulose associated with it.

LUMEN: The central opening or cavity within a wood cell.

MIDDLE LAMELLA: A thin cementing layer between plant cells composed, in wood, principally of lignin. This layer is dissolved out in chemical pulping.

MOISTURE GRADIENT: A condition of graduated moisture content between the successive layers of a material, such as wood, which may be losing or absorbing moisture. During seasoning the gradations are between the moisture content of the relatively dry surface layers and the wet layers at the center of the piece.

MOISTURE-PROOFING: Making wood resistant to moisture changes. As referring to wood, moisture-proofing is a relative rather than absolute term. No practicable coating or treatment for wood is known that will completely prevent moisture changes.

NAVAL STORES: A term applied to turpentine and rosin.

OLEORESIN: The viscous mixture of non-volatile solids and essential oil secreted by the resin-forming cells of the pines and certain other trees. That from long-leaf and slash pine is of great commercial importance, being the raw material of the United States' turpentine and rosin production. It is obtained by regularly repeated wounding of the living tree.

PARENCHYMA: Short cells with simple pits which function primarily in the metabolism and storage of plant food materials. They retain their protoplasmic contents and remain alive longer than the tracheids, fibers, and vessel segments, sometimes for many years. Two kinds of parenchyma cells are recognized, those in vertical strands, known more specifically as "wood parenchyma," and those in horizontal series in the rays, known as "ray parenchyma."

PECK: An advanced stage of decay involving the formation of pockets or areas of disintegrated wood. Usually associated with cypress and incense cedar. Peck corresponds to what is technically termed "medium pocket rot," in which the holes or pockets range from 1/16 to 1/2 inch in width and from 1/4 inch to 2 inches in length. Compare BIRD PECK.

PHLOEM: The inner bark, a tissue developed from the external side of the cambium layer. It serves for the translocation and storage of plant compounds. See also XYLEM, CAMBIUM.

PIT: A relatively unthickened portion of a cell wall where a thin membrane permits liquids to pass from one cell to another. A *bordered pit* has an overarching rim which is not present in a simple pit.

PLYWOOD: Wood made up of three or more layers of veneer joined by glue, the grain of adjacent plies usually being at right angles. Almost always an odd number of plies are used to secure balanced construction.

PLAIN SAWED: See FLAT GRAIN.

POROUS WOODS: Another name for the hardwoods, which frequently have vessels or pores large enough to be readily seen under magnification.

PROGRESSIVE KILN: A dry kiln in which a number of truck loads of lumber are in process of drying at the same time, the green lumber going in at one end, where relatively mild atmospheric conditions exist, and by stages progressing toward the opposite end where the drying conditions are more severe and whence the load is eventually removed. Compare COMPARTMENT KILN.

QUARTER-SAWED: See EDGE GRAIN.

RAYS: Strips of cells extending radially within a tree and varying in height from a few cells in some species to 4 inches or more in the oaks, in which species they produce the characteristic "silver grain" seen on radial (quarter-sawed) surfaces. The rays serve primarily to store food and transport it horizontally in the tree.

RING-POROUS WOODS: A group of hardwoods in which the pores are comparatively large at the beginning of each annual ring and decrease in size more or less abruptly toward the outer portion of the ring, thus forming a

distinct inner zone of pores known as the springwood and the outer zone with smaller pores known as the summerwood.

RADIAL SECTION: A lengthwise section in a plane that passes through the center line of the tree trunk.

RESIN PASSAGES: Intercellular passages which contain and transmit resinous materials. On a cut surface they are as a rule inconspicuous.

ROTARY-CUT VENEER: Veneer cut in a continuous strip by rotating a log against the edge of a knife in a special type of lathe. Compare **SLICED VENEER** and **VENEER**.

SAP: The term commonly used to refer to all of the fluids in a tree, special secretions and excretions, such as oleoresin, excepted. *Crude sap* is the water and dissolved nutrients as absorbed by the root system.

Elaborated sap is the material produced within the leaves by the interaction of carbon dioxide, air, the crude sap, and chlorophyll. The compounds resulting from this interaction are conducted down the tree to serve as food.

SAPWOOD: The (usually) light-colored zone of wood next to the bark, 1 to 3 or more inches wide, which is actively involved in the life processes of the tree (water and sap movement, food storage). Under most conditions sapwood is more susceptible to decay than heartwood; as a rule it is more permeable to liquids than heartwood. Sapwood is not essentially weaker or stronger than heartwood of the same species.

SECOND-GROWTH: Denotes timber that has grown after the removal of all or a large portion of the previous stand whether by cutting, fire, wind, or other agency. Typical second-growth conditions may come about in a forest that is untouched so far as lumbering operations are concerned. Second-growth material is frequently of rapid growth during its early life.

SEMI-CHEMICAL PROCESS: Any pulping process combining mild cooking and mechanical defiberizing of softened chips. The name is specifically applied to a pulping process involving essentially (1) mild cooking or partial disintegration of wood chips with sodium sulphite and sodium bicarbonate followed by (2) further pulping or disintegration in a defiberizing apparatus such as a rod mill. Yields from the semi-chemical process are in

the neighborhood of 70 per cent on the basis of the oven-dry weight of wood chips admitted to the digester. SET: Restraint or fixation of wood fibers which are kept from shrinking or swelling, with loss or gain of moisture, by adjoining fibers which are at a different moisture content.

SLICED VENEER: Veneer which is literally sliced off the log or bolt by moving the log or flitch against a large knife. Compare ROTARY-CUT VENEER and VENEER.

SODA PROCESS: An alkaline pulping process involving the use of an aqueous solution of sodium hydroxide, used in the production of book, magazine, and lithograph pulps, principally from hardwoods. The paper produced by the soda process is normally soft, bulky, opaque, and easily bleached and loaded. The yield is in the neighborhood of 40 per cent based on the oven-dry weight of chips admitted to the digester.

SOFTWOODS: See GYMNOSPERMS.

SPIRAL GRAIN: A type of growth in which the fibers take a spiral course about the bole of the tree instead of the normal vertical course. The spiral may extend right handed or left handed around the tree trunk.

SPRINGWOOD: The inner, earlier-grown, frequently thinner walled and larger lumened portion of the annual ring.

STARVED JOINT: A glued joint in which, as a result of the use of excessive pressure or insufficient viscosity of the glue, or a combination of these causes, the glue is forced out from between the surfaces to be joined, leaving insufficient glue to make a strong joint.

STORAX: The commercial name for *sweet gum* the grayish-brown, sticky, semi-liquid substance containing cinnamic acid, etc., obtained in the United States from the sweet gum tree, *Liquidambar styraciflua*, in Asia Minor from *Liquidambar orientalis*. Used in mildly medicinal and pharmaceutical preparations, adhesives, incense, soap, and tobacco as a perfume, flavoring material, and expectorant.

STRENGTH: The term in its broader sense embraces collectively all the properties of wood which enable it to resist different forces or loads. In its more restricted sense, strength may apply to any one of the mechanical properties, in which event the name of the property under

consideration should be stated; thus strength in compression parallel to grain, strength in bending, hardness, etc. **SULPHATE PROCESS:** An alkaline pulping process, involving the use of caustic soda and sodium sulphide (the latter derived, from salt cake or sodium sulphate by a smelting process), used in the production of wrapping papers and container boards from both hardwoods and softwoods (mostly softwoods). The paper produced by the sulphate process is tough and difficult to bleach. The yield is about 50 per cent on the basis of the oven-dry weight of chips admitted to the digester.

SULPHITE PROCESS: An acid pulping process, involving the use of an aqueous solution of sulphur dioxide and calcium or magnesium bisulphite or a mixture of the two, used in the production of newsprint and writing papers from long-fibered softwoods with low resin content, such as the spruces, firs, and hemlocks and such hardwoods as the birches, gums, and maples. The paper produced is long-fibered and light-colored. The yield is about 40 per cent on the basis of the oven-dry weight of chips admitted to the digester.

SUMMERWOOD: The outer, later-formed, usually denser portion of the annual ring.

TANGENTIAL SECTION: A longitudinal section through a tree or limb perpendicular to a radius. Flat-sawed lumber is cut tangentially.

TENSION SET: A condition of wood in which a group of fibers, owing to restraint imposed by adjoining fibers or by an external mechanical agency, are fixed or set in a condition of tension as a result of a restraint on normal shrinkage during a drop in moisture content.

TYLOSES: Masses of parenchyma cells appearing somewhat like froth in the pores of some hardwoods, notably the white oak and black locust. Tyloses are formed by the extension of the cell wall of the living cells surrounding vessels of hardwoods or sometimes in a similar manner by the extension of the cell wall into resin passage cavities in the case of softwoods.

VENEER: Thin sheets of wood produced by rotary cutting, sawing or slicing. Veneer thicknesses to some extent overlap the thicknesses of resawn lumber.

WARP: Any variation from the true or plane surface. Warp includes crook, bow, cup, and twist, or any combination of these defects.

TRACHEIDS: The elongated cells that constitute the greater part of the structure of the softwoods (frequently referred to as "fibers") as well as a portion of some hardwoods. Tracheids are distinguished from the true wood fibers of hardwoods by being larger in diameter and having numerous distinctly bordered pits, and from vessel segments by being closed at both ends. Tracheids serve the dual function of conducting sap and giving mechanical strength to the wood.

TRANSVERSE SECTION: A section through a tree or timber at right angles to the pith.

WEATHERING: The mechanical and chemical disintegration and discoloration of the surface of wood due to exposure to light and to the alternate shrinking and swelling of the surface fibers with continual changes in moisture content due to weather changes.

WHITEWATER: Water, carrying fiber, clay, and chemical, recovered or wasted from the wire and suction box of a paper machine. The water is white or milky in appearance.

WOOD FLOUR: Wood ground finely enough to pass a 40- to 140-mesh screen, produced by stone mills of the "top runner" type, steel burr roller mills, or any one of the several types of hammer and beater mills; used chiefly in linoleum, dynamite, and synthetic resin products.

WOOD PRESERVATIVE: A substance applied to or injected into wood to protect it from attack of fungi, insects, or marine animals.

WOOD SUBSTANCE: The materials in the cell walls of wood. The extractives and other infiltrated materials and cell contents of wood, of course, are not a part of wood substance. There is no wide variation in chemical composition or specific gravity between the wood substance of various species, the characteristic differences of species being due largely to differences in infiltrated materials and variations in relative amounts of cell walls and cell cavity or lumen.

XYLEM: The portion of the tree trunk, branches and roots that lies between the pith and the cambium.