CHAPTER 2

TIMBER

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LIST OF ILLUSTRATIONS

General

1. Although timber is being replaced by metal for structural parts of aircraft, it is still an important constructional material and for certain purposes its use is likely to continue. Timber differs essentially from metals in that it is an organic material, and being the result of natural growth, it is influenced by changes in climate or weather which produce variations in both size and strength. It does not suffer appreciably from chemical corrosion, rusting, oxidation, etc., to which metals are liable, but it may deteriorate owing to attack by fungus, or may be injured by insects.

Structural characteristics

2. Wood is a structure rather than a homogeneous material and consists of tubes or cells firmly cemented together, the majority lying along the longitudinal direction of the grain. Viewed microscopically, a cross-section of the end grain resembles a honeycomb, and this resemblance is particularly marked in soft woods, e.g. spruces, firs, larches, pines, etc., in which the wood is composed chiefly of longitudinal cells or tubes laid side by side—see fig. 1. Hardwoods have longitudinal cells —side by side—to approximately the same extent. The thickness of the cell walls depends upon the season of the year at which their growth takes place. This seasonal variation may be seen on cross sections of the wood and gives rise to the concentric annual rings.

3. The hardwoods have a more complex structure. The longitudinal fibres are usually small and thick walled but relatively large tubes known as "vessels" are interspersed—see fig. 2. Rows of cells running radially from the centre to the edge of the tree are known as "medullary rays". These rays are indistinct and small in the conifers but in many of the hardwoods they are a prominent feature and influence the strength of the wood, although they are supposed to have a deleterious effect on some strength properties.

4. A log usually consists of heartwood, sapwood, and bark—see fig. 3. In a few species, e.g. spruce, there is little difference either in appearance or strength between the heartwood and sapwood.

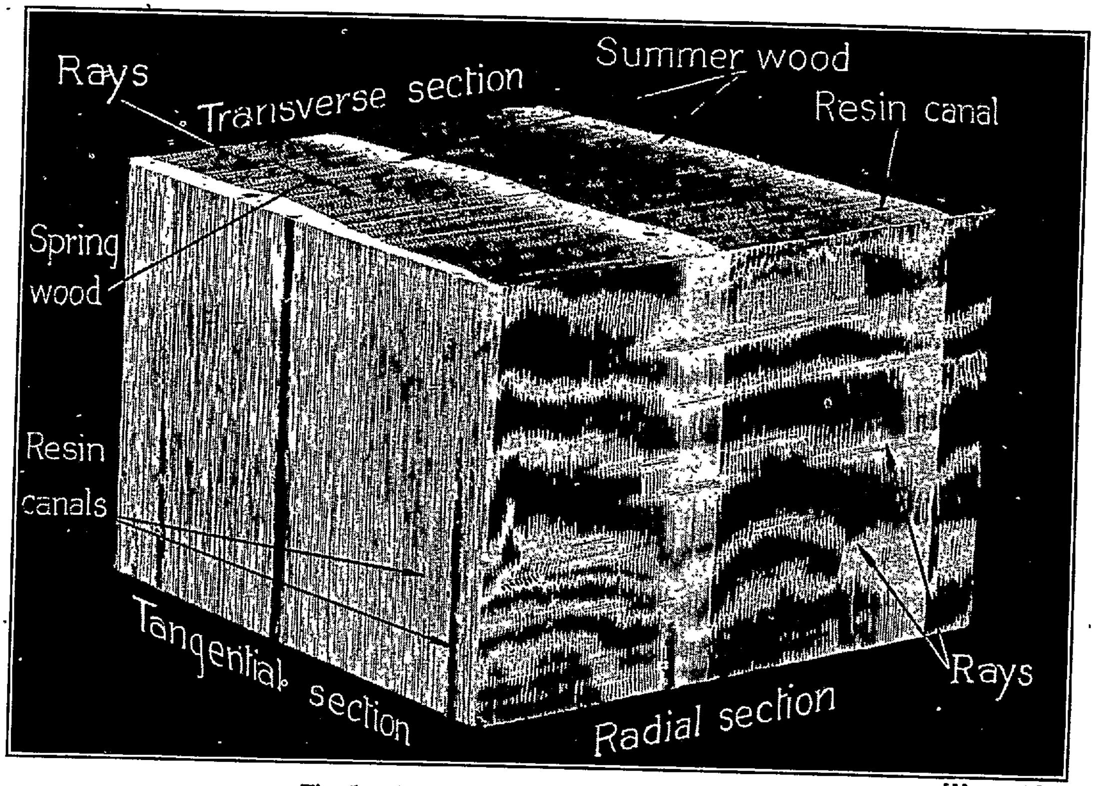

Fig. 1.—Softwood—Scots pine (*Pinus sylvestris*) [Mag. × 19]

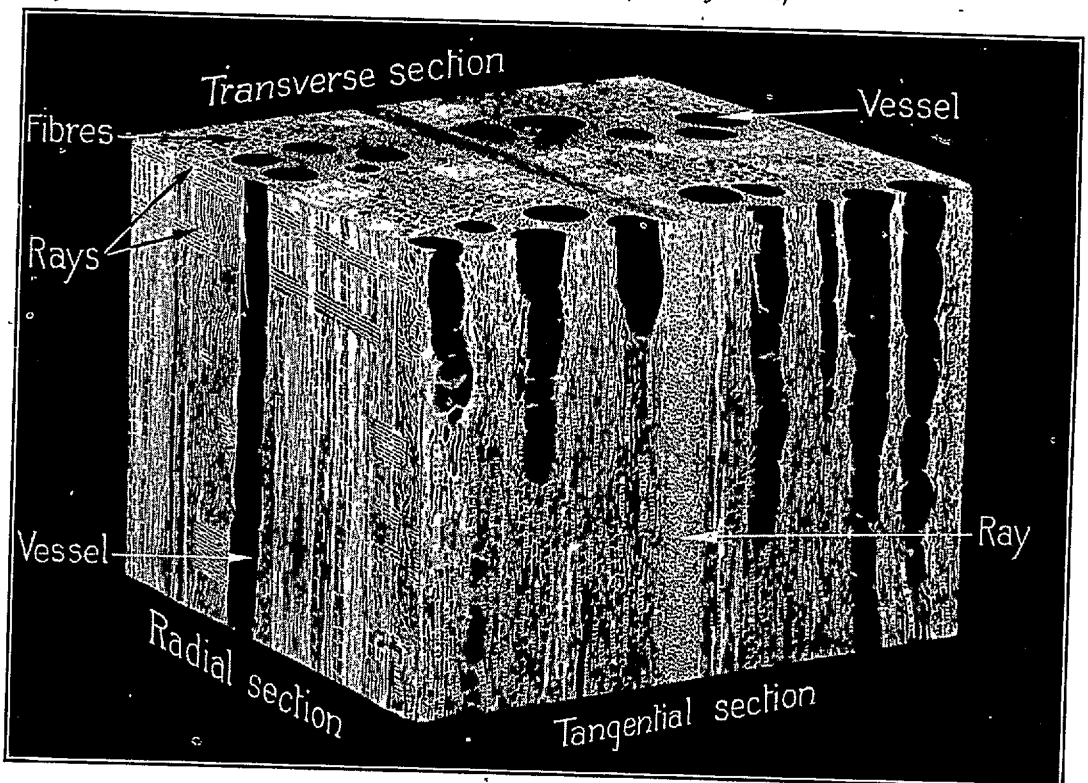

Fig. 2.—Hardwood—Oak (*Quercus robur*) [Mag. × 30]

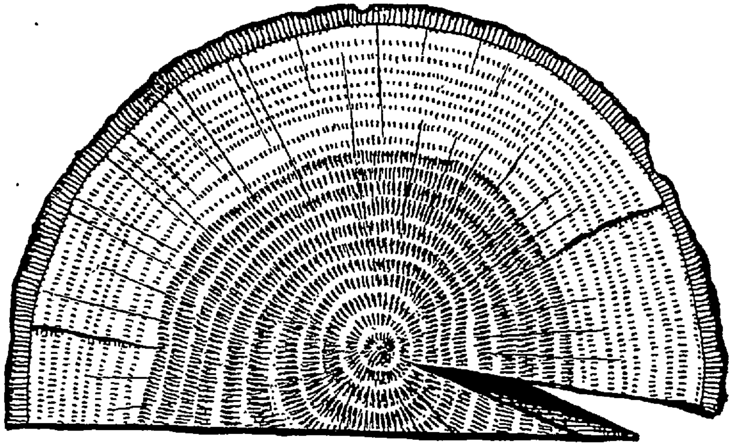

Fig. 3.—Cross-section of a log

In most species, however, the heartwood, which occurs towards the centre of the tree, is darker in colour and more durable than the sapwood and is found to yield the best timber for structural purposes.

The photographs for figs. 1, 2, 9, 10, 11, and 12 have been reproduced by courtesy of the Forest Products Research Laboratory.

The peripheral zone of sapwood is generally less durable than heartwood, and certain cells of the sapwood contain food materials which attract insects and support the growth of some fungi. The bark, although vital to the growing tree, has no utility as a structural material.

Seasoning

5. When a tree is felled, the wood is in a moist state. In this condition it is described as "green" and since removal of surplus moisture from the wood improves its strength, lightens its weight and makes it more immune to fungal attack, it causes shrinkage to occur before the timber is cut to size. A certain amount of drying is necessary before the wood is suitable for use. A log must be converted to planks before any drying will occur; this applies to air or kiln-drying referred to in para. 6.

6. The process of drying is called seasoning. So-called "natural" seasoning consists of exposure of the log to the atmosphere until a state of equilibrium between the moisture in the wood and the dampness of the atmosphere has been reached, when the wood is said to be "air dry". In some instances it is economical, or otherwise advisable, to accelerate or control the drying process by exposure of logs or planks in a heated chamber. This process is usually called "kiln-drying" and when carefully done, kiln-dried timber is superior to that which has been air-seasoned under poor conditions.

7. If artificial drying is not conducted under suitably controlled conditions it may cause temporary or permanent damage to the timber, but damage may also be caused during so-called natural seasoning if the conditions of stacking and storage have been unsuitable and if the atmospheric conditions are other than normal.

8. The success of kiln drying depends chiefly on control of the rate of removal of the moisture from the wood. As wood dries it shrinks. If the surface be rapidly dried while the centre is still moist, shrinkage will occur on the surface and at the ends while the central portions are still unchanged in size—see fig. 4. This will result in the formation of shrinkage cracks or "shakes". The stresses introduced by the uneven shrinkage may not be sufficient to drag the fibres of the wood apart and leave visible cracks, but may leave the wood with serious residual internal stresses so that the application of further stress by external forces will cause early failure. Wood in this condition is liable to warp after being cut.

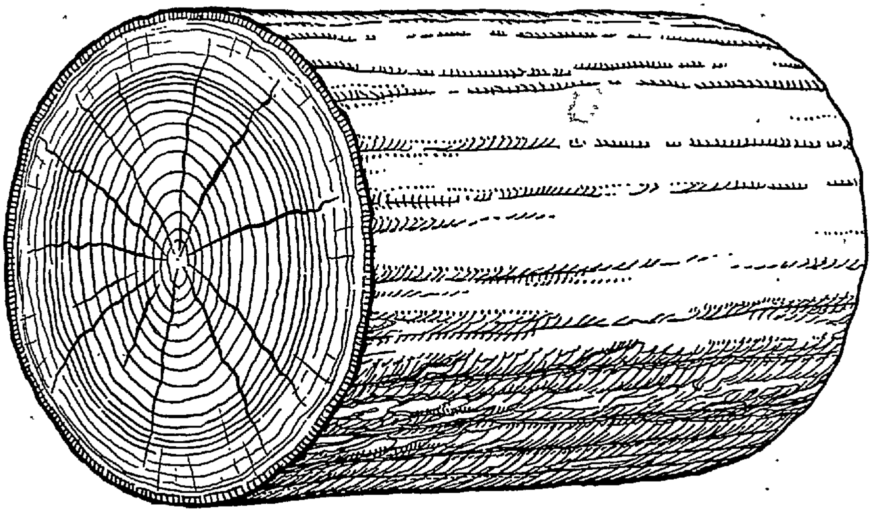

Fig. 4.—Typical surface cracks on the end of a log

Case-hardening

9. A common defect due to improper seasoning is that in which the surface layers of the wood are left in compression. This condition is known as "case-hardening" and the effect is not evident until the piece is cut. A simple test to detect the presence of case-hardening is illustrated in fig. 5.

Shrinkage

10. Wood retains its ability to shrink or expand with loss or gain of moisture throughout its lifetime. From an engineering point of view this constitutes a grave defect and is the cause of many of the troubles associated with the use of timber as a structural material. The rate of shrinkage is not equal in all directions but is greatest in the tangential (or circumferential) direction of the grain. In the radial direction of the grain, i.e. at right angles to the annual rings, the rate of shrinkage is about half as great and in the longitudinal direction of the grain the shrinkage is practically negligible. The extent of shrinkage will vary in the different species.

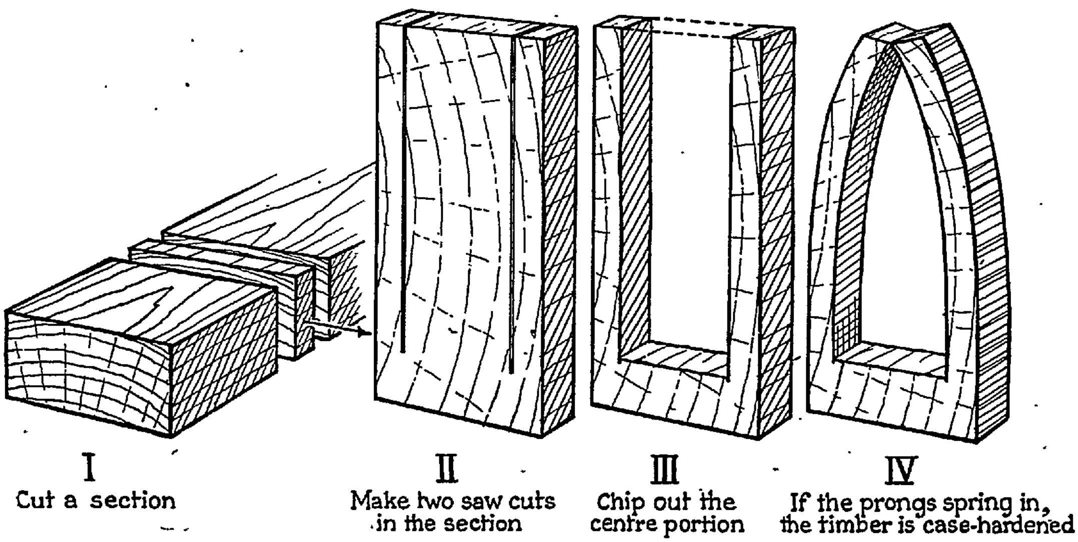

Fig. 5.—Shrinkage of timber

Defects

11. Timber is liable to various defects which may be the result of conditions of growth or injury during growth, felling, seasoning or transit. These defects should be eliminated, where possible, by rejection after careful inspection before the timber is used, but defects may develop or be disclosed during conversion of the timber or during its life as a structural member.

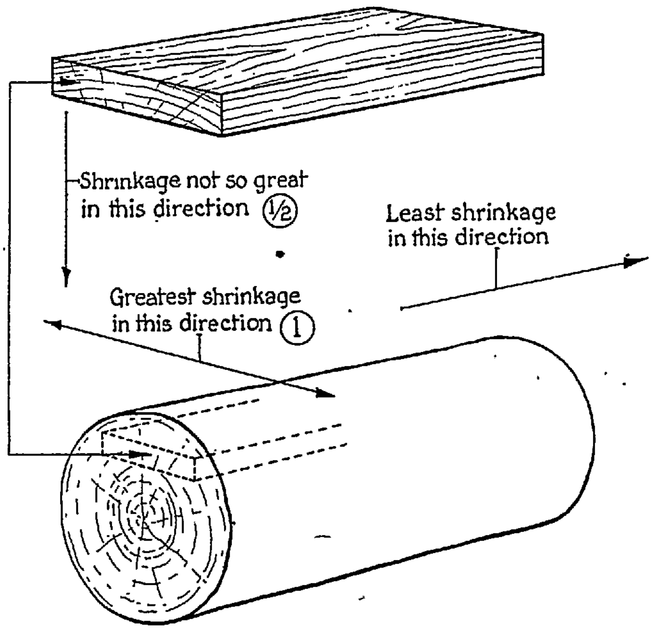

Fig. 6.—Direction of shrinkage

Structural defects

12. The general direction of the grain in timber may be disturbed by the presence of branches, or even buds, and also by accidental injuries to the bark or growing wood caused by various small accidents, such as abrasions, blows, bird pecks or insect attack. Branches cause a disturbance in the grain which may take the form of inconspicuous curls or swirls, or may take the form of knots—*see* fig. 7.

(i) *Knots.*—Knots are usually a source of structural weakness but their deleterious effect depends on their position and frequency, on their size and on whether or not the centre portion of the knot is loose.

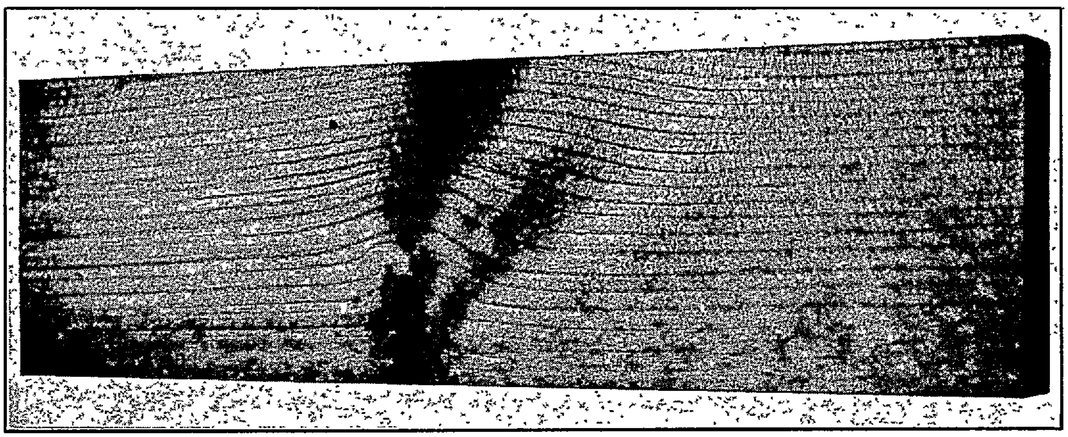

Fig. 7.—Disturbance of grain due to knots

(ii) *Interlock grain.*—Disturbance of the general direction of the grain is periodic in some species in which the grain of successive concentric layers may vary in inclination, giving rise to a condition known as interlock grain and producing on quartered surfaces alternating stripes of varying lustre, known as "roe" or "stripe"—see figs. 8 and 9. This is a feature of mahogany and many of the tropical hardwoods and though contributing to the strength in resistance shearing along the grain and splitting, it is detrimental to the strength in bending, particularly under suddenly applied loads.

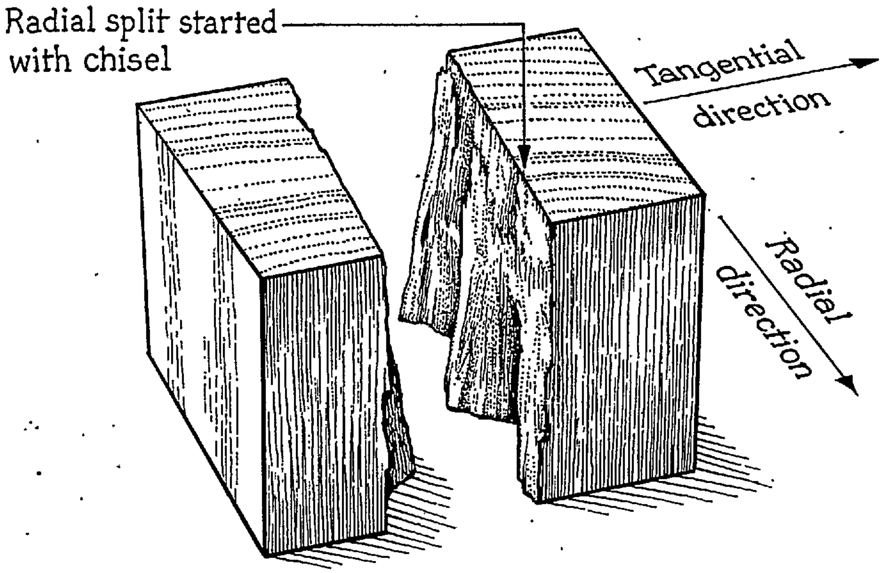

Fig. 8.—Change of direction of grain

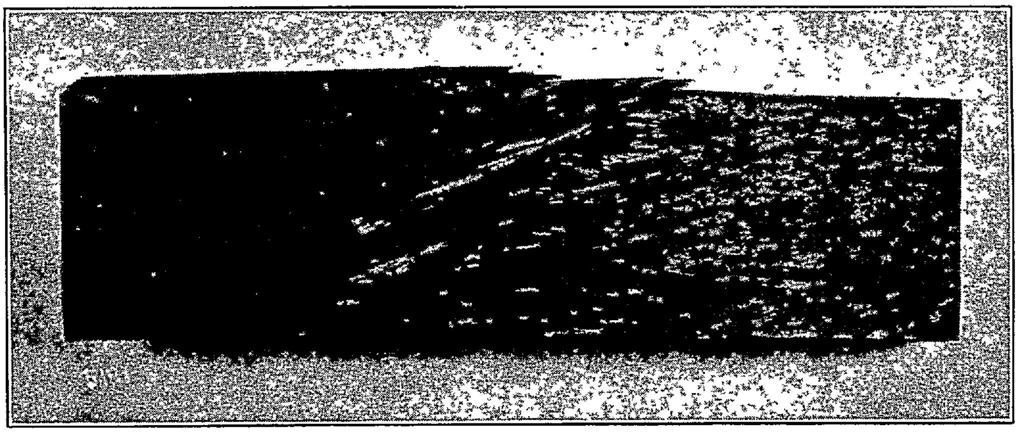

Fig. 9.—Fracture of a bending specimen showing interlock grain

Defects due to insect attack

13. Extensive damage to timber is caused by the larvae (or grubs) of certain insects. Although the larvae are usually soft bodied they possess jaws capable of breaking down the cell walls of the wood. Timber which has been injured by insect (e.g. pinhole borers) attack during growth or while in the log, is usually eliminated by inspection before it reaches a stores depot, or before it is converted into aircraft parts. Occasionally, however, bore holes are found in timber which is in store or in use.

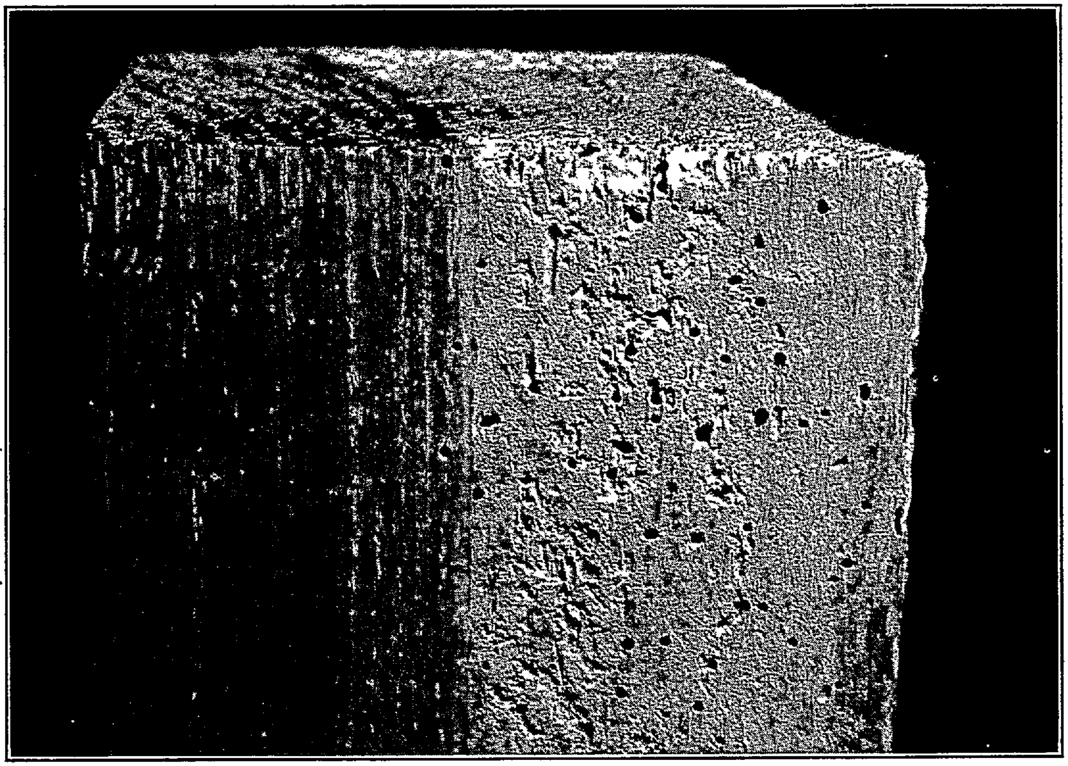

Fig. 10.—Oak plank attacked by powder-post beetles

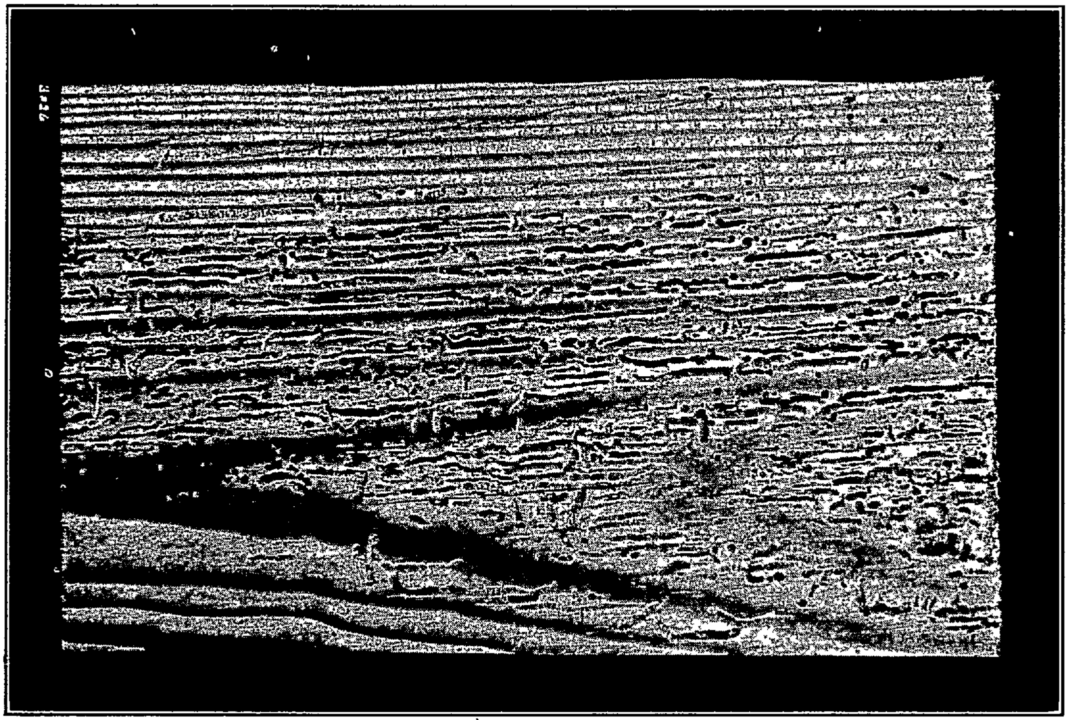

Fig. 11.—Damage done to Scots pine by common furniture beetles

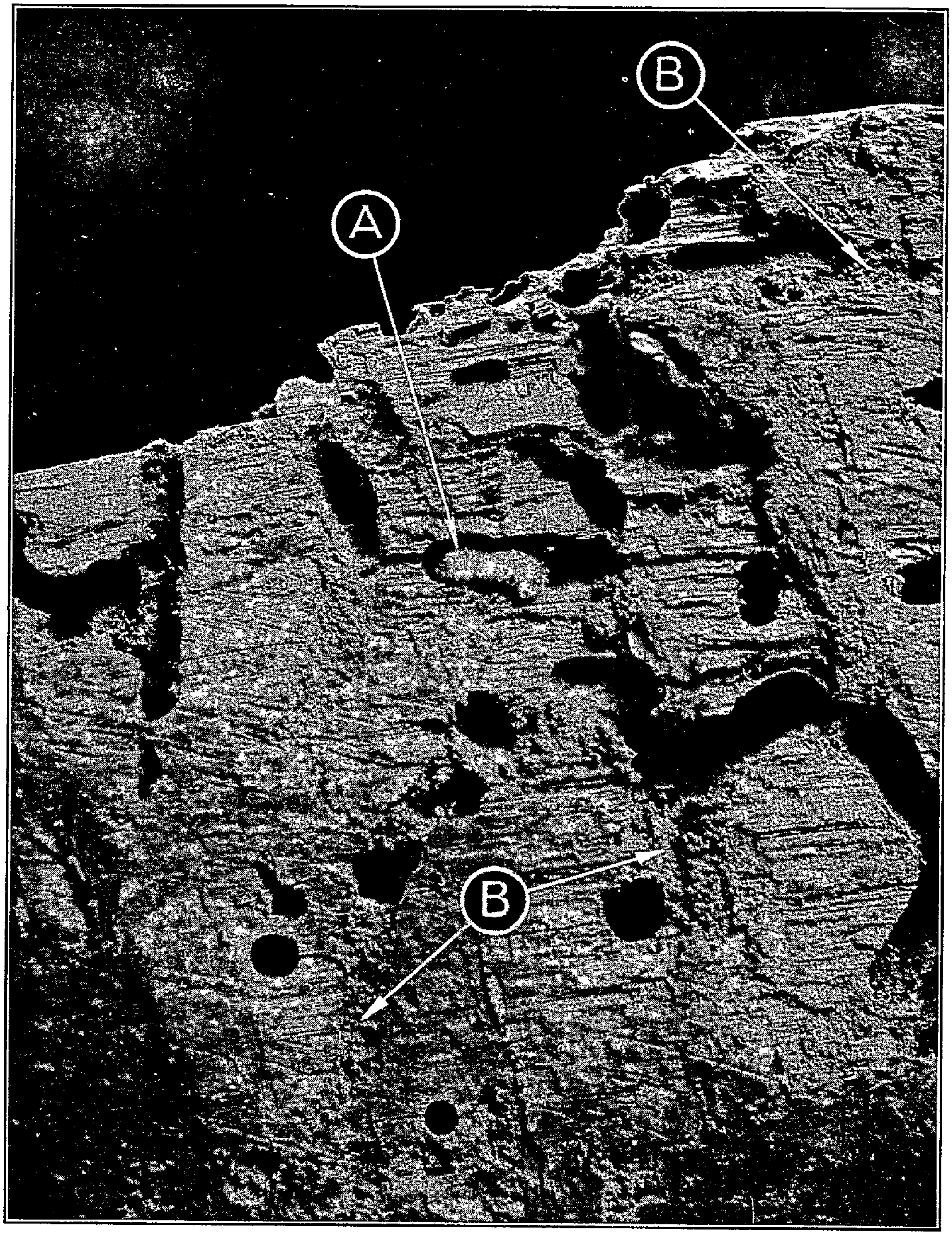

Fig. 12.—Oak beam attacked by death-watch beetles.

14. The reduction in strength due to the presence of bore holes will depend upon their size and number and also upon the location of the holes in relation to the stresses which the timber will have to support. Discovery of bore holes suggests the possibility of active attack and precautionary measures may be necessary to prevent spread of attack—see para. 18.

15. Injury to converted timber in this country is usually due to attack by powder-post (*Lyctus*) beetles, common furniture (*Anobium punctatum*) beetle, or the death-watch (*Xestobium rufo-villosum*) beetle. Fig. 10 shows a portion of oak plank attacked by the powder-post bettle, in which the dust-filled galleries follow the grain of the wood. Fig. 11 shows the damage done to Scots pine by the common furniture bettle. Fig. 12 shows a section of a portion of oak beam attacked by the death-watch beetle, in which A indicates the larva in tunnel (bore-dust or frass dislodged in cutting section) and B indicates bun-shaped pellets, characteristic of the bore-dust or frass of the death-watch beetle.

(i) *The powder-post beetle.*—Several species of this beetle which may be found in England appear to have been imported in considerable quantity since the war (1914–1918). The beetles cause much damage by attacking the recently, or partly seasoned sapwood of some hardwoods such as ash, walnut, etc. They select those woods which have pores of a size to suit their eggs. On this account birch is rarely attacked and softwoods (e.g. spruce, larch, etc.) are immune.

(ii) *The common furniture beetle.*—This beetle prefers the sapwood of well seasoned old wood, but may attack softwoods or hardwoods, including three-ply. As the beetle lays its eggs in cracks or crevices on the surface of the wood it is not limited by the pore size. This beetle never deposits eggs on a smooth or varnished surface.

(iii) *The death-watch bettle.*—This is the largest of the furniture beetles. It prefers old timber and usually confines its attack to oak, walnut, and similar hard woods. It is rarely found in timbers of small dimensions, but prefers large structural timbers in old buildings. This beetle is unlikely to be found in aircraft material.

16. All these beetles are small, elongated and cylindrical. They are only a few millimeters in length, the death-watch beetle, having a length of 6 to 8 mm., being the largest. The life cycle of the beetles is variable and depends on surrounding conditions. For the powder-post beetle it is usually one year, for the common furniture beetle one to two years and for the death-watch beetle two to three years. The eggs hatch out in about a fortnight and the grubs tunnel into the wood and remain for one or more seasons. It is at this stage that the damage to the timber chiefly occurs. Each grub eventually selects a position near the surface of the timber and turns into a chrysalis (or pupa). After two to four weeks the adult beetle emerges and, choosing suitable conditions of temperature, etc., bites its way to the surface and escapes leaving a small circular hole. Emergence may take place at any time in spring or early summer but is most likely during May or June for powder-post and furniture beetles and during April to June for the death-watch beetle.

17. The presence of these holes is usually the first indication that attack has taken place due to infection at least a year previously. Frequently the grubs betray their presence by throwing out small piles of wood dust or "frass". Examination of this "frass" may give a clue to the type of beetle concerned. The powder-post beetle leaves fine and powdery frass, the furniture beetle leaves granular frass in the form of small oval or cylindrical pellets and the death-watch beetle leaves comparatively large bun-shaped pellets. A further clue to the identity of the beetles is given by the size of the exit holes, i.e. about $\frac{1}{16}$ in. dia for the powder-post and furniture beetles and $\frac{1}{8}$ in. dia. for the death-watch beetle, and by the species and condition of the wood which is attacked.

18. Preventive treatment consists chiefly of preventing access of the beetle to the end grain of the wood by close fitting of joints, etc. Beetles are not likely to lay eggs on smooth surfaces especially if protected by varnish. Wood in store should be well ventilated and care should be taken that infected wood, or wood which is liable to be infected (such as fresh sapwood), should not be allowed to remain in the vicinity. The storage of timber is described in A.P. 830, Vol. II—see also para. 28.

19. Where attack is suspected, it is usually possible to prevent extension of the damage by treatment with an approved insecticide. Several applications should be made in spring or early summer at intervals of about a fortnight and the treatment should be repeated a year later—*see* para. 29. It is important to seal up joints, old bore holes, etc., where fresh egg laying might take place.

Decay

20. Injury to timber by decay is usually the result of attack by fungus. Fungi, which are low forms of plant life, can spread through the wood by means of fine strands or "hyphae" which are usually visible under the microscope only. Some fungi feed on the contents of the wood cells. Fungi

of this type cause most of the sap stains which discolour the wood but do not necessarily cause any reduction of strength. Other fungi have the power of digesting the material of the cell walls. These fungi may cause rapid deterioration of strength and under suitable conditions may eventually destroy the wood. Infection by fungus may occur by contact with wood which is already infected or by means of minute "spores" which are produced in large numbers under suitable conditions of growth and which may be conveyed by wind, in dust, etc.

21. Fungus will develop and spread only under suitable conditions of moisture and oxygen supply. Wood which has a moisture content of less than 20 per cent. in unlikely to suffer from fungus attack, but wood which is wet provides a suitable breeding ground. The presence of oxygen is, however, necessary as wood which is completely submerged in water may be preserved for hundreds of years.

22. The fungus which causes the greatest amount of injury to structural timbers is dry-rot or *Merulius lacrymans.* This fungus, in spite of its misleading name, not only requires moisture for its growth but can produce drops of moisture. Spruce is liable to attack by brown pocket rot or *Trametes serialis* fungus. In both instances the early stages of infection are very difficult to detect. As the infection spreads, discolouration may be observed and the timber may be found to be brittle. In advanced stages, the wood becomes brown with longitudinal and transverse cracks giving an appearance somewhat similar to that of charred wood.

23. Injury by fungus may be prevented by poisoning the food supply of the fungus with some preservative fluid such as creosote, by ensuring that the wood is kept in a dry and well ventilated condition and by reducing the risk of infection by removal of other wood which is infected or is likely to become infected.

Conversion

24. Since timber has greater strength along the grain than in any other direction it is important that the timber should be so sawn (or "converted") that the longer dimensions of the piece are parallel to the direction of the grain. The true direction of the grain can be found by splitting, but this is not always convenient.

25. Where the grain is inclined to the length of the piece on two opposite faces and parallel to the length on the two remaining faces, the degree of inclination can easily be estimated. An example is shown in fig. 13 of a piece of timber which has been so cut that the grain on all four faces is inclined

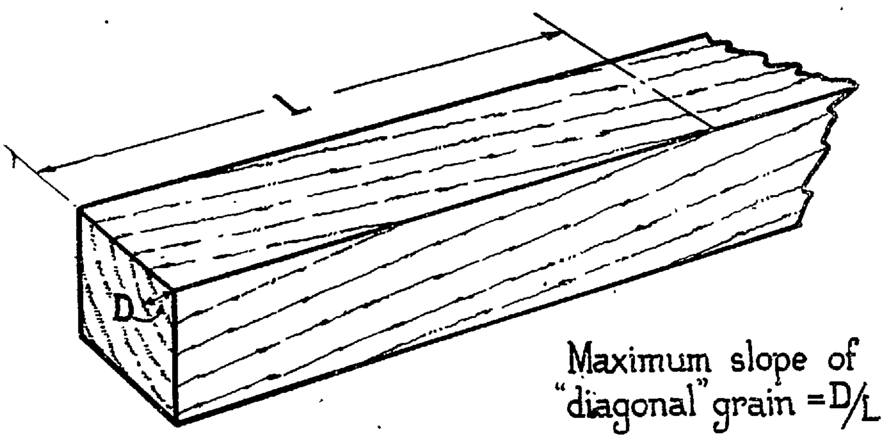

Fig. 13.—Slope of grain

to the length of the piece. The true inclination of the grain is greater than the apparent inclination and should be measured by the method shown. A piece of timber with the grain inclined in this manner is said to have "diagonal" grain.

26. If a split be made in a radial plane, the split may or may not travel in a direction parallel to the axis of the tree. In some trees the growth has a twisted or helical direction so that the grain in any annual ring may lie on a steep helix and therefore at an angle to the axis of growth. The true direction of grain in the annual ring cannot easily be determined by simple examination but may be found by making a small radial split (where possible) as at a–b, or by making an ink mark on a tangential surface as at c–c_1 and noting the direction in which the stain runs. Inclination of the grain with respect to the axis of the tree is known as "spiral" grain and is illustrated in fig. 14.

27. In some hard woods the direction of helical growth reverses at intervals of two or more years which leads to the banded appearance of a radial surface known as "roe"—see para. 12 (ii). In some timbers, such as spruce, the helical grown may be uniform over the whole piece. This condition is rather difficult of detection but the ink test (mentioned previously) will be found to operate well on tangential surfaces of these timbers.

Precautions during storage and use

28. Damage by beetle attack during storage may be limited by suitable precautions. The piling fillets or "stickers" which are used for separating the layers in a pile should either be of heartwood or of a coniferous wood rather than of sapwood of any timber which is liable to encourage attack. Any sapwood should be examined thoroughly in autumn and spring for signs of attack.

29. *Timber spraying fluid.*—Wood which has been attacked or which has been in the vicinity of infected pieces may be sprayed with a protective fluid, such as a mixture of orthodichlorbenzine 91 per cent., pure castile soap 7 per cent., and cedar wood oil 2 per cent. Good results for articles of furniture can also be obtained by brushing on paraffin or turpentine, with the usual precautions against fire. Several applications of the insecticide should be made at intervals of about 10 days.

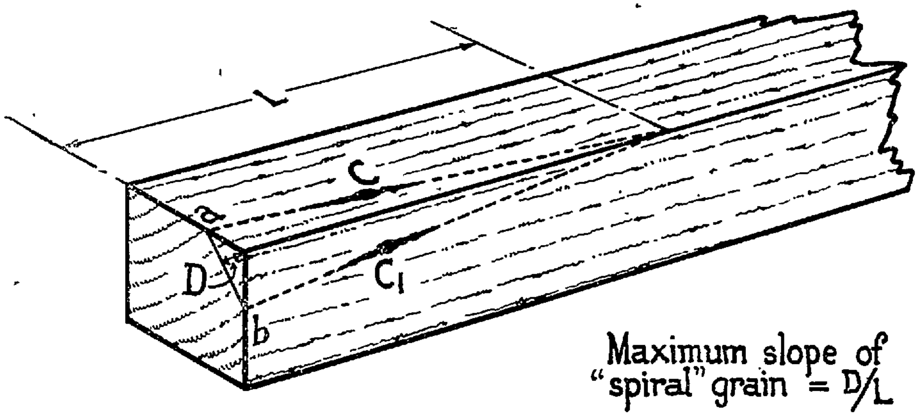

Fig. 14.—Test for determination of slope of grain

Where practicable it is advisable to segregate infected timber during treatment. This may be done by an enclosure of canvas screens which can be arranged to prevent the escape of any beetles which may emerge from the timber.

30. Attack by fungus can usually be prevented by ensuring that all timber in storage or in use is kept dry and well ventilated. Contact with infected timber should be prevented. All storage enclosures should be kept clean and free from sawdust, chips, bark, etc. Where dry conditions cannot be ensured the timber should be treated with some preservative. For exterior structural work creosote may be applied.

Mechanical characteristics

31. Owing to the peculiar structure of wood, the strength varies greatly in different directions. The tensile strength, for example, is about 25 times greater in the longitudinal direction of the grain than in the tangential, the compression strength is about six times greater in the strongest than in the weakest direction and the shear strength about three times greater. As all the properties of timber are affected by moisture content and by density, it is important that these factors be taken into account in all strength measurements and calculations.

32. The following table gives the minimum requirements in mechanical properties and density at the stated moisture content, stipulated in specifications for aircraft timbers.

Aircraft Timber	Bend Test				Compr. test Max. lb/sq. in.	Impact ft. lb. Izod	Specification
	Density lb/cub. ft.	Per cent. Moisture.	"E" lb/sq. in. $\times 10^6$	Modulus of rupture lb/sq. in.			
Ash	40	15	1·5	10,500	5,800	8	B.S.I.3V4
Walnut ...	35	15	1·5	11,500	7,000	7	B.S.I. 3V5
Mahogany ...	32	15	1·5	10,000	6,250	4	B.S.I. 3V7
Spruce ...	24	15	1·5	8,000	5,000	6	D.T.D. 36a

33. *Tensile strength.*—Wood has relatively high tensile strength in the direction of the grain but it is seldom that this strength can be fully developed. Measurement of tensile strength is difficult and requires great care in the design and construction of the test piece so that premature failure shall not occur by crushing or shearing of the ends. Tensile strength is of importance in airscrews where the roots of the blades have to withstand large centrifugal forces and it also plays a part in resisting final rupture during bending.

34. *Compression strength.*—The strength of wood in compression is of major importance since this property usually limits the load which can be carried by any member. Failure occurs by collapse of the tubular structure. In most timbers this collapse is at first confined to narrow bands running transversely across the grain. These compression bands or creases are most easily visible in conifers such as spruce. It is important to be able to detect creases at an early stage. Experiments may easily be made by bending a strip of spruce (or other conifer) in the hands and observing the compression (or concave) face. If a strong light be arranged to fall at grazing incidence (skimming along the surface) the small creases will show up at an early stage of the bending.

35. Wood which has once formed a compression crease is permanently damaged. Although it is able to withstand compression it can no longer withstand tension and is, therefore, a potential danger in any position where it may be subject to reversals of load. This may be demonstrated in a simple manner by reversing the direction of bending on the small strip described in para. 34. If a compression crease has been formed, the reversed bending will apply tension across the crease and the strip will snap suddenly.

36. When compression acts across the grain, local creases do not usually form. The walls of the wood cells gradually collapse allowing the exposed surfaces to assume a ribbed or washboard appearance. A large amount of compression is possible without definite fracture and it has even been proposed to use wood compressed or "consolidated" in this manner, in place of other woods of greater density.

37. *Bending strength.*—A member which is in bending is subject to compressive strain along its concave face and tensile strain along its convex face. If the bending be continued, compression creases will form, but the adjacent parts will continue to support the compression stresses. As the bending strain increases, these compression failures will extend into the member until the tensile stress on the convex side becomes greater than the wood can stand, when the beam will collapse.

38. It is well known that the "modulus of rupture", or apparent stress which a rectangular bar will support when subject to bending, is considerably greater than the compression strength of the material. (About 60 per cent. greater in spruce.) This is not because any part of the wood can support more compressive stress in a beam than in a compression test piece but because the method of calculating the stress in bending takes no account of the power or ability of the wood to pass on any stress which it cannot support to surrounding portions which are less severely strained by the bending action. It is evident that in the case of a spar of "box' or "I" section where the less strained material has been largely removed, the wood has little opportunity of escaping its punishment and the member fails soon after the surface stress reaches the compression strength of the timber.

39. It will be clear from this that the "Modulus of rupture" must be used with caution in the design of wood members. In America it has been customary to apply to the "Modulus of rupture" a correcting factor (called "form factor") to allow for the effect of the shape of the cross section. In the British Isles a rough working rule has been used by which the compression strength of spruce is taken as ·500 lb/sq. in. greater in bending than in simple end compression.

40. Much may be learnt by careful examination of the fractures of light rods of spruce (or other timbers) broken in the hands. If a simple bending fracture be viewed from the end, in line with the grain (preferably using one eye only) the fractured area will be seen to consist of two parts, namely (i) The compression side, with comparatively flat areas where compression creases have formed—where this type of fracture extends across the entire section, the fracture is sometimes described as "short", "carrotty", or "block" fracture—and (ii) the tension side, with jagged, splintery surfaces. In timber which is weak for its species, the fracture on the tension side may also be very short; this is the characteristic of brittle timber. Experience in recognising these types of fracture is frequently of value in determining the nature of the forces which may have caused the accidental breaking of a wood member.

41. *Shear.*—One of the important characteristics of wood is the disparity between its tensile and shear strength. In most materials the shear strength is at least half the numerical value of the tensile strength. In woods it is less than one tenth of the tensile strength. It is largely for this reason that the full tensile strength of wood can seldom be utilised since attempts to apply tension to the wood are liable to cause shear failures.

42. *Elasticity.*—The most useful elastic property of wood is its extensibility under loads applied in the direction of the grain. The resistance to change in length is usually expressed as (Young's) "Modulus of elasticity" or "E". The value of "E" in the radial direction of the grain is about one tenth and in the tangential direction, one twentieth of the value for the longitudinal direction.

43. *Brittleness.*—Most of the mechanical properties of any species of wood vary in sympathy with the density of particular samples, the heavier pieces being correspondingly stronger and stiffer. This relation is much less marked in the case of brittleness and particularly "notch-brittleness" or liability to break off easily at any notch or sudden change of section, when subject to quickly applied bending forces. Many instances have been observed where samples of timber which are satisfactory in other respects are unusually brittle and although heavy samples are more likely to be tough, this is not always found to be the case.

Methods of test

44. The methods of test have now been standardised and are described in British Standard Specification No. 373. The tests usually made to determine the main physical properties of timber are as follows:—

Moisture content.
Density.
Compression. Parallel and perpendicular to the grain.
Shear.
Bending.
Impact.
Hardness.
Cleavage (liability to splitting).

Aircraft timbers

45. The species of timber most frequently used in aircraft are:—

Sitka spruce (*Picea sitchensis*).—The best known timber for spars, struts and structural parts generally. Chief source of supply—Canada.

Cuban mahogany (*Swietenia mahogani*)
Honduras mahogany (*Swietenia macrophylla*) } Used for airscrews.

Chief source of supply—Central America. There are many varieties of so-called mahoganies. Some of the better known come from West Africa. Although some samples are suitable substitutes for the Central American mahoganies the average quality is inferior.

Sweet birch (*Betula lenta*)
Yellow birch (*Betula lutea*) } Used for plywood and occasionally for the outer laminations of airscrews. Chief source of supply—Canada.

European ash (*Fraxinus excelsior*).—Occasionally used in structural parts where special hardness and strength are required. Source of supply—Europe.

American black walnut (*Juglans nigra*).—At one time extensively used for airscrews. The supply of suitable quality is now very limited.

46. The English names of timbers vary greatly and cause considerable confusion. As the Latin or botanical names are not always convenient or suitable for general use particular English names are being standardised in this country. A list of timbers which are, or have been, considered for use in aircraft is given in British Standard Specification No. 491.

Plywood

47. A characteristic of wood which is usually a disadvantage is the inequality of its strength properties in different directions with respect to the grain. This disadvantage can be overcome to some extent by gluing sheets of wood together with the grain of adjacent pieces running at right angles to one another. The resulting material is usually called "plywood".

48. The necessary thin sheets of wood are obtained from the log by slicing or by shaving circumferentially in a lathe. The sheets—which are called "veneers"—are then known as "slice" or "rotary" cut and can be obtained in almost any thickness from that of paper upwards.

49. The plywood most generally used consists of three of these veneers arranged with the grain of the middle ply running at right angles to the grain of the two outer plies. After being coated with cement in a special machine the plies are assembled and placed in a large press.

50. Plywood for use in structural parts is usually made of birch but for parts where great strength is not necessary other woods are sometimes used.

51. *Cements.*—The cements most common in aircraft plywood are (i) Blood albumen, (ii) Casein, and (iii) Synthetic resin.

(i) Blood albumen plywood is usually made in heated presses ("Hot press" process). It may be recognised by the dark colour of the adhesive when the plies are pulled apart.

(ii) Casein cement (which is a product derived from milk) can be applied without heat. Plywood which has been made with casein cement can usually be recognised by the presence of minute white flecks or spots in the adhesive layer.

Note.—Both these cements offer considerable resistance to the action of moisture but neither can claim to be waterproof.

(iii) *Synthetic resin.*—The recent introduction of synthetic resin cements has greatly increased the water resistance of plywood, especially in thin sizes. The synthetic resin is prepared by chemical processes and in its final form is similar to the material commonly known as "bakelite". It is usually applied in the form of thin sheets of impregnated tissue which are interleaved between the plies. The boards are then placed in hot presses which convert the resin into its final form and thus bind the plies of the wood together. This type of adhesive is also very resistant to fungus attack.

Demands for timber

52. To assist the issuing depot in the selection of suitable material, demands for timber should, wherever possible, state the finished sizes and particulars of the items to be manufactured, thus reducing the wastage of material in converting it to the required dimensions. It must be remembered that often the thicker sizes are inferior in general quality, owing to the irregularity of growth and seasoning, this being especially true of ash.

53. It is emphasised that the procedure of resawing timber down the centre of thick planks is wrong in principle, firstly because of the probability of the thicker plank having been cut from old trees of inferior quality and secondly because the exposure of the new surfaces, which may have a higher moisture content, is an inducement to warping and splitting; also, two thinner boards are cheaper than one of double thickness.

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