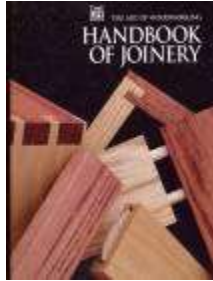


Το Ξύλο

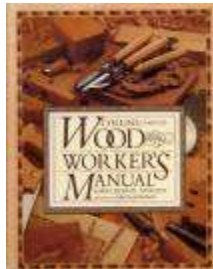
Μορφοποίηση και Συνδεσμολογία



Η προέλευση των περισσότερων εικόνων της παρούσης διαλέξεως είναι από τα βιβλία:



*The Art of Woodworking, **Handbook of Joinery**. Ed
TIME-LIFE books, 1993
ISBN. 0-8094-9941-X*



*A.T. Jackson- D. Day, **Wood Worker's Manual**, ed.
Harper-Collins Publishers, 1994
ISBN. 0-00-411565-1*

*A. Watts, **Modern Construction Handbook**, ed.
Springer Wien New York, 2001
ISBN. 3-211-83491-5*

SEE ALSO

Converting wood	12
Softwoods	16-19
Hardwoods	20-29
Handtools	75-114
Power tools	123-154
Machine tools	155-208

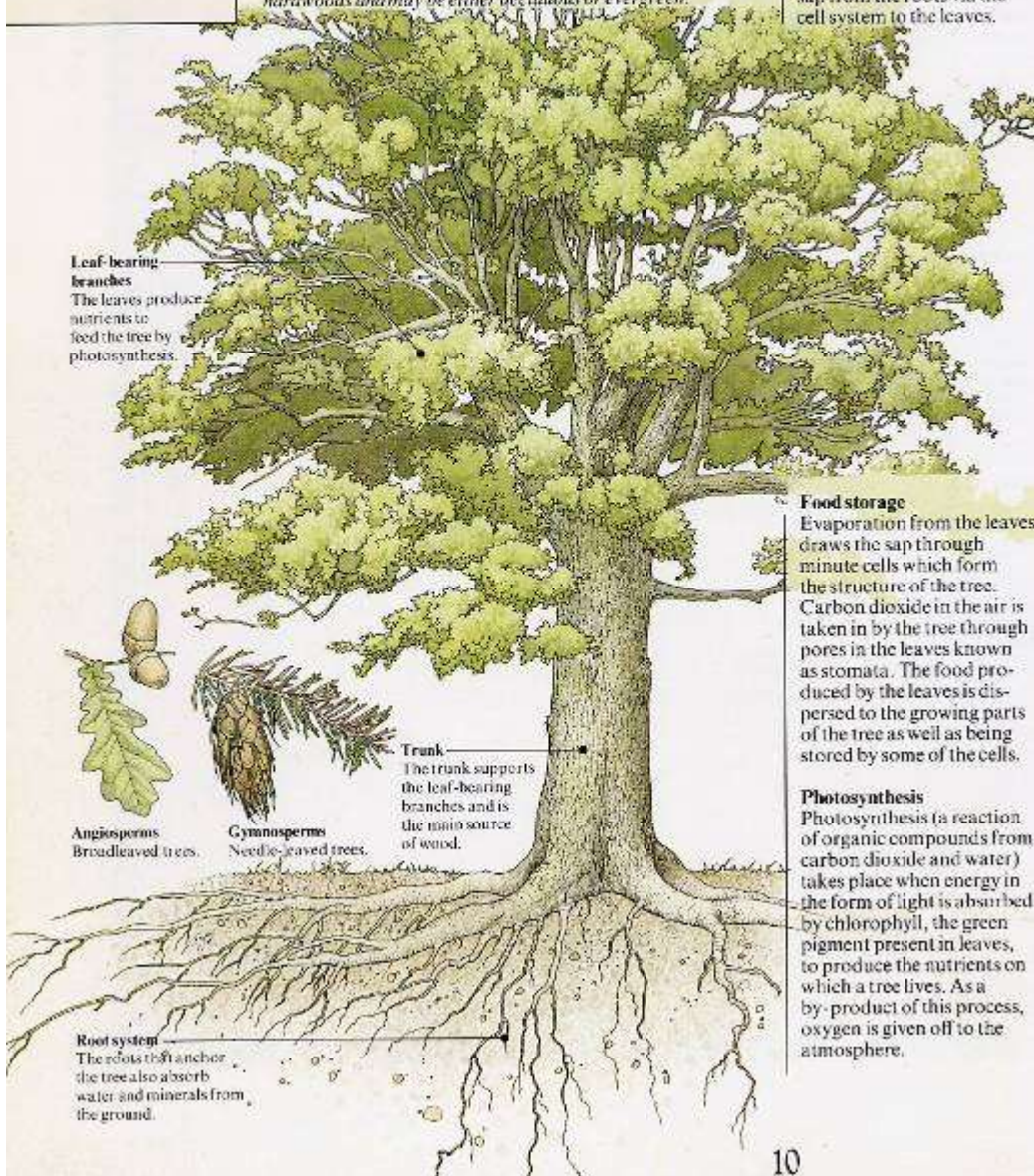
THE LIVING TREE

In order to appreciate the properties of wood and how it is worked and finished, it is worthwhile understanding something of the way trees grow.

Trees form an important division of the plant kingdom known as the Spermatophyta (seed bearing plants). This division is subdivided into Gymnospermae and Angiospermae. Gymnosperms are needle-leaved coniferous trees commonly referred to as softwoods. Angiosperms are broadleaved trees known as hardwoods and may be either deciduous or evergreen.

The structure of a tree

A typical tree has a main stem, known as the bole or trunk, which carries a crown of leaf-bearing branches. A root system anchors the tree in the ground and absorbs water and minerals to sustain the tree. The trunk carries the sap from the roots via the cell system to the leaves.

**Leaf-bearing branches**

The leaves produce nutrients to feed the tree by photosynthesis.

Trunk

The trunk supports the leaf-bearing branches and is the main source of wood.

Angiosperms
Broadleaved trees.

Gymnosperms
Needle-leaved trees.

Root system

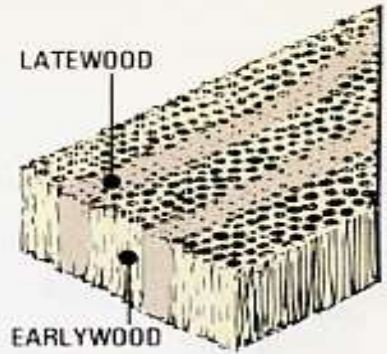
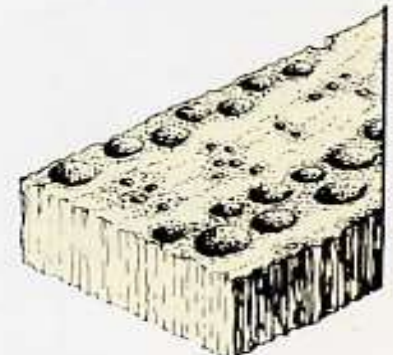
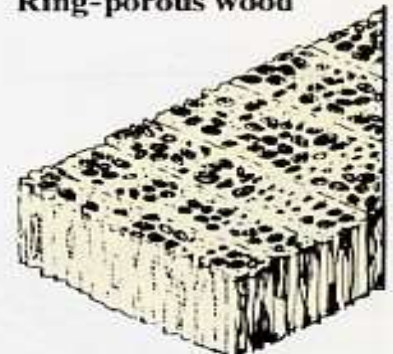
The roots that anchor the tree also absorb water and minerals from the ground.

Food storage

Evaporation from the leaves draws the sap through minute cells which form the structure of the tree. Carbon dioxide in the air is taken in by the tree through pores in the leaves known as stomata. The food produced by the leaves is dispersed to the growing parts of the tree as well as being stored by some of the cells.

Photosynthesis

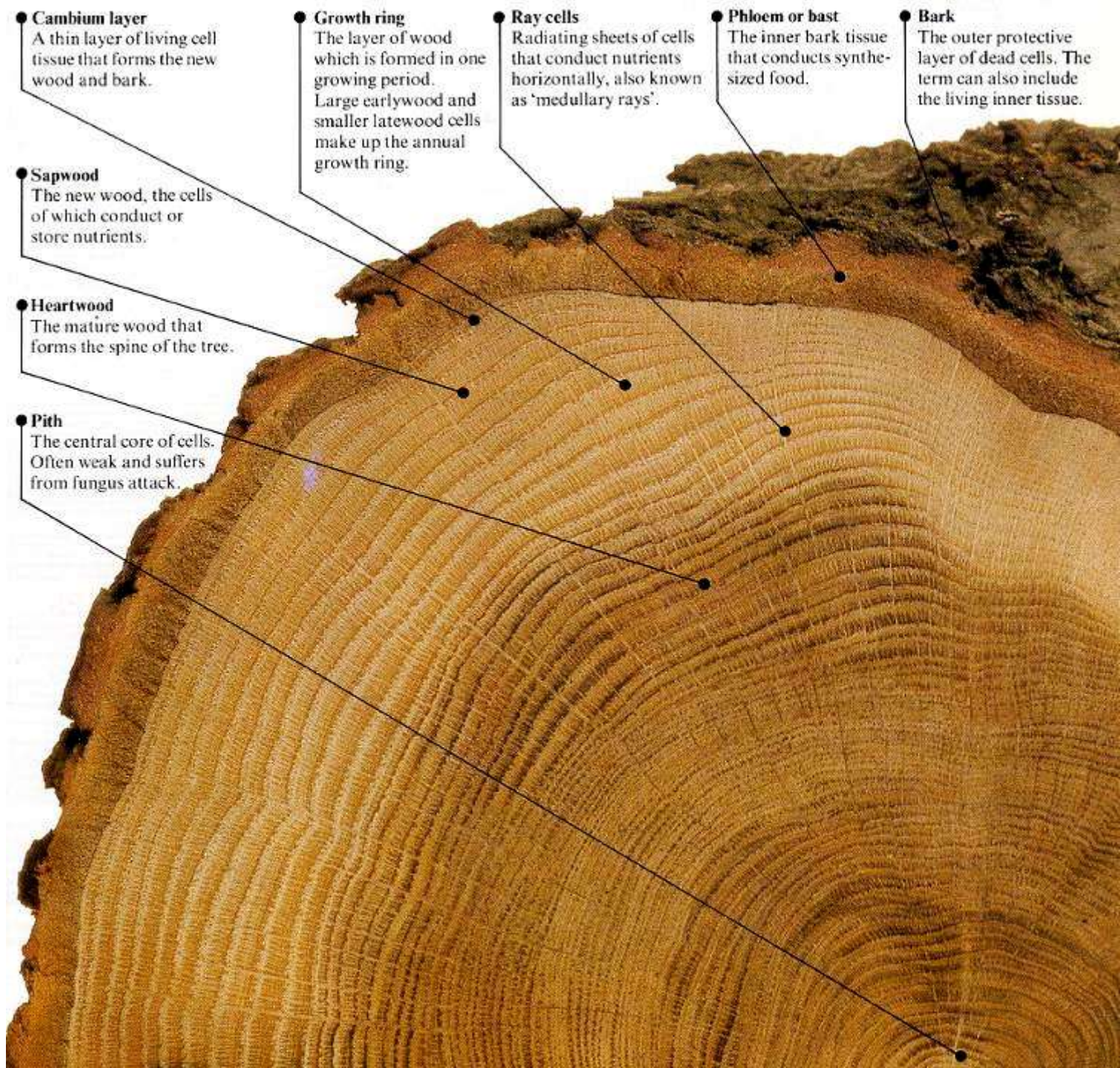
Photosynthesis (a reaction of organic compounds from carbon dioxide and water) takes place when energy in the form of light is absorbed by chlorophyll, the green pigment present in leaves, to produce the nutrients on which a tree lives. As a by-product of this process, oxygen is given off to the atmosphere.

LATEWOOD**EARLYWOOD****Earlywood and latewood****Ring-porous wood****Diffuse-porous wood**

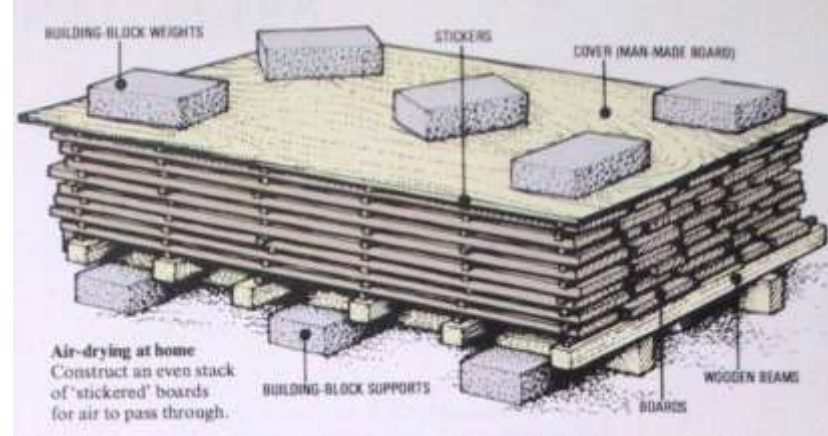
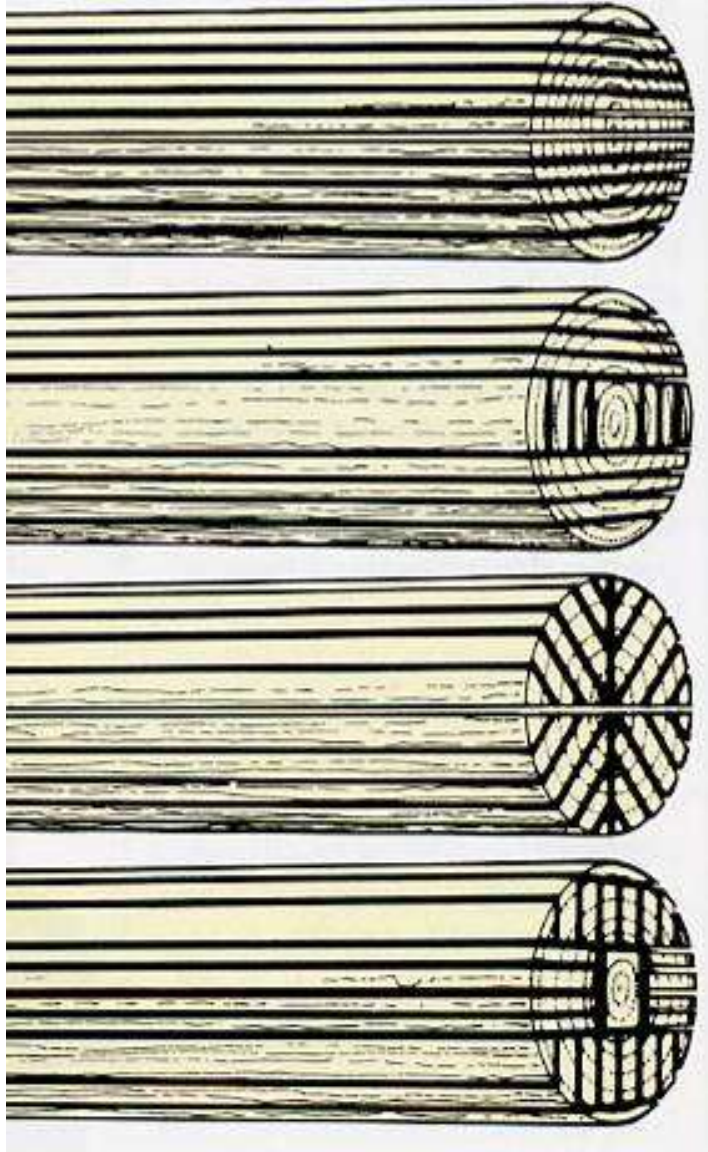


**Υλοτόμηση
την κατάλληλη εποχή,
μεταφορά και ξήρανση**

Τα μέρη του κορμού του δέντρου



Το σχίσμο του ξύλου στον καταρράκτη & η αποθήκευσή του για ξήρανση



Honeycomb checks occur inside the board when the outside stabilizes before the inside is dry. The inside shrinks more than the outside, which usually results in torn internal fibres.

Shakes are splits that occur in the structure of the wood due to growth defects or shrinkage stresses. Cup or ring shakes are splits that open between the annual-growth rings.

Bow

Twist or wind

Spring

Ingrown bark can mar the appearance and weaken the structure of the wood.

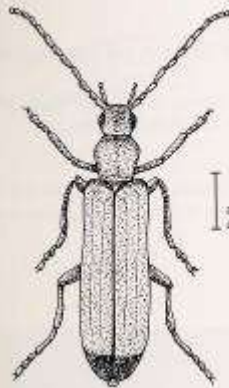
Dead or encased knots are the remains of dead branches, the stumps of which are overgrown by new growth rings. Dead knots tend to fall out when the wood dries. The grain of the wood surrounding a knot is irregular, which makes it hard to work.

Surface checking usually occurs along the rays, and is usually caused by rapid drying of the surface.

End splits are common and are caused by rapid drying of the exposed end. Sealing the ends with waterproof paint can prevent splitting.

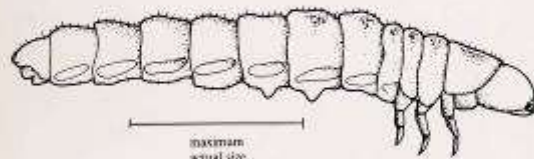
Bowing or warping is caused by stacking boards badly and introduces stresses which make the wood difficult to cut. 'Reaction' wood is also prone to cast when dried or cut.

Ελαττώματα του ξύλου κυρίως λόγω κακής ξήρανσης και ακατάλληλης αποθήκευσης.



average
actual size

Wharf borer beetle — adult (from above)

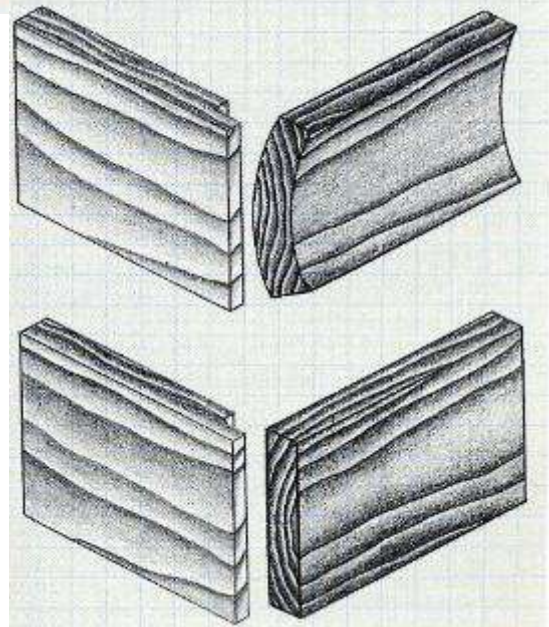
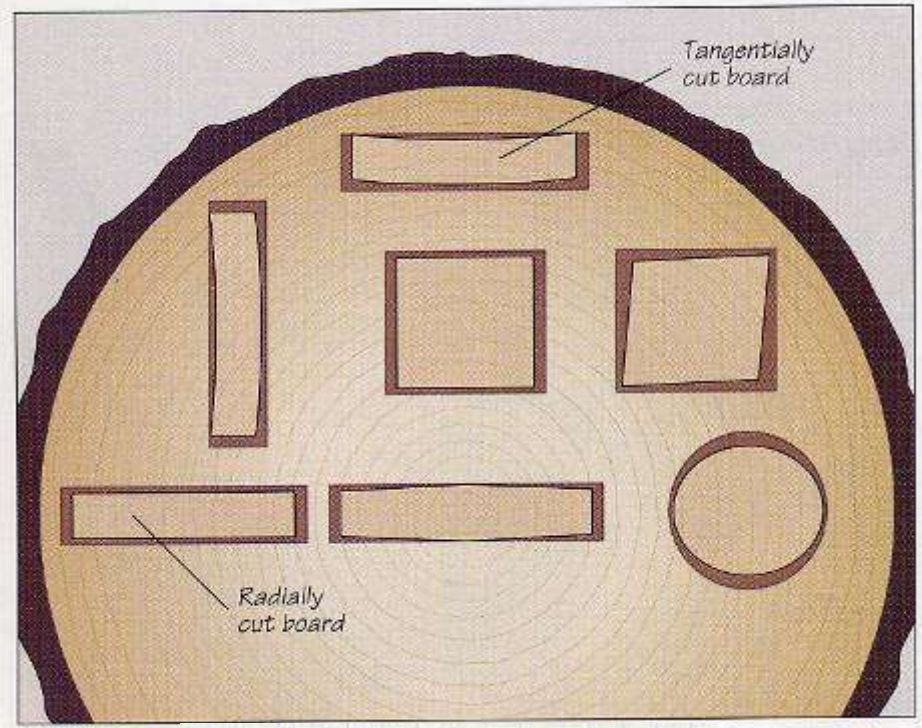


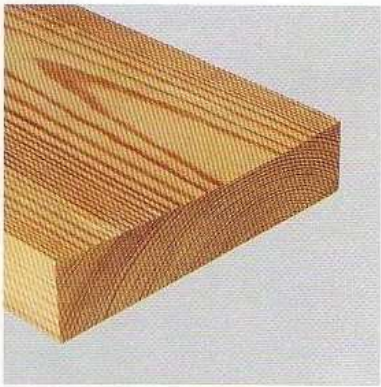
maximum
actual size

Wharf borer beetle — larva (from the side)

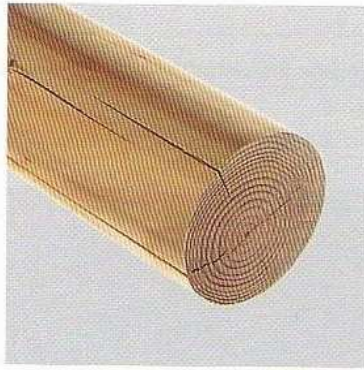


GROWTH RINGS AND MOVEMENT

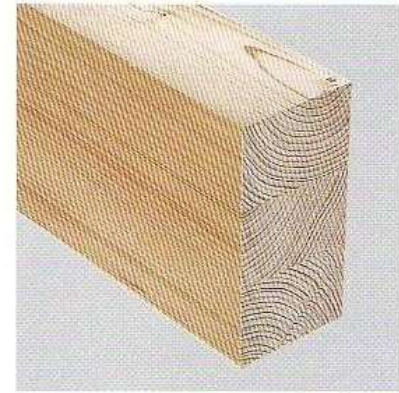




Board



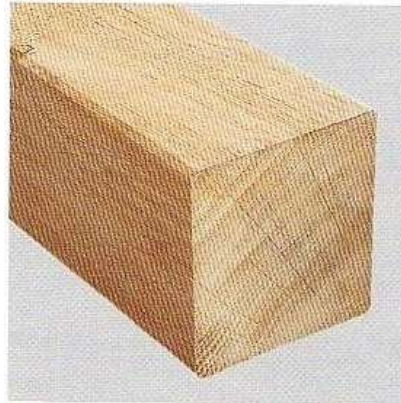
Log



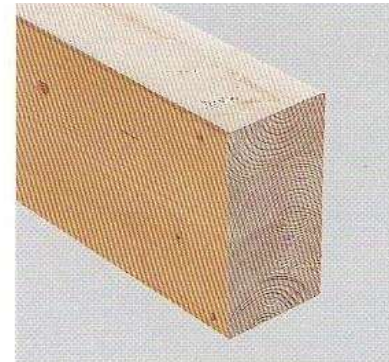
Trio beam (duo beam similar)



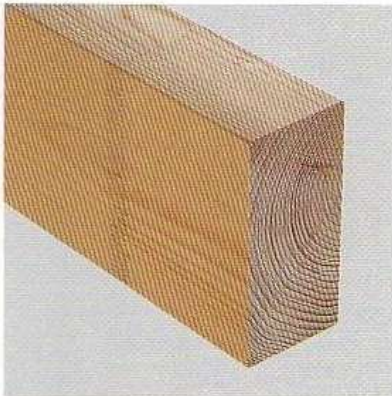
Profiled boards



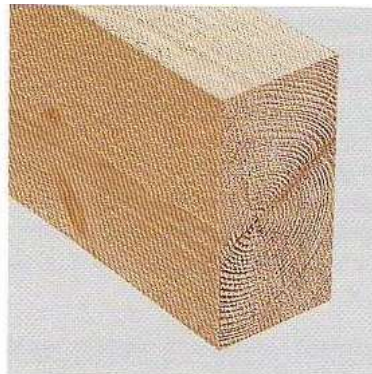
Solid hardwood section



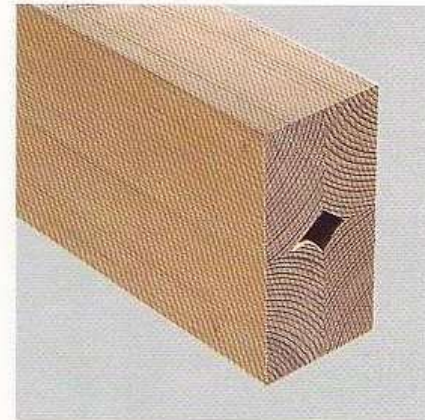
Glued laminated timber (glulam)



Solid structural timber KVH®



Solid softwood section



Four-piece beam

• CEDAR OF LEBANON
Cedrus libani
Other names: True cedar.
Source: Middle East.
Characteristics: An aromatic wood, with light-brown heartwood. Clearly marked grain produced by contrasting earlywood and latewood. Can be knotty.
Workability: Good.
Average dried weight: 560kg/m³ (35lb/ft³).
Common uses: Interior and garden furniture, construction, joinery.
Finishing: Good.

• CEDAR, WESTERN RED
Thuja plicata
Other names: Giant arbor vitae (USA), red cedar (Canada), British Columbia red cedar (UK).
Source: Canada, USA, UK, New Zealand.
Characteristics: Relatively soft aromatic timber. Reddish brown in colour, fading to silver-grey after long exposure to weathering.
Workability: Good.
Average dried weight: 370kg/m³ (23lb/ft³).
Common uses: Shingles, exterior boarding and cladding, greenhouses and sheds.
Finishing: Good.

• CEDAR, YELLOW
Chamaecyparis noveboracensis
Other names: Alaska yellow cedar, Pacific coast yellow cedar.
Source: Pacific coast of North America.
Characteristics: A pale yellow even-textured wood, with fine straight grain. It is relatively light, stiff and stable when dry.
Workability: Good.
Average dried weight: 500kg/m³ (31lb/ft³).
Common uses: Furniture, boatbuilding, joinery, veneer.
Finishing: Good.

• FIR, DOUGLAS
Pseudotsuga douglasii
Other names: British Columbian pine, Oregon pine.
Source: Canada, Western USA, UK.
Characteristics: A straight-grained reddish-brown timber, with pronounced grain. Obtainable in large knot-free sizes.
Workability: Good.
Average dried weight: 530kg/m³ (33lb/ft³).
Common uses: Plywood, joinery. Widely used in North America for building work.
Finishing: Fair.

• FIR, SILVER
Abies alba
Other names: White wood.
Source: Central and Southern Europe.
Characteristics: A pale cream non-resinous and almost colourless wood, with straight grain and fine texture. Similar to and often marketed together with Norway spruce (*Picea abies*).
Workability: Good.
Average dried weight: 480kg/m³ (30lb/ft³).
Common uses: Joinery, construction, boxes, plywood, poles.
Finishing: Good.

• HEMLOCK, WESTERN
Tsuga seryphylla
Other names: Pacific hemlock, British Columbia hemlock.
Source: Canada, USA, UK.
Characteristics: A pale-brown semi-lustrous wood, with relatively distinct growth rings. It is even-textured, has straight grain and is non-resinous.
Workability: Good.
Average dried weight: 500kg/m³ (31lb/ft³).
Common uses: Construction work, joinery, plywood.
Finishing: Good.

• KAURI, QUEENSLAND
Agathis spp.
Other names: North Queensland kauri, South Queensland kauri.
Source: Australia.
Characteristics: A straight-grained wood, with fine even texture. Colour varies from pale cream-brown to pinkish-brown.
Workability: Good.
Average dried weight: 480kg/m³ (30lb/ft³).
Common uses: Joinery, furniture.
Finishing: Good.

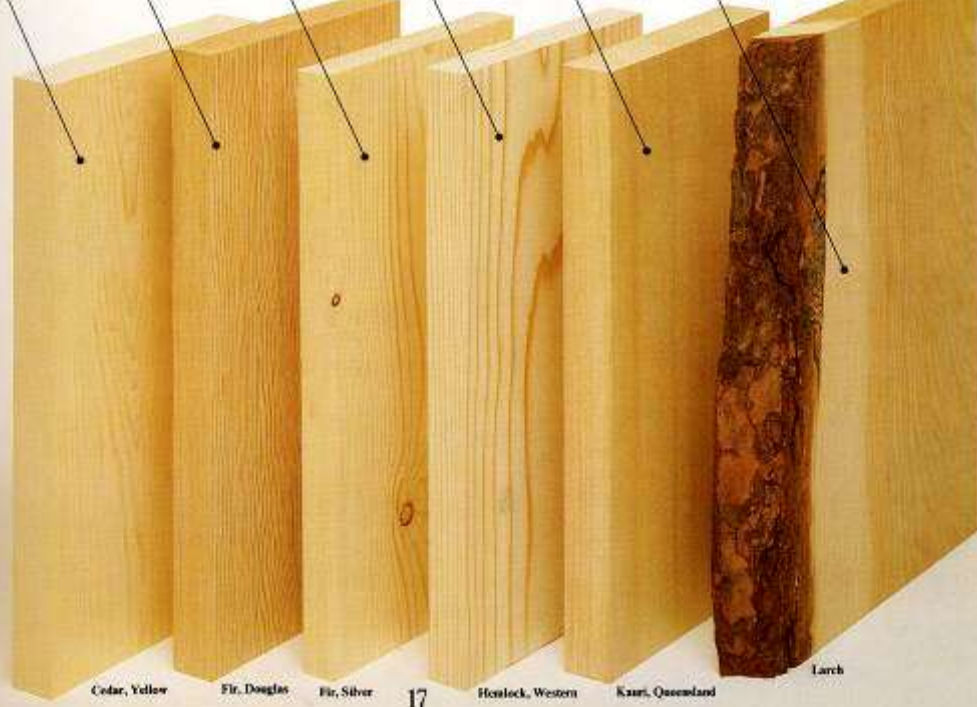
• LARCH
Larix decidua
Other names: None.
Source: Europe, particularly mountainous areas.
Characteristics: Tougher than most conifers, it is a straight-grained timber of uniform texture. Pale to rich red heartwood, light-coloured sapwood. Larches shed their needles in winter.
Workability: Medium.
Average dried weight: 500kg/m³ (31lb/ft³).
Common uses: Joinery, pit props, boat planking.
Finishing: Fair.

• Colour change
 The small square samples show the actual grain-size of each species and the effect when a clear finish is applied.



Cedar of Lebanon

Cedar, Western red



Cedar, Yellow

Fir, Douglas

Fir, Silver

Hemlock, Western

Kauri, Queensland

Larch

● PINE, HOOP
Ascaris cuneiformis
Other names: Quocolor pine (though not a true pine)
Sources: Australia, Papua New Guinea
Characteristics: A straight-grained fine-textured wood. Similar to Patana pine in appearance, it has wide light-brown sapwood with yellow-brown heartwood.
Workability: Good.
Average dried weight: 50kg/m³ (31b/ft³).
Common uses: Joinery, furniture, turnery, construction.
Finishing: Good.

● PINE, PARANA
Ascaris argenteifolia
Other names: Brazilian pine (USA), Sources: Argentina, Brazil and Paraguay
Characteristics: Even-textured straight-grained timber, with inconspicuous growth rings. Light brown heartwood, with dark-brown core. Often has bright red streaks.
Workability: Good.
Average dried weight: 50kg/m³ (31b/ft³).
Common uses: Joinery, furniture, turnery.
Finishing: Good.

● PINE, PONDEROSA
Pinus ponderosa
Other names: Western yellow pine, Californian white pine (USA), British Columbia soft pine (Canada), Sources: Western Canada and USA.
Characteristics: The wide pale-yellow sapwood is soft, non-resinous and even-textured. The heavier heartwood is deep yellow to reddish-brown, and resinous.
Workability: Good-fair.
Average dried weight: 48kg/m³ (30b/ft³).
Common uses: Pattern-making, doors, furniture (sapwood), joinery, construction (heartwood).
Finishing: Fair.

● PINE, SUGAR
Pinus lambertiana
Other names: Californian sugar pine, Sources: USA.
Characteristics: Moderately soft, with medium-course texture and even grain. It has white sapwood and pale to reddish-brown heartwood.
Workability: Good.
Average dried weight: 45kg/m³ (28b/ft³).
Common uses: Joinery, light construction.
Finishing: Fair.

● PINE, WESTERN WHITE
Pinus monticola
Other names: Idaho white pine, Sources: Canada, USA.
Characteristics: A straight-grained even-textured wood. Pale yellow to reddish brown, with little variation in colour between sapwood and heartwood.
Workability: Good.
Average dried weight: 45kg/m³ (28b/ft³).
Common uses: Joinery, construction, furniture, scabbling, plywood.
Finishing: Good.

● PINE, YELLOW
Pinus strobus
Other names: Eastern white pine, Northern white pine (USA), Quebec pine, Weymouth pine (UK), Sources: USA, Eastern Canada.
Characteristics: A soft pine with straight grain, fine even texture and inconspicuous annual growth rings. It is pale yellow to pale brown in colour, with fine resin duct marks.
Workability: Good.
Average dried weight: 42kg/m³ (26b/ft³).
Common uses: Pattern-making, joinery, musical instruments, furniture, construction work.
Finishing: Good.

● RIMEU
Ascaris cupressiformis
Other names: Red pine, Sources: New Zealand.
Characteristics: A fine even-textured straight-grained timber. Heartwood is reddish brown, turning to lighter shades of brown through to the yellowish sapwood.
Workability: Good.
Average dried weight: 52kg/m³ (33b/ft³).
Common uses: Furniture, joinery, plywood, veneer.
Finishing: Good.

● REDWOOD
Pinus resinosa
Other names: Scots pine, Scandinavian redwood, Russian redwood, Sources: Europe, Northern Asia.
Characteristics: A light-coloured resinous wood, with yellow-brown to reddish-brown heartwood and light white-yellow sapwood.
Workability: Fair.
Average dried weight: 42kg/m³ (26b/ft³).
Common uses: Shingles, exterior cladding, interior joinery, coffins, posts, plywood.
Finishing: Good.

● SEQUOIA
Sequoia sempervirens
Other names: Californian redwood, Sources: USA.
Characteristics: A straight-grained reddish-brown timber, with marked contrast between earlywood and latewood. The texture can vary from fine and even to relatively coarse. It is non-resinous.
Workability: Fair.
Average dried weight: 42kg/m³ (26b/ft³).
Common uses: Shingles, exterior cladding, interior joinery, coffins, posts, plywood.
Finishing: Good.

● SPRUCE, NORWAY
Picea abies
Other names: European whitewood, European spruce, Sources: Europe.
Characteristics: A lustrous straight-grained even-textured wood, with almost white earlywood and pale yellow-brown latewood.
Workability: Good.
Average dried weight: 47kg/m³ (29b/ft³).
Common uses: Construction, joinery, bones, plywood, piano soundboards and violin bellies.
Finishing: Good.

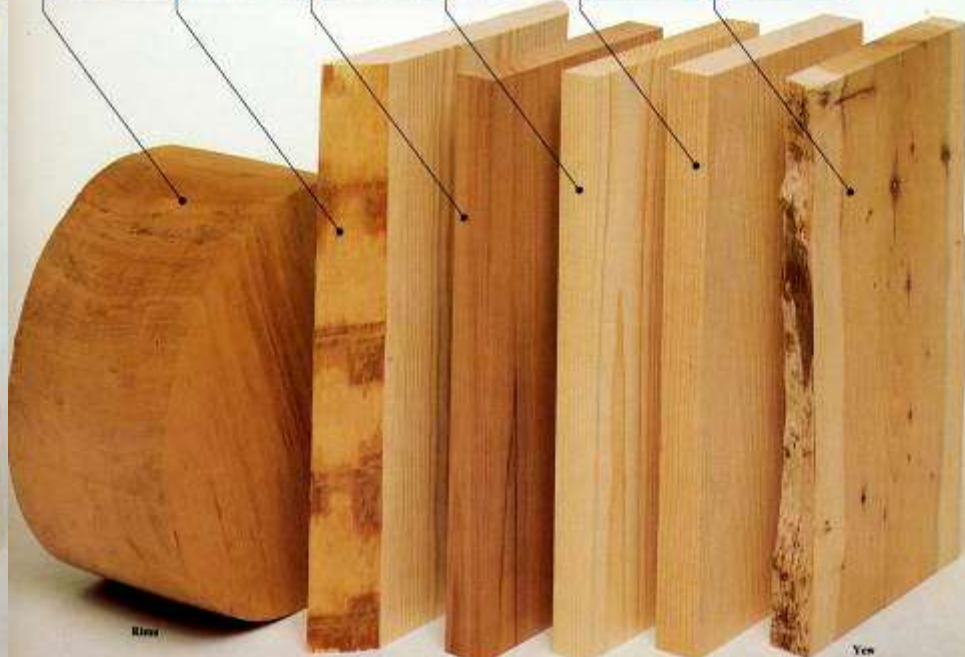
● SPRUCE, SITKA
Picea sitchensis
Other names: Silver spruce, Sources: Canada, USA, UK.
Characteristics: A non-resinous creamy-white wood, with highly pink heartwood. Usually straight-grained with even texture, depending on rate of growth.
Workability: Good.
Average dried weight: 48kg/m³ (30b/ft³).
Common uses: Construction, joinery, interior joinery, musical instruments, gliders, oars, racing skulls, plywood.
Finishing: Good.

● YEW
Taxus baccata
Other names: Common yew, European yew, Sources: Europe, Asia Minor, North Africa, Burma and the Himalayas.
Characteristics: A tough, hard softwood. It has an orange-red heartwood, with distinct light-coloured sapwood. The growth pattern makes the wood very decorative.
Workability: Difficult.
Average dried weight: 670kg/m³ (42b/ft³).
Common uses: Furniture, turnery, joinery.
Finishing: Good.

● Colour change
 The small square samples show the actual grain sizes of each species and the effect when a clear finish is applied.



Pine, Hoop Pine, Parana Pine, Ponderosa Pine, Sugar Pine, Western white Pine, Yellow



Rimeu Redwood, European Sequoia Spruce, Norway Spruce, Sitka Yew



Enlarged species
The indiscriminate destruction of the world's rainforests is leading to a severe shortage of tropical hardwoods. To conserve valuable resources, we only show those woods grown on plantations or managed forests. The species most at risk are marked with a felled-tree symbol.

Colour change
The small square samples show the actual grain size of each species and the effect when a clear finish is applied.

AFORMOSIA

Piptocarpha
Other names: Aosenle (Ivory Coast, France); kokrodia (Ghana, Ivory Coast); yim, egh (Nigeria).
Sources: West African.

Characteristics: A durable wood, with straight to interlocked grain. The yellow-brown heartwood darkens to the colour of oak, which it resembles, though it is finer textured and not so oily as oak.

Workability: Good.
Average dried weight: 710kg/m³ (44lb/ft³)
Common uses: Veneer, interior and exterior joinery, interior and exterior furniture.
Finishing: Good.



ALDER, RED

Alnus rubra
Other names: Western alder, Oregon alder.
Sources: Pacific coast of North America.
Characteristics: A soft relatively straight-grained even-textured wood, pale yellow to reddish brown in colour.

Workability: Good.
Average dried weight: 530kg/m³ (33lb/ft³)
Common uses: Furniture, turnery, carving, plywood, veneer.
Finishing: Good.



ASH

Fraxinus americana
Other names: Cinablan ash (UK); white ash (USA).
Sources: Canada and USA.
Characteristics: A coarse but generally straight-grained wood, with almost white sapwood, and pale-brown heartwood similar to European ash.

Workability: Medium.
Average dried weight: 670kg/m³ (42lb/ft³)
Common uses: Sports equipment and tool handles, boat building, joinery.
Finishing: Good.



ASH, EUROPEAN

Fraxinus excelsior
Other names: English, French, Polish ash etc. (according to origin).
Sources: Europe.
Characteristics: A tough coarse-textured straight-grained wood, which is pale brown in colour.

Workability: Good.
Average dried weight: 710kg/m³ (44lb/ft³)
Common uses: Sports equipment and tool handles, bentwood furniture, cabinet-making, plywood, veneer.
Finishing: Good.



BALSA

Ochroma lagopus
Other names: Guano (Puerto Rico, Honduras); kono (Cuba); polak (Belize, Nicaragua); topa (Paraguay); topa (Bolivia).
Sources: South America.
Characteristics: The softest and lightest commercial hardwood. An open straight-grained wood, with lustres very pale beige to pinkish colour.

Workability: Good.
Average dried weight: 160kg/m³ (10lb/ft³)
Common uses: Insulation, buoyancy aids, model-making, packaging.
Finishing: Fair.



BASSWOOD

Tilia americana
Other names: American lime.
Sources: Canada, USA.
Characteristics: A fine straight-grained even-textured wood. Creamy-white colour, turning to pale brown on exposure.

Workability: Good.
Average dried weight: 410kg/m³ (26lb/ft³)
Common uses: Carving and turnery, pattern-making, veneer, joinery.
Finishing: Good.



BEECH, AMERICAN

Fagus grandifolia
Other names: None.
Sources: Canada, USA.
Characteristics: Straight-grained wood, with fine even texture. Light brown to reddish brown in colour, slightly coarser than European beech.

Workability: Medium.
Average dried weight: 700kg/m³ (43lb/ft³)
Common uses: Cabinet-making, bentwood furniture, interior joinery, turnery.
Finishing: Good.



BEECH, EUROPEAN

Fagus sylvatica
Other names: English, Danish, French beech etc. (according to origin).
Sources: Europe.
Characteristics: Straight-grained wood, with fine even texture. Whitish brown, turning to yellowish brown on exposure. 'Steamed beech' is reddish brown.

Workability: Medium.
Average dried weight: 720kg/m³ (45lb/ft³)
Common uses: Cabinet-making, bentwood furniture, interior joinery, veneer, turnery, plywood.
Finishing: Good.



Afromosia

Alder, Red



Ash, American white

Ash, European



Balsa



Beech

Beech, European

Endangered species
The indiscriminate destruction of the world's rainforests is leading to a severe shortage of tropical hardwoods. To conserve valuable resources, use only those woods grown on plantations or managed forests. The species most at risk are marked with a felled-tree symbol.

Colour change
The small square samples show the actual grain-size of each species and the effect when a clear finish is applied.

BIRCH, PAPER
Betula papyrifera
Other names: American beech (UK); white birch (Canada).
Source: Canada, USA.
Characteristic: A fine straight-grained even-textured wood. It has a wide creamy-white sapwood and pale-brown heartwood.
Workability: Good.
Average dried weight: 540kg/m³ (40lb/ft³).
Common uses: Turnery, domestic woodware, plywood, veneer.
Finishing: Good.



BIRCH, YELLOW
Betula alba/pedunculata
Other names: Hard birch, betula wood (Canada), Canadian yellow birch, Quebec birch, American birch (UK).
Source: Canada, USA.
Characteristic: Straight-grained wood, with fine even texture. It has light yellow sapwood, and reddish-brown heartwood with distinct darker-colored growth rings.
Workability: Good.
Average dried weight: 710kg/m³ (44lb/ft³).
Common uses: Furniture, joinery, turnery, plywood.
Finishing: Good.



BLACKBEAN
Cassia sopherum
Other names: Merrett Bay bean, Merrett Bay chestnut, bean tree.
Source: Eastern Australia.
Characteristic: A generally straight-grained wood, but sometimes interlocked. Hard and heavy, it is rich brown in colour with grey-brown streaks.
Workability: Medium.
Average dried weight: 720kg/m³ (45lb/ft³).
Common uses: Furniture, joinery, veneer.
Finishing: Good.



BLACKWOOD, AUSTRALIAN
Acacia melanocoryne
Other names: Black wattle.
Source: Australia.
Characteristic: Generally straight-grained, but can be interlocked and wavy. A medium and even-textured wood, with lustrous golden-brown to dark-brown colour.
Workability: Medium.
Average dried weight: 670kg/m³ (41lb/ft³).
Common uses: Furniture, interior joinery, tannery, billiard tables, gun stocks and decorative veneer.
Finishing: Good.



BOXWOOD
Buxus sempervirens
Other names: European, Turkish, Iranian boxwood (according to origin).
Source: Southern Europe, Asia Minor, Western Asia.
Characteristic: A fine even-textured wood. It is dense and heavy, can have straight to irregular grain and a light yellow in colour.
Workability: Medium.
Average dried weight: 930kg/m³ (58lb/ft³).
Common uses: Carving, tool handles, turnery, rulers, inlay.
Finishing: Good.



BRAZIL WOOD
Calophyllum brasiliense
Other names: Pernambuco wood, balia wood, paro wood.
Source: Brazil.
Characteristic: Hard and heavy, with straight grain and fine even texture. Pale sapwood, contrasting with bright orange-red heartwood turning to red-brown. Stripy figure.
Workability: Medium.
Average dried weight: 1200kg/m³ (75lb/ft³).
Common uses: Dyewood, turnery, violin bows, gun stocks, exterior joinery, veneer.
Finishing: Good.



BUBENGA
Gaduaria africana
Other names: African rosewood, kevotingo (Gabon), ewingaga (Cameroon).
Source: Cameroons, Gabon.
Characteristic: Moderately coarse even-textured wood. It can have straight or interlocked and irregular grain. Red-brown in colour, with purple veining.
Workability: Good.
Average dried weight: 880kg/m³ (55lb/ft³).
Common uses: Furniture, veneer.
Finishing: Good.



BUTTERNUT
Juglans cinerea
Other names: White walnut.
Source: Canada, USA.
Characteristic: A straight-grained coarse-textured wood, with medium-brown heartwood.
Workability: Good.
Average dried weight: 490kg/m³ (30lb/ft³).
Common uses: Furniture, carving, interior joinery, veneer.
Finishing: Good.



CHERRY, AMERICAN
Prunus americana
Other names: Black cherry (Canada, USA); cabinet cherry (USA).
Source: Canada, USA.
Characteristic: A hard straight-grained wood, with fine texture. Heartwood is reddish brown to deep red, with brown flecks and some gum pockets.
Workability: Good.
Average dried weight: 580kg/m³ (36lb/ft³).
Common uses: Furniture, pattern-making, joinery, musical instruments, tobacco pipes.
Finishing: Good.



CHESTNUT, AMERICAN
Castanea dentata
Other names: Warty chestnut.
Source: Canada, USA.
Characteristic: Coarse-textured, with wide growth rings. Similar to oak in appearance, but lacks broad rays. Insect attack causes 'woolly chestnut'.
Workability: Good.
Average dried weight: 480kg/m³ (30lb/ft³).
Common uses: Furniture, coffin, poles, stakes.
Finishing: Good.



CHESTNUT, SWEET
Castanea sativa
Other names: Spanish chestnut, European chestnut.
Source: Europe, Asia Minor.
Characteristic: Coarse-textured, with straight or spiralled grain. Colour and texture similar to oak, but lacks oak ray figure. Reacts to ferruginous metal.
Workability: Good.
Average dried weight: 560kg/m³ (35lb/ft³).
Common uses: Furniture, turnery, coffin, poles, stakes.
Finishing: Good.



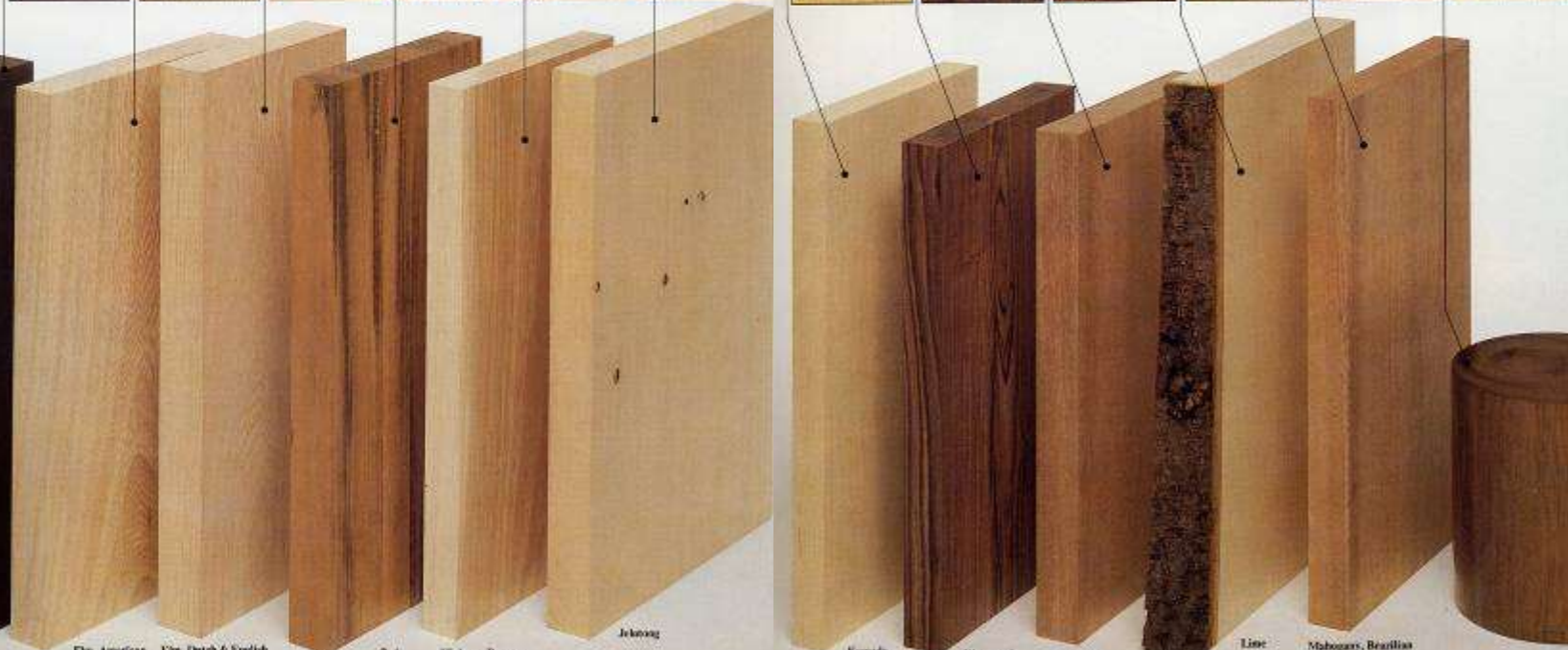
COCOBOLO
Dalbergia sissoo
Other names: Cozandillo (Mexico).
Source: West coast of Central America.
Characteristic: Hard, heavy, tough wood with irregular grain and medium-texture. Attractive variegated colour, from purple to yellow, with black markings turning to deep orange-red on exposure.
Workability: Good.
Average dried weight: 1000kg/m³ (63lb/ft³).
Common uses: Turnery, cutlery handles, brush backs, veneer.
Finishing: Good.



Birch, Paper Birch, Yellow Blackbean Blackwood, Australian Boxwood Brazil Wood Bubenga Butternut Cherry, American Chestnut, American Chestnut, Sweet Cocobolo

Endangered species
The imminent
destination of
the world's rainforests is
leading to a severe
shortage of tropical
hardwoods. To conserve
valuable resources, we
only show woods grown
on plantations or
managed forests. The
species most at risk are
marked with a falcon
symbol.

Colour change
The small square
samples show the actual
grain-size of each
species and the effect
when a clear finish is
applied.



EBONY
Diospyros ebenum
Other names: Tandu, tuku, ebano.
Source: Sri Lanka, India.
Characteristics: A hard, dense and heavy wood with fine even texture and straight, irregular or wavy grain. The sapwood is yellowish, the heartwood dark brown to black.
Workability: Difficult.
Average dried weight: 1190 kg/m³ (74 lb/ft³).
Common uses: Turnery, musical instruments, curly handker, inlay.
Finishing: Good.

ELM, AMERICAN WHITE
Ulmus americana
Other names: Water elm, swamp elm, soft elm (USA), orlumoos (Canada).
Source: Canada, USA.
Characteristics: A coarse-textured, strong, tough, medium-density wood, usually straight-grained, but can be interlocked. Has good bending properties. The heartwood is a pale reddish brown.
Workability: Good.
Average dried weight: 380 kg/m³ (24 lb/ft³).
Common uses: Boat-building, cooperage, furniture, agricultural implements.
Finishing: Good.

ELM, DUTCH & ENGLISH
Ulmus hollandicus
Ulmus procera
Other names: Dutch Cork bark elm, English Red elm.
Source: Europe.
Characteristics: A coarse-textured, strong, tough, medium-density wood, with distinct irregular growth rings giving attractive figure. The heartwood is beige-brown in colour.
Workability: Difficult.
Average dried weight: 950 kg/m³ (59 lb/ft³).
Common uses: Furniture, turnery, veneer.
Finishing: Good.

GONCALO ALVES
Artocarpus franciscanus
Other names: Zebra wood (UK), tigris wood (USA).
Source: Brazil.
Characteristics: Hard, medium-textured wood with irregular, inter-locked grain and hard and soft layers of material. Reddish-brown with dark streaks, similar in appearance to rosewood.
Workability: Difficult.
Average dried weight: 950 kg/m³ (59 lb/ft³).
Common uses: Furniture, turnery, veneer.
Finishing: Good.

HICKORY, PECAN
Carya hirsuta
Other names: Sweet pecan.
Source: USA.
Characteristics: A coarse-textured wood, generally straight-grained but can be irregular or wavy. The sapwood is white, heartwood reddish brown.
Workability: Difficult.
Average dried weight: 750 kg/m³ (47 lb/ft³).
Common uses: Striking tool handles, sports equipment, chairs and bentwood furniture.
Finishing: Good.

JELUTONG
Diospyros cordata
Other names: Jelutung bakit, jelutung, pany (Sarawak).
Source: Southern Asia.
Characteristics: A soft, medium, fine, even-textured wood with straight grain. Creamy pale brown in colour. Limes disease may be present.
Workability: Good.
Average dried weight: 470 kg/m³ (29 lb/ft³).
Common uses: Pattern-making, drawing boards, interior joinery, carving.
Finishing: Good.

KAUWUA
Endocarpus medellinus
Other names: Sato, New Guinea banyanwood.
Source: Papua New Guinea, Solomon Islands.
Characteristics: A fine even-textured, pale yellow-brown in colour, with a rather plain appearance.
Workability: Good.
Average dried weight: 680 kg/m³ (43 lb/ft³).
Common uses: Interior joinery and furniture.
Finishing: Good.

KINGWOOD
Dalbergia cordata
Other names: Violet wood, violeta (USA).
Source: South America.
Characteristics: A fine even-textured, porous wood. The heartwood has attractive variegated variped figure of violet-brown, black and golden yellow.
Workability: Good.
Average dried weight: 1200 kg/m³ (75 lb/ft³).
Common uses: Joinery, furniture, veneer.
Finishing: Good.

LAUAN, RED
Shorea rogersii
Other names: Noto.
Source: Philippines.
Characteristics: A relatively coarse-textured wood, with interlocked grain. The heartwood is medium to dark red in colour.
Workability: Good.
Average dried weight: 630 kg/m³ (39 lb/ft³).
Common uses: Interior joinery, boat-building, furniture, veneer.
Finishing: Good.

LIME
Tilia vulgaris
Other names: Linden (Germany).
Source: Europe.
Characteristics: A soft straight-grained wood, with fine uniform texture. Colour white to pale yellow, darkening to light brown on exposure.
Workability: Good.
Average dried weight: 500 kg/m³ (31 lb/ft³).
Common uses: Bronch handles, hat blocks, sounding boards, harps, toys, claps, carving.
Finishing: Good.

MAHOAGANY, BRAZILIAN
Saccolobos macrophylla
Other names: Central American, Honduran, Costa Rican, Dominican mahogany etc. (according to country of origin).
Source: Central and South America.
Characteristics: A medium-textured wood with straight and even or slightly wavy grain. Heartwood is reddish brown to deep red.
Workability: Good.
Average dried weight: 560 kg/m³ (35 lb/ft³).
Common uses: Interior paneling and joinery, boat planking, carving, furniture, pianos, veneers.
Finishing: Good.

LIGNUM VITAE
Guaiacum officinale
Other names: Guayacan (Spain), botou de gao (France), guayacan negro, palo santo (Cuba), ironwood (USA).
Source: West Indies and tropical America.
Characteristics: Very hard, heavy wood, has fine texture and closely interlocked grain. Heartwood is dark greenish brown to black. Naturally oily.
Workability: Difficult.
Average dried weight: 1250 kg/m³ (78 lb/ft³).
Common uses: Bearings, pulleys, rollers, turnery.
Finishing: Good.

Ebony Elm, American Elm, Dutch & English Goncalo Alves 24 Hickory, Pecan Jelutung Kauwua Kingwood Lauan, Red 25 Lime Mahogany, Brazilian Lignum Vitae



Endangered species
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Colour change
The small square samples show the actual grain-size of each species and the effect when a clear finish is applied.

MAPLE, HARD
Acer saccharum
Other names: Rock maple, sugar maple.
Sources: Canada, USA.
Characteristics: Hard, heavy, straight-grained wood with fine texture. White unspiced, with light reddish-brown heartwood.
Workability: Difficult.
Average dried weight: 740kg/m³ (45lb/ft³).
Common uses: Furniture, turnery, musical instruments, butcher's blocks, flooring, veneer.
Finishing: Fair.

MAPLE, SOFT
Acer rubrum
Other names: Red maple.
Sources: Canada, USA.
Characteristics: Straight-grained fine-textured wood, not as strong as hard maple. Light creamy-brown in colour.
Workability: Medium.
Average dried weight: 630kg/m³ (39lb/ft³).
Common uses: Furniture, interior joinery, turnery, veneers, fused instruments, flooring, plywood.
Finishing: Good.

OAK, AMERICAN RED
Quercus rubra
Other names: Northern red oak.
Sources: Canada, USA.
Characteristics: Straight-grained, with coarse texture and less attractive figure than white oak. Pinkish red in colour.
Workability: Good.
Average dried weight: 750kg/m³ (46lb/ft³).
Common uses: Furniture, interior joinery, turnery, veneers, fused instruments, flooring, plywood.
Finishing: Good.

OAK, AMERICAN WHITE
Quercus alba
Other names: White oak (USA).
Sources: USA, Canada.
Characteristics: Straight-grained, with medium-coarse to coarse texture. Similar in appearance to European oak, but more variable in colour.
Workability: Good.
Average dried weight: 730kg/m³ (45lb/ft³).
Common uses: Construction, flooring, furniture, interior joinery, plywood, veneers.
Finishing: Good.

OAK, JAPANESE
Quercus mongolica
Other names: Okinao.
Sources: Japan.
Characteristics: Straight-grained and coarse-textured wood, milder than European and American white oak. Light yellowish brown in colour.
Workability: Good.
Average dried weight: 670kg/m³ (41lb/ft³).
Common uses: Furniture, joinery, flooring, boatbuilding, joinery, veneer.
Finishing: Good.

OAK, EUROPEAN
Quercus robur
Quercus petraea
Other names: English, French, Polish oak etc. (according to country of origin).
Sources: Europe, Asia Minor, North Africa.
Characteristics: A coarse-textured and straight-grained wood with distinct growth rings and broad rays when quarter-sawn. Pale brown in colour.
Workability: Good.
Average dried weight: 720kg/m³ (45lb/ft³).
Common uses: Furniture, joinery, exterior woodwork, flooring, carvings, boatbuilding.
Finishing: Good.

OBECHE
Triploca danielliana
Other names: Obetsi, ambe (Nigeria), sawu (Ghana), samba, sawa (Ivory Coast), ayem (Cameroon).
Sources: West Africa.
Characteristics: A light-weight (rather featureless) wood, with fine even texture. The grain can be rather locked. Creamy white to pale yellow in colour.
Workability: Good.
Average dried weight: 590kg/m³ (37lb/ft³).
Common uses: Interior joinery, furniture, turnery, handles, flooring, known as a dyewood.
Finishing: Good.

PADAUK, AFRICAN
Pterocarpus soyauxii
Other names: Camwood, barwood.
Sources: West Africa.
Characteristics: A hard, heavy wood with straight to interlocked grain and moderately coarse texture. Rich red to purple-brown colour, with red streaks.
Workability: Good.
Average dried weight: 710kg/m³ (44lb/ft³).
Common uses: Interior joinery, furniture, turnery, handles, flooring, known as a dyewood.
Finishing: Good.

PLANE, EUROPEAN
Platanus occidentalis
Other names: London plane, English, French plane etc. (according to origin).
Sources: Europe.
Characteristics: Straight-grained wood, with fine to medium texture. Light reddish-brown heartwood, with distinct darker rays producing attractive fleck figure known as 'laserwood' when quarter-sawn. Similar to but darker than American sycamore (*Platanus occidentalis*).
Workability: Good.
Average dried weight: 600kg/m³ (37lb/ft³).
Common uses: Furniture, turnery, veneer.
Finishing: Good.

PURPLEHEART
Polydora spp.
Other names: Amaranth (USA), karoboreh, saka, sukavali (Guyana), purplehart (Surinam), pau roso, amarante (Brazil).
Sources: Central and South America.
Characteristics: Uniform fine to medium texture. Usually straight-grained. Attractive purple colour, darkening to rich brown due to oxidation.
Workability: Medium.
Average dried weight: 800kg/m³ (50lb/ft³).
Common uses: Construction work, boatbuilding, veneer, turnery, furniture.
Finishing: Good.

RAMIN
Gonystylis macrophylla
Other names: Melawis (Malaysia), ramu kelor (Sarawak).
Sources: Southeast Asia.
Characteristics: Moderately fine even texture, usually straight-grained. Pale creamy-brown colour.
Workability: Good.
Average dried weight: 570kg/m³ (35lb/ft³).
Common uses: Furniture, interior joinery, turnery, lugs, carving, flooring, veneer.
Finishing: Good.

ROSEWOOD, BRAZILIAN
Dalbergia nigra
Other names: Rio rosewood, Bahia rosewood (UK), jacarandá da Bahia, jacaranda preto (Brazil), palisander, palisandre da Brazil (France).
Sources: Brazil.
Characteristics: Hard and heavy, medium texture, with straight grain. Highly figured, with brown, violet, brown to black colour.
Workability: Medium.
Average dried weight: 870kg/m³ (54lb/ft³).
Common uses: Veneer, furniture, joinery, carving.
Finishing: Good.



Maple, Hard

Maple, Soft

Oak, American red

Oak, American white

26

Oak, Japanese

Oak, European

Obeche

Padouk, African

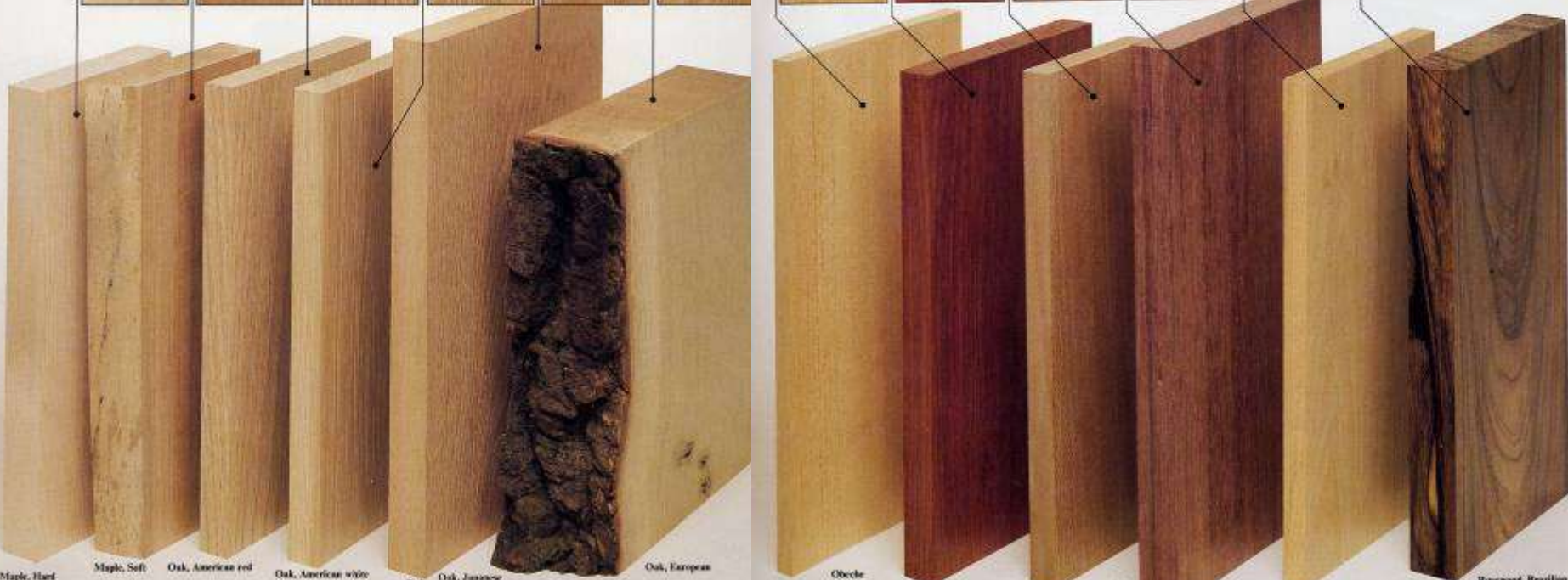
Plane, European

27

Purpleheart

Ramin

Rosewood, Brazilian





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Colour change
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ROSEWOOD, INDIAN
Dalbergia latifolia
Other names: East Indian rosewood, Bombay rosewood (UK), Bombay blackwood (India).
Source: India.
Characteristics: Heavy, lustrous wood, with fine even texture and interlocked grain producing striped figure. Golden brown, with darker streaks.
Workability: Medium.
Average dried weight: 990kg/m³ (61lb/ft³).
Common uses: Furniture, interior joinery, turnery, veneer.
Finishing: Good.



SATINWOOD
Cleistanthus biflorus
Other names: East Indian satinwood.
Source: Central and Southern India, Sri Lanka.
Characteristics: Heavy lustrous wood, with fine even texture and interlocked grain producing striped figure. Golden brown, with darker streaks.
Workability: Medium.
Average dried weight: 990kg/m³ (61lb/ft³).
Common uses: Furniture, interior joinery, turnery, veneer.
Finishing: Good.



SILKY OAK
Cardwellia sphaeroides
Other names: Bull oak, Northern silky oak (Australia), Australian silky oak (UK).
Source: Australia.
Characteristics: Coarse even-textured wood, usually straight-grained with straight grain. Reddish-brown colour similar to American oak, though not a true oak.
Workability: Good.
Average dried weight: 590kg/m³ (37lb/ft³).
Common uses: Furniture, veneer, interior joinery.
Finishing: Good.



SYCAMORE, AMERICAN
Platanus occidentalis
Other names: American plane (UK), buttonwood (USA).
Source: USA.
Characteristics: Fine even texture, usually with straight grain. Botanically a plane tree, but lighter than European plane. Pale brown, with distinct darker rings producing lacewood when quarter-sawn.
Workability: Good.
Average dried weight: 560kg/m³ (35lb/ft³).
Common uses: Joinery, farmers, butcher's blocks, veneer.
Finishing: Good.



SYCAMORE, EUROPEAN
Acer pseudoplatanus
Other names: Sycamore plane, great maple (UK), Platan (Scotland).
Source: Europe, Western Asia.
Characteristics: Fine even texture. Usually straight-grained - but can be wavy, producing fiddleback figure when quarter-sawn. White to yellowish-white colour.
Workability: Good.
Average dried weight: 630kg/m³ (39lb/ft³).
Common uses: Turnery, furniture, kitchen utensils, flooring. Fiddleback sycamore wood for violin backs.
Finishing: Good.



TEAK
Tectona grandis
Other names: Kyan, sagwan, teku, teka.
Source: South and Southeast Asia, Africa, Caribbean.
Characteristics: Coarse uneven texture with oily feel. Straight or wavy-grained, according to origin. Burma teak is a uniform golden brown; others are darker and more marked.
Workability: Good.
Average dried weight: 660kg/m³ (41lb/ft³).
Common uses: Interior and exterior joinery, boatbuilding, exterior and garden furniture, plywood, turnery, veneer.
Finishing: Good.



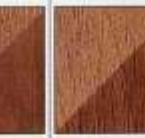
TULIPWOOD
Dalbergia melanocera
Other names: Pink wood (USA), bois de rose (France), pau rosa, jacaranda rosa, pseudo-fes (Brazil).
Source: Brazil.
Characteristics: Dense, hard wood with medium to fine texture; usually has irregular grain. Attractive pinkish-yellow colour, with pink to violet-red stripes.
Workability: Difficult.
Average dried weight: 960kg/m³ (60lb/ft³).
Common uses: Turnery, woodware, boxes, trays, veneer.
Finishing: Good.



LILLE
Euclea dybiodora
Other names: Sepo (Ivory Coast), asse (Cote d'Ivoire).
Source: Africa.
Characteristics: A medium-textured wood, usually with interlocked grain, producing striped figure when quarter-sawn. Pinkish-brown colour, turning to red-brown.
Workability: Good.
Average dried weight: 660kg/m³ (41lb/ft³).
Common uses: Furniture, interior and exterior joinery, boatbuilding, flooring, plywood, veneer.
Finishing: Good.



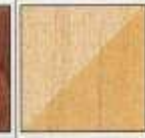
WALNUT, AMERICAN
Juglans nigra
Other names: Black American walnut, Virginia walnut (UK), black walnut (UK, USA).
Source: USA, Canada.
Characteristics: A tough wood, with rather coarse texture; usually straight-grained, but can be wavy. Rich dark brown to purplish black.
Workability: Good.
Average dried weight: 660kg/m³ (41lb/ft³).
Common uses: Furniture, gun stocks, musical instruments, turnery, carving, plywood, veneer.
Finishing: Good.



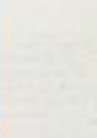
WALNUT, EUROPEAN
Juglans regia
Other names: English, French, Italian walnut etc. (according to origin).
Source: Europe, Asia Minor, Southwest Asia.
Characteristics: Rather coarse texture, with straight to wavy grain. Grey-brown with darker streaks, though colour and markings vary according to origin.
Workability: Good.
Average dried weight: 670kg/m³ (42lb/ft³).
Common uses: Furniture, interior joinery, gun stocks, turnery, carving, veneer.
Finishing: Good.



WALNUT, QUEENSLAND
Euclea papyrifera
Other names: Australian walnut, warrat bean, oriental wood.
Source: Australia.
Characteristics: Similar to European walnut in appearance, but not a true walnut. Usually has interlocked and wavy grain. Wide colour variation, from light to dark brown.
Workability: Difficult.
Average dried weight: 600kg/m³ (37lb/ft³).
Common uses: Furniture, interior joinery, shop fittings, flooring, veneer.
Finishing: Good.



WHITEWOOD, AMERICAN
Liriodendron tulipifera
Other names: Yellow poplar, tulip poplar (USA), tulip tree (UK and USA), canoe whitewood (UK).
Source: Eastern USA, Canada.
Characteristics: A moderately soft and light-weight wood, with straight grain and fine texture. White sapwood; pale olive-green to brown heartwood, with coloured streaks.
Workability: Good.
Average dried weight: 500kg/m³ (31lb/ft³).
Common uses: Joinery, furniture, carving, light construction, interiors, boats, toys, plywood.
Finishing: Good.



Rosewood, Indian



Satinwood



Silky Oak



Sycamore, American



Sycamore, European



Teak



Tulipwood



Lille



Walnut, American



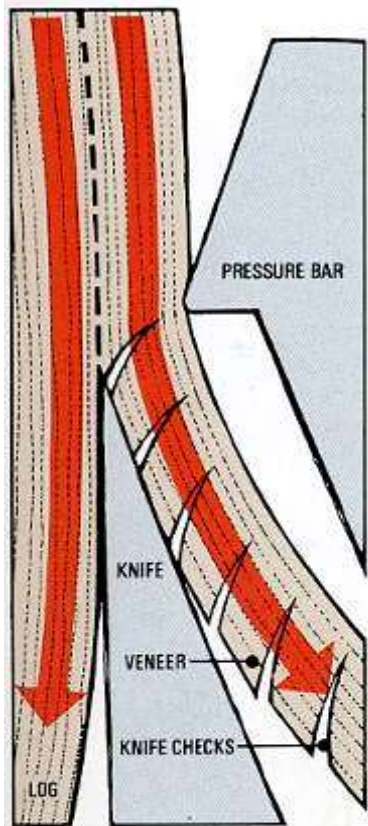
Walnut, European



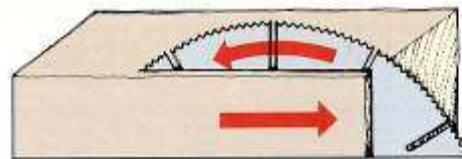
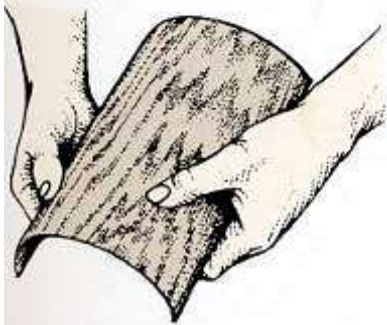
Walnut, Queensland



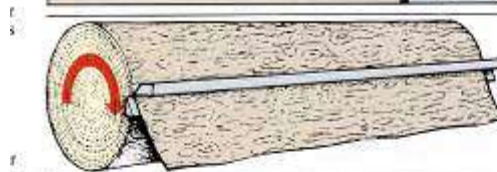
Whitewood, American



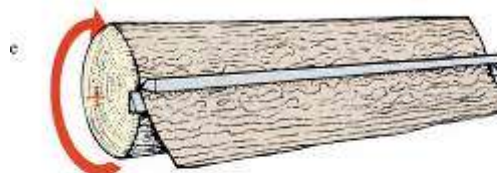
1 Knife checks on back face



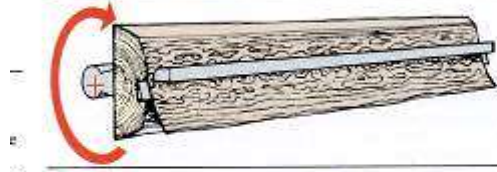
Saw cutting
This is not a common method today but is still used for some thick-cut veneers.



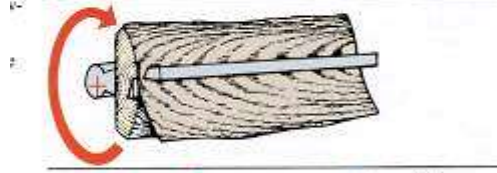
Rotary cutting
Widely used for constructional and some decorative veneers, such as bird's-eye maple.



Off-centre cutting
A rotary-cutting method that produces a figure similar to flat-sliced veneer.



Half-round cutting
This is similar to off-centre cutting, and also produces figure like flat-sliced veneer.



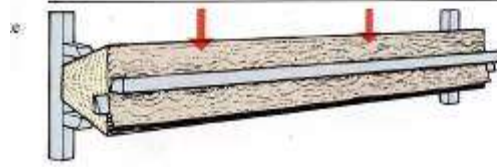
Back cutting
A rotary method used for cutting decorative butt and curl veneers.



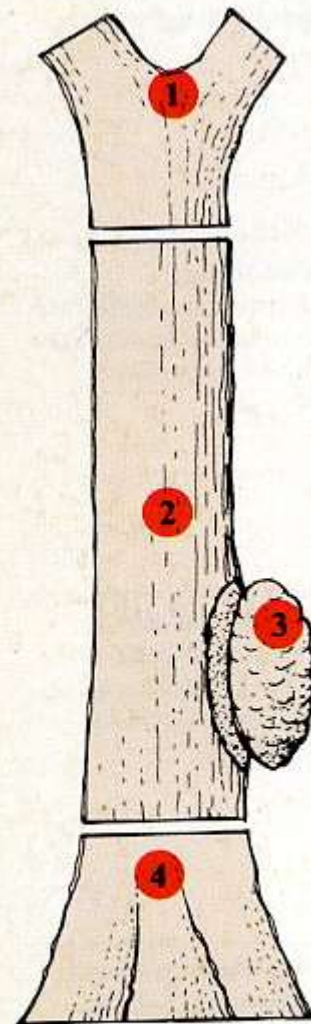
Flat slicing
A common method for producing traditional crown-cut veneers.



Quarter-cut slicing
Used to produce veneers displaying attractive quarter-cut figure.



Flat-sliced quartered
Quartered logs are sometimes cut tangentially to make flat-sliced veneers.



Parts of the tree used for veneers

- 1 Crotch
- 2 Trunk
- 3 Burr or burl
- 4 Stump or butt

● **Burr or burl veneer**

Burs or burls are abnormal growths on the trunk of a tree. Burr veneers display an attractive pattern of tightly packed bud formations that appear as rings and dots. They are the most expensive type of veneer and are highly prized for furniture and small woodware. Burr veneers are supplied in irregular shapes, from 150 x 100mm (6 x 4in) to about 1m (33 3/4in) long by 450mm (1ft 6in) wide.

● **Butt veneer**

Butt veneers are cut from the stump, or 'butt', of certain trees. Highly figured veneers, caused by the distorted grain, occur by back-cutting on a rotary lathe.

● **Coloured veneer**

Artificially coloured veneers are available from specialist suppliers. Light-coloured woods, such as sycamore, are used. 'Harewood' is chemically treated sycamore which turns silver-grey to dark-grey. Dyes are used to produce other colours, the veneer being pressure-treated for maximum penetration.



● **Crown-cut veneer**

Tangentially cut flat-sliced veneer is known as 'crown cut'. It displays an attractive figure of bold sweeping curves and swirls along the centre of the leaf, with striped grain nearer the edges. Crown-cut veneer is produced in lengths of 2.4m (8ft) or more and in various widths, ranging from about 225mm (9in) to 600mm (2ft), depending on species. It is used for furniture-making and wall panelling.

● **Curly-figured veneer**

Wavy-grained woods produce veneers with 'beads' of light and dark grain running across the width of the leaf. 'Fiddleback' sycamore is a typical example. The wood gets its name from its use for violin backs.

● **Curl veneer**

Curl veneer is cut from the 'crotch' or 'fork' of a tree where the trunk divides. When the crotch is sliced perpendicularly an attractive figure is revealed. The distorted diverging grain produces a lustrous upward-sweeping plume pattern known as 'feather figure'. It is available in slats from 300mm to 1m (1ft to 3ft 3in) long and 200 to 450mm (8in to 1ft 6in) wide.

● **Feather-figured veneer**

Hardwood logs with irregular growth may be rotary cut to produce veneer displaying various patterns. Bird's-eye maple and masur birch are examples. Irregular-grained woods can also produce veneer with 'blistered figure' and 'quilted figure'.

● **Ray-figured veneer**

Woods such as oak and pine have striking figure when quarter-cut. The distinct ray cells in oak produce 'ray-fleck' or 'splash' figure. Quarter-cut plane veneer is known as 'lacewood'.

● **Striped veneer**

Quarter-cut veneers usually display a striped figure where the radial cut is taken across the width of the growth rings. Striped or 'ribbed' veneer also occurs on woods which grow with interlocked reverse-spiral grain. The stripes of ribbon veneer appear to change from light to dark, depending on the angle they are viewed from.



Cabinet construction	63-65, 70
Home workshop	210-211
Veneering	256-270
Wood screws	304
Knock-down fittings	308

● **Laminboard** is superior to blockboard for veneer work, as the core is less likely to show through. It is also more expensive. Boards of three-ply and five-ply construction are produced. The plies of the five-ply type may either be perpendicular to the core or cross-banded.

● **Blockboard** is a stiff material suitable for furniture applications, particularly shelving and worktops. It makes a good substrate for veneer work, but the core strips can 'telegraph' (i.e. show through). It is made in panel sizes similar to plywood, in thicknesses ranging from 12mm (½ in) to 25mm (1 in). Thicker boards of three-ply are made up to 44mm (1½ in).

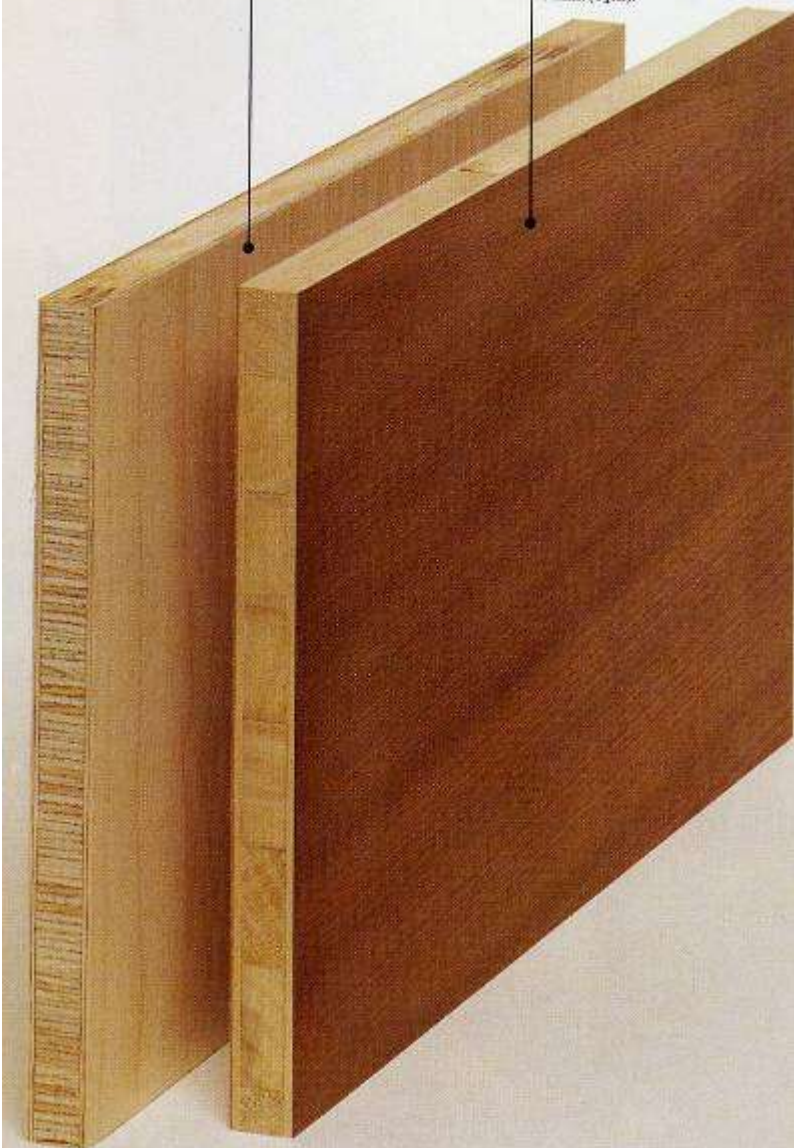
● **Decorative plywood** is faced with selected flat-sliced or quarter-cut matched veneers, usually of hardwoods such as afrormosa, beech, cherry or oak, and is mainly used for panelling. A balancing veneer of lesser quality is applied to the back of the board.

● **Three-ply board** has the face veneers bonded to a single core veneer. Their thickness may be the same, or the core may be thicker to improve the balance of the construction. This type is sometimes called 'balanced' or 'solid core' plywood. Thin three-ply boards are used for drawer bottoms and cabinet backs.

● **Drawerside plywood** is the exception to the cross-banding construction method. This type has the grain of all the plies running in the same direction. It is made of hardwood to a nominal thickness of 12mm (½ in) and is used for drawer sides in place of solid wood.

● **Multi-ply** has a core consisting of an odd number of plies. The thickness of each ply may be the same, or the cross-banded ones may be thicker. This helps give the board equal stiffness in its length and width. It is a good material for use in making veneered furniture.

● **Four-ply and six-ply** Four-ply has two thick-cut plies bonded together, with their grain in the same direction and perpendicular to the face plies. This type is stiffer in one direction and is usually used for structural work. Six-ply (shown here) is similar to four-ply in construction but has the core parallel to the face, with cross-banded ply in between.



made from small chips or flakes of
under pressure. Various types are
shape and size of the particles,
the thickness of the board and the
and them together. Softwoods are
proportion of hardwood material is

and uniformly consistent
died with fine particles have
re highly suitable as groundwork
of pre-veneered decorative boards
plastic laminates are available.
relatively brittle and have a lower
wood.

ard of interest to the woodworker
mmonly known as chipboard.
od products, is adversely affected
board swells in its thickness and on
However, moisture-resistant types
at conditions are made.

● **Single-layer chipboard**
is made from a mat of
similar-sized particles
evenly distributed
throughout. It has a
relatively coarse surface.
This type is suitable for
wood veneer or plastic
laminate, although not
for painting.

● **Three-layer chipboard**
has a core layer of coarse
particles sandwiched
between two outside
layers of fine high-
density particles. The
outer layers contain a
higher proportion of
resin, which produces a
smooth surface suitable
for most finishes.

● **Graded-
density chipboard**
has surfaces of very fine
particles and a core of
coarser particles. Unlike
layered types, there is a
gradual transition from
the coarse particles to
the fine surface.

● **Decorative chipboard**
is manufactured with a
facing of selected wood
veneer, plastic laminate
or a thin melamine foil.
The wood-veneered
boards are sanded ready
for polishing, the foil-
faced and plastic-
laminated boards need
no finishing. Some
plastic-laminated boards
for worktops are made
with finished profiled
edges, while matching
edging strips are
available for fitting
melamine-faced and
wood-veneered boards.

● **Oriented-strand board**
is a three-layered
material made from long
strands of pine. The
strands in each layer are
laid in one direction,
and each layer is per-
pendicular to the next
in the same manner
as plywood.

● **Flakeboard or waferboard**
uses large shavings of
wood which are laid
horizontally and overlap
one another. These
boards have greater
tensile strength than
standard chipboard.



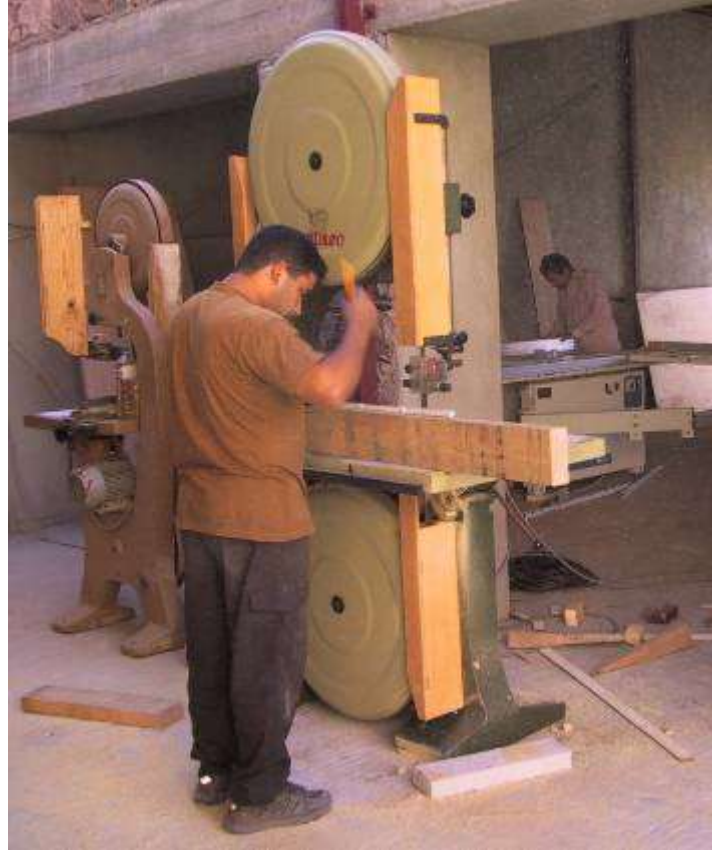


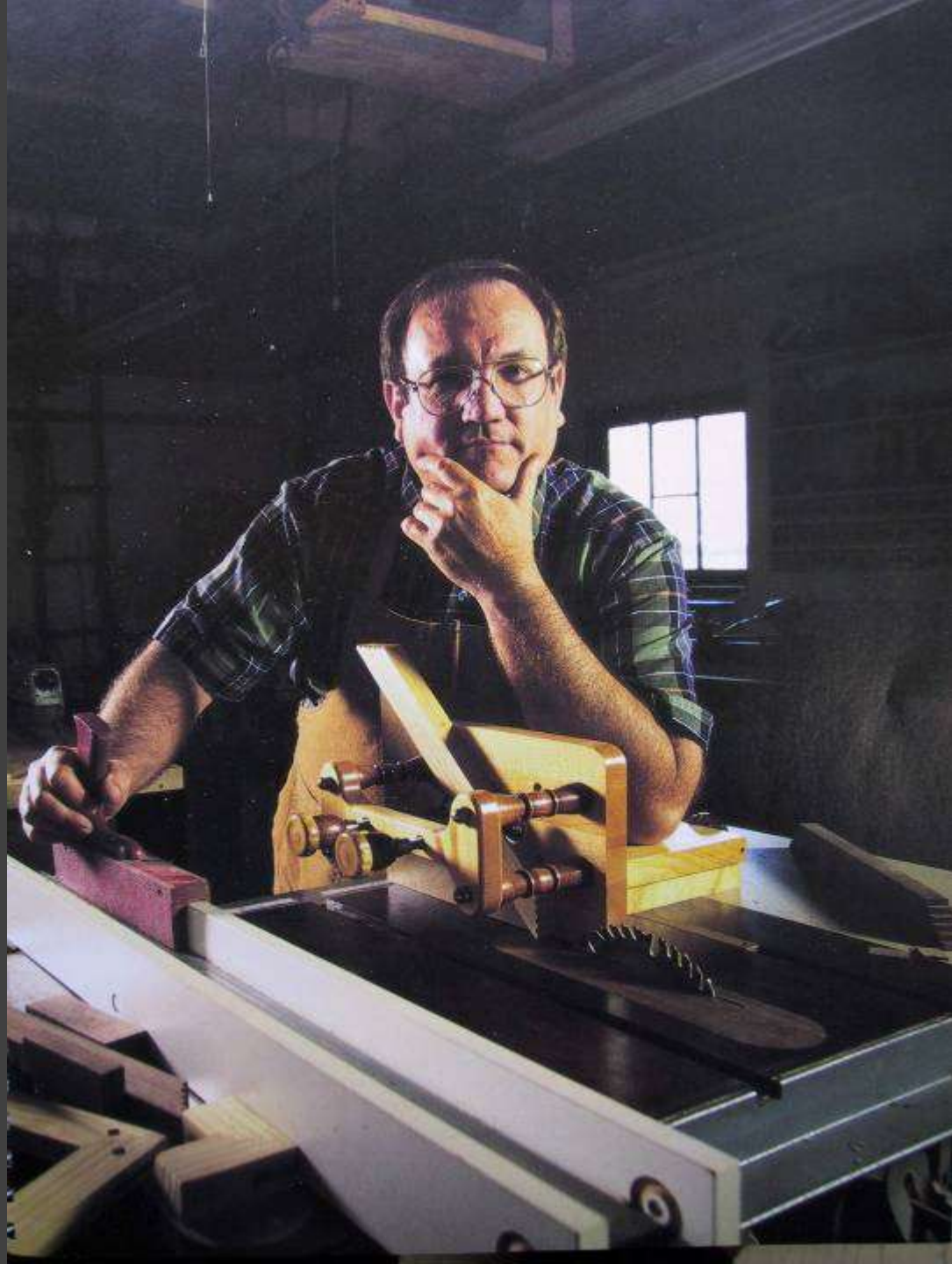
Medium boards
1 High-density (HM) board
2 Low-density (LM) board
3 Medium-density fibreboard (MDF)
4 Oak-veneered MDF board



Hardboards
5 Standard hardboard
6 Tempered hardboard
7 Embossed hardboard
8 Decorative-faced hardboard
9 Perforated hardboard

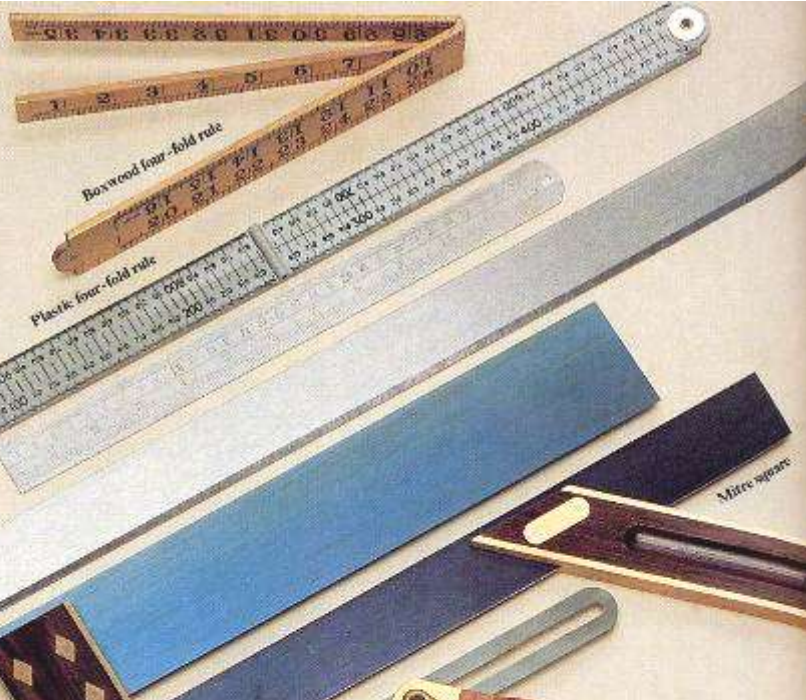






Four-fold rule

A traditional carpenter's folding rule is made from boxwood with brass hinges and protective endcaps. A well-made rule will stay rigid in its extended form until the hinges are folded deliberately. A 1m (3ft) rule, folding into four equal parts, is the most popular model. Whatever system of measurement you prefer, it makes sense to buy a rule with metric dimensions marked on one side and feet and inches on the other.



Steel rule

A steel rule is primarily a metalworker's tool but you should have at least one 900mm (1ft) rule for making every precise measurements. It is also useful as a short straightedge.

It is convenient if one side is marked as a centre-finding file, calibrated with equal divisions from the centre point towards each end of the rule.

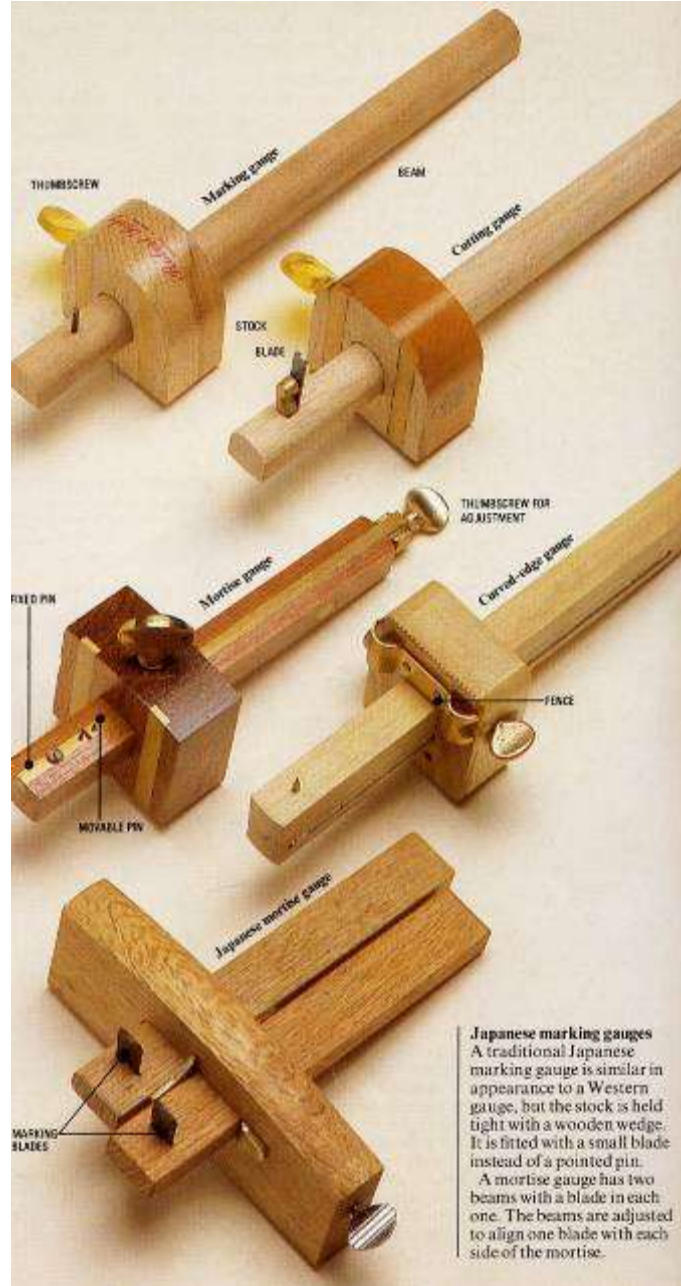
Straightedge

An unmarked strip of steel with one bevelled edge, this tool is used to check the flatness of a surface and as a guide for cutting straight lines with a marking knife. Being thick and relatively heavy, a straightedge is particularly useful for holding down veneers when trimming them to size. Straightedges range from 500mm

Retractable tape measure

A flexible steel tape measure, about 5m (16ft) long, is an essential tool for every workshop. Choose one which is calibrated with metric and imperial dimensions on opposite edges so you can readily convert one system to another.

The hook at the tip of the tape is intentionally loose on its rivets so that it can move fractionally to take internal and external measurements. This hook can become displaced if you allow the tape to snap back into its case. Buy a tape with a locking mechanism that prevents the



Japanese marking gauges

A traditional Japanese marking gauge is similar in appearance to a Western gauge, but the stock is held tight with a wooden wedge. It is fitted with a small blade instead of a pointed pin. A mortise gauge has two beams with a blade in each one. The beams are adjusted to align one blade with each side of the mortise.

Φορητά εργαλεία χειρός : μετρητικά

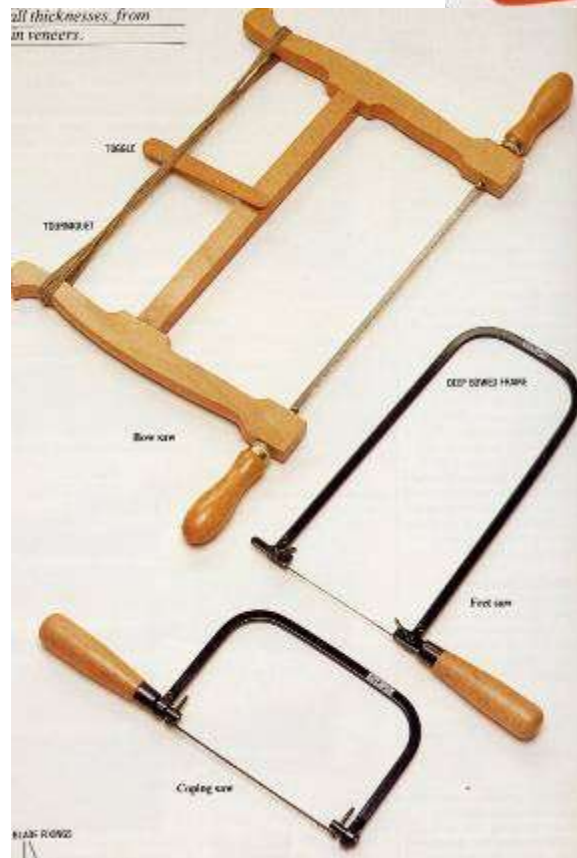
Φορητά εργαλεία χειρός : κοπτικά



Panel saw
A panel saw has relatively fine crosscut teeth – 10 to 12 PPI – for cutting man-made boards, but it is also used as a general purpose crosscut saw. Blade lengths vary from 500 to 550mm (16 1/8 to 17 3/8in).

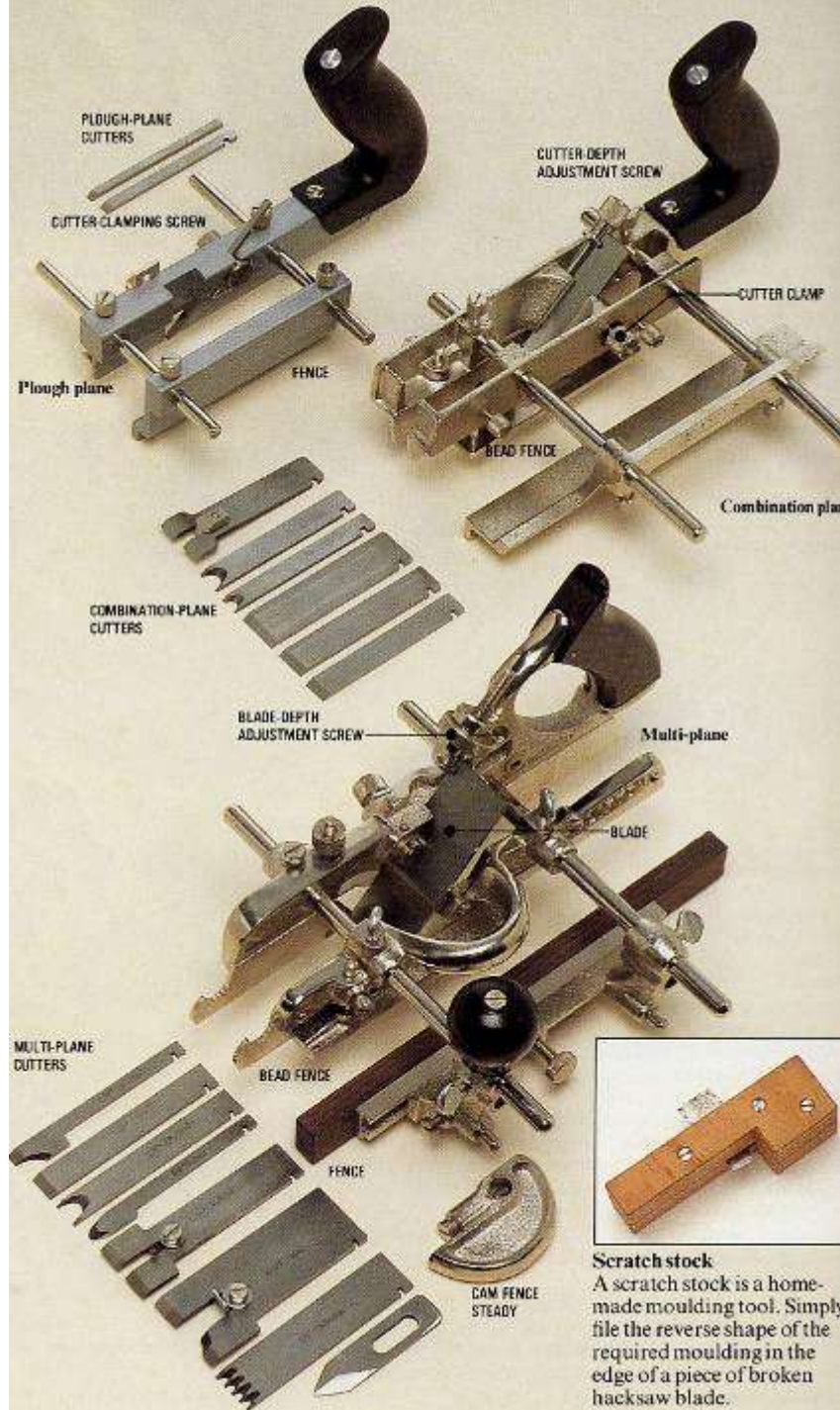


Frog saw
The traditional-style frame saw (see right) has hardly changed since medieval times. The narrow blade is held under tension by tightening a twisted cord or wire cable running between the two end posts or 'chocks'. The blade can be turned to swing the frame clear of the work when ripping long boards. Blades of 4, 5, 8 and 11 PPI can be found in use.



all thicknesses, from 20mm to 100mm.

BLACK RINGS



Scratch stock
A scratch stock is a home-made moulding tool. Simply file the reverse shape of the required moulding in the edge of a piece of broken hacksaw blade.



*action recess along the
is often used to receive a
angles to the rebated
back panel is fitted into a
al planes are required to*

Metal bull-nose plane

Wooden bull-nose plane

... slipstone to sharpen the curved cutting edges.

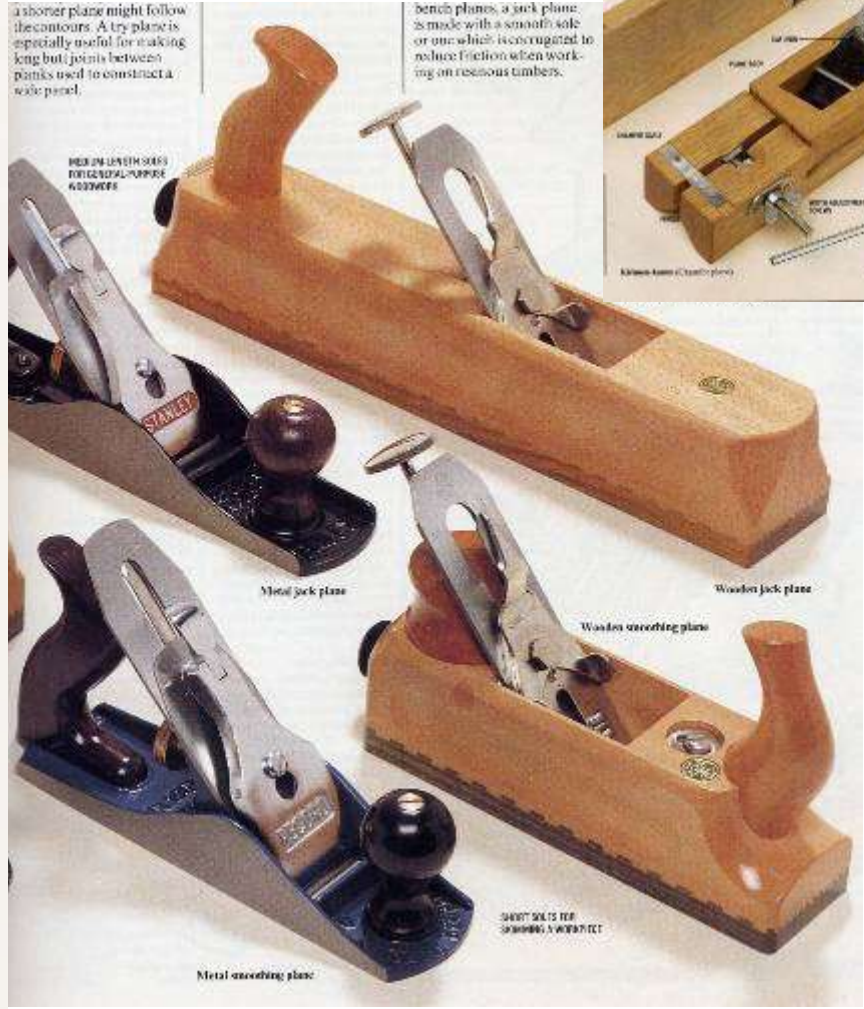
Clamp cutters in a honing guide



- Plane cutters**
- 1 Tongue
 - 2 Window-sash moulding
 - 3 Ovolo
 - 4 Bead
 - 5 Reeds
 - 6 Flute
 - 7 Rebate
 - 8 Groove

A shaper plane might follow the contours. A try plane is especially useful for making long butt joints between planks used to construct a wide panel.

bench planes, a jack plane is made with a smooth sole or one which is concrograted to reduce friction when working on resinous timbers.



MEDIUM GRAIN SOFTWOODS FOR GENERAL-PURPOSE WORKERS

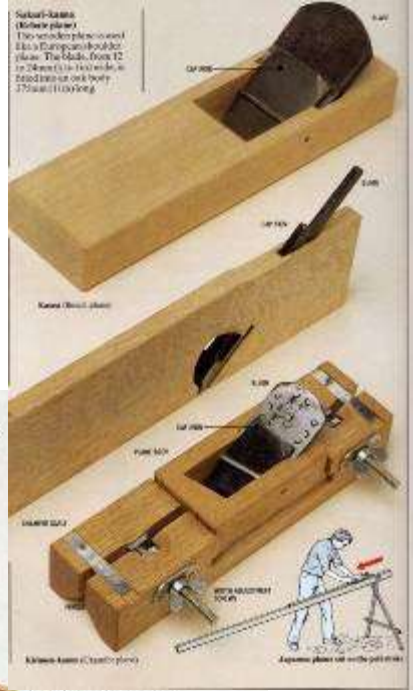
Metal jack plane

Wooden jack plane

Wooden smoothing plane

Metal smoothing plane

SAFETY SLOTS FOR GRABBING A WORKPIECE



Suberol-Rainier (Koblenz plane)
This versatile plane is used for European double-be plane. The blade, from 12 to 24mm (1/2 to 1) wide, is mounted on a cast-iron body 375mm (15 in) long.

Karam (Shank) plane

Koblenz-Rainier (Koblenz) plane

Japanese plane cut on the joint of a joint



Brace

A brace is driven by cranking its frame in a clockwise direction while pressure is applied to the round handle at the rear of the tool. The circle described by moving the frame is known as the sweep, and the size of a brace is given as the diameter of its sweep. Most woodworkers use a 250mm (10in) brace, but they are made with sweeps as small as 147mm (5 7/8in) and as large as 300mm (1ft).

Most braces are made with a ratchet mechanism just behind the chuck so that the tool can be used in places where a complete sweep is impossible. Having driven the bit as far as possible in a clockwise direction, a movement in reverse operates the ratchet, leaving the chuck stationary until the clockwise movement is resumed to drive the bit further. Adjusting a cam ring on the ratchet mechanism reverses its action or locks it solid.



right angles and fitted with a turned wooden handle.



CURVED-EDGE BLADE

FORGED TANG

Drawknife (German pattern)

TURND HANDLE

Swedish push knife

Drawknife (English pattern)

CUTTING EDGE

Inshave

CUTTING EDGE

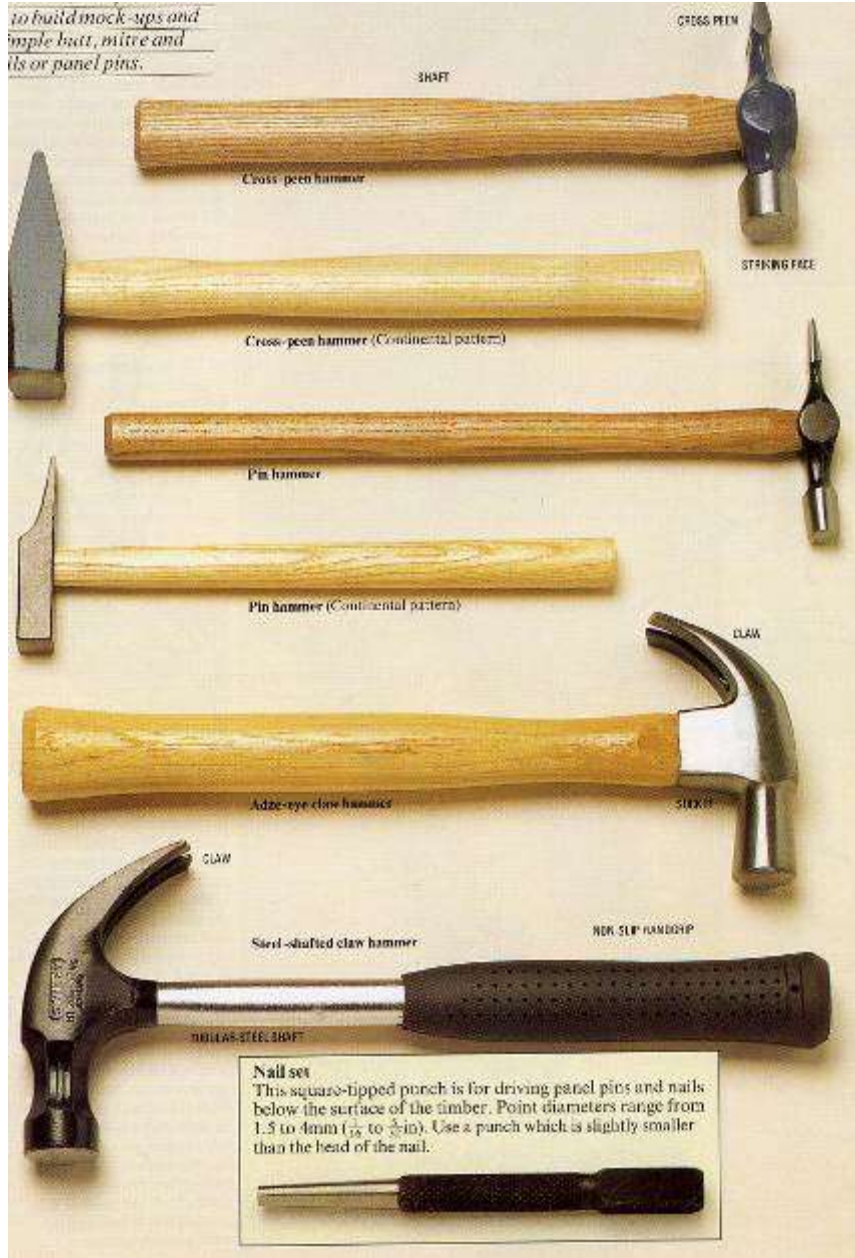
Scorp

Swedish push knife
A modern derivation of the drawknife, this tool has a short 100 x 25mm (4 x 1in) blade and two straight handles. It is used on both the push and pull stroke.

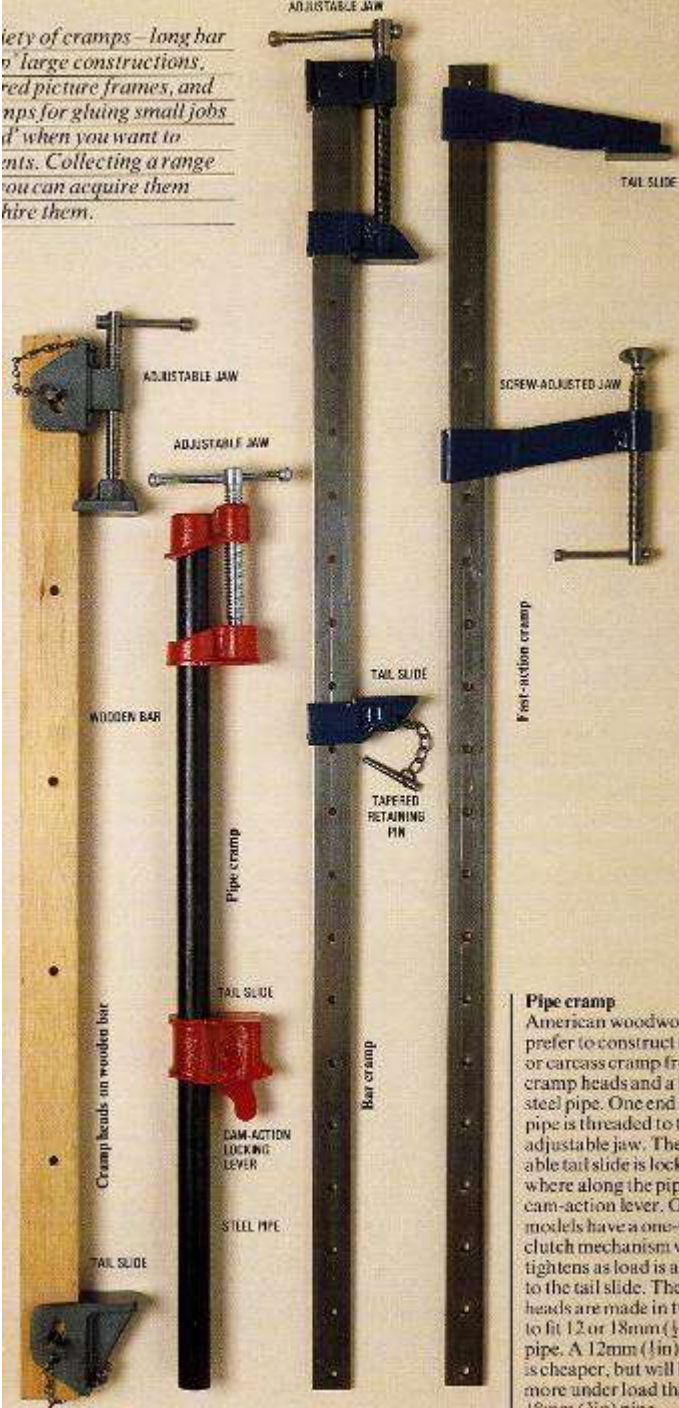
Inshave
This drawknife is in the shape of a tight curve for working deep hollows. Inshaves are usually bevelled on the outside of the curve.

Scorp
A scorp is a one-handed inshave for work such as wooden bowls and spoons.

*to build mock-ups and
imple butt, mitre and
ds or panel pins.*

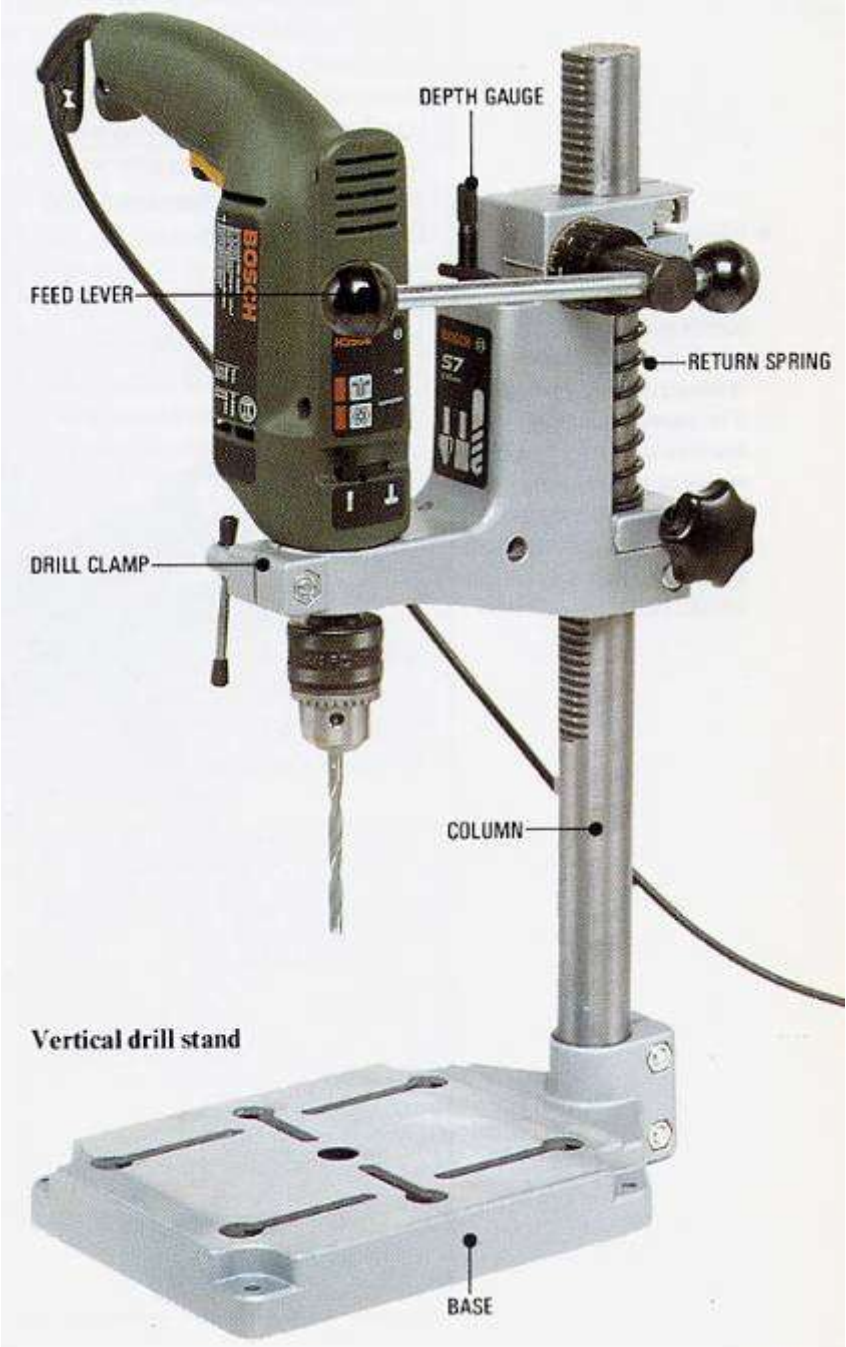


ety of cramps—long bar
o large constructions,
red picture frames, and
nps for gluing small jobs
d when you want to
nts. Collecting a range
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hire them.



Pipe cramp
American woodworkers prefer to construct a frame or carcass cramp from cramp heads and a length of steel pipe. One end of the pipe is threaded to take the adjustable jaw. The movable tail slide is locked anywhere along the pipe with a cam-action lever. Other models have a one-way clutch mechanism which tightens as load is applied to the tail slide. The cramp heads are made in two sizes to fit 12 or 18mm (½ or ¾in) pipe. A 12mm (½in) cramp is cheaper, but will bend more under load than the 18mm (¾in) pipe.





Φορητά ηλεκτρικά εργαλεία του τεχνίτη





It is fitted to the depth of a planer. Planers will set than 2mm minimum or maximum 20 and to 2 and so regulates to rebate.

Power planer

Disconnection
Power planers throw out so many shavings that it is worth fitting a collecting bag to the exhaust port or attaching a vacuum cleaner hose when the tool is clamped upside down as a jointer.



POWERED LAR SAWS

order name to a saw before the cut is made. The saw is able to cut up to 40mm thick wood. It was made especially for use in construction, especially for use in the construction of roofs and floors.

Motor-powered circular saw



When cutting straight up and down, with vertical strokes, by advancing the blade with the handle, the saw cuts and is set at the angle of the blade. The degree of oscillation is adjustable to suit the work. In general, the saw is used quickly to cut through wood and metal. It is ideal for use in construction for the removal of steel and concrete.

Motor-powered jigsaw



BEVEL-CUTTING GROOVE



When taking the place of a wheel, the motor and the rotating power tool, it can be used as a hand tool for the same purpose. The motor is a powerful motor, and the results are precise and accurate. In principle, all routers are the same. The only difference is the speed of rotation and the diameter of the bit. The motor is a powerful motor, and the results are precise and accurate. In principle, all routers are the same. The only difference is the speed of rotation and the diameter of the bit.

Plunge router

Φορητά ηλεκτρικά εργαλεία του τεχνίτη (πλάνη, δισκοπρίνο, σέγα, ρούτερ)

the edge of the machine and deposit it in a dust-collecting bag. Some manufacturers supply a dust shield that surrounds the base-plate for connection to a

ELECTRICAL INSULATION
Plastic bodies not only make for lightweight sanding machines but also insulate the user from live electrical components.



Keep the tool moving while sanding a workpiece.

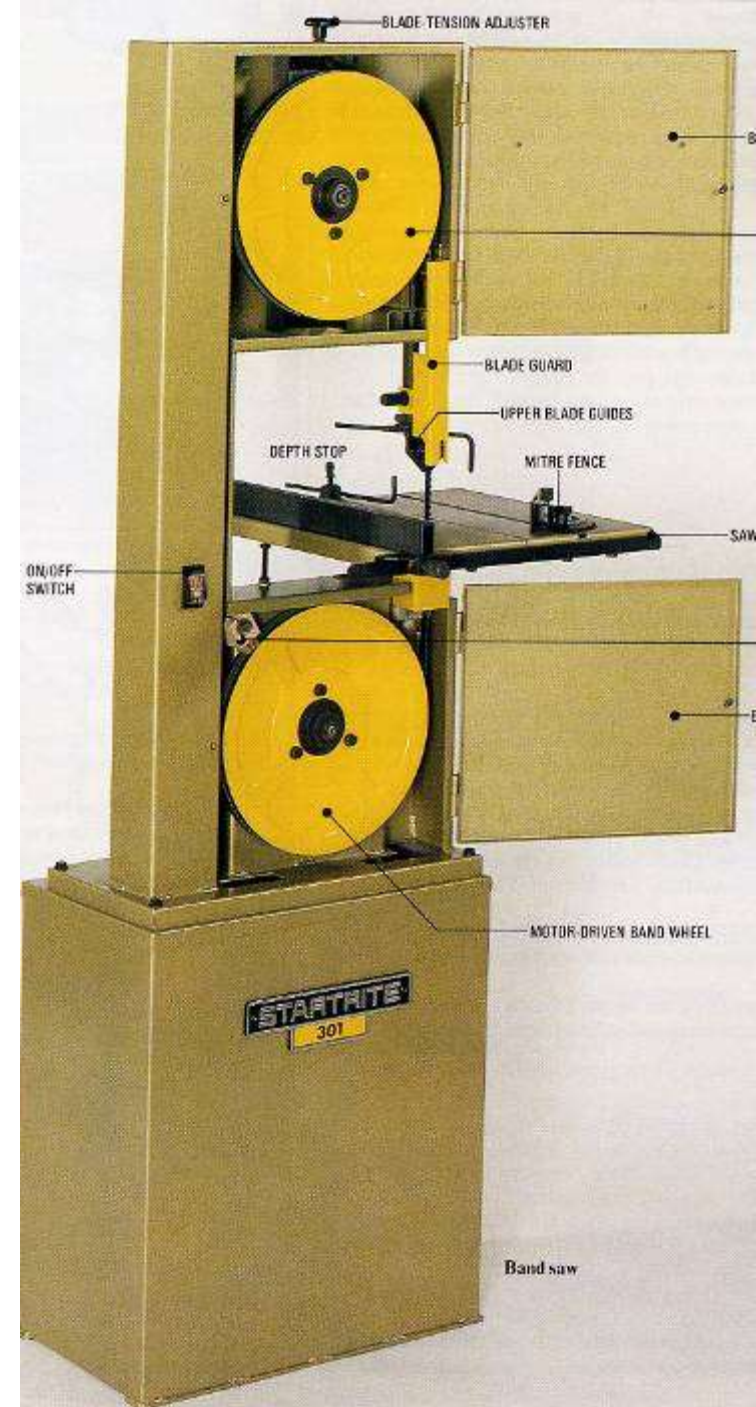


BELT SANDERS

Belt replacement
Changing the belt is a simple process on most machines. The tension is released by pulling a lever on the side of the sander; then, having removed the old belt, the new one is slipped over both rollers. The arrows printed on the belt must point in

**Φορητά ηλεκτρικά εργαλεία του τεχνίτη
(τριβεία παλινδρομικά και με συνεχή ταινία)**

Μηχανήματα που εξοπλίζουν ένα ξυλουργείο (δισκοπρίνο-γωνιάστρα, κορδέλλα)



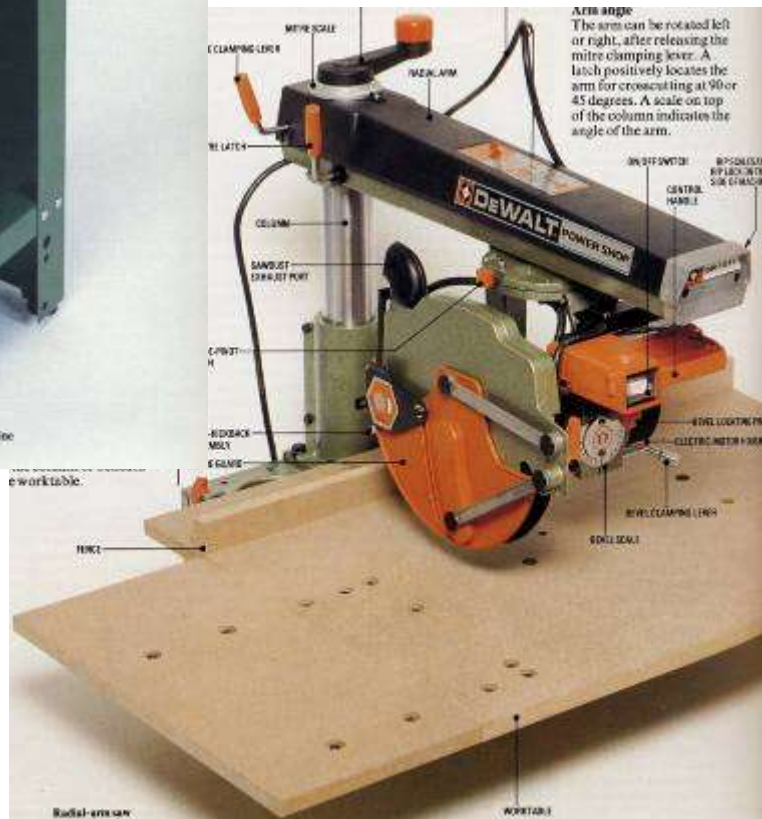


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Sanding machine

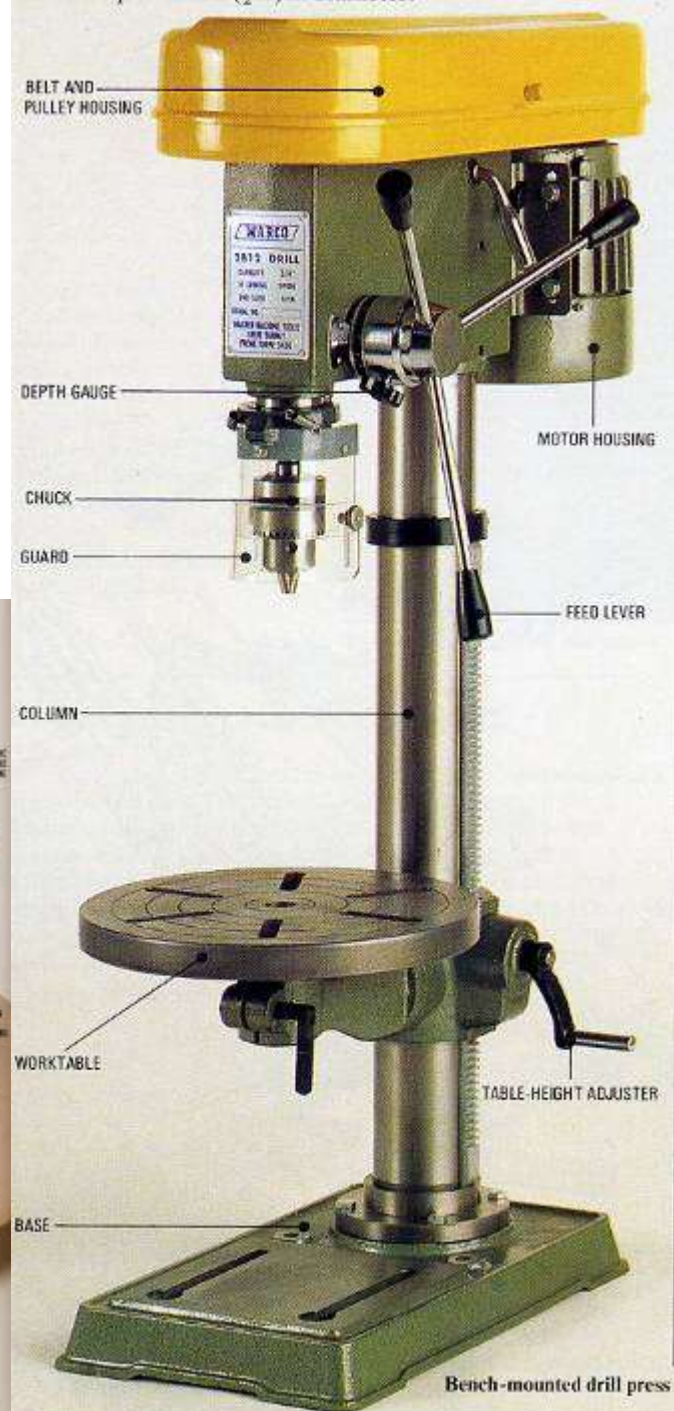


Worktable

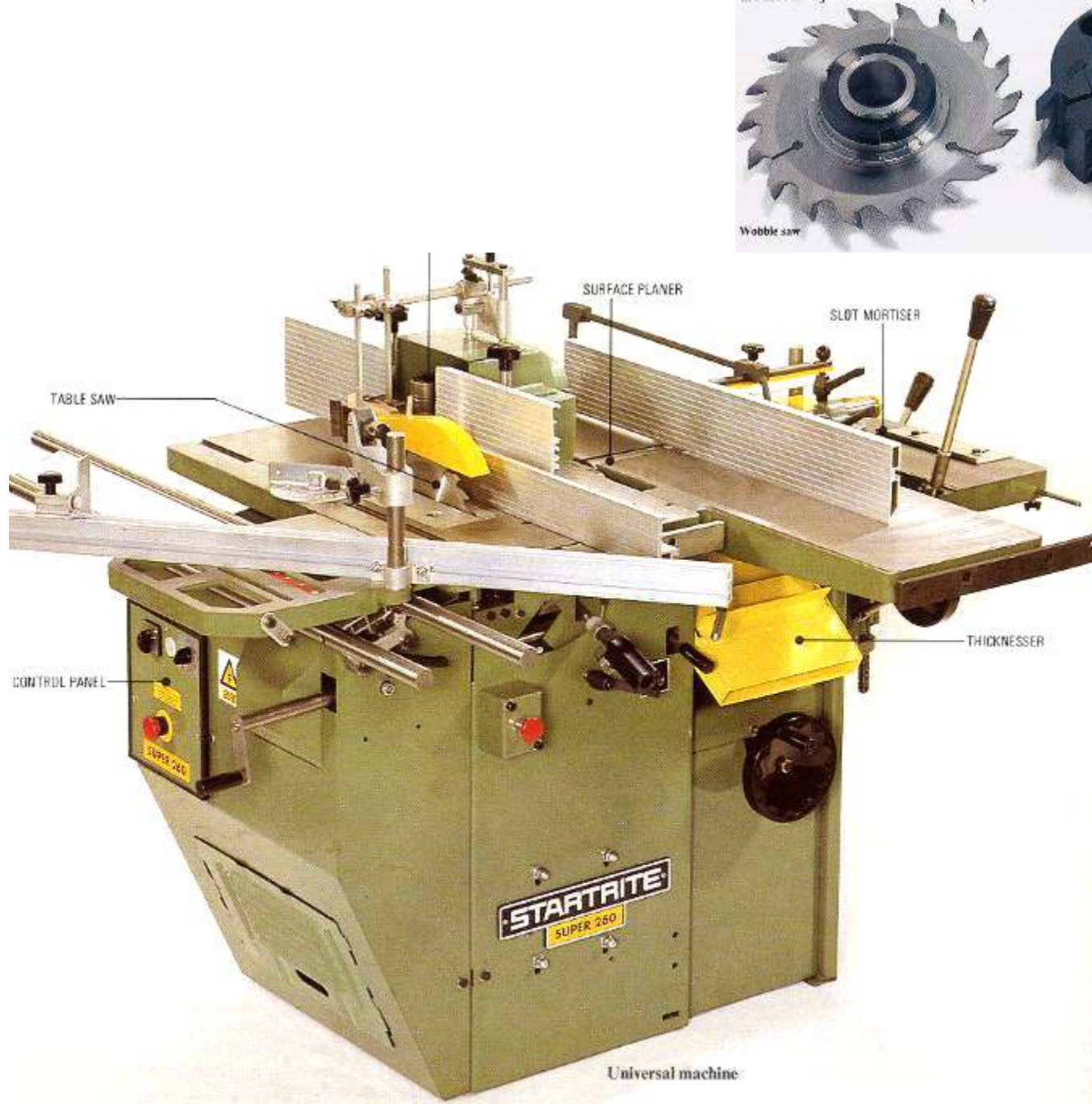
FENCE

Radial arm saw

WORKTABLE



Bench-mounted drill press



Universal machine



Wobble saw

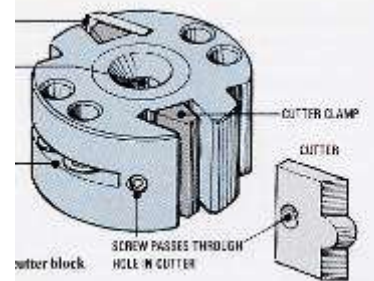
Interchangeable-cutter block



Moulding cutters

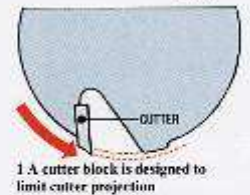
Moulding cutters

Solid-profile block



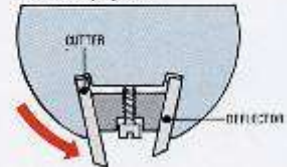
cutter block

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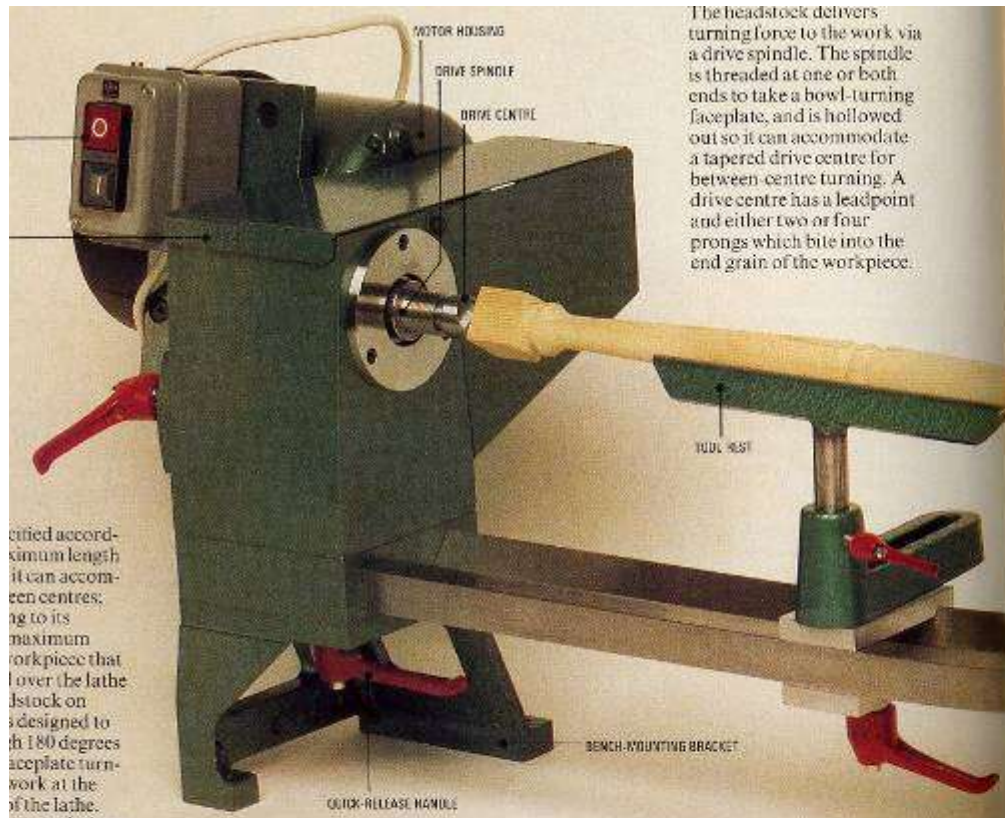


1 A cutter block is designed to limit cutter projection

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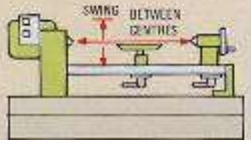


REFLECTOR



The headstock delivers turning force to the work via a drive spindle. The spindle is threaded at one or both ends to take a bowl-turning faceplate, and is hollowed out so it can accommodate a tapered drive centre for between-centre turning. A drive centre has a leadpoint and either two or four prongs which bite into the end grain of the workpiece.

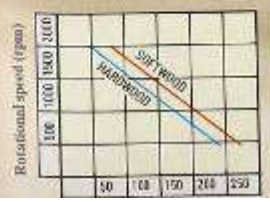
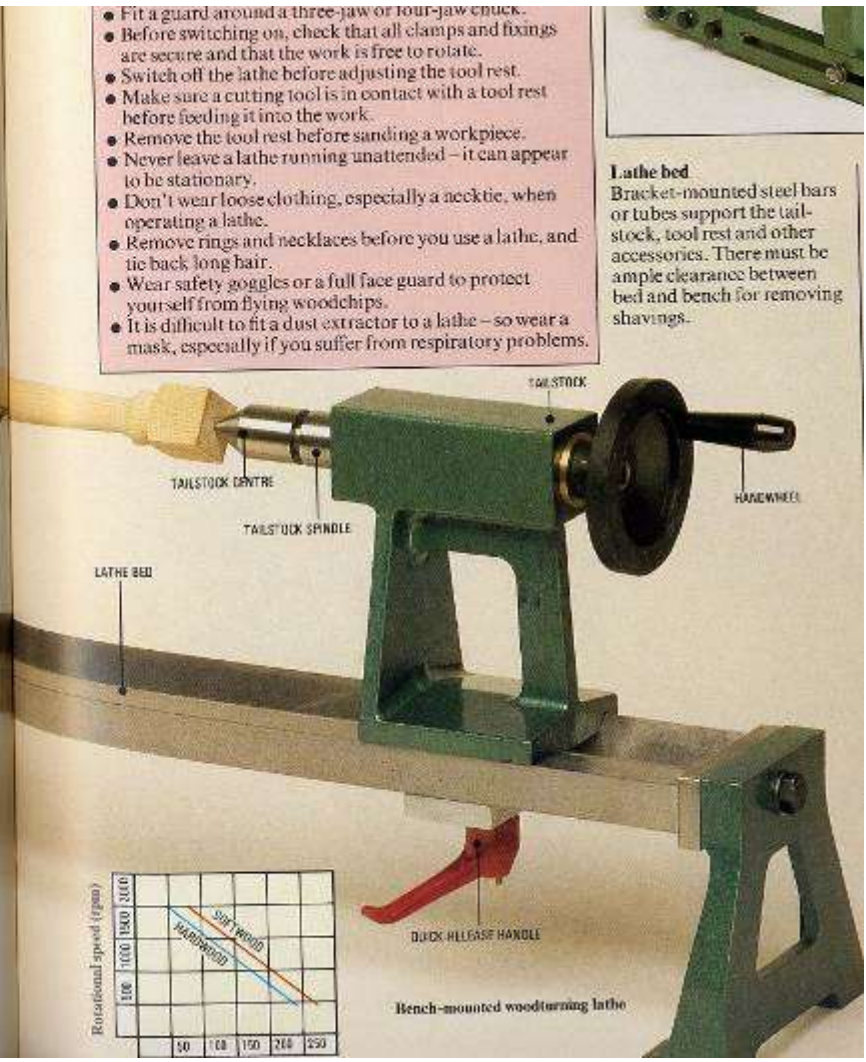
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Speed control
Most lathes use a belt drive to transmit power from a 375 to 750W (½ to 1hp) electric motor to the headstock spindle. Stepped pulleys provide three or four pre-set spindle speeds with a typical range of between 450 and 2000 rpm. Some more expensive lathes use electronic variable-speed control. Use the lowest speed for rough-cutting workpieces and then move the drive belt up the speed range as work progresses. The size of the work and the type of wood you are turning also affect speed selection. There are no hard and

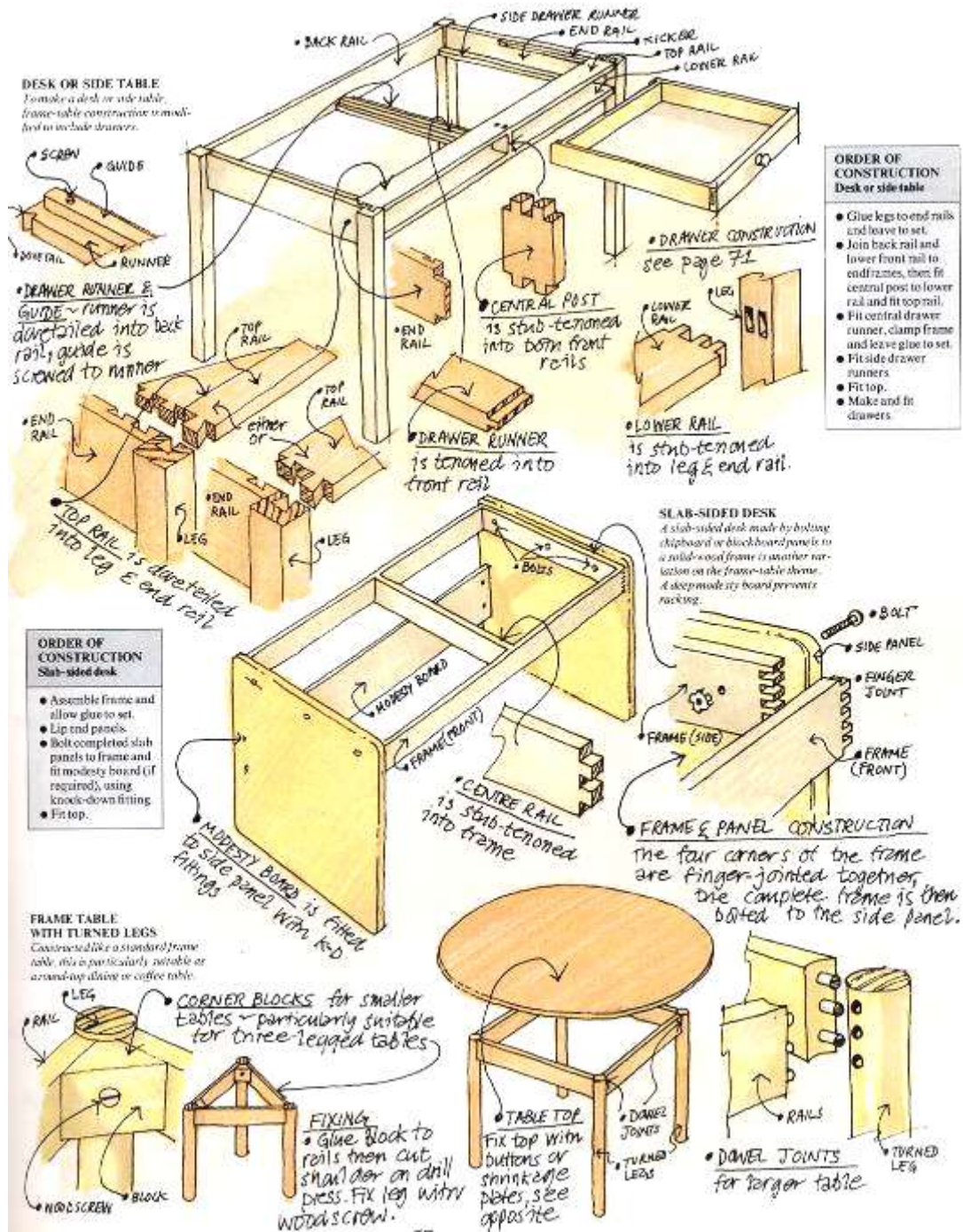
- Fit a guard around a three-jaw or four-jaw chuck.
- Before switching on, check that all clamps and fixings are secure and that the work is free to rotate.
- Switch off the lathe before adjusting the tool rest.
- Make sure a cutting tool is in contact with a tool rest before feeding it into the work.
- Remove the tool rest before sanding a workpiece.
- Never leave a lathe running unattended – it can appear to be stationary.
- Don't wear loose clothing, especially a necktie, when operating a lathe.
- Remove rings and necklaces before you use a lathe, and tie back long hair.
- Wear safety goggles or a full face guard to protect yourself from flying woodchips.
- It is difficult to fit a dust extractor to a lathe – so wear a mask, especially if you suffer from respiratory problems.

Lathe bed
Bracket-mounted steel bars or tubes support the tailstock, tool rest and other accessories. There must be ample clearance between bed and bench for removing shavings.

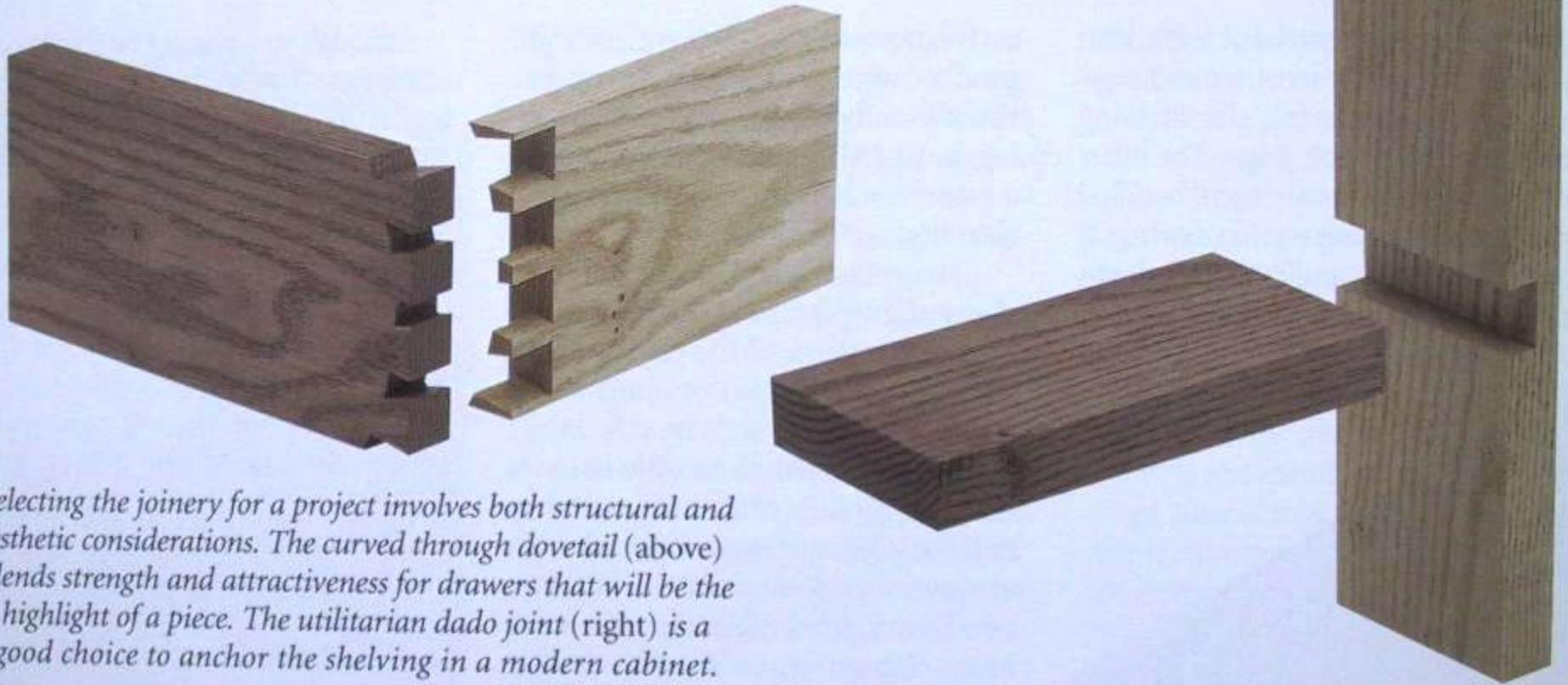


Bench-mounted woodturning lathe

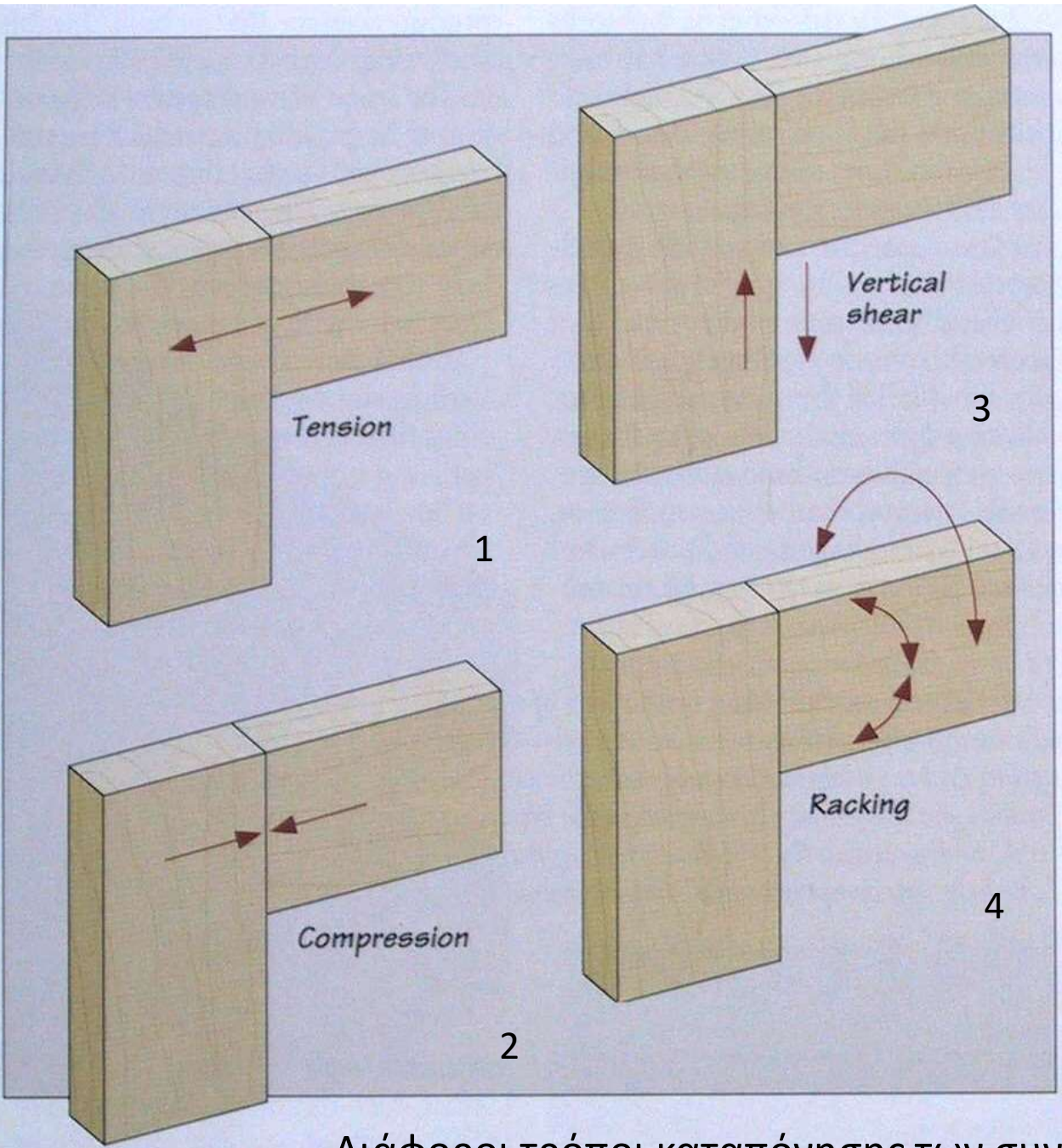
Μελέτη και σχεδιασμός της ξύλινης κατασκευής



FORM AND FUNCTION



Selecting the joinery for a project involves both structural and esthetic considerations. The curved through dovetail (above) blends strength and attractiveness for drawers that will be the highlight of a piece. The utilitarian dado joint (right) is a good choice to anchor the shelving in a modern cabinet.



1. Εφελκυσμός
2. Θλίψη
3. Διάτμηση
4. Στρέψη

Διάφοροι τρόποι καταπόνησης των συνδέσεων

BASIC JOINT TYPES

Frame joint

Panel joint

Blind joint

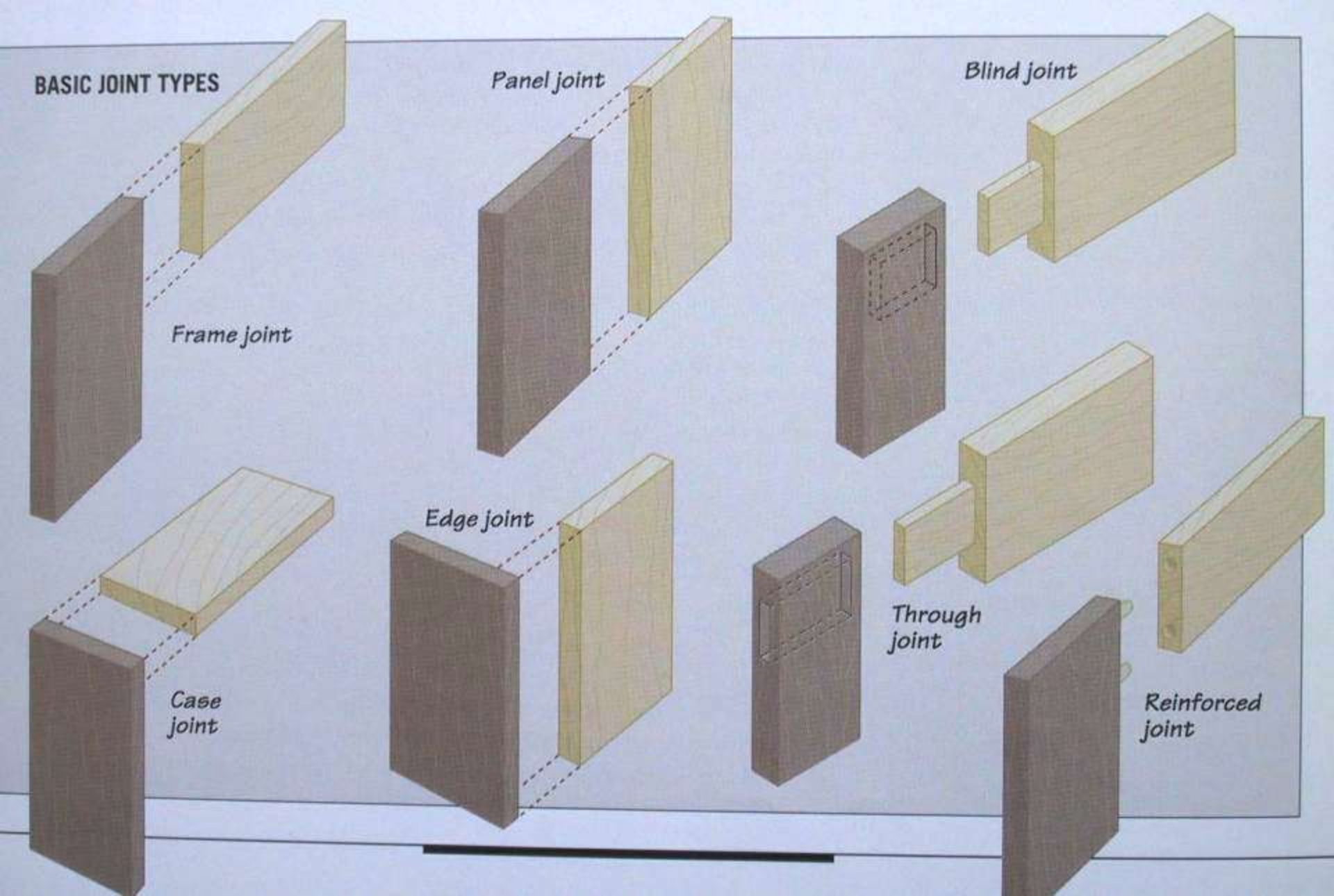
Edge joint

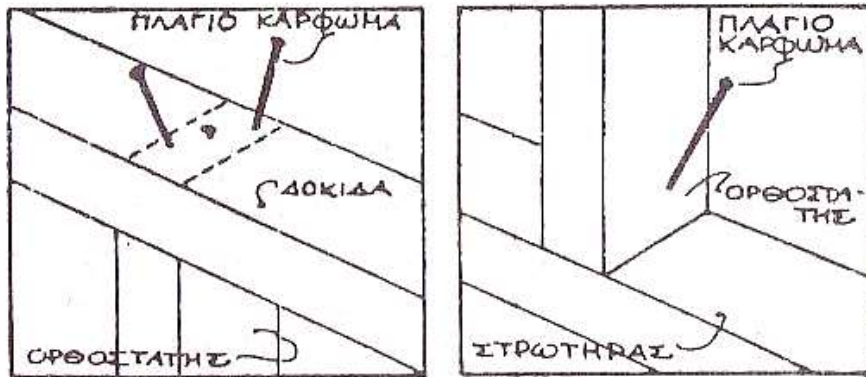
Through joint

Case joint

Reinforced joint

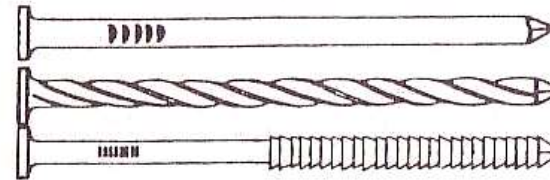
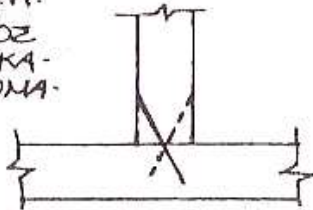
Βασικές κατηγορίες συνδέσεων ξύλινων στοιχείων





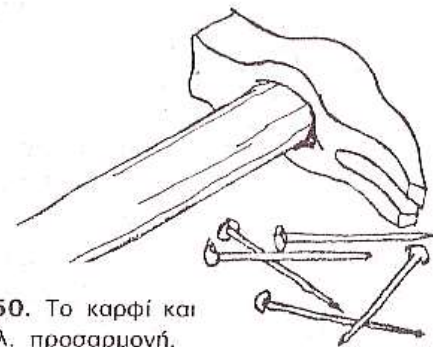
Σχ. 12.48. Κάρφωμα.

ΠΟΛΥ ΑΠΛΕΣ ΚΑΙ ΓΡΗΓΟΡΕΣ ΕΝΩΣΕΙΣ ΜΕ ΑΠΛΟ, ΑΛΛΑ ΠΛΑΓΙΟ ΚΑΡΦΩΜΑ. ΤΟ ΠΛΑΓΙΟ ΚΑΡΦΩΜΑ ΓΙΝΕΤΑΙ ΥΠΟ ΓΩΝΙΑ 20° ΕΩΣ 30° ΠΡΟΣΟΧΗ ΣΤΟ ΞΗΡΟ, ΣΚΛΗΡΟ ΞΥΛΟ, ΜΗΔΕ ΑΥΟΙΞΗ. ΣΥΛΛΗΘΗΣ ΤΡΟΠΟΣ ΕΝΩΣΗΣ ΣΤΙΣ ΚΑΤΑΣΚΕΥΕΣ ΙΚΡΙΩΜΑΤΩΝ Η ΦΥΛΟΤΥΠΩΝ. ΚΑΤΑΣΚΕΥΕΣ ΜΙΚΡΟΥ ΜΕΓΕΘΟΥΣ.

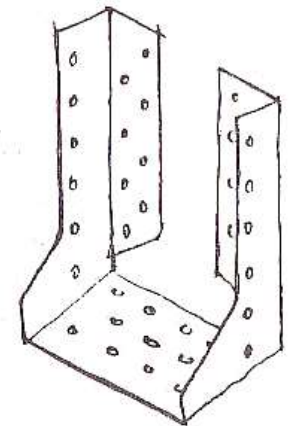


ΔΙΑΦΕΡΟΝ ΤΥΠΟΙ ΚΑΡΦΩΝ.

Σχ. 12.49. Καρφιά.



Σχ. 12.50. Το καρφί και η μεταλ. προσαρμογή.



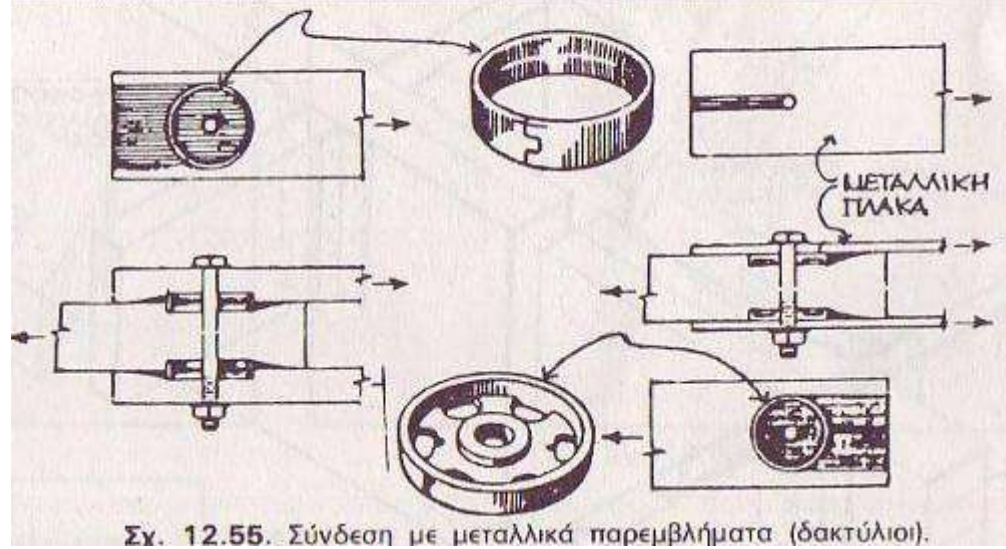
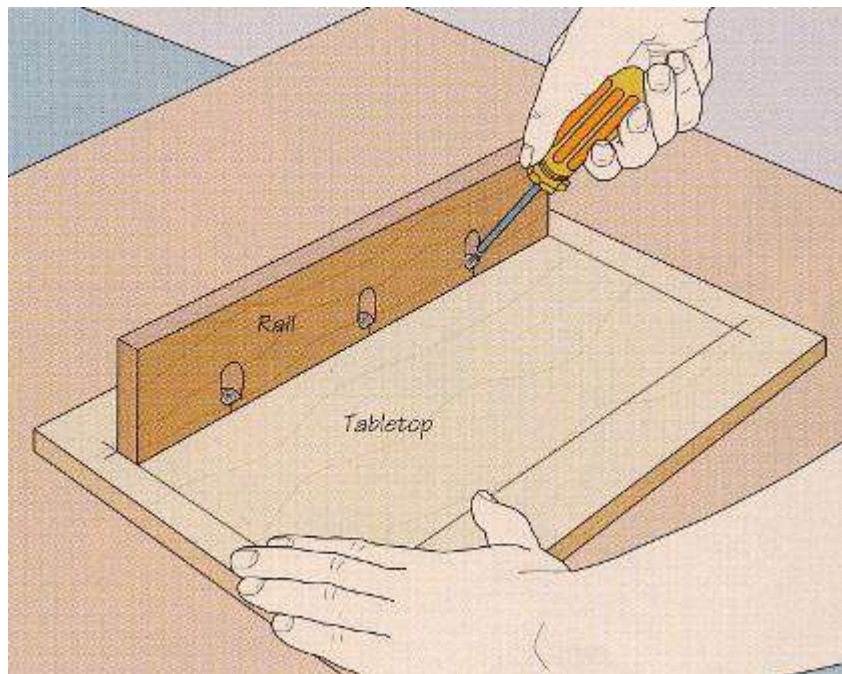
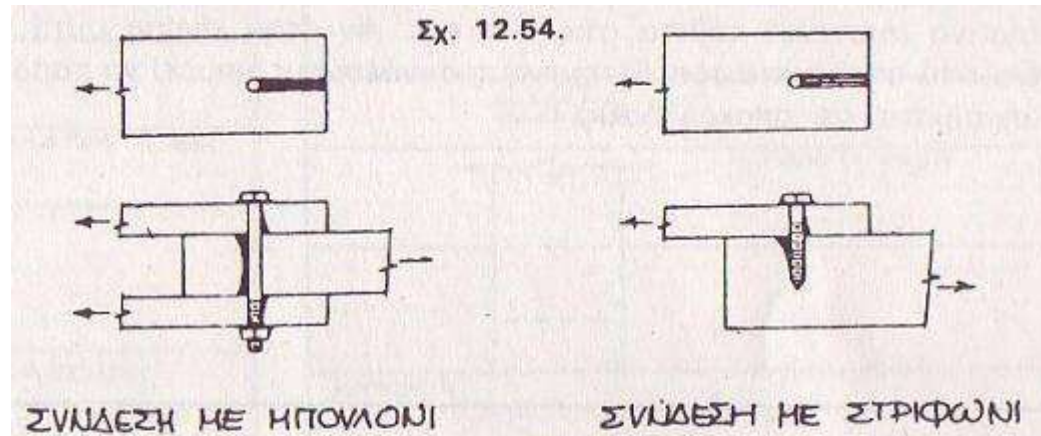
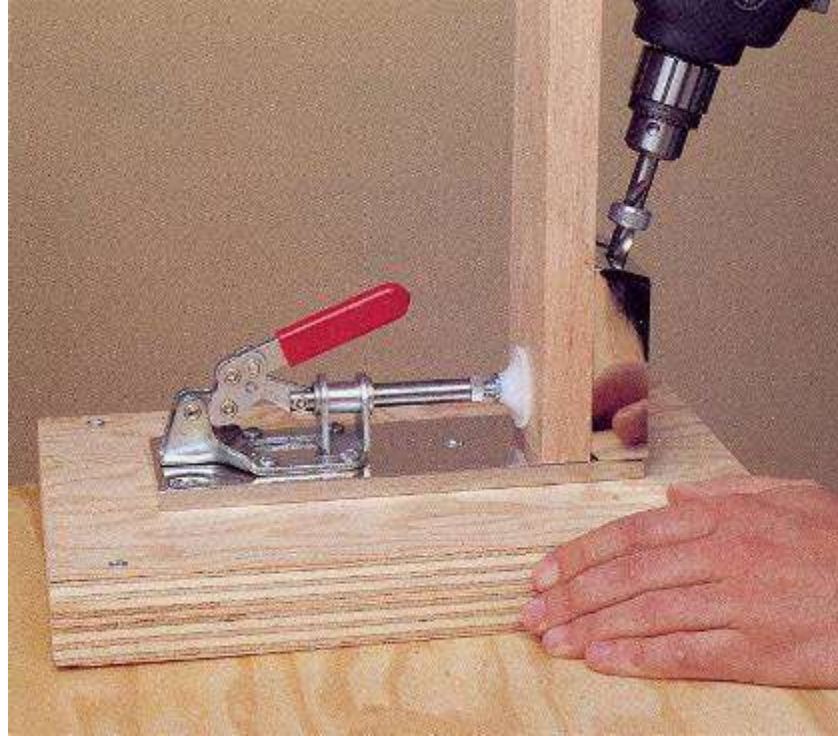
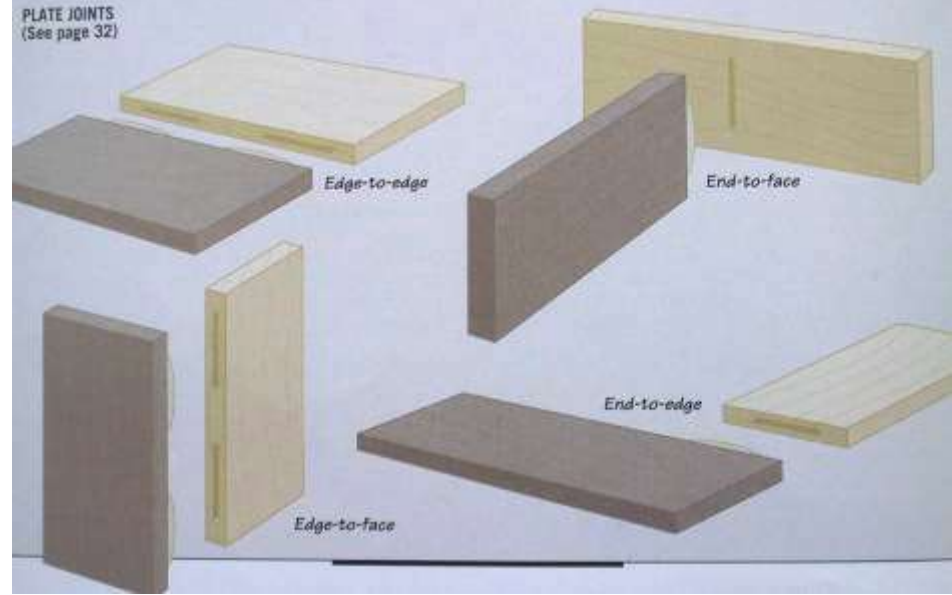
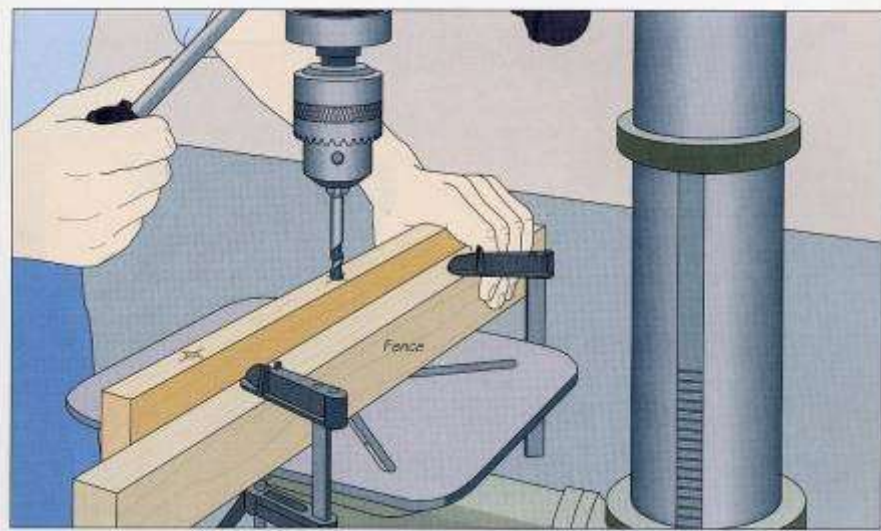
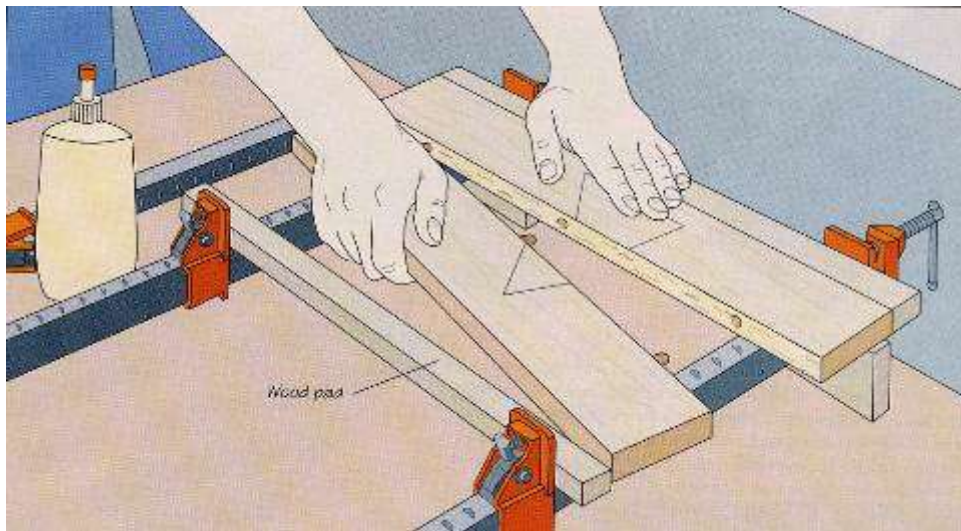




PLATE JOINTS
(See page 32)



Συνδέσεις με λαμέλα



DOWEL JOINTS (See page 28)

Edge-to-face

End-to-face

End-to-edge

Edge-to-edge

Συνδέσεις με καβίλιες

DOWEL JOINTS



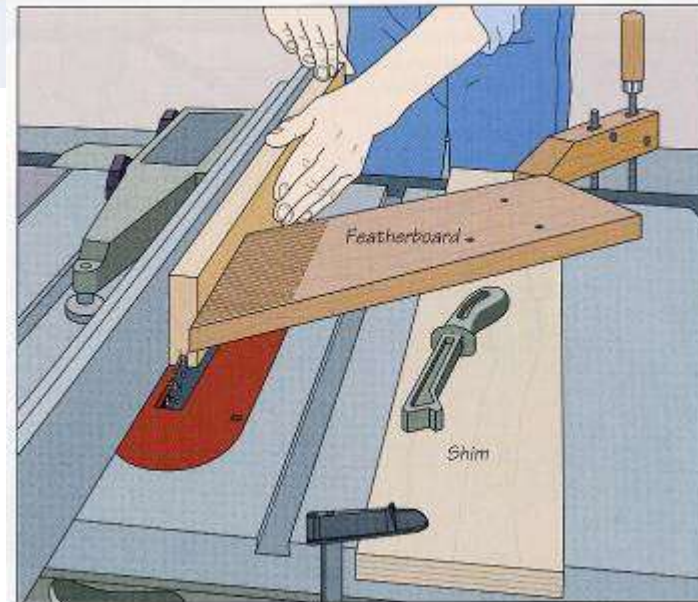
Dowels can transform a weak butt joint into solid joinery. In edge gluing (right), the wooden pins help align the boards. In frame (above, left) and case (above, right) butt joinery, the dowels reinforce the relatively weak bond between end grain and long grain. Dowel joints generally hold up well to shear stress—when the pieces are being pushed past each other; they are less effective at resisting tension—when the pieces are being pulled apart (page 15).

SPLINE JOINTS

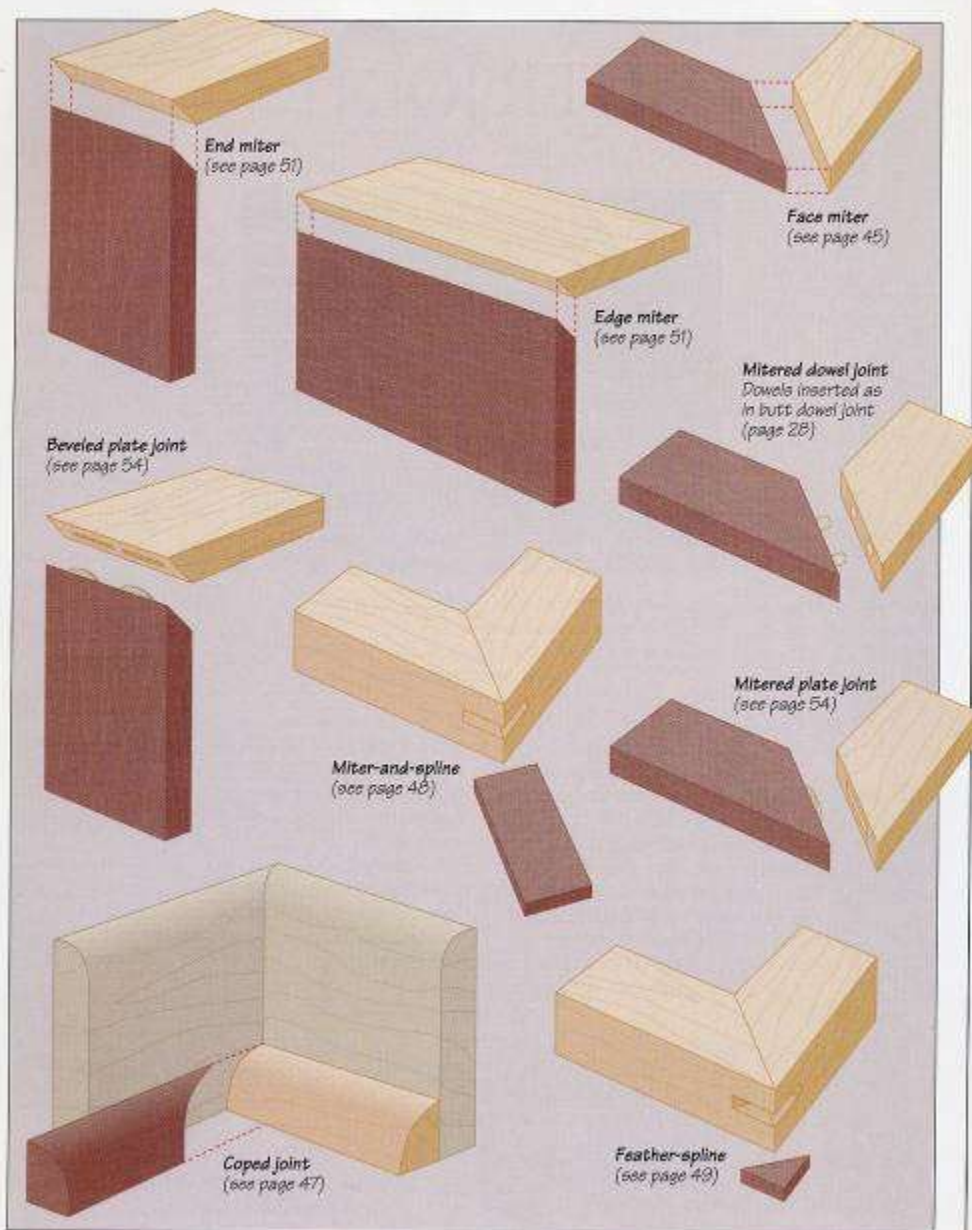


Splines are thin strips of wood commonly used to align and reinforce butt joints, like the edge, case, and panel joints shown above (clockwise from top left). Made from plywood or solid wood no more than $\frac{1}{8}$ the thickness of the stock, splines extend into grooves cut in both mating surfaces. Solid-wood splines should be cut with the grain running across their width, rather than lengthwise, to provide maximum strength. The width of the grooves should equal the thickness of the splines; their depth should be slightly more than one-half the width of the splines to allow for excess glue.

Συνδέσεις με γκινισόπηχεις



COMMON MITER JOINTS



MITER-AND-SPLINE JOINTS

The miter-and-spline is basically a face miter with a spline glued into grooves cut in the mitered ends. For maximum strength, the spline should be cut so that its grain runs across its width, rather than lengthwise, or be made from plywood.



FEATHER-SPLINE JOINTS

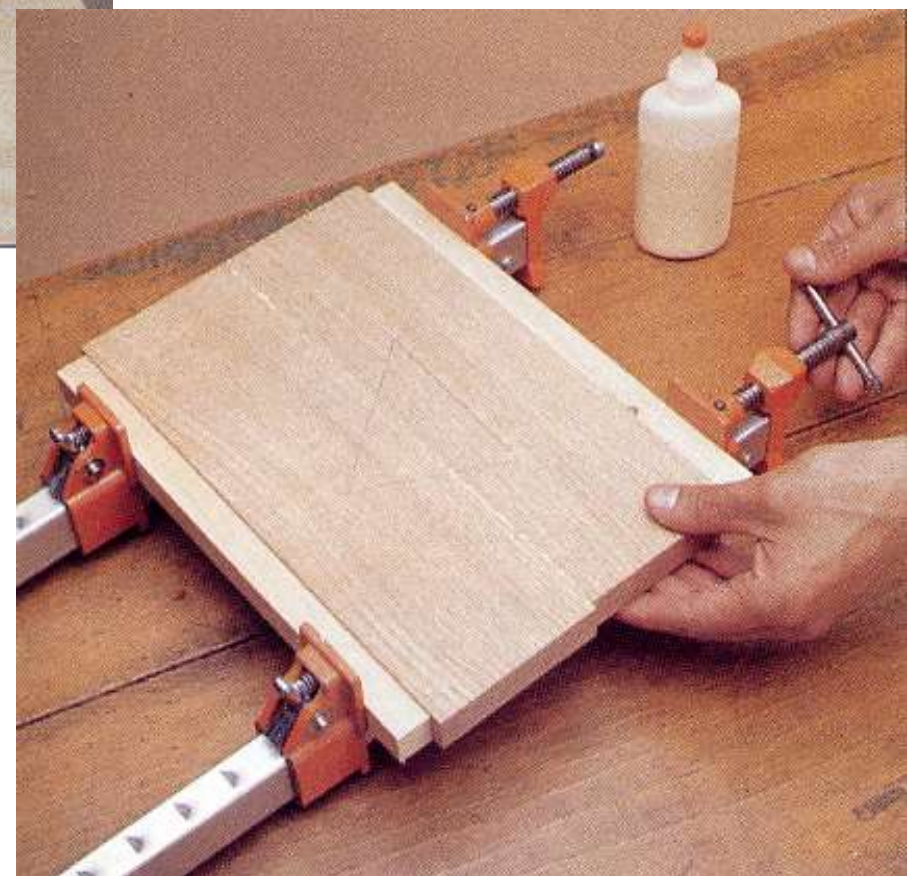
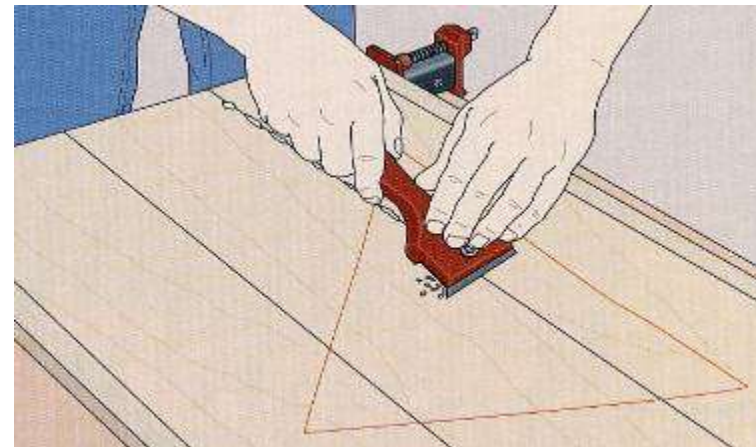
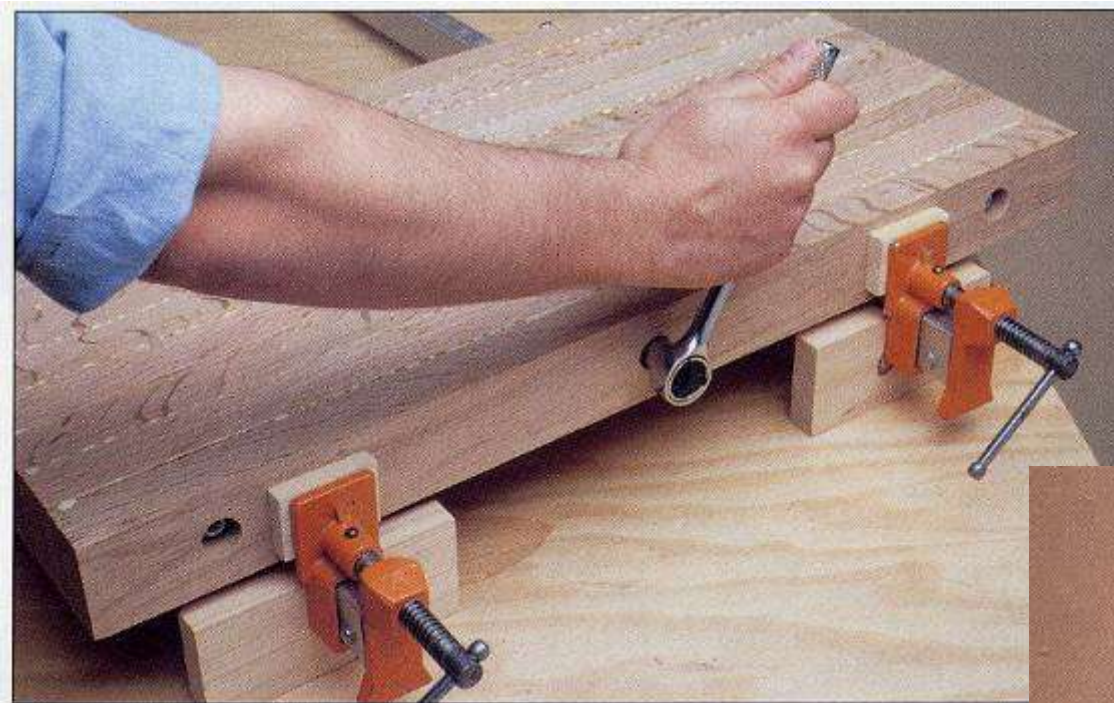
The spline in a feather-spline joint serves more of a decorative role than a structural one. In contrast to the miter-and-spline, the groove for the feather spline is cut after the corner is glued up.



EDGE MITER JOINTS

Edge miter joints feature matching bevel cuts in the mating pieces, either across the workpiece and (below) or along the edge (far right). The edge miter is a popular joint for carcass corners because it conceals end grain. Both examples shown are reinforced with splines.





GLUING ACCESSORIES

Glue brush

Long handles make brush ideal for delicate work; to prevent rust stains, linen-wound ferrule has no metal parts



Putty knife

For scraping away excess glue. Plastic type less likely to mar wood

Printer's trayer

Rubber roller evenly spreads a thin film of glue over a wide area; can be cleaned by repeatedly rolling it over a scrap board



Glue syringe

For applying glue in awkward places; available with flexible or curved tip which can be cut back for faster flow

Plate joiner

Holds glue bottle upside-down so that adhesive remains near tip, keeping it ready for application; nozzle is shaped to spread glue evenly on sides of slots cut by plate joiner

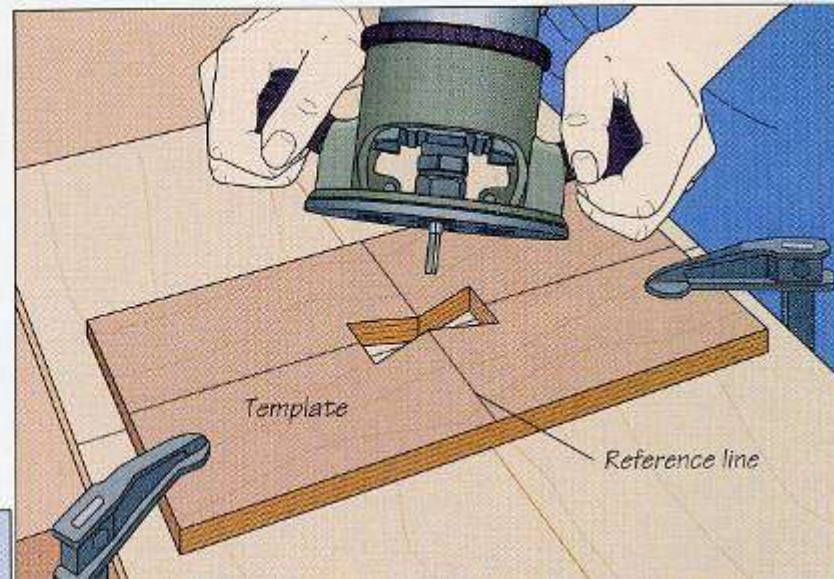


Συγκόλληση

BUTTERFLY KEY JOINTS

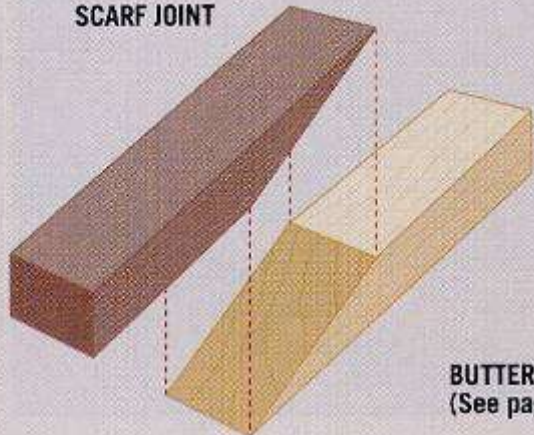


Also known as a double dovetail, the butterfly key joint serves to strengthen panel joints. If it is cut from a contrasting hardwood, the key adds a decorative element. There are several methods for making the joint, but here, the keys are fashioned on a table saw and the recesses for the keys are plowed with a router.



SCARF JOINT

BUTTERFLY KEY JOINT



BUTTERFLY
(See page



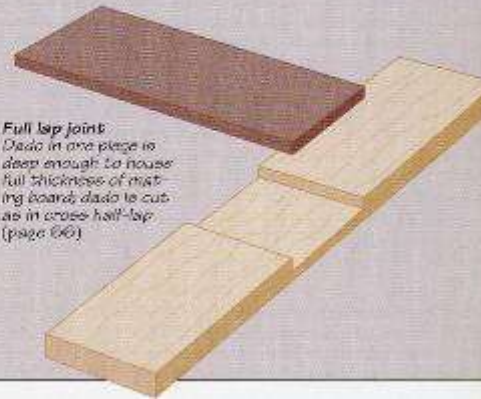
Μισοχαρακτές ενώσεις ξύλου

LAP JOINTS

T half-lap joint
Identical to cross half-lap joint (page 66), except one or both pieces intersect between ends, rather than at ends.

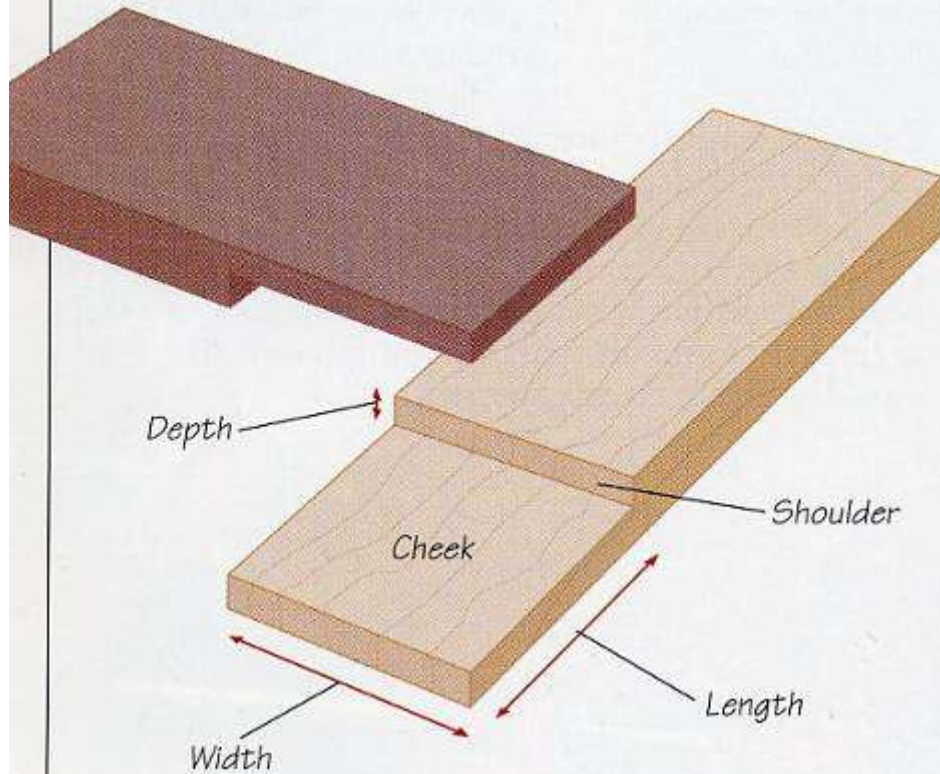


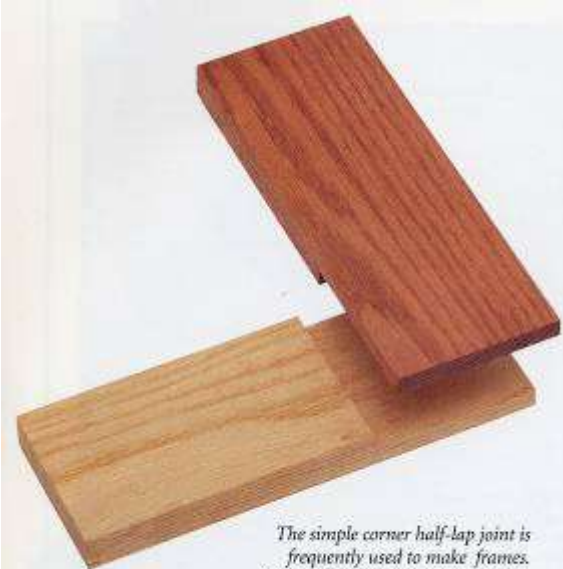
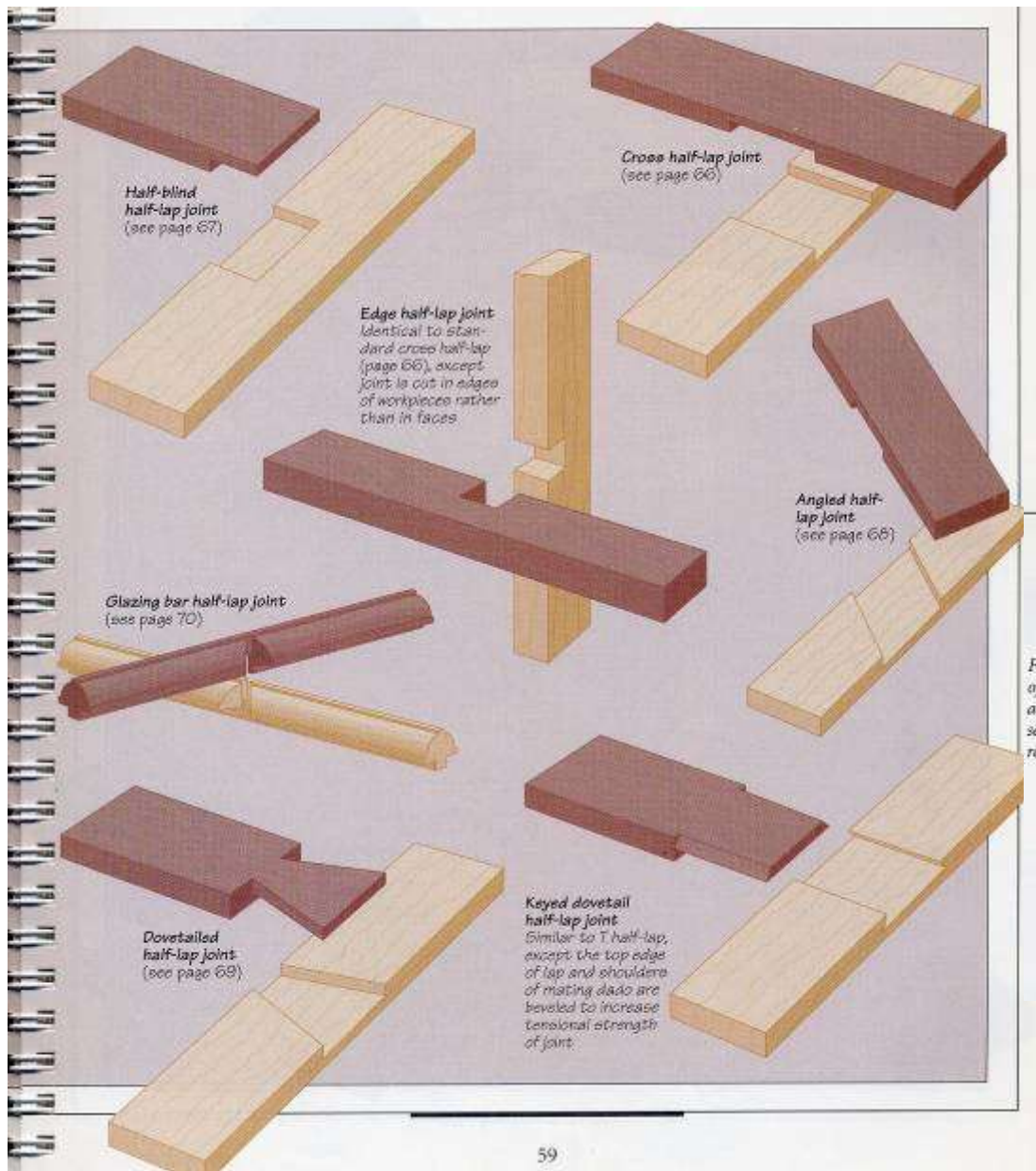
Mitered half-lap joint
Similar to corner half-lap (page 64); cheek of one piece and shoulder of mating board are mitered at 45°.



Full lap joint
Dado in one piece is deep enough to house full thickness of mating board; dado is cut as in cross half-lap (page 66).

ANATOMY OF A CORNER HALF-LAP JOINT (See page 64)





The simple corner half-lap joint is frequently used to make frames.

CROSS HALF-LAP JOINTS

Formed by cutting dados in two boards of equal thickness, the cross half-lap is an excellent method of joining the intersecting pieces of face frames. This joint requires no reinforcement.



DOVETAILED HALF-LAP JOINTS



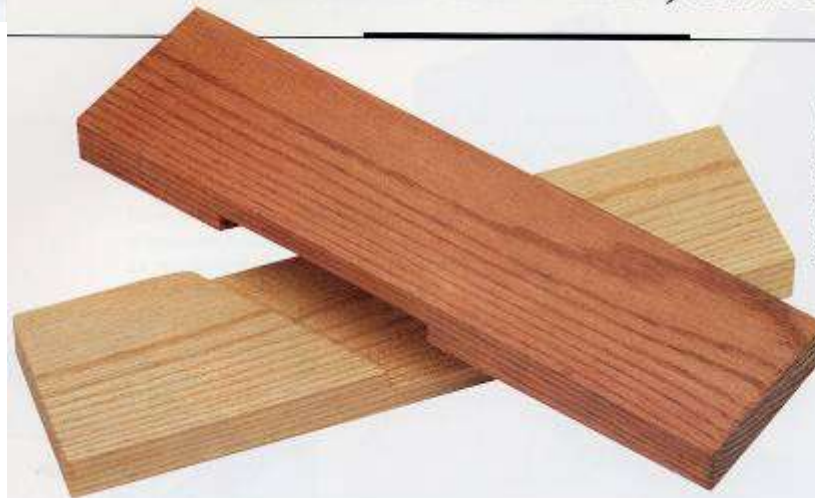
Combining the strength of the dovetail joint with the simplicity of the half-lap, the dovetailed half-lap is a favorite joinery method for frames and table stretchers. The joint strongly resists tension.

GLAZING BAR HALF-LAP JOINTS



For many of us, the glazing, or sash, bar half-lap joint is as familiar as the view from the kitchen window. Featuring a mitered half-lap cut into a molded wood strip, the joint has traditionally been used to create a grid to hold the glass panes of a cabinet door or window. The panes sit in rabbets routed along the edges of the bars and are held in place with thin strips of molding.

ANGLED HALF-LAP JOINTS

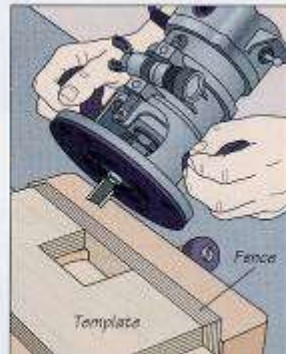


Woodworkers use the angled half-lap—or oblique lap joint—to join boards that cross at angles other than 90°, such as diagonal table leg stretchers.

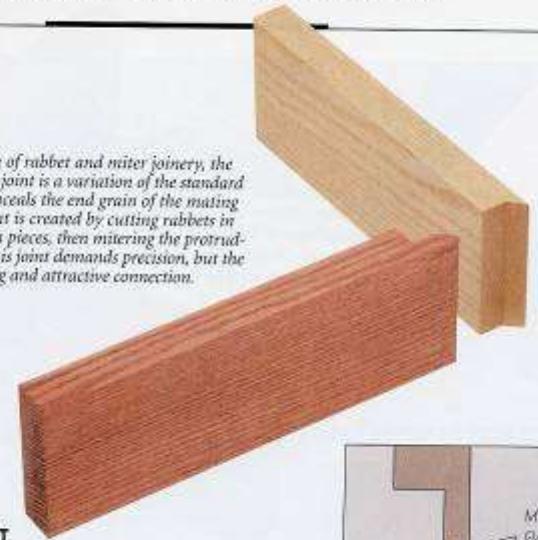
HALF-BLIND HALF-LAP JOINTS



A variation of the T half-lap, the half-blind half-lap joint conceals the end grain of one member. The socket for the half-lap can be cut with a router, as shown below, or by hand using a chisel.

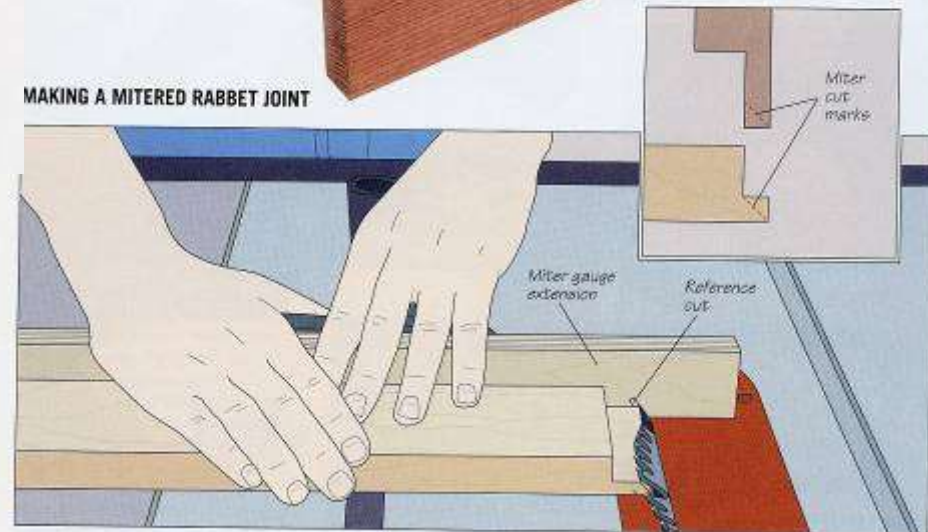


MITERED RABBET JOINTS



A combination of rabbet and miter joinery, the mitered rabbet joint is a variation of the standard rabbet that conceals the end grain of the mating pieces. The joint is created by cutting rabbets in the ends of both pieces, then mitering the protruding tongues. This joint demands precision, but the result is a strong and attractive connection.

MAKING A MITERED RABBET JOINT



TONGUE-AND-GROOVE JOINTS

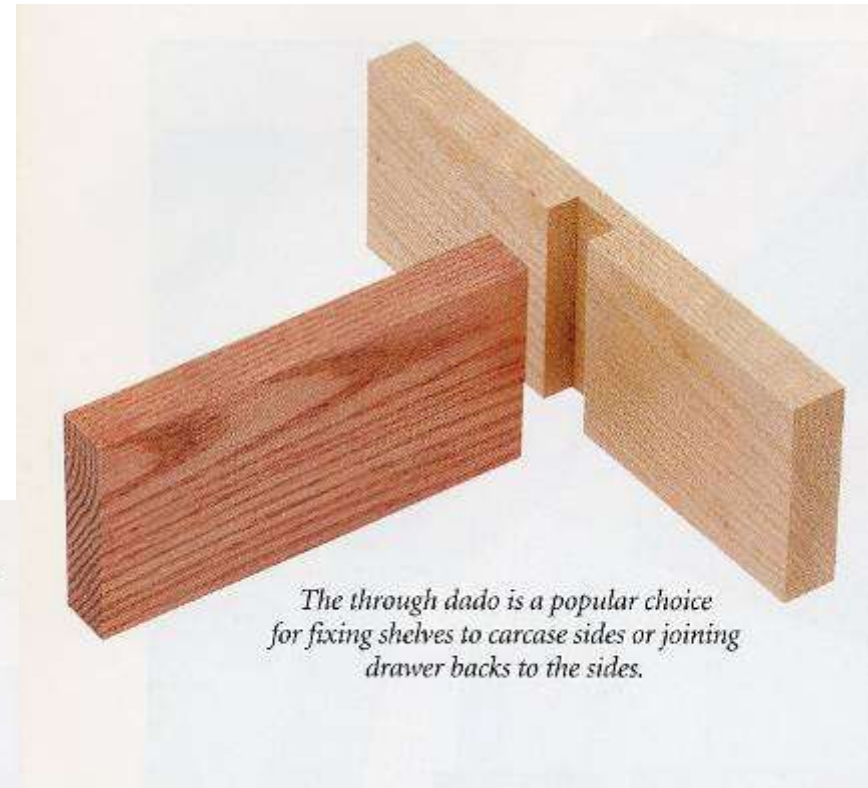


The tongue-and-groove joint has many uses for the woodworker—from joining boards edge-to-edge to fixing shelving to carcases. When used to form carcass panels, the joint can be assembled without glue to allow for wood movement caused by fluctuations in humidity.

SLIDING DOVETAIL JOINTS

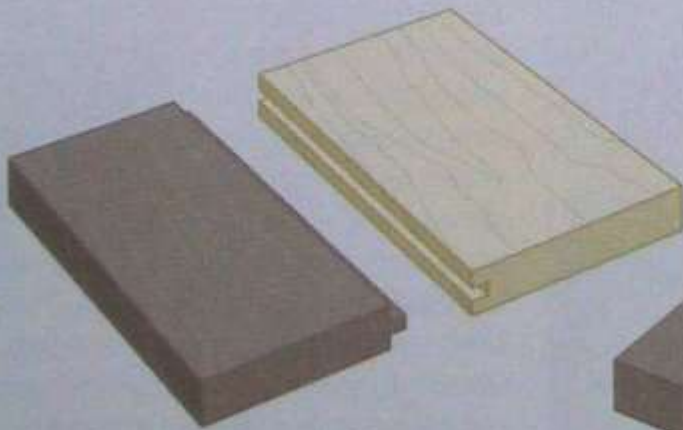


The sliding dovetail is commonly used to assemble drawers, attach crown molding to cabinets, and install shelves in carcasses. Because glue is not required to lock the mating pieces together, the joint is a good choice for furniture that must be disassembled.



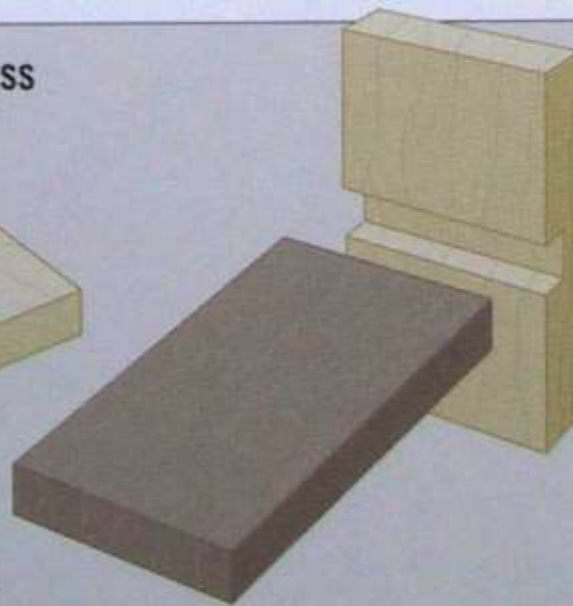
The through dado is a popular choice for fixing shelves to carcass sides or joining drawer backs to the sides.

IMPROVING A JOINT'S RESISTANCE TO STRESS



Tongue-and-groove joint

Simple, unreinforced butt joints resist compression only; they provide poor resistance to tension, shear, and racking. Replacing an edge butt with a tongue-and-groove joint makes it much more stress-resistant.



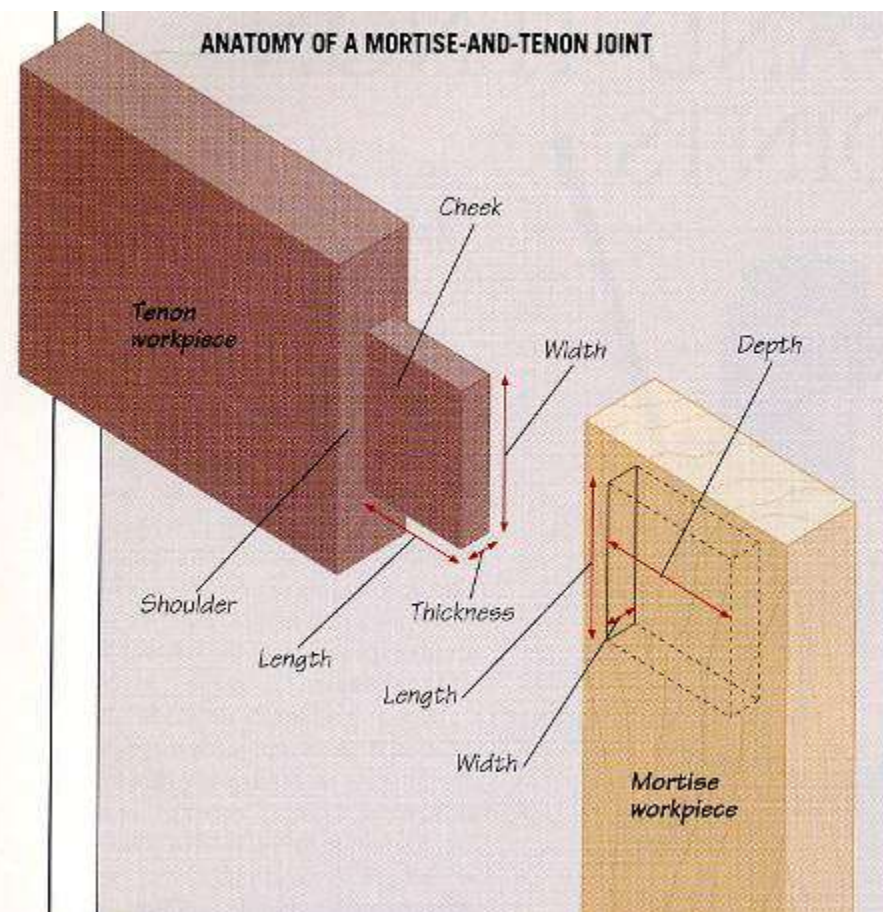
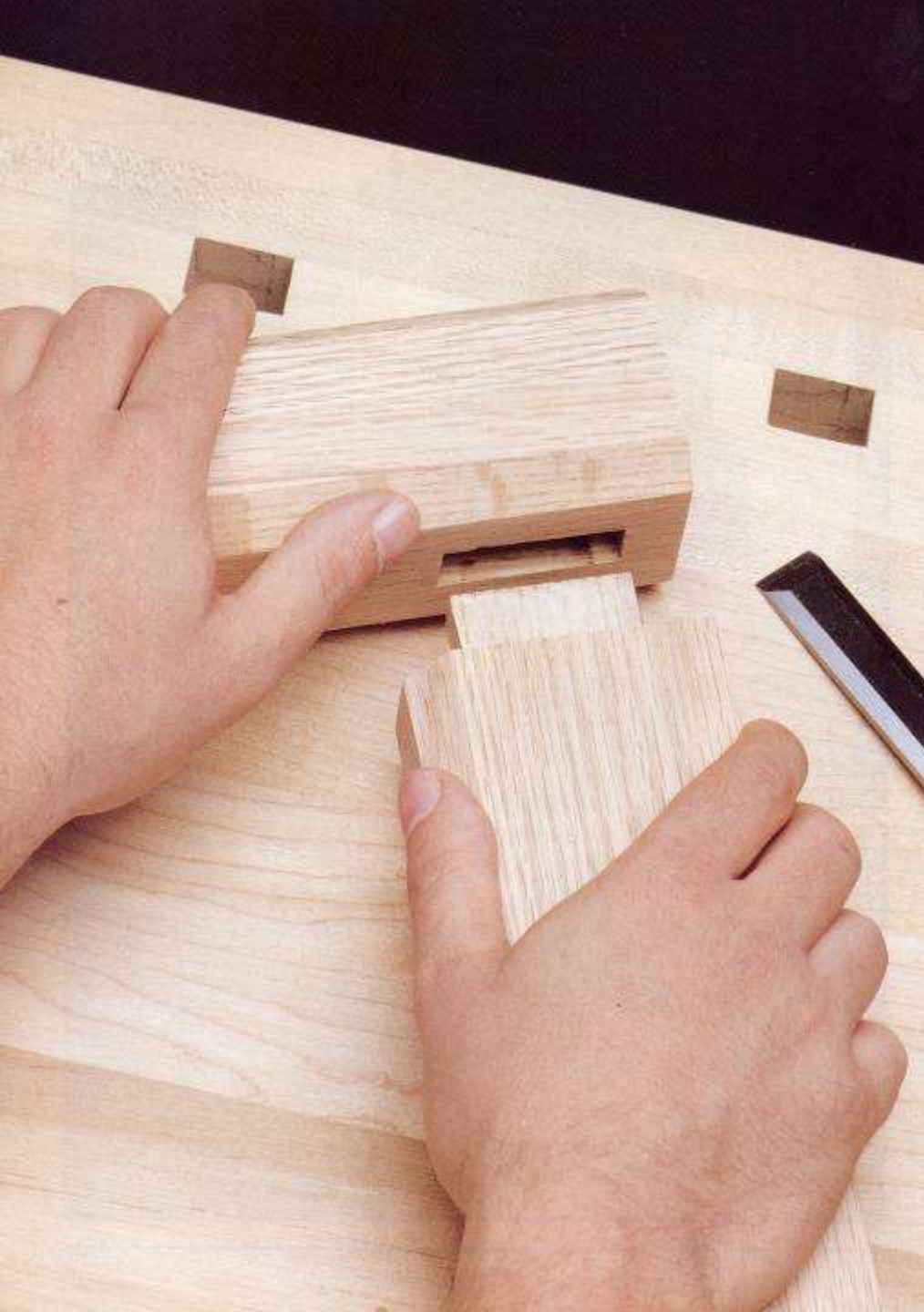
Dado joint

A simple dado joint resists compression, shear, and racking, but tension can pull it apart.

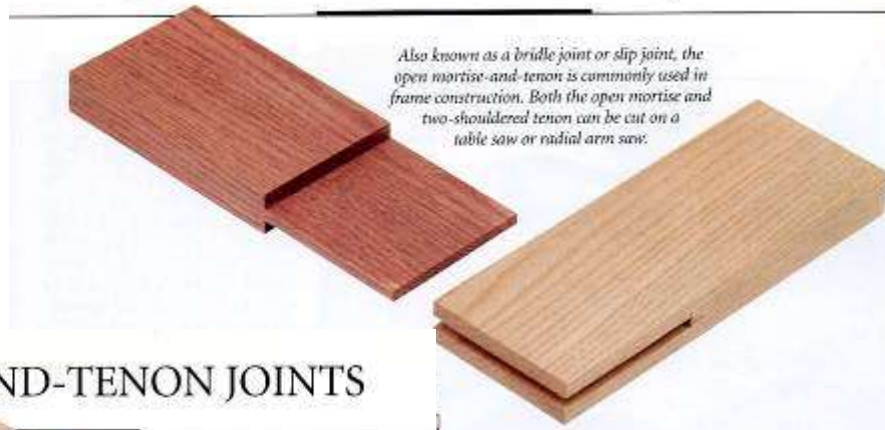
Stopped sliding dovetail joint

Fixing a shelf to a carcass side with a stopped sliding dovetail allows the joint to resist tension as well as compression, shear, and racking.





OPEN MORTISE-AND-TENON JOINTS



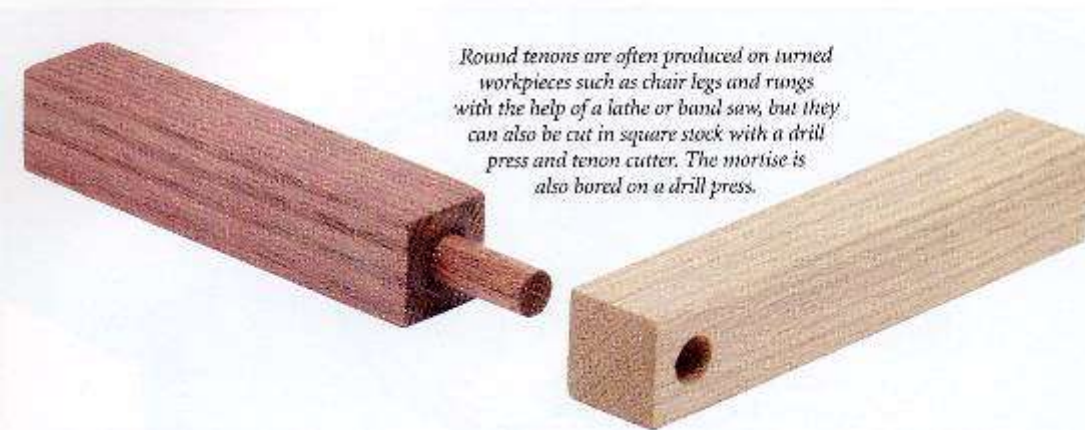
BLIND MORTISE-AND-TENON JOINTS



WEDGED THROUGH MORTISE-AND-TENON JOINTS



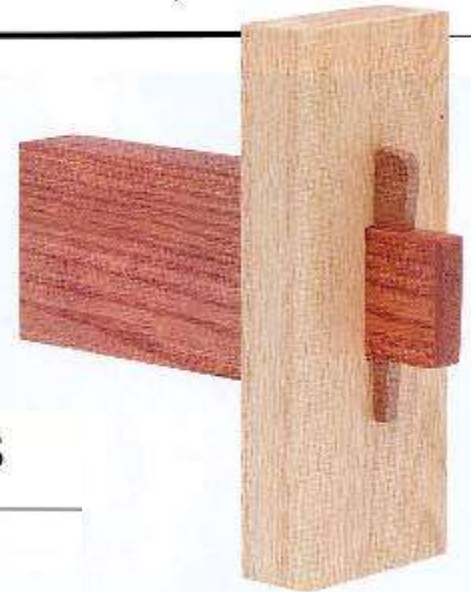
ROUND MORTISE-AND-TENON JOINTS



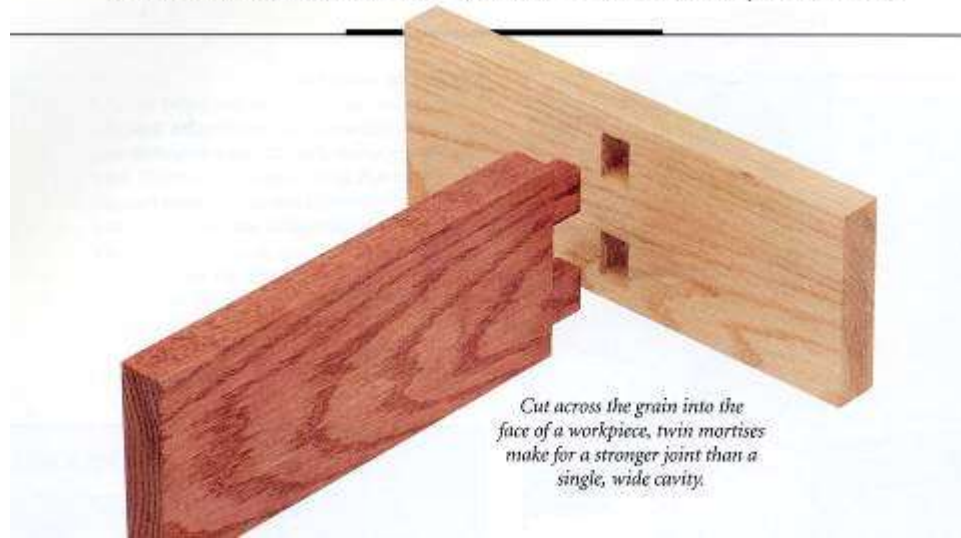
Round tenons are often produced on turned workpieces such as chair legs and rungs with the help of a lathe or band saw, but they can also be cut in square stock with a drill press and tenon cutter. The mortise is also bored on a drill press.

TUSK TENON JOINTS

The tusk tenon is commonly used to join the legs and stretcher of a trestle table. The tenon extends beyond the through mortise so that a tusk-like wedge can be inserted to lock the joint while enabling it to be disassembled. Depending on the length and width of the tenon, the wedge can be inserted through either its thickness or its width.

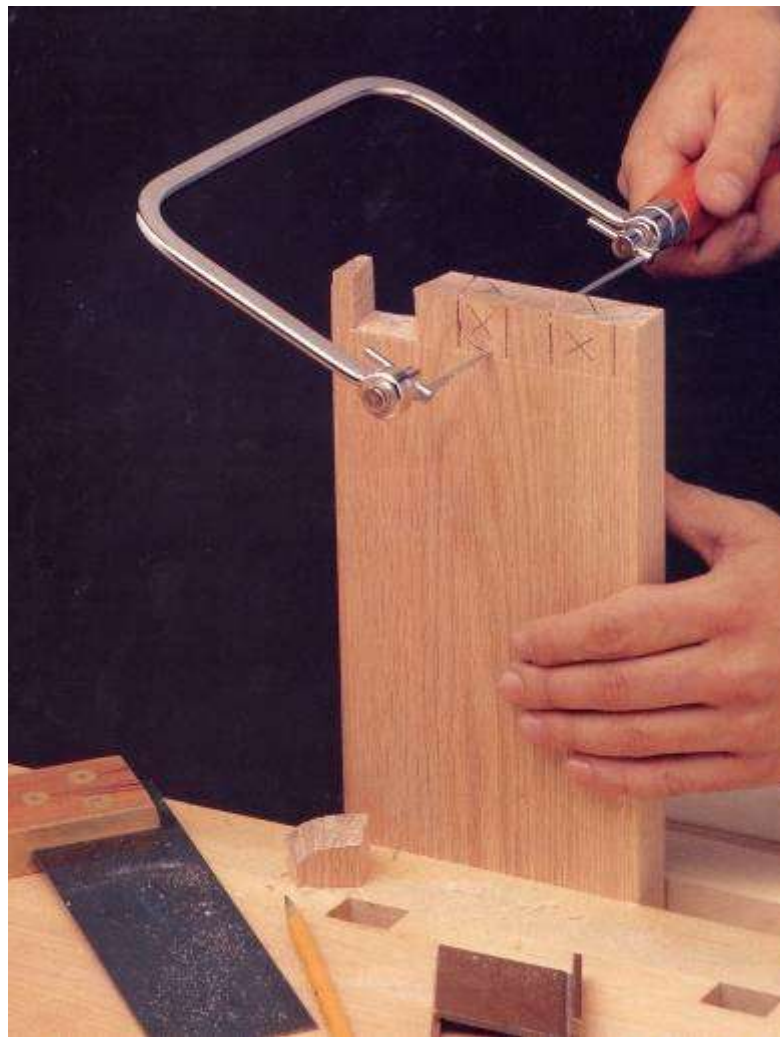


TWIN MORTISE-AND-TENON JOINTS

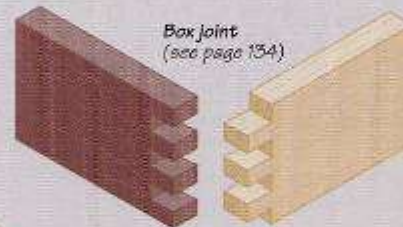
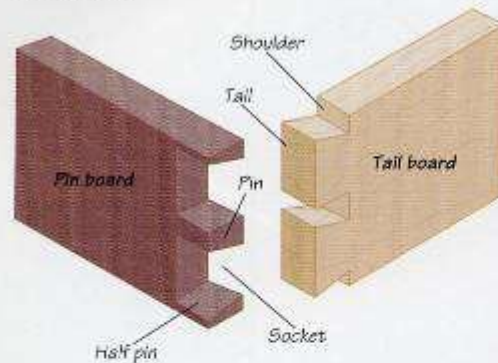


Cut across the grain into the face of a workpiece, twin mortises make for a stronger joint than a single, wide cavity.

A SELECTION OF DOVETAIL AND BOX JOINTS



ANATOMY OF A THROUGH DOVETAIL JOINT
(See page 118)



Blind dovetail
Similar to the half-blind dovetail joint, except the ends of the boards are rabbeted and the edges are mitered before the pins and tails are cut, concealing the end grain of both pieces

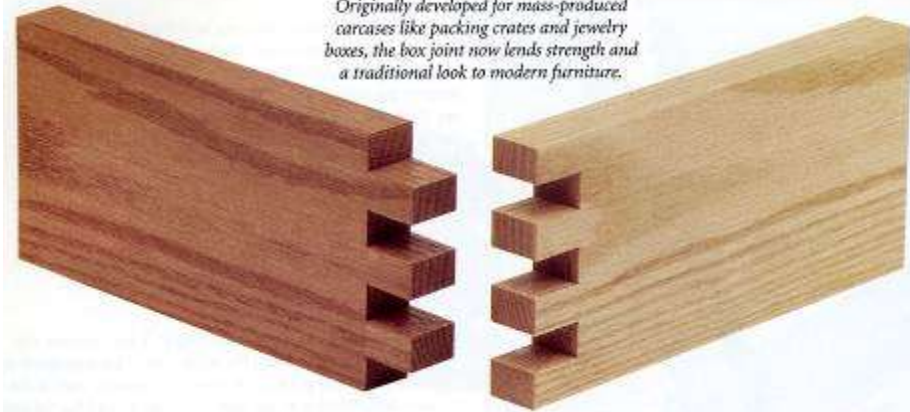
THROUGH DOVETAIL JOINTS

Combining mechanical strength with a distinctive appearance, the through dovetail joint is frequently used in fine furniture to join drawers and carcass corners.



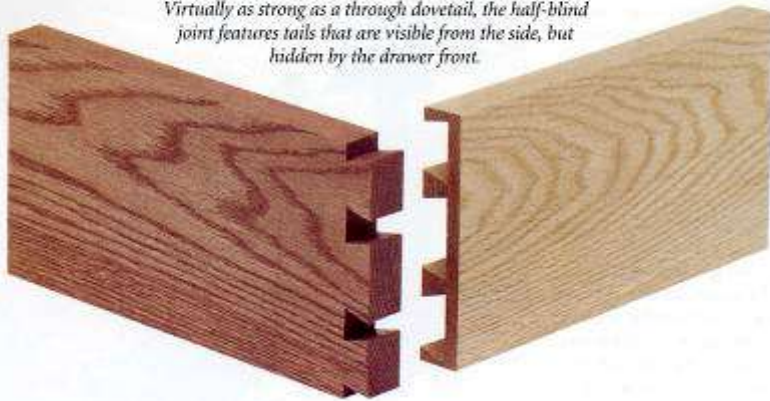
BOX JOINTS

Originally developed for mass-produced carcasses like packing crates and jewelry boxes, the box joint now lends strength and a traditional look to modern furniture.



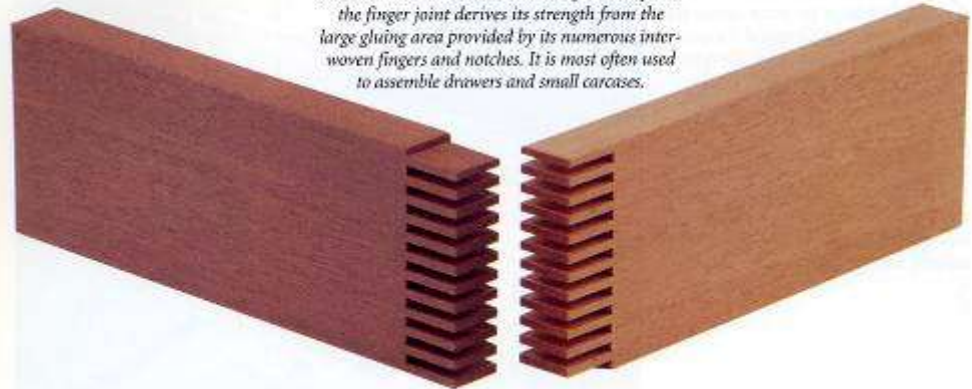
HALF-BLIND DOVETAIL JOINTS

Half-blind dovetails are often used for drawer fronts. Virtually as strong as a through dovetail, the half-blind joint features tails that are visible from the side, but hidden by the drawer front.

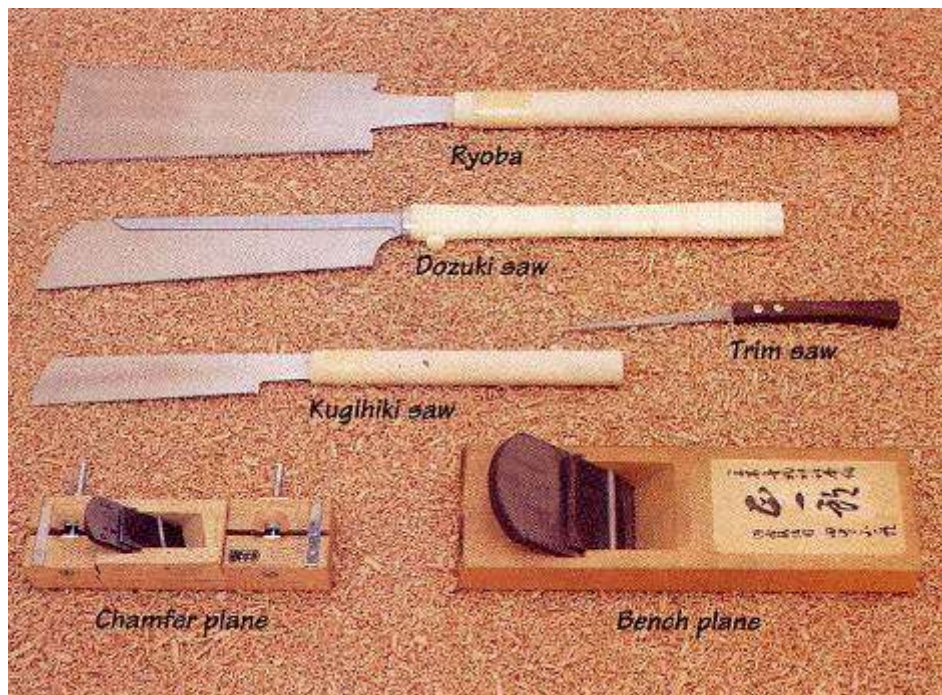


FINGER JOINTS

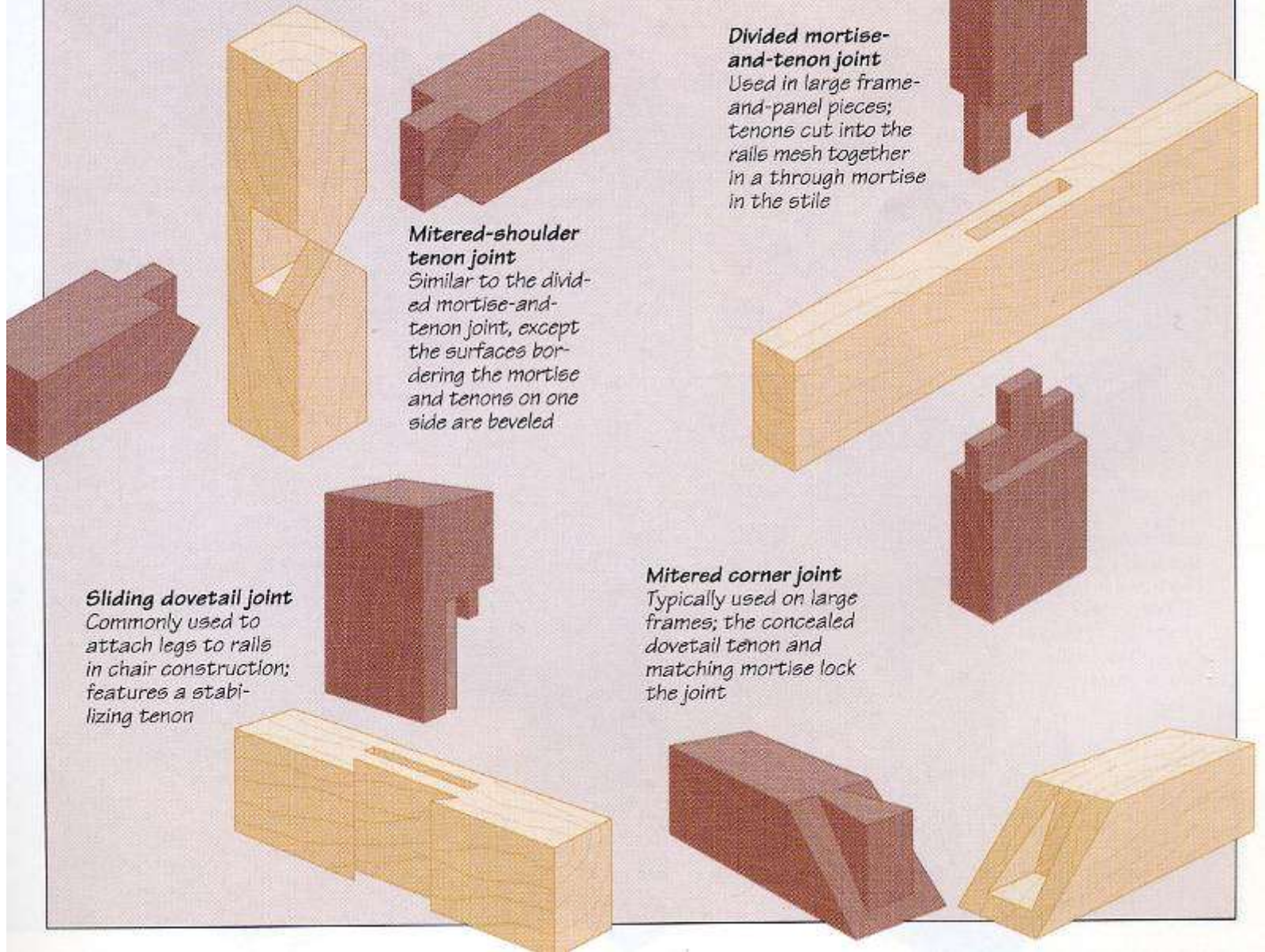
An attractive and solid variation of the box joint, the finger joint derives its strength from the large gluing area provided by its numerous interwoven fingers and notches. It is most often used to assemble drawers and small carcasses.

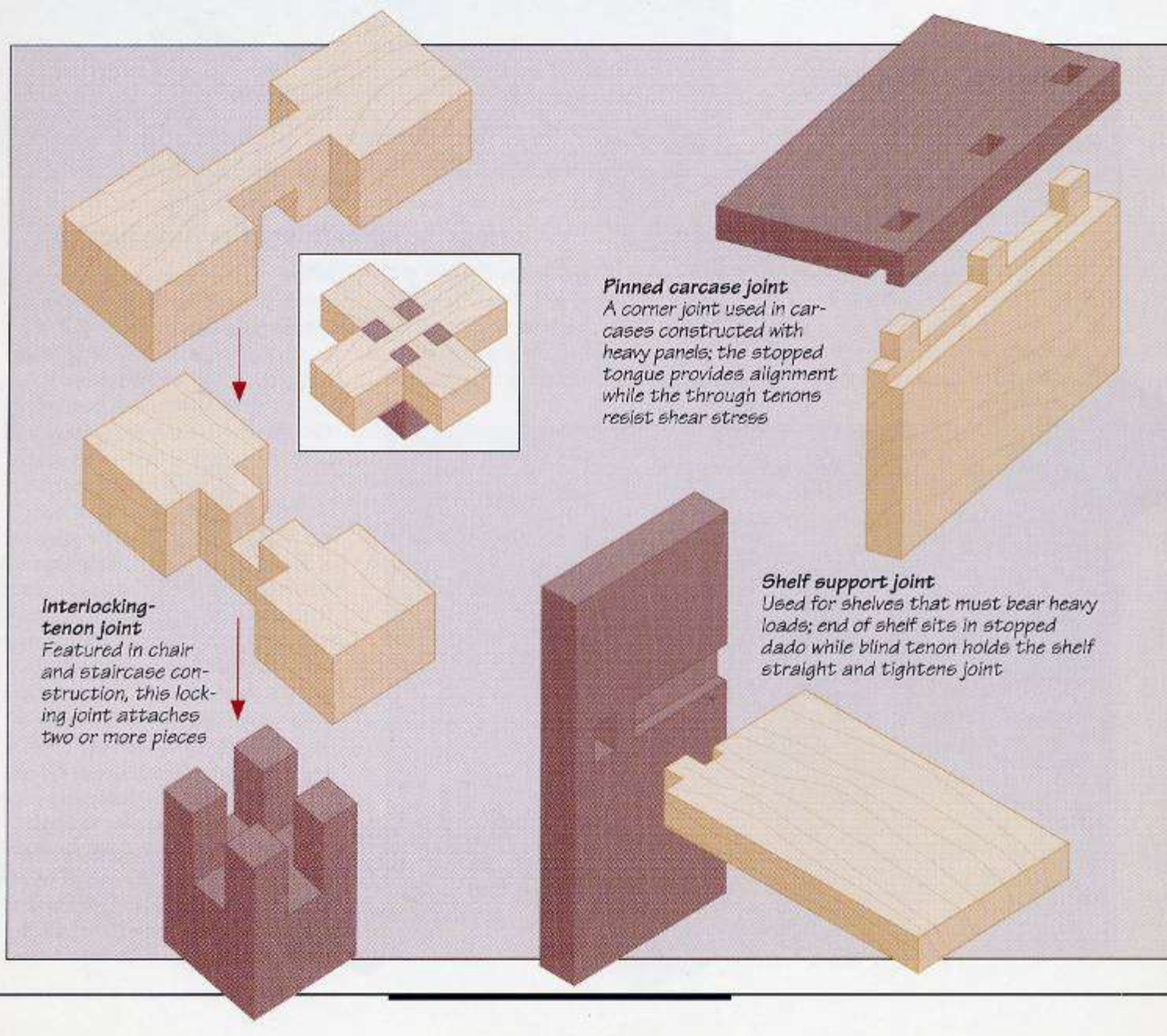


ΣΥΝΔΕΣΜΟΛΟΓΙΑ ΤΗΣ ΙΑΠΩΝΙΚΗΣ ΞΥΛΟΥΡΓΙΚΗΣ



A GALLERY OF JAPANESE JOINTS

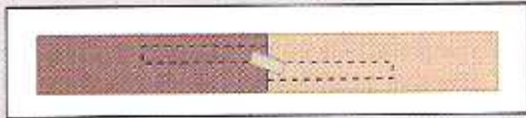




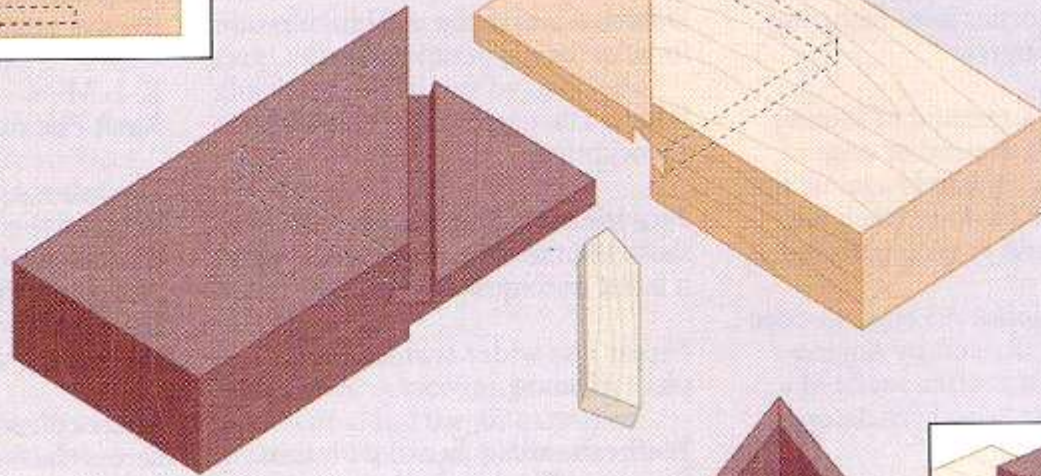
Interlocking-tenon joint
 Featured in chair and staircase construction, this locking joint attaches two or more pieces

Pinned carcass joint
 A corner joint used in carcasses constructed with heavy panels; the stopped tongue provides alignment while the through tenons resist shear stress

Shelf support joint
 Used for shelves that must bear heavy loads; end of shelf sits in stopped dado while blind tenon holds the shelf straight and tightens joint

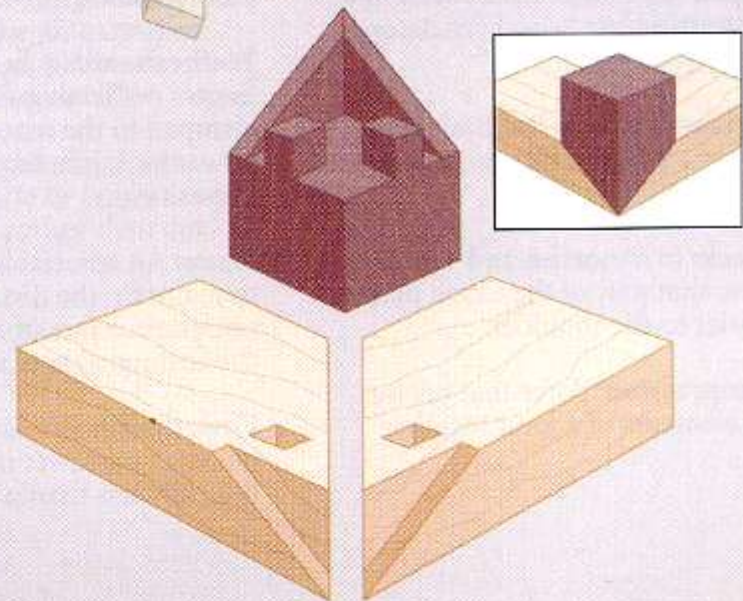
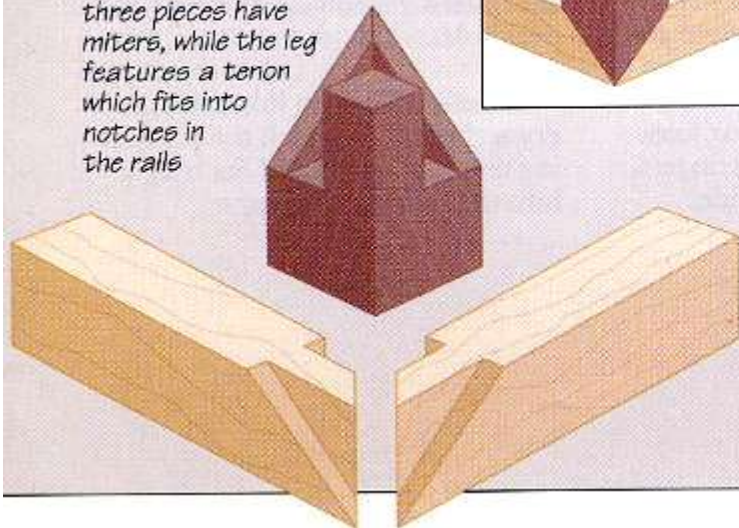
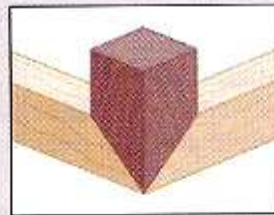


Interlocking-miter joint
Used in heavy frame construction; a half-lap-like joint with mitered shoulders and matching grooves in the cheeks sized to accept a spline. The joint is not glued, allowing it to be disassembled

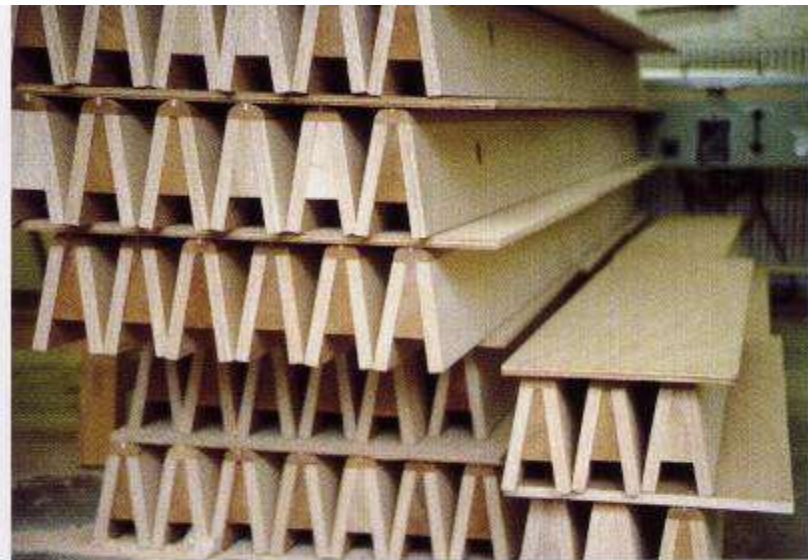


Three-way corner miter joint

A corner joint used in desks and dining room tables; all three pieces have miters, while the leg features a tenon which fits into notches in the rails



Three-way pinned corner miter joint
Similar to the three-way corner miter, this joint is used to reinforce thick rails connected at a face miter; two tenons in the leg pin the joint together



68B



5



7

