5.02 Timber Processing

a. tools
b. felling
c. pit sawing
d. sawmills
e. woodworking machinery
f. seasoning
g. preservative treatments
h. antproofing

a. tools

Australian hardwoods were unfamiliar to British settlers, and there were problems even in cutting down any of the more durable trees suitable for building. Governor Phillip complained from the first that 'bad tools are no kind of use'.[1] The problem was not only that the Australian timber was so much harder than the British, for English axes proved just as inadequate in Upper Canada, where Governor Simcoe made similar complaints.

> Particular attention must be given to the tempering of the Steel. without which the Axe will be of no value as is the case of those already sent over. The little attention given to this particular in England has already deprived her of a great part of the manufactory of edge tools.

He accompanied this with a ample American axehead, saying that if it could not be duplicated England could forget about selling axeheads in Upper Canada.[2] A little later he wrote even more forthrightly to Evan Nepean that 'The axes sent to this Country are so carelessly fabricated as to be totally incompetent to any Service whatever.'[3] In Australia likewise, Phillip, four years after his first complaint, was still asking for saws and axes, as those from England had worn out. Some attempts were being made to forge tools locally from scrap iron, but with very little success.[4]

By the 1820s distinctive local tools had begun to develop, and Peter Cunningham stated that' edge tools require to be particularly well tempered to withstand our hard woods.'[5] as he said:

> The common English *sale* [probably meaning 'shell'[6]] gimlets are either soon broken at the point by our woods, or else the handle becomes loose. The best

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1 Morton Herman, *The Early Australian Architects and their Work* (Sydney 1954), p 4, citing *Historical Records of News South Wales,* I, part II, p 556.
2 J I Rempel, *Building with Wood and other aspects of Nineteenth-Century Building in Central Canada* (Toronto 1980 [1967]), p 362.
3 Rempel, *Building with Wood,* p 365.
4 Herman, *Early Australian Architects,* p 4, citing *Historical Records of News South Wales,* I, part II, p 643.
5 Peter Cunningham, *Two Years in New South Wales* (2 vols, London 1827), II, p 165.

> method is to file off a portion of the screw, sharpening the remains to a point, give the gimlet a half turn backwards every bore you make, and clean it frequently. Centre-bits are by far the most expeditious, however, and a dozen sets each of bits for boring nail-holes of all sizes ought to be taken out.[7]

The inadequacy of the tools available, and the initial lack of understanding of the local species, delayed the adoption even of practices which were common in Britain. Even weatherboard cladding, widespread in Wales, Kent and Sussex,[8] made only a belated appearance, as will appear below. Nonetheless, most tools were of standard overseas types, mainly British at first but increasingly American as time wore on. Cross-cut saws, however underwent a similar process to that for axes.

In the 1850s John Capper recommended to the settler a 'crosscut saw, six feet plate at least; seven feet better, square teeth; files for ditto, at least half-a-dozen; and saw-set.[9] Spear & Jackson of Sheffield showed a wide range saws and other tools at the Melbourne International Exhibition of 1880, and were awarded a gold medal,[10] while later in the decade they were reported to have taken 'a great hold on the market' for saws,[11] though this was by no means a monopoly. In 1886 F Lowe & Co of Melbourne were advertising as agents for the saws and other products of W Tyaack, Sons & Turner, of Sheffield.[12] Then in 1888-9 Disston & Sons of Philadelphia exhibited their circular and flat saws, and their 'saw grinding machinery', and they were soon to take a substantial share of the local market.[13] During the 1880s saws with 'square teeth' were introduced in the United States, typically with an arrangement of two clearing teeth alternating with one cutting tooth.[14]

In 1897 a Tasmanian, A Goold, introduced saws with teeth in the shape of a large inverted 'M' instead of a single peg tooth, but did not patent the design.[15] Salaman, however, describes the M-tooth type as a popular one dating from the fifteenth century and implies that the Tasmanian type is different, though he does not illustrate it.[16] Disston and Son of the United States, and a British company, apparently Spear & Jackson, immediately began to produce this type, which became known as the Tasmanian pattern. This was soon recognised as the best, and other British makers began to produce it.[17] About the turn of the century Disston saws won all competitions, followed by Simmonds, then Spear & Jackson. At the International Wood Chop and Sawing Competition of 1899, however, neither Spear & Jackson nor any other British firm entered, so the competition was between the Americans

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6 H A Salaman, *Dictionary of Woodworking Tools* (Mendham [New Jersey] 1997 [1989 (1975)]), p 278.

7 Peter Cunningham, *Two Years in New South Wales* (2 vols, London 1827), II, p 166.

8 Trudy West, *The Timber-Frame House in England* (Newton Abbot [Devonshire] no date), p 88.

9 Capper, *Philips' Emigrant's Guide*, p 45.

10 Melbourne International Exhibition, 1880-1881, *Official Record* (Melbourne 1882), p 614.

11 *Australasian Builder & Contractor's News*, 3 September 1887, p 268.

12 *Australasian Ironmonger* , 1 December 1886, advertisement p vi.

13 Centennial International Exhibition 1888-1889, *Official Record* (Melbourne 1890), pp 833, 837.

14 C D Elliott, *Technics and Architecture* (Cambridge [Massachusetts] 1992), p 15.

15 Val Quanchi, 'World Competition to Ascertain the Best Saw and Axe', *Tool Chest*, XI, 1 (February 1999), p 27.

16 Salaman, *Woodworking Tools*, p 416.

17 Quanchi, 'The Best Saw and Axe', p 27.

Simmonds, H Disston & Co, and the eventual winners, the Atkins saw Co.[18] Henceforward the 'Tasmanian tooth' as well as the plain or peg tooth saw was a feature of the Australian market, and though Disstons had not won the competition, they appear to have become the leading suppliers.[19] In 1924 Colton, Palmer and Preston of Adelaide stocked both Tasmanian tooth and 'Great American Tooth' Disston crosscut saws.[20] It is interesting, by comparison, to find that a leading French supplier in around 1900 advertised nothing but uniformly toothed saws.[21]

Some other tools evolved significantly during the period of Australian settlement, though the changes were not initiated here. One was the woodworker's plane, a tool known since Roman times and recognisably the same in all salient respects. In 1829 a United States patent was issued for a plane with a metal sole, and in 1843 W Foster received a patent for an improvement whereby the thickness of the shaving was varied by turning a screw. In 1854 a screwed clamp was introduced instead of a wedge, to secure the iron. In 1858 Leonard Bailey received a patent for a friction device to adjust the cutter, which was not very effective. However he introduced a number of further improvements until 1869, when he sold his business to the Stanley Rule and Level Co, and himself became head of their plane department. The Stanley all-metal plane followed in due course.[22] A full range of Stanley planes was offered by Colton, Palmer & Preston in the 1920s.[23]

b. felling

One of the best descriptions of felling a tree is that of a settler of the 1850s, quoted in W T Pyke's *Bush Tales:*

> First, it is requisite to seek a tall, straight, stringy bark tree of good size, and after cutting a small piece out to see how the grain runs, the next thing is to 'ring it,' as it is technically called; that is, to cut off a strip of bark all round the tree for about a foot in width, and applying a saw to the side on which the tree leans, cut it until the saw is jammed. At this point an axe is used to cut underneath the butt, in order to have the end of the trunk square; after this the other side must be cut, and the tree will presently fall. Sometimes when the tree happens to stand very straight, it will need a wedge to be inserted in the cut made by the saw, and driven in until the tree falls.[24]

The aim in cutting a tree was to get above the 'buttresses' or flared ribs at the base, leading to the roots, for the straight part of the trunk was much less in diameter and proportionately easier to cut. But this required the construction of a platform for the

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18 Quanchi, 'The Best Saw and Axe, pp 28-9.

19 Danks, *Wood-Workers' Catalogue*, p 9. A 'Jarrah' or 'M tooth' crosscut saw, in which the tooth shape is similar but perhaps slightly simplified, was later being made by Simmonds and by Sanderson Bros. & Newbould: McPherson's, *Catalogue*, p 25.

20 Colton, Palmer & Preston, Ltd., *Tools for all Trades* (Adelaide [1924), p 47.

21 Comptoire de l'Industrie, L Laurent, Carrée & Binoche [successors of L Laurent & Carrée], *Tarif pour Sciences Mécaniques (No. 10)* (nd), bound with Comptoire de l'Industrie, L Laurent & Carrée, *Tarif des Fournitures Générales pour l'Industrie* (Reims [c 1890]).

22 Stanley Works (G.B.) Ltd, *A Brief History of the Woodworker's Plane* (Sheffield, no date), passim.

23 Colton, Palmer & Preston, *Tools for all Trades*, pp 40-41

24 W T Pyke, *Bush Tales by old Travellers and Pioneers* (Melbourne 1893 [1888]), p 71.

men to stand on, or the insertion of logs or planks into the trunk as cantilevers for the same purpose. A device intended to reduce the strain of supporting the saw involved hanging it from struts fixed into the trunk above, so that it could be rocked back and forth freely, but nothing seems to have come of this.[25]

English axes had the same limitations as other English tools. In Van Diemen's Land in 1817 William Thornley tried to cut down a tree using heavy broad axes which he had brought from England, but had much more success with the 'camp axes' which he bought in Hobart, and which were 'much longer in the handle and narrower in the blade', though it is not clear where they were made.[26] In Western Australia from 1829 the settlers also found English axes unsuitable for local hardwoods, and got around the problem mainly by ringbarking and burning to clear the land.[27] Even in 1841 James Allen of Brownhill Creek, South Australia, wrote 'Few axes that are sent here will stand against our wood, without being re-hardened'.[28] By the 1820s distinctive local tools had begun to develop, at least in the east, and Peter Cunningham stated 'Our felling axes are long and narrow, to penetrate our iron woods more readily, and with one somewhat larger and narrower still, the mortices are cut in the posts.'[29] This implies that axes different from the English standard were used, but it may be that this was a question of selecting one of the less usual English types rather than redesigning the implement entirely.

Robert Irving has explained that the English felling axe, though unsuitable for the job, remained the norm in Australia until the American axe was imported, probably in the 1860s.[30] It may have been somewhat earlier than this, for the problem had been obvious from the beginning. In Canada it was said in 1838 that 'an axe has not yet been manufactured in England in the form or temper which long experience has proved best. A good chopper will do treble the work with an American made axe than he could do with an English made one.'[31] In New Zealand George Earp wrote in 1853 that carpenters:

> should always have a good assortment of tools ...
> .. make a selection of American axes, all others are of no use ... the timber of New Zealand will try the goodness of the best article.[32]

In fact suitable axes began to be made in Australia at about this time, and John Capper recommended the settler to equip himself with 'a common Australian axe

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25 John Vader, *Red Cedar, the Tree of Australia's History* (French's Forest [New South Wales] 1988]), p 85.

26 William Thornley [ed J S Mills], *The Adventures of an Emigrant in Van Diemen's Land* (Adelaide 1973 [1840s]), pp 40-41.

27 J M R Cameron, 'Patterns on the Land, 1829-1850', in J Gentilli [ed] *Western Landscapes* (Nedlands [Western Australia] 1979), p 209.

28 Colin Kerr, *'An Exelent Coliney'* (Adelaide 1978), p 130.

29 Peter Cunningham, *Two Years in New South Wales* (2 vols, London 1827), II, p 165.

30 Robert Irving, 'The First Australian Architecture' [MArch, University of New South Wales 1975], p 187, citing inter alia Mary Gilmore, *More Recollections* [], pp 145, 146, with a comparative illustration of axe heads from Ralph Hodgkinson, *Tools of the Woodworker* [technical leaflet No 28 of the American Association for State and Local History].

31 Rempel, *Building with Wood*, p 365.

32 G B Earp, *New Zealand Emigration and the Gold Fields* (London 1853), quoted in C P Murphy, 'The Fencible Cottage: Soldier Housing' (MArch, University of Auckland, 1995), p 73.

forged in the colony'.[33] Certainly by 1866 axes on the American pattern were being made in Melbourne by Peter Valot, and the judges at the Intercolonial Exhibition considered them virtually indistinguishable from the real thing, made of the finest steel and properly tempered.[34]

A German observer commented that the American axe would fell and smooth logs in the same number of hours as the German axe would require days.[35] It was likewise superior to the English one, which had a large but light head, a straight cutting edge, straight tapered cheeks and a straight short handle. The American axe, 'a steel version of the Red Indian axe', had a small, heavy head with fat cheeks and a curved cutting edge, and a long tough hickory handle which could absorb shock: it was swung wide and thrown into the wood, whereas the English axe was used like a chopper.[36] Salaman explains that the English axe had a smoothly curved handle, oval in cross-section, and thickened slightly at the foot. American felling axes had a double curved 'fawn-foot' pattern handle, apparently devised in the mid-nineteenth century, which permits a fixed grip near the foot with one hand, and a sliding grip with the other.[37] Salaman also illustrates an axe head made in Britain for the Australian market, a heavy version of what is known as the 'Kent' type. This embraces a number of variations, but all with a symmetrical round-shouldered blade, a flat poll (the side opposite the cutting face), and pointed lugs above and below the eye through which the handle is fitted.[38]

Late in the century settlers in the Goulburn Valley used an American axe called 'The Sharp', made by the Douglas Axe Co, and this gave rise to an idiomatic expression 'swinging Douglas'.[39] By the 1890s the Douglas and other American brands such as Plumb, Underhill, Hubbard, Chopper's Pride Mam, and Lippincoat, had largely displaced English axes such as Elwell and Gipin. In axemen's competitions Plumb and Underhill proved the best, and by 1892 most competitors favoured the Underhill bronze coloured axe. Local blacksmiths were themselves making improved axes, and the United Axemen's Association invited axe competitors and manufacturers to submit ideas for the best axe design. Agreement was reached that the ideal was a blade $5^1/_4$ to $5^1/_2$ inches [134-141 mm] wide, a total depth of $7^1/_2$ inches [192 mm], a half inch [13 mm] pole, a width at the handle of $4^1/_2$ inches [115 mm], and a total weight of six pounds [2.72 kg]. Four American companies, but no British ones, were able to supply this.[40] By 1897 90% of competitors preferred American axes despite a general belief that the British ones were of higher quality manufacture.[41] It does not appear, however, that Australia took to the double-sided axe which West Coast lumbermen had adopted in the 1870s. There the motivation was that one side could

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33 John Capper [ed D J Golding], *Philips' Emigrant's Guide to Australia* (Melbourne 1973 [London 1855]), p 45.

34 Intercolonial Exhibition of Australasia, 1866-67, *Official Record* (Melbourne 1867), pp 31, 332.

35 John Fitchen, *Building Construction before Mechanisation* (Cambridge [Massachusetts] 1986), pp 136-7.

36 J K Andrews, 'History of Merrigum' (manuscript, Merrigum [Victoria] 1954, copy supplied by Anne Tyson 1997), p 27.

37 Salaman, *Woodworking Tools*, p 48; also p 194 for illustrations of fawn-foot handles.

38 Salaman, *Woodworking Tools*, pp 52 58.

39 J K Andrews, 'History of Merrigum' (manuscript, Merrigum [Victoria] 1954, copy supplied by Anne Tyson 1997), p 27.

40 Quanchi, 'The Best Saw and Axe, p 25.

41 Quanchi, 'The Best Saw and Axe', p 27.

be used for undercutting, while the other was reserved for hard knots and other work that would quickly dull the edge.[42] Such contrasts were perhaps less pronounced in Australian timbers.

J C Penny, writing after the turn of the century, refers to the astonishing workmanship of Tasmanian axemen, who produced surfaces as clean and true as if cut by machinery, and who were expert with the broad axe as well as 'the ordinary American axe'.[43] In 1898 the English company Brades had taken an interest in the market, and sent out specimen axes, which were judged to be the best yet seen. Brades then sent out a case of axes for the International Wood Chop and Sawing Competition in Tasmania in 1899 and won the competition, notwithstanding the fact that the American Axe and Tool Company had produced their Hollow Concave Axe in January 1899. This latter company had by 1902 acquired many of the other American manufacturers.[44] It was this competitive process which established the form of the 'Tasmanian Axe' as manufactured for many years afterwards. Soon John Danks of Melbourne advertised Plumb's, Collins and Brades (Cockatoo brand) axes in the Tasmanian pattern, each in seven weights from 4 to 5½ pounds [1.82 - 2.50 kg].[45] In 1924 Colton, Palmer & Preston stocked the Plumb Tasmanian pattern and the Kelly Standard Hand Made Axe in the Tasmanian pattern, as well as 'Kelly's Perfect Yankee Pattern'.[46] In 1949 McPhersons of Melbourne were similarly advertising Plumb's Tasmanian Pattern, Kelly Dandenong Tasmanian Pattern and Brade's Cockatoo axes.[47]

c. pit sawing

Bulk timber was sawn over a pit, in a manner which was traditional not only in Britain, but in many other parts of the world,[48] and requires no particular description here.[49] According to Robert Irving, some of the first sawpits were dug by the marines and were worked by convicts, who were able to saw some slabs in their own time and barter them for other goods.[50] By April 1788 there were already several such pits on the east side of Sydney Cove and at the head of the Tank Stream.[51] A sawpit was established in Brisbane by 1826, and measured 15 by 7.2 metres, to accommodate at least four sawyers. It was built with strong posts, wall plates, tie beams and a

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42 Elliott, *Technics and Architecture*, p 14.

43 J C Penny, *Tasmanian Forestry* (Hobart 1910), p 42.

44 Quanchi, 'The Best Saw and Axe', pp 27-8.

45 John Danks & Son Pty. Ltd., *Wood-Workers' and Builders' Tool Catalogue* (Melbourne, no date [c 1900]), p 55.

46 Colton, Palmer & Preston, *Tools for all Trades*, p 2

47 McPherson's Limited, *Catalogue* (Melbourne 1949), p 278.

48 Fitchen, *Building Construction before Mechanisation*, p 274, n 10, refers to pit sawing in the Philippines, Japan, Manchuria, Afghanistan, Turkey and Armenia.

49 For a brief description see Philip Cox & J M Freeland, *Rude Timber Buildings in Australia* (London 1969), pp 16-17.

50 Irving 'The First Australian Architecture', p 154.

51 [Francis Fowkes, attrib], 'Sketch and Description of the settlement at Sydney Cove, &c', 16 April 1788, reproduced in Tim McCormick et al, *First Views of Australia 1788-1825* (Chippendale [New South Wales] 1987), p 37.

thatched roof for shade.[52] Most pits were much smaller, and indeed were built as required close to a stand if timber, or even an individual tree, as an easier option than dragging logs to a more established pit. For example at Arthur's Seat, Port Phillip, in 1845, J McClure dug a pit next to his hut, for reasons of convenience, rather than use an established one further away on the hillside.[53]

There was considerable skill involved in breaking up the log in the most advantageous way, so as to extract the largest amount of good boarding or scantling. In 1803 the Sydney magistrates heard a case in which Andrew Cunningham, a sawyer, had cut the principal part of a log of cedar into boards, 'but in so negligent a manner as to render the boards unfit for use' and had then abandoned the log with the work incomplete.[54] Good sawyers would be engaged by entrepreneurs for substantial periods, and Simeon Lord offered at least six months of guaranteed employment for two or three sawyers to cut cedar, stringybark and 'oaks'.[55]

In the bush travelling sawyers would not dig a full pit, but rely upon a partial excavation with a framework to raise the log over it. This is well described by Alexander Harris, who was cedar cutting in the 1820s:[56]

> the ground was so rough and thickly wooded that we had to build a fresh pit to almost every tree. These pits were merely scaffold side-strikes lodged on posts against trees, with long easy skids leading up to them for pitting the log. Sometimes six inches or even a foot of earth might be excavated; but to have dug regular ground pits would have been much too tedious a job; besides which in many places it was so rocky that it would have been impossible. Usually the pits were made very solid; but at other times I felt, I must acknowledge, not quite easy while working under a log of two or three tons weight lodged on side-strikes so small and limber that they sprang up and down two or three inches at every stroke of the saw. ... It was seldom we cross-cut the logs off longer than ten or twelve feet, but our planks were sometimes a couple of feet square on the end, or three and four feet in depth, by six, eight, or ten inches in thickness. These planks were always taken out on either one side or other of the heart, that part of the log being too porous and spongy for use. As the various planks came off the pit, they were rolled over into one large stack in some convenient spot a few feet off; and when the whole tree was cut up, this heap was covered over with cabbage tree leaves, on the outside, to protect the timber from the weather.

In 1881 the *Town and Country Journal* published a description of a sawpit which is more detailed, but shows that practice was essentially unchanged after sixty years.

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52 L V Dulhunty, Superintendent of Convicts, 'Quarterly Return of Public Labour and Expenditure of Materials at Morton [*sic*] Bay from the 25th of December 1825 to the 24th March 1826, Inclusive'' Archives Office of New South Wales, ref 4/1917, quoted in J G Steel, *Brisbane Town in Convict Days 1824-1842* (St Lucia [Queensland] 1975), pp 52, 54.

53 W G McCrae to A & G McCrae, 25 February 1845, in G G McCrae [ed], *Letters to Georgiana from her Four Sons* (Arthur's Seat [Victoria] 1962), no page.

54 *Sydney Gazette*, 17 July 1803, p 2.

55 *Sydney Gazette*, 2 October 1803, p 4.

56 [Alexander Harris], *Settlers and Convicts* (Melbourne 1953 [London 1847]), p 44.

The working surface of the pit was formed of the two 'side skids', of 230 mm diameter timber dressed flat on the upper face, and 6 to 7.5 metres long. This carried the 'transoms' or cross pieces, about 1.8 m long and 150 mm square, upon which the log was to be placed, including the 'weighing transom' on which a lever was used to manipulate the log, the 'heading in transom' and the 'heading out transom' at either end, and two others upon which planks were placed to form as stage for the top man to stand on when tailing out. The substructure which supported all this above the ground was basically a small stack of cross logs at one end, and a log leaning onto a convenient tree at the other. The pit was dug beneath to a sufficient depth to allow about 150 mm clearance between the pitman's head and the transoms. Two rolling up skids, 3.5 to 5 metres long, leaned against the side of the structure, and the log was manoeuvred up these into its position.[57]

However traditional practices were not unchallenged, for some time previous to this the same journal had relayed a report from the *Scientific American* of what was not actually a pit saw but an 'improved cross cut sawing machine'. It was a device which allowed the operator to sit on an inclined bench and use his muscles more effectively than in the ordinary sawing process. There is no evidence that the machine reached Australia.[58]

d. sawmills

The timber sawmill has been surmised to date from as early as the fourth century AD,[59] and sawmills operated both by water wheels and windmills are said to have been used in medieval Germany. Villard de Honnecourt's sketchbook, of the thirteenth century, shows a reciprocating saw driven by water,[60] and there are a number of apparent references to sawmills in the early fifteenth century, all of which can be assumed to have used an up-and-down motion.[61] Peterson reports that mechanical sawmilling appeared in the United States in 1611, technicians having been recruited in Hamburg 'to build Saw Mills & Sea them at ye falls.'[62] The Dutch were also pioneer sawmillers, and by 1633, when the first sawmill was opened in Massachusetts they were already operating sawmills in New York.[63] In 1646 Joseph Jenks of Massachusetts received a patent for improved sawmills and scythes, which was in fact the first patent issued in the United States fore a mechanical invention.[64] In 1663, when much sawn timber was sill imported into Britain from Holland, the

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57 *Town and Country Journal*, 24 December 1870, p 12.

58 *Town and Country Journal*, 4 June 1881, p 1077.

59 George Gregory, *A New and Complete Dictionary of Arts and Sciences* (3 vols Philadelphia 1816), sv Saw-Mills, quoted in O W Carroll, 'Mr. Smart's Circular Saw Mill c. 1815', in *APT Bulletin*, V, 1 (1973), pp 58-64.

60 Akira Satoh [ed Ralph Morton], *Building in Britain, the Origins of a Modern Industry* (Aldershot [Hampshire] 1995 [1986]), p 133.

61 Gregory, v Saw-Mills, loc cit.

62 C E Peterson, 'Early Lumbering: a Pictorial Essay' *Illustrated Register of the Centennial Exhibition, Philadelphia, 1876, and of the Exposition Universelle, Paris, 1878* (New York 1879), p 39.

63 F H Norton, *Illustrated Register of the Centennial Exhibition, Philadelphia, 1876, and of the Exposition Universelle, Paris, 1878* (New York 1879), p 66.

64 Nathan Rosenberg, 'America's Rise to Woodworking Leadership'z in Brooke Hindle [ed], *America's Wooden Age: Aspects of its Early Technology* (Tarrytown [New York] 1975, p 42.

first water-powered sawmill in England is said to have been built, but torn down again by Luddites,[65] whereas by this time hundreds of mills were in operation by the British settlers of New England.[66]

The circular saw is claimed to have been invented in England by John Mainwaring in the 1770s and sold to George Smart in 1799,[67] though it has also been said that it was invented by Samuel Miller of Southampton in 1772,[68] or that circular saws - having been long used in Holland - were introduced to England by General [Samuel] Bentham. They were used at the Portsmouth Dockyard and elsewhere, but even in the 1820s were not widely adopted in England.[69] They are claimed to have reached the United States in 1814,[70] and machine sawn timber dating from about 1815 has been found there,[71] though not proved to be locally produced. However it took half a century for the mechanical sawmill to reach Australia.

The first mechanical sawmill in Australia was a water-powered one established near Hobart in 1825. Peter Degraves and Major Hugh McIntosh acquired land on the face of Mount Wellington in 1824 or 1825, and here Degraves put up a sawmill which he had brought with him from Britain, supplied by one Barton, a steam engine maker and millwright of Falcon Square, London. Degraves and McIntosh employed an overseer and twenty timber getters and mill hands. Despite insolvency proceedings from 1826 to 1831 Degraves persisted, and later built a second mill.[72] J C Penny, who credits Degraves with building the first Tasmanian sawmill at the Cascade in the 1840s, is perhaps referring to this second mill, and it was closely followed, according to Penny, by Richard Hill's mill at Hospital Bay.[73]

Water powered flour mills were not uncommon, especially amongst the private settlers,[74] all of them potentially capable of being used for sawmilling as well, but

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65 Norton, *Centennial Exhibition*, p 39.

66 Hugh Morrison, *Early American Architecture from the First Colonial Settlements to the National Period* (New York 1952), p 33, quoting James E Defebaugh, *History of the Lumber Industry of America* (Chicago 1907), II, p 9.

67 Wyatt Papworth [ed], *The Dictionary of Architecture* (London 1852-92), sv Saw; see also Hentie Louw, 'The Mechanisation of Architectural Woodwork in Britain', *Construction History*, VIII (1992), p 22. Carroll gives Smart's name as George, and cites the description and illustration in Gregory. Elliott, *Technics and Architecture*, p 9, refers to a British patent of 1777 for a circular saw - presumably that of Mainwaring.

68 Rosenberg, 'America's Rise', p 46. Satoh, *Building in Britain*, p 133, attributes the invention of the circular saw to Walter Taylor and his father, of Southampton, in 1790: ref *Builder*, VIII (1850), pp 136-7; *MPICE*, XVII (1857-8), p 18.

69 W Harris et al, *The Oxford Encyclopaedia* (7 vols, Oxford 1828), sv Saw-Mills.

70 Rosenberg, 'America's Rise', p 46, citing R C Loehr, 'Saving the Kerf: the Introduction of the Band Saw Mill', *Agricultural History*, July 1949, pp 168-9.

71 Carroll, 'Mr. Smart's Circular Saw Mill,' p 58.

72 M L Read-McIlreavy, 'Peter Degraves (1788-1852)', in A G L Shaw & C M H Clark [eds], *Australian Dictionary of Biography*, I (Melbourne 1966), pp 302-3; Brian Carroll, *The Engineers* (Barton [Australian Capital Territory] 1988), pp 26-7.

73 Penny, *Tasmanian Forestry*, p 40.

74 An advertisement of 1817 mentions a water mill in Hobart: *Hobart Town Gazette*, II, 36 (1 February 1817), p 1. The first windmill opened shortly afterwards on Robert Nash's property at Pitt Water, followed by another built by William and Nathaniel Lucas at Port Dalrymple, near Launceston: ibid, 37 (8 February 1817), p 2; II, 44 (29 March 1817), p 2; 51 (27 May 1817), p 2. In March it was reported that Arnold Fisk had 'at enormous expense' established a flourmill at Wellington Bridge, Hobart: ibid, 41 (8 March 1817), p 1. In about 1821 William Thornley

rarely used in this way. Thomas Hall describes the complicated plans that led in the 1850s to the construction of a water powered sawmill on the Killarney cattle station near Warwick, Queensland, which required the building of a dam and the construction of machinery powerful enough to operate four large circular saws. Upon its completion the ready availability of sawn timber stimulated a demand for new houses in Warwick: another mill was established on Rosella Creek, not far way, and then after 1862 John Affleck of the Killarney Mill established a steam mill on the Upper Swan Creek.[75]

The story of watermills being superseded by steam was to be a universal one, though the exact date in individual cases was dependent upon the sufficiency of the water power, the availability of fuel, and the proximity of the market. The first steam sawmill in Australia was projected by the accomplished engineer, John Dickson, but did not come to fruition. Dickson reached Sydney in 1813 with tools, turning lathes, and a steam engine to work his mill. The engine was set up on Cockle Bay (Darling Harbour) and was working in 1815, but used only for grinding flour, not for sawmilling as intended.[76] In 1820 W C Wentworth commented that someone who would take out to Sydney a six or eight horsepower steam engine and machinery for making boards would have a fair chance of success.[77]

It was also in about 1820 that a design for a prefabricated sawmill for Van Diemen's Land was prepared, apparently by the engineer Marc Brunel, but it is not clear what became of it, or how it was to have been powered.[78] By 1833 the Van Diemen's Land Company had steam machinery at Circular Head driving a flour and sawmill, with both vertical and circular saws,[79] and by 1837 there were steam sawmills operating in Launceston.[80] These pioneers seem to be forgotten by J C Penny, who names the first sawmill in the north as that of Cummings, Raymond & Co on the River Don in

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constructed a small undershot mill at his property on the Clyde: William Thornley [ed J S Mills], *The Adventures of an Emigrant in Van Diemen's Land* (Adelaide 1973 [1840s]), p 59. In the 1840s Captain Hepburn at Smeaton, Victoria, had built his own water mill, and his neighbour Alfred Joyce, after experimenting with wind power, built a mill powered by an undershot waterwheel, notwithstanding the fact that it had to be dismantled each season to prevent it being destroyed when the creek was in flood. In turn Joyce's neighbour Benjamin Bucknall, who was more fortunately placed at a fall in the creek, built an overshot wheel housed in a permanent mill house. Alfred Joyce [ed G F James], *A Homestead History* (2nd ed, Melbourne 1949 [1942]), pp 69-72. There is no indication that any of these were used for timber milling.

75 Thomas Hall, *The Early History of the Warwick District and Pioneers of the Darling Downs* (Toowoomba [Queensland] 1988 [Toowoomba, no date (?1920s)]), pp 124-6

76 G P E Walsh, 'John Dickson (1714-1843)', in A G L Shaw & C M H Clark [eds], *Australian Dictionary of Biography*, I (Melbourne 1960), p 306.

77 Cox & Freeland, *Rude Timber Buildings*, p 37, n 5, quoting W C Wentworth, 1820.

78 Terence Lane of the National Gallery of Victoria reported a meeting in 1988 with the English art critic, Edward Lucie-Smith, who held four of five drawings for this mill, which he wished to sell. They were said to 'have some connection with the British engineer, Brunel', which, given the date, must mean Mark Brunel rather than his more famous son. I wrote to Smith seeking information with a view to making an offer, but received no reply.

79 Thomas Horton & Kenneth Morris, *The Andersons of Western Port* (Bass [Victoria] 1983), p 38, citing Records of the Van Diemen's Land Company at Circular Head, Archives Office of Tasmania.

80 A R J Billman, 'The Timber Vernacular' (BArch, Deakin University 1992), p 165, citing John Dargavel [ed], *Sawing, Selling and Sons* ([Centre for Resource and Environmental Studies] Canberra 1988), p 19.

1852,[81] whereas in fact this mill seems to have been opened in 1854, burnt down in 1855, then rebuilt.[82] It was therefore preceded even by William Moore's Ilfracombe Sawmill on the Tamar, near Beaconsfield, built in 1853,[83] and by the Romney Sawmill on the Mersey. which opened that year with one circular and six 'perpendicular' saws.[84]

On the settlement of Adelaide the South Australian Company engaged Henry Mildred to buy the necessary apparatus in the north of England for a steam saw and corn mill, as well as a shipyard and patent slip. He reached Kangaroo Island on 22 April 1837 and after some delay part of the plant was moved to Adelaide. Here the engine and mills were put up, and were generally known as the 'Company's mill'.[85] In 1839 a handbook for South Australian emigrants was advertising 'sawing machines'.[86] In about 1847-9 G M Stephen established a steam sawmill with a sixty horsepower [35 kW] engine at Cox's Creek, though the iron smelter which was intended to go with it never eventuated.[87] In November 1849 the brothers Robert and John Shepherdson opened a portable sawmill in the redgum country at Littlehampton, near Mount Barker. Robert is said to have designed the mill himself and constructed it using forgings and castings from C & H Wyatt's foundry in Adelaide.[88] Robert moved the mill to Penola in 1862, then soon afterwards to Springhill, Victoria, where he continued to operate and move it, in the vicinity of Springhill, Trentham, Kyneton and Tylden.[89]

In Sydney the first steam powered saw is claimed to have been in operation by October 1838, and it is said to have been a vertical reciprocating saw which could turn out true pieces in a hundredth the time of the pit sawyers.[90] In 1842 a circular saw, described as being twice as fast as its predecessor, went into operation in Sydney.[91] A steam sawmill was built at Brisbane Water, New South Wales, in about 1853-4 under the supervision of the engineer H C Mais.[92] John Young, while constructing the Sydney Exhibition Building in 1878-9, rented out from Hudson Brothers and operated on the site what is referred to as a sawmill, though it seems to have been much more. It included two circular saws, a cylinder planing machine, a

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81 Penny, *Tasmanian Forestry,* p 39.

82 James Fenton, *Bush Life in Tasmania Fifty Years Ago* (London 1891), pp 106-7.

83 Penny, *Tasmanian Forestry,* p 39.

84 Fenton, *Bush Life in Tasmania,* p 85.

85 J W Bull, *Early Experiences of Life in South Australia* (London 1884), 24.

86 Henry Capper, *Capper's South Australia* (3rd ed, London 1839 [1837]), advertisements p 34.

87 Douglas Pike, *Paradise of Dissent* (Melbourne 1967 [1957]), p 358, ref *South Australian Gazette and Colonial Register,* 25 September 1847; *South Australian Register,* 10 October 1849.

88 David Mack, *The Shepherdsons: Timber Milling in Australia 1849-1984* (Camden Park [South Australia] 1986), p 2.

89 Mack, *The Shepherdsons,* p 3.

90 Cox & Freeland, *Rude Timber Buildings,* p 37, n 4, quoting the *Sydney Herald,* 31 October 1838. They presumably refer to a mention on p 1 of 'Dickson's Steam Mills', though these, as we have seen, were apparently flour rather than sawmills. In the *Herald* of 26 October 1838 there is an advertisement for W G Card & Co's Australian Saw Mills in Bathurst Street, though it is not stated that these are steam powered. Where Cox and Freeland get their information about the type of saw is unclear.

91 Cox & Freeland, *Rude Timber Buildings,* p 37, n 6.

92 Sally O'Neill, 'Henry Coathupe Mais (1827-1916)', in Bede Nairn et al [eds], *Australian Dictionary of Biography,* V (Melbourne 1974), p 200.

universal boring machine, a four-sided moulding machine, a cross-cut saw bench, and a hand saw [?band saw] for circular cutting.[93] In 1879 the 'Patent Guide-Lined Circular Saw', which at $88^{5}/_{8}$ inches [2.251 m] diameter was the largest circular saw ever made in Britain, was shown at the Sydney Exhibition by Taylor Brothers of Sheffield.[94]

Two steam flour and sawmills seem to have opened in Melbourne in 1841, and there were several by 1845.[95] In 1844 Western Australia's first steam sawmill began operations at Guildford.[96] In Brisbane William Pettigrew opened the first steam sawmill on the corner of William and Margaret Streets, by Queens Wharf, in 1853,[97] with a capacity of 75,000 super feet [17.7 m^3] per day.[98] In the early 1860s Pettigrew established at Dundathu on the Mary River, eleven kilometres below Maryborough, a mill which was soon to produce 3.3 million super feet [7800 m^3] of timber per year, at an annual profit of £15,000.[99] By 1865 there were nineteen sawmills in Queensland as a whole, and thirty-one by 1868.[100] By 1890 a single mill, J D Campbell's at Breakfast Creek, was employing up to four hundred workers.[101]

The 'ribbon or endless saw', later known as the band saw, was patented in Britain by William Newberry in 1808, and is said to have been independently reinvented in the US soon afterwards,[102] but seems not to have been seriously taken up until the 1850s,[103] and we have no indication of when it reached Australia. Otherwise the fundamentals of sawmilling remained unchanged for about a century and a half. The Donnelly River Timber Mill at Nannup, three hundred kilometres south of Perth, was opened in 1949, and in 2005 was reported to be Western Australia's last and most complete example. It had employed up to 150 men, on eight saw benches powered by a horizontally mounted Robey steam engine, and could break down logs up to two metres diameter into slices as slim as 8 mm (used for fruit boxes).[104]

e. woodworking machinery

The development of woodworking machinery effectively began with the British patented machines of Samuel Bentham, including a planing machine in 1793, and

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93 Peter Proudfoot, 'Management and Materials: the Genius of John Young', in Peter Proudfoot, Roslyn Maguire & Robert Freestone [eds], *Colonial City Global City: Sydney's International Exhibition 1879* (Darlinghurst [New South Wales] 2000), p 69, note 17, ref *Sydney Mail,* 8 March 1879.

94 Sydney International Exhibition 1879, *Official Catalogue of the British Section* (London 1879), p 65.

95 Miles Lewis, 'Tradition and Innovation in Victorian Building' (3 vols, PhD, University of Melbourne 1972), I, p 137; III, pp , 557-8.

96 Jenny Mills, *The Timber People* (Perth 1986), p 67.

97 Donald Watson, *The Queensland House* (report, Brisbane 1981), p 4.3.

98 Dimity Dornan & Denis Cryle, *The Petrie Family: Building Colonial Brisbane* (St Lucia [Queensland] 1992), p 115.

99 Dornan & Cryle, *The Petrie Family,* p 102.

100 Watson, *The Queensland House,* p 5.3.

101 Dornan & Cryle, *The Petrie Family,* p 169, ref *History of Brisbane,* p 5.

102 Rosenberg, 'America's Rise', p 47, citing *Niles Weekly Register,* 27 March 1819; 28 September 1833; Satoh, *Building in Britain,* pp 136, 137.

103 R S Burn, *Modern Building and Architecture* (London, no date [c 1870]), p 192.

104 Tony Moulds on the Engineering Heritage web site, 10 January 2004.

with other developments by Henry Maudslay and Marc Brunel (whose sawmill for Van Diemen's Land has been mentioned). In the United States there were few technical developments until the 1820s, and the planing machine was not much used before 1828,[105] when William Woodworth patented his machine.[106] More is known of milling and moulding machinery. In 1846 milling machines appeared in Sydney, including one which could run four faces of a moulding simultaneously (like that later used by Young), and, operating with two men and a boy, could do the work of 250 joiners.[107]

In 1846 W H Burnett of London was promoting a new moulding machine on the basis that he would sell only two in Sydney and one in Melbourne,[108] but in Melbourne at least, a moulding mill was established only in early 1854 by James Swinbourne (later Bleasby, Swinbourne & Co).[109] Later that year, however, W & J Gripe of the City Saw Mills showed at the Melbourne Exhibition a moulding machine which had actually been made in the colony, as well as some of the mouldings made by it.[110] By 1855 there were at least six moulding mills in Melbourne,[111] and in that year the firm of Goodlet & Smith was founded in Sydney,[112] though it is unclear whether they were anything more than a sawmill in the first instance.

The United States had been behind Britain, but in 1848 C B Rogers & Company of Norwich, Connecticut, brought into production what has been claimed to be the first successful moulding machine.[113] The products doubtless reached Australia, but there is no evidence of the machine itself being used in the colonies. Overseas, the advent of such machines had no immediate effect upon the design of joinery and components, for, apart from speed and efficiency, their capacities were similar to those of manual operators. So far as the US was concerned the result was a greater use of mouldings, rather than any stylistic innovation,[114] and the same was doubtless true in the Australian colonies. The machines themselves arrived in due course, and at the Melbourne International Exhibition of 1880 the Atlas Co of Engineers showed a moulding, planing, tonguing and grooving machine, presumably of their own manufacture.[115]

In the 1880s a South Australian called Rendon invented a planing and moulding machine which was said to be more effective than any then known in the colonies. In the 1890s the architect L J Flannagan was simply citing catalogue numbers of

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105 J H Englund, 'An Outline of the Development of Wood Moulding Machinery', *APT Bulletin,* X, 4 (1978), pp 20-21.

106 Rosenberg, 'America's Rise', p 48.

107 Cox & Freeland, *Rude Timber Buildings,* p 37, n 7.

108 *Port Phillip Herald,* 12 November 1846.

109 Isaac Selby, *The Old Pioneers' Memorial History of Melbourne* (Melbourne 1924), p 144; C B Mayes, *The Victorian Contractors' and Builders' Price-Book* (Melbourne 1859), p xliv. By 1855 there were six mills: Lewis, op cit, I, p 142.

110 Melbourne Exhibition 1854, *Official Catalogue* (Melbourne 1854), p 15.

111 Lewis, 'Victorian Building', I, p 141-2.

112 *Australasian Builder & Contractor's News,* 28 May 1887, pp 37.

113 Englund, 'Wood Moulding Machinery', p 23.

114 Englund, 'Wood Moulding Machinery', p 25.

115 Melbourne Exhibition 1880, *Catalogue,* p 50.

mouldings on his working drawings, as with 'Jas Moore 446', 'Jas Moore 422', 'A Kerr No 184', and 'A Kerr 510'.[116]

Mortising machines came into general use overseas towards 1850. In 1791 Samuel Bentham had used a cruciform bit to cut mortices with rounded ends, which then had to be finished with a chisel, but in 1807 in association with Maudslay he invented a machine using a chisel with a reciprocating motion of four hundred strokes a minute, to cut a square hole.[117] This makes it difficult to accept at face value the claim that Marc Brunel introduced mechanisation at the Royal Naval Dockyards, after approaching Bentham in 1801, in his capacity as Inspector-General of Naval Works, although a mortising machine for pulley blocks survives from this period.[118] A later mortising machine was that invented by the American engineer J A Fay in about 1840,[119] which was patented in England by William Furness of Liverpool, and was in use at E T Bellhouse's works at Manchester by 1849.[120] It as claimed to be suitable for hard as well as softwood.[121] At the Great Exhibition of 1851 Furness displayed a power mortising machine, foot mortise machine, and a tenoning machine, as well as planing and moulding machines.[122] By 1853 he was advertising that his machines were in general use throughout the United Kingdom for planing, squaring up, moulding, tenoning, mortising, grooving, rebating, sawing and boring.[123]

At the Melbourne Exhibition of 1854, Joseph Hill of Emerald Hill, Melbourne, displayed a 'Coulson's Patent Mortising Machine, with 6 chisels in various sizes and 2 spanners, for altering the machine at convenience.'[124] This was an imported machine, only one of at least four types which had become available in England after Furness's, and also said to be able to mortise hardwood as well as soft.[125] It was the registered design of William Coulson of York, dating from January 1852.[126] By 1858 another type, Hugh's patent, had been imported by the Collins Street agent G H Pettigrew,[127] and at the 1866-7 Exhibition, Briscoe and Company of Melbourne showed a mortising machine of unspecified origin.[128] In 1870 Greville & Co of Sydney showed two Merrett & Gibbs patent boring and mortising machines, one with

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116 Flannagan photographs, SLV, door and window details and amended plan of bathroom for the architect's own house, Thanet and Ray Streets, Malvern, 1890-1.

117 Satoh, *Building in Britain*, p 143, ref Holtzapffel, *Turning and Mechanical Manipulation*, II, pp 505-6; M P Bale, *Woodworking Machinery* (London 1894), pp 148-151.

118 Barry Russell, *Building Systems, Industrialization, and Architecture* (London 1981), pp 36-7.

119 Satoh, *Building in Britain*, p 143.

120 *Manchester Examiner and Times*, I, 98 (10 October 1849), p 4.

121 *Builder* (London), XI, 565 (3 December 1853), p 739: the advertisement includes a small illustration.

122 Great Exhibition of the Works of Industry of all Nations, 1851, *Official Descriptive and Illustrated Catalogue* (3 vols, London 1851), I, p 298.

123 *Builder* (London), XI, 539 (4 June 1853), p 367.

124 Melbourne Exhibition 1854, *Catalogue*, p 19.

125 *Builder*, X, 396 (19 July 1852), p 398. See also V, 221 (1 May 1847), p 210, for Jones's patent; VII, 335 (7 July 1849) for Mortimer's patent; and 525 (28 February 1853), p 144, for Worssam & Co's.

126 *Builder*, XI, 550 (20 August 1853), p 543: the advertisement includes an illustration of the machine.

127 Victoria Industrial Society, *Catalogue of the Eighth Annual Exhibition* (Melbourne 1888), p 28.

128 Intercolonial Exhibition, 1866-67, *Official Record*, p 39.

a wooden and one with an iron frame, though these were more specifically intended for fence posts.[129]

At the 1866-7 Exhibition, Briscoe and Co had also shown an imported steam-driven machine for planing, grooving, boring, moulding, tenoning and mitreing.[130] One of the leading British makers of woodworking machinery was Samuel Worrsam & Co of London, who in 1879 exhibited at Sydney

> Patent General Joiner and Combined Moulding and Planing Machine for Sawing, Tenoning, Grooving, Moulding and Planing, Mortising and Boring curved and irregular work, &c. Improved Saw-Sharpening Machine for Circular and Frame Saws. Improved Plain Band Saw Machine, for sawing curved or straight work. Improved Small Four-Cutter Moulding and Planing Machine for working all four sides of mouldings at one operation. Improved Hand Mortising and Boring Machine for Joiners' Work, Patent Self-Acting Rope Feed Circular Bench, with Carriages and Rails.[131]

British and overseas developments in woodworking machinery are so numerous that it is difficult to analyse their impact in Australia. Fretwork was probably one of the outcomes. It provided a cheap alternative to the elaborately modelled bargeboards of the picturesque Gothic house. It came into vogue in Britain in the years following the Paris Exhibition of 1867, and became especially popular in the 1880s, when it was produced using fret machines from the United States.[132] The situation was probably just the same in Australia.

> A light wooden frame-work is constructed 6 feet [1.8 m] square by 6'6" [1.95 m] in height, with sloping hip-rafters on top to form a square roof. This frame-work is covered with canvas or Hessian cloth down to 9 inches above the (pine) floor. The lower 9 inches is occupied by a fly-proof perflation panel of fly-netting. From the peak of the roof, a vertical ventilating pipe takes off, capped by a cowl. This pipe is about 6 feet long so as to induce a good draught. A framed door, covered with canvas, is provided in one side of the room.

Mechanical woodcarving made an appearance in Britain in the 1840s, with machines by Pratt and Jordan, which were also used to carve stone,[133] but only roughed the work out, leaving it to be finished by hand. Another, patented by Irving, was used at a Pimlico factory owned by Pratt, under the supervision of R W Billings, and consisted of a simple drill on a movable arm. It too was used for both wood and stone carving, powered by steam or by a hand-turned wheel, with the work on a movable table. It was later used at Lambeth in association with Jordan's machine.[134] This

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129 *The Industrial Progress of New South Wales* (Sydney 1871), p 113.

130 Intercolonial Exhibition 1866-67, *Official Record,* p 39.

131 Sydney Exhibition 1879, *Catalogue of British Section,* p 241.

132 Louw, 'The Mechanisation of Architectural Woodwork in Britain, Part IV', pp 20- 21.

133 Satoh, *Building in Britain,* pp 121-3, 142, & 156 note 25. T B Jordan's machine received the medal of the Society of Arts in 1847, and is described and illustrated in Charles Tomlinson [ed], *Cyclopædia of Useful Arts & Manufactures* (in parts, London c 1852), II, pp 346-7 (sv Carving by Machinery).

134 C J Richardson, *The Englishman's House from a Cottage to a Mansion* (London 1870), pp 278-9.

latter achieved considerable commercial success in the 1860s and 1870s and until late in the century, when there was a revival of activity based largely upon American machines.[135]

In 1866 William Williams exhibited at Melbourne a machine intended for turning axe handles, but in principle capable of much wider application:[136]

> A model of the article to be produced is placed in one portion of the machine, and a piece of wood roughly shaped, and of sufficient bulk to enable an article of similar size and shape to be manufactured from it, is introduced into another part of the machine. By an ingenious arrangement of mechanism, the model is strictly copied, and its form reproduced in the rough timber placed in apparatus.

The machine had already been in use in Melbourne for some years, and there is no reason to suppose that it was a local invention, so it was probably one of the overseas models such as Jordan's.

Subsequently Marles and Butt of England developed what was described as the first effective wood carving machine, the 'Marbut', which was manufactured for them by the Ransome Engineering Works and patented all over the world.[137] This was claimed to produce work equal to anything that could be done by hand.[138] A Melbourne man, A Holloway, visited England and obtained patent rights for Australia, then established the Australian Marbut Carving Company Limited, of Queen Street, Melbourne. Much of the production consisted on non-architectural goods such as furniture and picture frames, but it also included skirtings, architraves and chair rails.[139]

f. seasoning

The degree of shrinkage in Australian timber is such as to make thorough seasoning very desirable. In 1820 Patrick Riley of Newcastle advocated felling the trees only in the winter months of May, June and July, cutting the timber into planks, and exposing it to the weather. How long it was to be thus seasoned is unclear, but Riley did say that insufficient time was being allowed at Newcastle because of the level of consumption at 'Head Quarters' [Sydney].[140] It seems improbable that the average timber cutter would be prepared to confine his activities to three months of the year, quite apart from the pressure to skimp on the seasoning. In 1877 Mayes prescribed the timber-getting season as being March to September. The timber was to be split or sawn, and then stacked in the shade in such a manner as to be well ventilated. The problem was that the ends opened up in the process of drying, and often they were

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135 Louw, 'The Mechanisation of Architectural Woodwork in Britain, Part IV', p 20.

136 Intercolonial Exhibition 1866-67, *Official Record*, p 368.

137 James Smith [ed], *The Cyclopedia of Victoria* (3 vols, Melbourne, 1903, 1904, 1905), II, p 159.

138 Louw, 'The Mechanisation of Architectural Woodwork in Britain, Part IV', p 28, quoting the *Illustrated Carpenter and Builder*, Supplement, 27 July 1900, p 4. According to Louw the machine was not invented by Marles and Butt, but by a joiner, H Marbut, employed by Allen Ransome & Co.

139 Smith, *Cyclopedia of Victoria*, II, p 159.

140 Evidence of Patrick Riley [undated but c 1820], in John Ritchie [ed] *The Evidence of the Bigge Reports* (2 vols, Melbourne 1971), I, p 113.

bolted together to ameliorate this effect. There could be no question of sealing the ends with tar, for the whole purpose was to let the sap evaporate, and such treatment would cause rot.[141]

Salt water seasoning was a traditional method, mentioned by Pliny and advocated by John Evelyn. Some, however, argued that fresh water was better, and there was also an intermediate school which favoured salt water for ships' timbers and fresh water building timbers.[142] Captain Henry Waterhouse reported in 1802 that logs which were cut down at Sydney in 1788 to clear the land for settlement, and rolled into the water, had been taken up years later and found to be as sound as they began.[143] This was of course fortuitous, and deliberate attempts at salt water seasoning come later. At Alexander Berry's 'Coolangatta' estate at Shoalhaven, in the 1820s, his builders were required to throw the planks for the barn floor

> into the canal and allow it to remain for a fortnight - this will not only extract the sap and render it less liable to shrink after it has again become dry - but the salt will prevent it from being attacked by the worm.[144]

In Western Australia jarrah logs were left in sea water for a few weeks, then drawn up onto the beach and covered with a few inches of seaweed, their ends protected from the sun. They were then left for a number of months to season, cut into boards 180 mm wide, stacked to allow air to pass around them, and left five or six months longer before use.[145]

An important innovation in the later nineteenth century was the introduction of seasoning on the Reiser system, which made a number of local timbers viable for joinery and finishing. Reiser was a Swiss who was reportedly on Maria Island, Tasmania, in 1887. In 1888 he was living in Melbourne, and obtained a patent for improvements in apparatus for seasoning timber,[146] and soon afterwards he and A D Hunter sought and gained government financial assistance,[147] probably for what was at first called the Melbourne Reiser Timber Seasoning Syndicate. By now the sawmiller R A Robertson was involved, for he told the Commissioner for Customs in June 1889 that he was representing a Swiss method of seasoning timber, and that if a duty were to be levied on imported wood he would be able to produce timber from colonial woods just as good as the imports.[148]

In 1892 the Australian Seasoned Timber Company Limited was formed to unite the interests of the Comet Mills, the Melbourne Reiser Timber Seasoning Syndicate and, apparently, the Victorian Terra Cotta Company, makers of terra cotta lumber (as

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141 Charles Mayes, *The Australian Builders' Price-Book* [3rd ed, Melbourne 1877], p 62.

142 T A Britton, *A Treatise on Dry Rot in Timber* (London 1885), pp 73-6.

143 Captain Waterhouse, 'Memorandum on the Timber of New South Wales', 2 March 1802, Public Record Office, London, CO 201/1, quoted in Daniel Paine [ed R J B Knight & Alan Frost], *The Journal of Daniel Paine 1794-1797* (Sydney 1987), p 78.

144 Papers of Alexander Berry, volume 5, 16 August 1824, quoted by Rachel Roxburgh & Douglass Baglin, *Colonial Farm Buildings of New South Wales* (Adelaide 1978), p 32.

145 Britton, *Dry Rot*, p 115.

146 *Australasian Builder & Contractor's News*, 29 December 1888, p 600.

147 G S Perrin, *Australian Timbers* (Sydney 1893), p 26.

148 *Australasian Builder & Contractor's News*, 29 June 1889, p 606.

discussed below).[149] The principals included Robertson, Hunter, and presumably Reiser himself, and a mill was established at Wandong on the North-Eastern Railway Line, near Kilmore.[150] An early instance of the use of the process is the court house at Bairnsdale, Victoria, for which 'samples of mountain ash of beautiful grain and colour, and to all appearances perfectly seasoned', were submitted in 1894 by the Australian Seasoned Timber Company.[151]

Neither the seasoning nor the terra cotta lumber business was viable during the depression of the 1890s, the latter being kept open for only three months in the second half of 1896, and apparently entirely inoperative in 1898 and 1899.[152] But the sawmill expanded, and despatched a shipment of wooden paving blocks to London, from which a major contract was expected to follow. Apparently this did not eventuate, and in any case the Comet Mill was burnt down in 1900, and it was decided in 1902-3 to move the business to Western Australia and to liquidate the Australian Seasoned Timber Company.[153]

After World War I the Melbourne firm of Cuming, Smith & Co established a wood distillation and timber seasoning works near Warburton. The seasoning was done by what they described as 'the moist air method', in which the timber, after some preliminary drying in the open air, was placed for a week or more in a kiln with the humidity controlled to suit the wood being treated.[154] The heat was supplied by steam-filled pipes, over which passed the air entering the kiln, and this seems to be but a little way short of the system of steam drying in kilns which was introduced in Western Australia. Jarrah had reputation for cracking, and did this even after a periods of open air seasoning at the mill.

The American visitor, H D Tiemann of the United States Forest Service,[155] developed his 'water spray humidity regulated kiln' for drying jarrah, in which the first rapid seasoning tests in the state were begun in 1918.[156] Timber was stacked in the kiln and dried using steam heated coils, and the air was humidified as it passed through water was sprayed within chambers on either side. When the drying was proceeding too rapidly, and traces of surface cracking began to appear, live steam was introduced, and by this means the moisture content was kept consistent throughout he plank during drying. The kilns at Yarloop were modified in accordance with this principle in 1921,[157] and Stanley Clarke, the officer in charge of seasoning investigations, promoted the concept. The kilns were sometimes referred to by his name, as when the Adelaide Timber Company of Western Australia constructed a battery of six 'S.A. Clarke' steam kilns in 1925-6, to meet a demand from South Australian and Victorian

149 J W Payne, *Pretty Sally's Hill* (Kilmore [Victoria] 1981), pp 56-7.
150 Perrin, *Australian Timbers*, p 26.
151 *Bairnsdale Advertiser*, 26 April 1894.
152 Colin Harvey, *Wandong Wanderer* (tour notes of the Light Railway Research Society of Australia Inc, 1981, unpaginated).
153 Payne, *Pretty Sally's Hill*, pp 57-8.
154 Cuming, Smith & Co Pty Ltd, *Our Forest Industries* (Melbourne, no date, unpaginated).
155 Council for Scientific and Industrial Research, Division of Forest Products, *Types of Timber Seasoning Kiln* [trade circular no 17] (Melbourne 1933), p 10.
156 S A Clarke, *The Seasoning of Western Australian Hardwoods* (Perth 1927), p 34.
157 Staples, *They Made Their Destiny*, p 331.

dealers, mainly for 5 x 1 inch [125 x 25 mm] flooring boards.[158] By 1932 all commercial kilns in Western Australia save one were of this type, though those of the Adelaide Timber Company closed permanently in about 1930 because of the economic depression.[159] In the meantime a range of modifications and developments had given rise to at least half a dozen local patents.[160]

In Victoria the method used by Cuming Smith remained adequate, and it was streamlined when P V Christensen of the firm of Christensen & Saxton, Moe, developed what became known as the 'Christensen truck', which eliminated double handling of the timber. The pieces which were being initially air-dried were placed on bolsters which rested in turn on sleds or foundations built over a set of rails, and the stack was of the size which was required to charge the kiln. When the time came to transfer the wood to the kiln the truck could be slid along the rails under the stack, lift it, and shift it as required.[161]

g. preservative treatments

The earliest preservative treatment for local timber was to char that part of it that was set in the ground. David Burn, writing of Van Diemen's Land in about 1840, said that this would enable fence posts to last fourteen or fifteen years.[162] For items like telegraph posts charring remained a common practice through the nineteenth and most of the twentieth century.

Chemical preservative treatments for timber were not so common in Australia as in Britain because hardwoods would not absorb chemicals to any significant extent, but of course there were primitive processes used at times. One of the earliest in Britain was J H Kyan's process, which involved soaking the wood in corrosive sublimate (mercuric bichloride). In 1828 Kyan obtained permission for his system to be tested at the government dockyards, and a specimen was immersed in a pit at Woolwich Dockyard for three years, 'subject to foul air and fungus mould', then in a further test in 1831 nine specimens were built into various structures susceptible to rot, and survived, while nine untreated pieces did not.[163] In March 1832 Kyan took out a patent,[164] the rights to which he transferred to a company which put the process into commercial operation. The company established 'stations of tanks' at Pimlico, Rotherhithe and City Road Basin, London, for the treatment of timber, canvas and

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158 Clarke, *Seasoning of Western Australian Hardwoods*, pp 34-42; Staples, *They Made Their Destiny*, p 331.

159 Mack, *The Shepherdsons*, p 39.

160 A J Gibson, *A Forest Products Laboratory for Australia* [Council for Scientific and Industrial Research pamphlet no 9] (Melbourne 1928), p 11.

161 *Combined Air and Kiln Seasoning: Handling by Means of the Christensen Truck* [Trade Circular no 12 of the Council for Scientific and Industrial Research, Division of Forest Products] (Melbourne 1932), passim.

162 David Burn, *A Picture of Van Diemen's Land* (Hobart 1973 [1840-41]), p 182.

163 *Mechanic's Magazine*, XVIII, 489 (22 December 1832), p 189; George Birkbeck, *The Preservation of Timber by Kyan's Patent* (London, no date [c 1835]).

164 British patent no 6253 to John Howard Kyan, 31 March 1832, for preserving certain vegetable substances from decay. This was followed by no 6309 of 22 September 1832 for preserving paper, canvas, cloth and cordage for ships and other purposes, also the raw materials, as hemp, flax or cotton, of which the said might be made.

cordage, as well as advertising its willingness to grant licences to others.[165] One such licensee was the Anti-Dry-Rot Company.[166]

Another approach was to coat the timber in an impervious layer of 'Jeffery's marine glue', a combination of 'elastic gum with non-elastic'.[167] The components - as revealed only at a later date - were:

1 part caoutchouc
2 parts asphaltum
12 parts undistilled coal tar.[168]

Jeffery glued blocks of wood together and tested the force required to pull them apart, and he sank coated blocks in Portsmouth Harbour, where they survived for twenty-three months without apparent ill-effect.[169] However he was unsuccessful in his efforts to get the glue adopted by the Royal Navy, and it never became prominent.

During the 1840s there was a great deal of attention given in England to preservative treatments for timber, spurred on especially by the demand for railway sleepers. John Bethell's process, patented in 1838, is the most relevant to later Australian developments. It involved impregnating the wood with oil of tar [creosote] and pyrolignite of iron [iron acetate].[170] Sir William Burnett's process, also dating from 1838, used zinc chloride which, when deposited in the timber, was supposed to harden it and to form a permanent compound which could never be leached out.[171] There were many preservative works in the country, but by 1853 Durrand's Bonded and Sufferance Wharf at Rotherhithe had particular connections with the foreign and colonial trade because it could import and re-export Baltic and other timbers without incurring British duties. By 1853 it was equipped for carrying out Bethell's, Payne's, Burnett's and Margery's processes. All were supposed to be preservative, and Bethell's also to have some fireproofing value.[172]

'Non-combustible' timber had made its appearance in Victoria by 1854,[173] but there was at first no attempt to treat the local timbers, doubtless because their structure made them far more difficult to inject, and because some were naturally very durable in any case. In June 1856 the *Australian Builder* published the first local description of a method of fireproofing timber, by steeping it for four or five days in a strong

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165 Advertisement appended to Birkbeck, *The Preservation of Timber*.

166 Information, 2005, from Stephen Massil, Librarian, Sir John Soane's Museum, London, from a prospectus held by the library.

167 Alfred Jeffery, *Notes on the Marine Glue* (London 1843), pp 5-6.

168 Raimund Hoffer [translated W T Brannt], *A Practical Treatise on Caoutchouc and Gutta Percha* (Philadelphia 1883), p 140.

169 Jeffery, *Notes on the Marine Glue*, passim.

170 Wyatt Papworth [ed], *The Dictionary of Architecture* (London 1853-92), svv Bethell's Patent; Creasote [*sic*]. This is allegedly the correct spelling, but it was spelled 'creosote' in Bethell's exhibit in 1851: Great Exhibition of the Works of Industry of all Nations, 1851, *Official Descriptive and Illustrated Catalogue* (3 vols, London 1851), I, p 196*.

171 Papworth, *Dictionary*, sv Burnettizing. See also Great Exhibition, *Official Catalogue*, I, p 196*.

172 *Builder*, XI, 526 (5 March 1853), p 160.

173 *Mount Alexander Mail*, 15 September 1854.

solution of alum and copper sulphate.[174] In 1874 the *Town and Country Journal* relayed an English report of a Dr Jones's patent treatment, which had been shown experimentally to protect timber and even gunpowder from fire. But the nature of the substance is not revealed, and there is no evidence of its use in Australia.[175]

Following the report on fireproofing timber, in 1856, the *Australian Builder* published a summary account of the three main processes for inhibiting decay, Kyan's, Payne's and Bethell's.[176] Of these Kyan's process, whereby the timber was either soaked in or injected with corrosive sublimate (mercuric chloride or bichloride) was particularly expensive - notwithstanding the fact that the chemical was widely used in Australia for treating scab in sheep - and it was ousted by Burnett's process, which used much cheaper zinc chloride. Both were in fact of limited value because they precipitated soluble salts which washed out, and because they were acidic and caused corrosion in any iron fittings attached to the wood.[177] Payne's process involved the precipitation of an insoluble salt, of which there were various types, but the original version used iron sulphate and calcium chloride to precipitate calcium sulphate.[178] The process was promoted in South Australia, after which an attempt was made to set up a company in Melbourne to market it. A meeting was held in the Criterion Hotel on 24 April 1858 to consider the matter,[179] but nothing seems to have come of it.

The most effective method of injecting timber was that of James Burton, using a pressure cylinder, but that was not introduced to the Australian colonies until many decades later. Apart from simple soaking, the alternative method was that of the French physician Boucherie, who inserted chemicals into the living tree so that they were taken up naturally. Something of the sort was done to trees in Royal Park, Melbourne, by one Léonce Richards, who claimed to have patented his process of 'metallisation',[180] but discrepancies in the reporting of this, and the absence of any patent in Richards's name or that of his agent Caspar, make it impossible to determine what was actually done.

A quite different approach was the use of silicates, which Frederick Ransome had developed in England principally as a means of preserving stone and of creating artificial stone, but also for preserving timber. Ransome's process, as well as the related ones of Dembinski and Szerelmey, have been discussed in detail in relation to stone. Richard Forrest obtained a Victorian patent in October 1861 for the

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174 *Australian Builder, 17* (26 June 1856), p 138.

175 *Town and Country Journal,* 4 June 1881, p 1077.

176 *Australian Builder,* 27 (21 November 1874), p 817, quoting the *Building News.*

177 For a more detailed discussion of these treatments see Miles Lewis, 'Tradition and Innovation in Victorian Building' (3 vols, PhD, University of Melbourne 1972), II, pp 163-8. For Kyan's process see especially George Birkbeck, The Preservation of Timbr on Kyan's Patent [offprint of a paper delivered to the Society of Arts, 9 December 1834] (London, no date [c1835]), passim. Birkbeck himself subsequently received a patent for a preservative method communicated to him by G Howitz: British patent no 2164 to G H Birkbeck [G Howitz], 30 July 1862.

178 Papworth, *Dictionary,* sv Payne's Process. See also Great Exhibition, *Official Catalogue,* I, p 208*.

179 *Argus,* 27 April 1858.

180 *Argus,* 25 November 1857 & corrigendum, 26 November 1857. Again, see Lewis, 'Tradition and Innovation', for more detail.

preservation of materials, including timber, using 'an alkaline solution of silica, from which, after application, the alkali is extracted by means of some other mineral.'[181] A further patent in Ransome's own name in 1862 seems to overlap with Forrest's in using 'certain silicates ... in the manufacture of artificial stone and cement or plaster, and in treating timber for the purpose of preserving the same.'[182] Forrest was reported to be a Melbourne merchant,[183] and it seems possible that he was a member of the firm of Sprigg, Addison & Co of Flinders Lane, who were Ransome's Melbourne agents.[184]

A further local patent by A C L De Lacy seems to cover similar ground, using 'certain chemical fluids and operations' for preserving wood and other materials from decay and fire, manufacturing artificial stone, &c. De Lacy was a Melbourne engineer, but it is impossible to determine whether this was in any sense his own development or whether - as seems more probable - it represents the extension of a British patent. Nor do we know whether it was put into practice locally. The patent is more concerned with the means of impregnation, using a pressure cylinder which he had patented five years earlier, and de Lacy named a number of chemicals which he would inject separately or in combination - calcium chloride, magnesium chloride, sodium silicate, aluminium sulphate, aluminium chloride, potash, creosote and fluoric acid.[185]

There is little reason to suppose that any of these treatments would be particularly successful, and no evidence to suggest that they were. Coating with tar was a practice which gained far more currency than injection with chemicals, and it rose to popularity with the establishment of gasworks, of which tar was a cheap by-product. In 1858 the Melbourne Gas Works engineer A K Smith exhibited coal tar which he said was suitable for the preservation of timber.[186] A patent was granted to James Thomson in that year for what seems to have been some sort of a varnish, combining tar with other chemicals,[187] and another to W J Barton in 1860 for 'indurating and enamelling' wood and other substances with a solution of gas tar and resin.[188] Barton & Co are known to have used the process for stone preservation, though not necessarily for timber. However the 'oil of tar' which was produced by both the Melbourne and the Collingwood gasworks, was reported to be used on timber as a preservative.[189] In 1878 the stumps of a courthouse in Queensland were specified to be of ironbark or bloodwood 'slightly charred and twice coated with hot coal tar + lime'.[190]

The next phase of development involved the use of oils other than (or in addition to) creosote. During the 1880s a product called 'Carbolineum Avenarius' was marketed

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181 Victorian patent no 508 granted to Richard Forrest, 26 October 1861.
182 Victorian patent no 593 granted to Frederick Ransome, 20 November 1862.
183 C B Mayes, *Australian Builders' Price-Book* (Melbourne 1862), p 144.
184 Mayes, *Australian Builders' Price-Book* (1862), pp xiii, 151.
185 Victorian patent no 602 to Alan Cameron Lyster De Lacy, 30 December 1862.
186 Victoria Industrial Society, *Catalogue of the Eighth Annual Exhibition* (Melbourne 1858), p 43.
187 Victorian patent no 91 granted to James Thomson, 17 March 1858.
188 Victorian patent no 393 granted to W J Barton, 9 October 1860.
189 Mayes, *Australian Builders' Price-Book* (1862), p 83.
190 'Specification of Work and material required in the erection of court house St Laurence', March 1878 [held by Historic Buildings Branch, Brisbane], no page.

in Melbourne through an agent, F Messner, as a wood preservative as well as a waterproofing agent for brick and stone. Its composition was not stated, but it was not to be applied in the direct sun because it would cause 'an irritation of the skin of the face', which was inconvenient, though not dangerous.[191] In 1887 it was announced that A M Fell & Son of Darling Harbour, Sydney, were supplying a wood preserving oil to prevent both dry rot and white ant, and that it was already in use by the government and several municipalities.[192] However A R Taylor of New Farm, Brisbane, responded that the Fell oils had already been abandoned in Queensland after repeated trials, and that his own patent preparation was now used instead.[193] In 1892 a resident of Merrigum, Victoria, recommended linseed oil into which pulverised coal had been mixed to bring it to the consistency of paint, which was guaranteed to prevent the rotting of posts in the ground.[194] In 1919 ironbark and bloodwood were still being used in Queensland for stumps, but now 'twice (2) well coated with crude castor oil, well dusted over with arsenic after each coat where below ground and the remainder given two coats of well boiled coal tar, applied hot'.[195] The use of arsenic indicates that this was now not merely a preservative but an ant-proofing measure, and such treatments will be further discussed below.

Early in the twentieth century the 'Powellising' process was apparently regarded as effective even for hardwoods. It was marketed by the N.S.W. Powell Wood Process Ltd. of Sydney, and claimed to improve, strengthen and thoroughly season the timber. H D Walsh, Chief Engineer of the Harbor Trust, used powellised decking in some of his jetties and wharves.[196] It was also carried out in Victoria, where it gave its name to Powelltown in the Little Yarra Valley, Gippsland. It has been reported as an English process which proved ineffective for Australian hardwoods,[197] but this must be an overstatement, given that it was used for some time in this country. In 1928 the visiting expert A J Gibson spoke of Powellising as a process used for some years in Western Australia, though not apparently elsewhere, and referred also to experiments with creosoting at the University of Adelaide.[198]

In Western Australia, apart from Powellising and creosoting, the Forests Department established a commercial operation to treat timber by the 'open-tank method' in a solution of sodium fluoride and arsenic, patented as 'fluarizing'. Western Australian efforts were directed more at fence posts than at building scantling, but the range of preservatives in use is interesting - coal tar creosote was regarded as most effective; tar and petroleum oil were useful; but creosote and oil mixtures had some value, and were cheaper than pure creosote. There were also various proprietary oil preservatives, some of very little value. The water-soluble preservatives were

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191 *Carbolineum Avenarius* [leaflet] (Melbourne, no date), passim.
192 *Australasian Builder & Contractor's News*, 17 September 1887, p 297.
193 *Australasian Builder & Contractor's News*, 22 October 1887, p 391.
194 *Farmer and Grazier*, February 1892, p 38.
195 'Specification: Erection and Completion of a new Rural School: Boonah', 17 February 1919 [held by Historic Buildings Branch, Brisbane], p 67.
196 *Building*, 12 December 1911, p 34, and advertisement. p 23.
197 Paul Edwards, in *Royalauto*, November 1996, p 66.
198 A J Gibson, *A Forest Products Laboratory for Australia* [Council for Scientific and Industrial Research pamphlet no 9] (Melbourne 1928), p 16.

sodium fluoride, zinc chloride, white arsenic, and various proprietary products.[199] When the Council for Scientific and Industrial Research came to produce its own circular on timber preservation, the means described were largely the same, but for the fact that copper sulphate, mercuric chloride and zinc meta-arsenate had ben added to the list, though only the last was in any sense new.[200]

Cuprinol, advertised in 1936, was presumably (from the name) one of the treatments based upon copper compounds. It was claimed to be a fungicide and insecticide which penetrated deeply, and could be painted or varnished over.[201] Water-soluble treatments such as 'Celcure' were later to become important in England,[202] but much less so in Australia because they could be effective only with pine. In 1957, however, Australia's first industrial scale pressure impregnation plant was opened at South Grafton, New South Wales, capable of treating even dense Australian hardwoods, and first used for electricity and telegraph poles.[203] In 1965 the Timber Preservers Association of Australia, apparently a recently formed body, published a seven page booklet, Timber Preservation in Australia. It described the two techniques in use, pressure impregnation and diffusion treatment. Pressure impregnation was used for the permanent protection of timber, and generally involved immersing the wood into a preservative solution in a cylinder at 200 psi [1380 kPa]. Diffusion treatment consisted simply of soaking. The preservatives were in two categories, water borne, which were generally of the copper-chrome-arsenate type, and oil-based, which were mostly creosote or pentachlorophenol dissolved in oil.[204]

h. antproofing

We have seen that the Fell oils and arsenic dust, were both used in treatments designed to prevent both decay and termite attack. But there were many other substances designed specifically to control white ants. Natal makes an interesting comparison with Australia, for not only was the use of stumps understood at an earlier date (as will appear below), but chemical treatments likewise. Early settlers had painted 'a low plinth' of Stockholm tar around the base of their buildings, though this proved ineffective.[205] In 1864 a paint for outside walls was recommended, supposed to render them impervious to white ants and other insects. It was made of '1 1/2 bushels of grey lime, 1 1/2 bushels of Roman cement, 6 lb. of copperas, 6 lbs. of soft soap, 6 lbs. of sulphur, and as much yellow ochre as will bring the whole to any desirable colour.'[206] In 1866 creosote was advertised a protective material.[207] In

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199 J E Cummins, *The Preservative Treatment of Fence Posts (with particular reference to Western Australia* [Council for Scientific and Industrial Research pamphlet no 24] (Melbourne 1932).

200 *Journal of the Royal Victorian Institute of Architects,* XXXIV, 4 (September 1936), p xxxvi.

201 *The Preservation of Timber* [trade circular no 27 of the Council for Scientific and Industrial Research, Division of Forest Products] (Melbourne 1935), pp 15-17.

202 Evelyn Drury et al [eds], *Architects', Builders' and Civil Engineers' Reference Book* (London 1950), pp 147, 148, 154.

203 *Cross-Section,* no 53 (1 March 1957), p 3.

204 Timber Preservers Association of Australia, *Timber Preservation in Australia* (Unley Park [South Australia] 1965), p [2].

205 Kearney, *Architecture in Natal,* p 68.

206 Kearney, *Architecture in Natal,* p 65, ref *Davis' Natal Almanac* of 1864.

207 Kearney, *Architecture in Natal,* p 65, ref H Brookes & Mann, *Natal, a History and Description of the Colony* (1876).

Rhodesia some pisé buildings had arsenate of soda or 'Atlas Compound' mixed into the lower layers to antproof them.[208]

Peter Bell reports the use of treacle and arsenic against termites at Bowen in 1882, as prescribed in an unidentified 'official circular', and of Street's and Faulding's White Ant Poison, based on arsenic, as well as the procedure of steeping the stumps in creosote before they were used.[209] As a prophylactic measure treacle and arsenic seemed, in at least one instance, only to render the timber more palatable, but Watson mentions a number of other chemicals which were used in Queensland. Carbolic acid and boiling water were applied to timber which was already under attack. Timbers were immersed in salt water, animal fats, oil or tar, or they were charred - all of which sound more like preservative than white ant measures. In the 1870s there appeared proprietary products such as the zinc-based compound marketed by Hiram Wakefield,[210] and in 1873 William Malpas of Athelstane, near Adelaide, obtained a patent for the use of copper sulphate combined with 'arsenious' acid and, optionally, sodium carbonate.[211] This was applied to the lower timbers of an existing building at Caboolture in 1878. 'Taylor's Anti-termite' was in use in the 1880s, as were 'Anti-ant Wood Preservative', which was allegedly in use in India, China, Japan and elsewhere, and 'Antine', which was tried out at Inglewood and proved quite ineffective. By 1895 tar and arsenic had resumed their dominant position.

Some protection was gained simply by using cypress pine, a timber less palatable to ants, and clearing the site of all loose timber which might harbour them.[212] In 1889 the Diocesan Architect, J H Buckeridge, examined the bell tower of the Anglican pro-cathedral in Brisbane, which had been constructed of English oak because this was thought to be termite-resistant. The hearts of the beams carrying the balls were completely eaten out. One of the legs, 450 mm square, was half eaten through to a height of nearly five metres. He replaced the damaged posts with Queensland hardwood on a concrete bed, and the treated the whole with an anti-termite preparation.

In 1908 the Bain's White Ant Extermination Company of Sydney claimed to be contractors to the Commonwealth, New South Wales and West Australian governments, the Sydney Harbour Trust and the Federated Malay States,[213] and by the 1920s they called their product Bainal and claimed that it killed both the ants and the eggs.[214] A liquid product called 'Jodelite' was claimed to be effective not only against the ant, but against fungus, dry rot and sea worm.[215] In about 1920 a chemical white ant preventative was regularly advertised in the post office directories in Queensland,[216] and soon 'Simplexol' was being sold by De Merin Ltd of Sydney.[217]

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208 Clough Williams-Ellis, *Cottage Building in Cob, Pisé, Chalk & Clay* (London 1919), pp 78-9.

209 Bell, *Timber and Iron*, p 163.

210 Watson, *The Queensland House*, pp 6.2-6.8.

211 Victorian patent no 1756, 1756A, to William Malpas, 214 April 1873. A second application by Malpas the following day, for the use of copper sulphate alone, was allowed to lapse.

212 Watson, *The Queensland House*, pp 6.2-6.8.

213 C E Mayes, *The Australian Builders and Contractors' Price-Book* (7th ed, Sydney 1908), p 226 & advertisements p xx.

214 *Building*, 12 October 1923, p 43.

215 Mayes, *Australian Builders Price-Book* (1908), p 22

216 Information from Peter Marquis-Kyle, 1991.

In the 1920s the Borer & White Ant Exterminating Co of Victoria, was marketing 'Borantibane', with which they had treated nearly two thousand houses built by the State Savings Bank of Victoria. What it contained was unstated, but it was claimed to be lethal to borers, white ants, cockroaches, silverfish, spiders, flies, bugs, fleas, lice and other household pests. It was stainless, but left a lasting deposit of poison in treated timbers.[218] In 1949 'Solignum', which had been in existence for thirty years, was being advertised in Australia as a 'wood preserving stain' and white ant and borer destroyer. However it was an English product, and references were cited from Khartoum,[219] so there is no clear evidence of its use in Australia. Indeed it is a moot point whether the 'remarkable penetration' claimed in the advertising, would have had any impact on Australian hardwoods.

In 1955 T Maxwell, a Sydney pest control contractor, demonstrated a system of 'permanently installed' poison sprays. Dunlop Flexatube plastic tubing was attached to each bearer and pierced near every stump, and poison was fed into the system every four months by the householder, using a stirrup pump.[220] In the following year it was reported that the new Parliament House in Darwin was suffering white ant attack even before it was completed, the ants having already eaten through a concrete slab and attacked the joinery.[221] Potentially more serious news was that the European borer, new to Australia, had been found attacking the softwoods in some Brisbane buildings, and was being combatted by the Queensland Department of Forests.[222]

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217 *Building*, 12 October 1923, p 43.

218 The Borer & White Ant Exterminating Co of Victoria, *The Great Menace to Our Homes* [brochure] (Melbourne, no date [late 1920s]), passim.

219 F Wentworth & W L Richardson [eds], *Ramsay's Architectural and Engineering Catalogue* (Melbourne 19549), §32,3.

220 *Cross-Section*, no 37 (1 November 1955), p 2.

221 *Cross-Section*, no 44 (1 June 1956), p 2.

222 *Cross-Section*, no 48 (1 October 1956), p 2.