5.11 Building Boards

plywood
building boards
wood fibre boards in Australia
Masonite
cane boards
Solomit

We are concerned here both with plywood and with building boards as more generally understood, formed out of composite fibrous materials.

plywood

Plywood is the older material, and seems to have developed in both Europe and the United States. Veneering machinery had a long history in Europe, and C D Elliott refers to the use of a circular saw to cut veneer in England in 1805, and to the introduction of a veneer slicer in France in 1830.[1] Though it is not very clear when layers of veneer were combined to create plywood, laminated cases for grand pianos were made in about 1860.[2] In the United States a number of patents had been taken after the Civil War out for layering wood veneer with the grain at right angles in alternate courses, the earliest known being that of John K Mayo in 1865 for making 'scale boards'.[3] It is unlikely that much was produced under this patent but plywood seems to have appeared around 1870.

Early in the 1870s George Gardner of Brooklyn began bending the material by steam to make plywood benches for uses such as railway stations.[4] Gardner & Co exhibited successfully at Philadelphia in 1876 and Paris in 1878, and their products included bent and perforated timber veneer for use in seating generally.[5] In 1882 a factory was established in Reval, Estonia, to produce three-ply birch seats for bentwood chairs.[6] By the 1880s the Grand Rapids Portable House Co of Grand Rapids, Michigan, was making prefabricated buildings of three-ply panels, suitable for summer cottages, hunters' cabins, children's playhouses, camp meeting cottages, bathhouses, photograph galleries, candy stands, and so on, each weighing between 225 and 900 kg including cases. These buildings were shown at the New South Wales Agricultural Society's exhibition of 1890, and were available in

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1 C D Elliott, *Technics and Architecture* (Cambridge [Massachusetts] 1992), p 20.
2 F P Kollman, 'Veneer, Plywood and Lamination', in F P Kollman et al, *Principles of Wood Science and Technology, II, Wood Based Materials* (New York 1975), pp 154-5.
3 T C Jester, 'Plywood', in T C Jester [ed], *Twentieth-Century Building Materials* (Washington [DC] 1995), p 132, citing Thomas D Perry, *Modern Plywood* (New York 1942), pp 26-7.
4 F T Schwab, 'Victorian Prototypes', *Architectural Record* [New York], September 1945, quoted in R B White, *Prefabrication* (London 1965), p 11.
5 C B Wood III Inc [bookseller], *Catalogue 97* (Cambridge [Massachusetts] 1998), pp 10-13, citing David Hanks, *Innovative Furniture in America*, and Kenneth Ames, 'Gardner and Company of New York', *The Magazine Antiques*, August 1971, pp 252-5.
6 Elliott, *Technics and Architecture*, p 20.

Australia through William Fleming of 22 and 24 Clarence Street, Sydney.[7] This may have been the first significant appearance of plywood on the Australian scene.

A description of an American veneering works appeared in the *Australian Engineering and Building News* in 1881,[8] but there is no indication that it had any local relevance or effect. However an American veneer cutting machine was brought to Australia, probably in the 1890s and certainly before 1904. It was not used to make plywood, but fruit baskets and other products of the Bee-Keepers' Supply Co of Melbourne.[9] It seems to have been in about 1912 that Alexander Sturrock went to the United States to learn the trade, taking a job as an ordinary machine hand in a factory. He then arranged to ship a plant to Australia, and spent two years experimenting with it before going into full production. At first the American knives were unsatisfactory, but this problem was resolved. Some local hardwoods from particular districts proved unsuitable, but others proved very satisfactory. Then it appeared that the foreign glue was neither strong enough nor waterproof, and Sturrock began experimenting with casein. By late 1914, when the Royal Victorian Institute of Architects visited the factory, Sturrock had finally achieved full production.[10]

Sturrock was certainly not the first to use casein glue for these purposes, for it had been produced commercially in Switzerland and Germany since about 1900,[11] but it was still very novel. According to Elliott the traditional hide glue, made from animal bones and skin, was replaced by blood albumen glue in 1912, and only after that by casein glue, during the period of the Great War.[12] The authoritative American text, D F Holtman's *Wood Construction*, of 1929, writes of the material as 'new commercially, though it has been used long enough to determine definitely that it has more advantages than any other glue'.[13] Earlier alternatives were hide glue, as used in the earliest plywood; vegetable glue from cassava flour, introduced in 1905; blood albumen glue, perfected by Henry Haskell in 1912; and soy glue, used in the 1920s.[14] In Australia casein glues were said in 1934 to have become common 'only in recent years', and it is unclear whether they were yet manufactured locally. Reference is however made to the fact that American manufacturers claimed to have developed a non-staining type, and thus to have overcome one of the main drawbacks of casein.[15]

Plywood had became popular by the 1930s, most commonly as a panelling material, and usually in dark hues. By 1936 the Council for Scientific and Industrial Research was of the opinion that artificial resin glues, and phenolic resins in particular (already common in the United States and Europe) would now prove competitive for plywood manufacture in Australia. They were already being used successfully in the commercial gluing of cross

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7 *Australasian Ironmonger, V*, 5 (1 May 1890), p 131.
8 *Australian Engineering and Building News*, 1 October 1881, p 64.
9 James Smith [ed], *The Cyclopedia of Victoria* (3 vols, Melbourne, 1903, 1904, 1905), II, p 144.
10 'Three-Ply Board', *Journal of the Royal Victorian Institute of Architects*, XII (November 1914), pp 237-8.
11 F P Kollman, 'Adhesion and Adhesives in Wood', in F P Kollman et al, *Principles of Wood Science and Technology, II, Wood Based Materials* (New York 1975), p 1.
12 Elliott, *Technics and Architecture*, pp 20-21.
13 D F Holtman, *Wood Construction* (New York 1929), p 409.
14 Jester, 'Plywood', p 134.
15 *Glueing Practice Part 2. Casein Glues* [Trade Circular no 19 of the Division of Forest Products, Council for Scientific and Industrial Research] (Melbourne 1934), passim.

bands and face plies to solid corestock.[16] This use of phenolic resin reflects the development by L H Baekeland in 1909-10 of the first synthetic resin, bakelite, which had first been used for cheap Art Deco jewellery and for electrical fittings.[17] Synthetic resin glue in sheet form was a German development, and although it was not made commercially there until 1933,[18] it was introduced in the United States only in 1931,[19] and from 1935[20] was available in the form of a spray or a film.[21]

By about 1930, plywood began to be manufactured by Brown & Broad, the well-established timber merchants and house builders of Brisbane. In 1934 they had an output of 15,000 square metres a week, using their own sawmills, an Australian-made lathe, and a two hundred tonne press said to be the largest in the country. They had even begun to export to England.[22] In 1939 Römcke Pty Ltd of Melbourne were advertising 'all grades and varieties' of waterproof and bending plywoods, as well as a range of doors and panelling.[23] The consumption of plywood increased during World War II when great advances were made in plastic bonding glues. In 1944 the *Australian Home Beautiful* reported a firm which at the outbreak of war had been manufacturing 'Standis' brand furniture. During the war it had been fully engaged in war work, including marine and aircraft plywoods, and in the marine work commonly used synthetic resin glue.[24]

A complete house using Douglas fir plywood for exterior walls, interior walls and roof sheathing, was shown at the New York World's Fair of 1939.[25] In Australia in 1944 Römcke engaged A V Jennings to design and construct a prototype prefabricated plywood house, a structure which still stands at 55 Naroo Street, Balwyn, though the project did not proceed.[26] In Sydney Veneer and Plywood Pty Ltd were helped by the Commonwealth Experimental Building Station to establish a factory and make a prefabricated plywood house,[27] while Ralph Symonds became the most enterprising maker not only of plywood but of glue laminated structures. The main glues were urea formaldehyde and phenol formaldehyde, of which the latter was better but required a high temperature for setting, using a hot press. Resorcinol formaldehyde had similar properties and did not require a hot press, but it was expensive and as yet little used in Australia. Metal-faced plywood was

16 *Glueing Practice Part 4. Artificial Resin Glues* [Trade Circular no 31 of the Division of Forest Products, Council for Scientific and Industrial Research] (Melbourne 1936), pp 5, 7.

17 Charles Wood, *Catalogue 106. Conservation & Restoration &c* (Cambridge [Massachusetts] 2000), p 41. Wood's notes relate to the publication, General Bakelite Co, *Bakelite. Information No. 1* (New York, November 1910). He refutes the statement in the *Random House Collector's Encyclopedia* that the material was invented in 1913. Elliott, *Technics and Architecture,* p 21, dates it to 1912, also incorrectly.

18 Elliott, *Technics and Architecture,* p 21.

19 Jester, 'Plywood', p 134.

20 Jester, 'Plywood', p 134.

21 Elliott, *Technics and Architecture,* p 21.

22 Ambrose Pratt [ed], *The National Handbook of Australia's Industries* (Melbourne 1934), pp 387-8.

23 W H Hallam, *Building Costs* (1st ed, Melbourne 1939), p 51. Two years earlier the range had been much more limited - furniture plywoods and veneer, various types of door, and 'Insula' moisture resisting wallboard: *Bulletin of the Melbourne University Architectural Atelier* (Melbourne 1937), p 3.

24 *Australian Home Beautiful,* September 1944, p 10.

25 T C Jester [ed], *Twentieth-Century Building Materials* (Washington [DC] 1995), pp 16-17.

26 Don Garden, *Builders to the Nation* (Melbourne 1992), p 63.

27 'Mass-produced All-timber House', *Architecture,* XXXVIII, 4 (October-December 1950), p 135.

increasingly used in engineering applications by the late 1940s, and was made using a mixture of a phenolic resin with rubber, the resin sticking to the timber and the rubber to the metal.[28]

In the 1950s plywood began to regain popularity as an internal lining, in lighter hues and matter finishes than those favoured before the war, and in 1960 'Graindek' pre-finished plywood panels were advertised as ideal for feature walls.[29] A waterproof plywood for external use, 'Super Harbord', had been in the United States in 1934.[30] The synthetic resin glues developed during the war had enabled the creation of better plywoods suitable for external use, of which the most dramatic example was the Myer Music Bowl in Melbourne. The plywood panels were faced with aluminium sheeting, and special joints were designed to allow for movement.[31]

building boards

Building boards come in such a bewildering variety of materials and finishes, and even more bewildering variety of trade names, that they are amongst the hardest materials to grapple with historically. Fibre boards, which are central to the present discussion, were produced from timber waste or other organic material by two basic processes - one, the lamination of thin layers, and the other the compression of pulp to produce a homogeneous sheet. They were of two basic but not mutually exclusive functions, a surfacing or wallboard, and an insulating board. In broad terms, the laminated products tended to be denser and more dimensionally accurate, and therefore suitable as wallboards, while the pulps tended to be less dense and better suited for insulation.[32] Somewhat related to plywood was 'Flexwood'. One Roberts of the Myer Emporium had come across the material while on an overseas trip, and acquired the sole Australian rights. It was a single veneer of walnut (quartered and sliced), oriental walnut, plain prima vera, quartered oak, ribbon mahogany, lancewood or knotty pine, and was glued to the wall like wallpaper.[33]

It may be useful to note the distinctions made by the British Building Boards Joint Committee in 1947, while bearing in mind that the categories are not absolute, and that most manufacturers produced boards in more than one category:[34]

Insulating Boards:
homogeneous insulating boards
laminated insulating boards
bitumen impregnated building boards

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28 H G Higgins, 'Recent Developments in Composite Woods', *Commonwealth Engineer*, 1 June 1948, p 428.

29 *Australian Home Beautiful*, June 1960, p 89, cited in Peter Cuffley, *Australian Houses of the Forties and Fifties* (Knoxfield [Victoria] 1993), p 83.

30 Jester, 'Plywood', p 134.

31 *Plywood and Plywood Products*, I, 6, pp 33-6, cited by Gavin Balharrie, 'Plywood', History of Building Construction 1995, pp 4-5.

32 R F Turnbull, *Fibre Boards* [CSIR Division of Forest Products technical paper no 6] (Melbourne 1932), pp 7-8.

33 Royal Victorian Institute of Architects, *Journal*, XXI, 3 (July 1933), p xiv.

34 Building Boards Joint Committee, *Fibre Building Boards* (London 1947), p 1.

acoustical boards

Wallboards:
homogeneous fibre wallboards
laminated fibre wallboards
bitumen laminated wallboards

Hardboards:
medium hardboards
standard hardboards
super hardboards

American usage tends to categorise them all as 'wallboards' and to refer to the intermediate category instead as 'medium density fiberboard'.[35]

In 1870 a United States patent was granted to W E Hale for an improved sheathing board, and in the following year a patent was issued for strawboard.[36] The first compressed fibre board on the Continent was developed by Radecke, and had reached the English market by 1887.[37] In 1890 the construction of multi-cylinder machines first made it possible to produce boards of a specified thickness without gluing together separate layers.[38] D M Sutherland, who from about 1875 had been experimenting in Edinburgh with processes for manufacturing boards from wood waste, succeeded in producing a millboard, which by 1882 had been used as a backing for Lincrusta Walton. He than established the Patent Millboard Company at Sunbury on Thames, and began marketing what has been described as a lining board in England from 1898.[39]

In 1908 a plant was established at Trenton, New Jersey,[40] to improve supply to the American market and to avoid import duties, and this was operated by the Agasote Millboard Co. The material was made by forming a wet lap of wood waste on an intermittent board-making machine, and then transferring it to a steam heated plate for drying.[41] This is possibly the same product which has been described as the first wallboard properly so-called, designed to provide a finished surface, though a date of 1906 is given for this.[42] The company later turned to the manufacture of a paper board, 'Homasote', which will be mentioned below

In 1909 'Ten Test' insulation board was produced at Thorold, Ontario,[43] the first rigid insulating board made in Canada from wood pulp.[44] By 1931 the Canadian manufacturer

35 Carol Gould et al, 'Fiberboard', in T C Jester [ed], *Twentieth-Century Building Materials* (Washington [DC] 1995), p 132, citing Thomas D Perry, *Modern Plywood* (New York 1942), p 120.
36 Gould, 'Fiberboard', p 120, citing US patent 99,432 to W E Hale, 1 February 1870.
37 Murray Leslie, 'Fifty Years of Architecture and Building, 1887-1936', in J E Sears & J E Sears [eds], *The Architects' Compendium and Annual Catalogue* (London 1936), p v.
38 Turnbull, *Fibre Boards*, p 8.
39 Marian Bowley, *Innovations in Building Materials* (London 1960), p 120.
40 F P Kollman, 'Fiberboard', in F P Kollman et al, *Principles of Wood Science and Technology, II, Wood Based Materials* (New York 1975), p 553.
41 Bowley, *Innovations in Building Materials*, p 120.
42 K C Milley, 'Homasote: the "Greatest Advance in 300 Years of Building Construction"', *APT Bulletin*, XXXVII, 2-3 (1997), p 58.
43 Kollman, 'Fiberboard', p 553.

was International Fibre Board Ltd,[45] but there seems to have been some sort of link with the manufacturers of Beaver Board, as will appear. Ten Test was still being exported from Canada to Britain in 1950, and advertised for sale through the Tentest Fibre Board Co Ltd of Hadley Wood, Barnet, Herefordshire.[46]

J P Lewis, a struggling paper manufacturer of Beaver Falls, New York, invented Beaver Board in 1903. He took the mat board which he produced for picture framing and glued individual plies together to create large sheets to use for lining his attic. On the strength of this he in 1906 established the Beaver Manufacturing Company, which was to dominate the wallboard market for the next two decades. In 1914 a patent for 'Wall-Board' was obtained on the company's behalf by John Thickens, formerly of the Forest Products Laboratory, and this was the product which made the company's name. The inner layers were of ground wood in short loose fibres, which had good insulating characteristics but not much strength or moisture resistance; the outer layers were of cooked wood, in thin close-knit fibres which were strong and resistant to moisture penetration; and a final outer layer of ground wood was placed over this for decorative effect.

The Beaver company headquarters were moved to the outskirts of Buffalo in 1910, and in 1911 satellite plants were established at London, Ottawa, and Roanoke Rapids, North Carolina. The Ottawa plant was moved south to Thorold two years later, and was claimed in a local advertisement to be the 'largest wallboard fibre mill in the world'.[47] As Thorold was the location of the Ten Test plant it seems possible that the latter had been taken over or in some way merged into the Beaver business. It is also unclear whether there was a connection with the Beaver Lumber Company of Canada.[48] There probably was, for an advertisement of 1915 refers to the Beaver Companies of Great Britain, Canada and the United States (with O D Gordon of Sydney as Australian representative).[49] Ultimately the main Beaver company fell a victim to its high debt levels, and in 1928 it was sold to the Certain-teed corporation, which maintained a wallboard under the Beaver brand until at least the 1940s.[50]

'Upson Board', was another laminated fibre board made in the United States.[51] It is said to have shared the exact raw materials, product and market of Beaver Board, but to have been run with a more conservative and sales-driven approach, which was to help it to weather economic downturns. It was founded by Charles Upson in Lockport, New York, in 1910, in association with his brother William Upson. It grew steadily, and in the 1950s

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44 Turnbull, *Fibre Boards*, pp 8-9.

45 *Ramsays Architectural Catalogue* [Melbourne 1931], pp 512-517.

46 Evelyn Drury et al [eds], *Architects', Builders' and Civil Engineers' Reference Book* (London 1950), pp 227, 233.

47 Shelby Weaver, 'Beaver Board and Upson Board', *APT Bulletin*, XXXVII, 2-3 (1997), pp 71-2.

48 Reportedly one of the largest lumber companies, with sixty yards across Manitoba and Saskatchewan: G Mills, *Buying Wood & Building Farms* (Ottawa 1991), pp 24, 43.

49 *Building*, 12 January 1915, p 132.

50 Weaver, 'Beaver Board and Upson Board', p 73. Beaver Colo wallboard was still being advertised in Britain into the 1960s, by the Merchant Trading Company Ltd: Drury, *Architects', Builders' &c Reference Book* (1950), p 226; William Kinniburgh, *Dictionary of Building Materials* (London 1966), p 38.

51 Waldo Bros. and Bond Company, *Building Materials and Construction Equipment* (Boston, no date [c 1920]), p 348; *Sweet's Architectural Catalogue* (1922), pp 1126-7. Waldo Bros list another type, 'Walbro Board', which has not been reported in Australia.

expanded into prefabricated houses and building boards for exterior use, then in 1955 bought the old Beaver Board plant at Buffalo from the Certain-teed Corporation and revived the Beaver brand name in a bid to capture the remaining loyal market. In the 1970s Upson ran into financial problems and it finally closed its doors, bankrupt, in 1984, though it soon afterwards reopened under the management of Niagara Fiberboard.[52]

'Amiwud' [that is, 'Am I wood?'] [53] was a compressed wood pulp board intended as a finished surface for wall panelling and ceilings. It came in 'golden oak', 'weathered oak', 'jenisero', 'mahogany' and plain, in sheets of up to 10 ft 6 in by 2 ft 8 in by 3/16 thick [3.23 m x 0.82 m x 4.8 mm], and was finished with 'battens' or cover straps at the joints.[54] The makers were the Paraffine Paint Co of San Francisco and Chicago, better known for their 'Malthoid' roofing, and they insisted that it was 'a mechanical reproduction (not an imitation) of the beautiful artistic Oak and other hardwood grains'.

Subsequent developments in America included a rigid fibre board patented by Carl G Meunch[55] and made from the ground wood tailings of a paper mill by the Minnesota & Ontario Paper Co at International Falls, with a pilot plant established in 1914 and marketed from 1915 or 1916 as 'Insulite',[56] and the material seems to have been manufactured in Britain as well as the United States.[57] 'Cornell', a compressed wood fibre board with an 'oatmeal' finish, was made by the Cornell Wood Products Co of Chicago at least by 1922.[58] Amongst the subsequent United States products in this category was 'Sterling Wallboard' made by a mill in western New York State in sizes up to four feet by twelve [1.2 x 3.6 m], 3/16 inch [5 mm] thick, and sized on both sides.[59] By the 1930s the United States Gypsum Co alone marketed 'Weatherwood Hardboard', of wood fibre; 'Fiber Wallboard', similar but less dense; 'Weatherwood Insulating Board' of felted wood fibre; Weatherwood Insulating Tile Board, Weatherwood Insulating Plank, and other products.[60] By 1950 'Maftex' board, made from fibres of liquorice root, was being exported from the United States to Britain, though it has not been reported in Australia.[61]

Mineral bonded wood wool slabs are said to have been first produced in Austria in 1914, using Portland cement or other hydraulic binders.[62] However this seems inconsistent with the fact that the combination of wood fibre with cement was patented in the United States in

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52 Weaver, 'Beaver Board and Upson Board', pp 73-4.

53 R A Prevost, *Australian Bungalow and Cottage Home Designs* [Sydney 1912], rear endpaper advertisement; *The Salon,* I, 1 (July-August 1912), advertisement p xi.

54 Mayes, *Price Book* (1914), p 238.

55 Gould, 'Fiberboard', p 132.

56 Kollman, 'Fiberboard', p 553; Turnbull, *Fibre Boards,* p 9.

57 F E Drury et al [eds], *Architects', Builders' and Civil Engineers' Technical Catalogue* (London 1946), pp 225, 313. 'Maftex' would appear to be a name derived from the British distributors, Macandrew & Forbes, so the original name is probably different.

58 *Sweet's Architectural Catalogue* (1922), pp 1124-5.

59 Chicago Millwork Supply Co, *Millwork and Building Material* (Chicago, no date [c 1925]), p 49.

60 United States Gypsum Company, *A Catalog of Building Materials* (Chicago 1936), section B, p 10, and section C, pp 1-10.

61 Drury, *Architects', Builders' &c Reference Book* (1950), p 226.

62 Pedro Guedes, *The Macmillan Encyclopedia of Architecture and Technological Change* (London 1979), p 276.

1904,[63] and that in 1914 a building board of this sort using 'limecement', and called Sackett Board, was already available in Australia. It was supposed to serve as a basis for plaster in lieu of laths.[64] The Austrian material was called 'Heraklith',[65] and used a magnesite cement. It was later manufactured by W F Schlesinger & Co Ltd of London.[66] By 1937 it had been tested in Australia and had been used in extensions to a hotel at Manly, New South Wales. The slabs were designed to be nailed to a timber frame, bonded with cement, rendered externally, and plastered internally. By the 1940s it was being manufactured in Australia as 'Woodtex'.[67] An English type which does not seem to have reached Australia is 'Centulith'.[68] Meanwhile by 1938 'Fibrerock' was being sold in Australia - of 'wood fibre petrified in cement (no Magnesite)'.[69] In more recent times still a Czech soil scientist, Dr Holly, is supposed to have experimented in central Australia with compressed spinifex and cement.[70]

wood fibre boards in Australia

By 1900 a 'compo' board was being advertised in Australia, consisting of laths of wood with the grain in different directions, laid edge to edge, and with 'fireproof cement' between them and in a layer on either face, then outside this on both faces a layer of 'damp-proof pulp board'. This material was available in lengths from eight to eighteen feet [2.4-5.4 m].[71] This was not a wood fibre board, but what was known in England as a 'laminated board', made in thicknesses from a half to two inches [13-52 mm] and much used for flush doors and furniture.[72]

Four wood fibre boards marketed in Australia can be named, 'Ten Test', 'Beaver Board', 'Upson Board' and 'Amiwud'.[73] By 1913 Gunnersen Nosworthy of Melbourne stocked 'Ten Test' in lengths of up to seventeen feet [5.1 m],[74] though later the available sizes seem

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63 Elwood O Baylor of Adrian, Michigan, was granted US patent 751,712 on 9 February 1904 for a 'building block' consisting of a combination of concrete and a woody fibrous substance. *Concrete*, I, 1 (March 1904), p 25.

64 Mayes, *Price Book* (1914), p 28; advertisement p 51.

65 Bridget Jolly, 'Solomit in Australia and its European Context' (PhD submission, University of Adelaide, 1998), p 198.

66 Kinniburgh, *Dictionary*, p 132.

67 Jolly, 'Solomit in Australia', p 198, ref *Advertiser* [Adelaide], 27 November 1937, p 24; South Australia, Building Act Enquiry Committee, *First Progress Report* (Adelaide 1937), p 11; Council for Scientific and Industrial Research file, '"Woodtex" Wall Covering', AA (SA), AP 665/1/0, G3387.

68 Kinniburgh, *Dictionary*, p 69.

69 C E Mayes, *The Australian Builders' and Contractors' Price Book* (10th ed, Sydney 1938), p 324.

70 Alistair Knox, *Living with the Environment* (Canterbury [Victoria] 1975), p 149. Jolly, 'Solomit', pp 8-9, identifies him as the A B Holly who visited Ernabella in 1971.

71 *MMBW Sewerage Scheme* (Melbourne 1900), no page [CHECK THIS]. What must be the same composition or 'compo' board was available in 1914 very cheaply - 3d per square foot as opposed to 1s 6d for plasterboard - in four foot [1.2 m] wide sheets from ten to eighteen feet [3 to 5.4 m] long: C E Mayes, *The Australian Builders & Contractors' Price Book* [8th ed, Sydney 1914], pp 28, 238.

72 Kinniburgh, *Dictionary*, p 149.

73 SOURCE? Apparently not *Building*.

74 S. A. Burns Ltd., *Price List*, p 19.

to have been smaller - up to 8 ft x 4 ft x 7/16 inch [2.4 m x 1.2 m x 9.5 and 4.8 mm].[75] It was being regularly advertised in Australia by 1931,[76] and R S Couche & Co of Melbourne sold it especially as a base for flooring materials over concrete slabs.[77] They advertised it as being of 'British manufacture', apparently in reference to its being made in a British dominion, for the raw material was now explicitly identified as Canadian spruce.[78] It seems to have disappeared from the local market soon after this time.

Beaver Board was available in Australia by 1914, and was used as a base for plastering. It was made of spruce wood fibre, and 3/16 in [4.8 mm] sheets 32 and 48 inches [0.82 and 1.23 m] wide by up to ten feet [3.07 m] long.[79] It was a four-ply laminated material.[80] An example of Beaver Board from 1918 has been identified by Geoff Ashley at Willandra homestead, New South Wales.[81] By 1926 Beaver Board in lengths of up to twelve feet [4.8 m] could be bought in Adelaide[82] and Brisbane, where there was also a 'Jumbo' Beaver Board (a zoologically mind-boggling concept), 25% thicker and costing 12.5% more.[83] In Sydney lengths could be had up to 16 feet (4.8 m), in both 3/8 in and 3/16 inch (9.5 and 4.8 mm) thicknesses,[84] of which the former was presumably the 'Jumbo', even though the difference is not 25%.

'Upson Board', was also imported to Australia.[85] 'Amiwud' was available in Australia by 1912,[86] and after the war it was available in New Zealand in sheets as long as twelve feet [3.6 m].[87] In 1938 'Insulite', described as the 'original wood-fibre insulating board', was available in Australia 'duo surfaced' with 'burlap' and smooth sides, and suitable for wall and ceiling surfaces,[88] but it is not known whether this was the American or the British variety. Only one board, 'Adamo' [pronounced *Ad*amo] seems to have been made in Australia from Australian wood pulp, and it was sold in all states by William Adams & Co Limited. It was claimed to be light, tough, rigid and white ant resistant, and was stocked in widths of 1 ft 6 in to four feet [0.45 to 1.2 m] and lengths of up to twelve feet [3.6 m].[89]

Imported boards proliferated in the 1920s and 1930s. The American 'Fiberlic' laminated fibre wallboard was available in Brisbane in 1922,[90] and 'Cornell' board[91] was available

75 W H Hallam, *Building Costs* (1st ed, Melbourne 1939), p 1.
76 *Ramsays Architectural Catalogue* [Melbourne 1931], pp 512-517.
77 RVIA, *Journal,* XXI, 3 (July 1933), advertisements p xii.
78 D W Tulloch, *Details of Australian Building Construction* (Melbourne, no date [c 1933]), p 76.
79 Mayes, *Price Book* (1914), p 238.
80 *Sweet's Architectural Catalogue* (17th ed, New York 1922), pp 1122-3.
81 Geoff Ashley, 'Two Centuries of the Western NSW Dwellings', in Peter Freeman & Judy Vulker [eds], *The Australian Dwelling* (Red Hill [ACT] 1990), p 80.
82 *The South Australian Building & Allied Trades Directory and Handbook* (Adelaide 1926), p 15.
83 *Architect and Builder's Journal of Queensland,* 10 July 1926, p 81.
84 S. A. Burns Ltd., *Price List* (Sydney 1926), p 19 & rear endpaper.
85 Turnbull, *Fibre Boards,* p 9. See also the advertisement for Upson Board in Alex Smith, *The Australian Home Carpenter* (Melbourne 1929), p 122.
86 R A Prevost, *Australian Bungalow and Cottage Home Designs* [Sydney 1912], rear endpaper advertisement; *The Salon,* I, 1 (July-August 1912), advertisement p xi.
87 Jeremy Ashford, *The Bungalow in New Zealand* (Auckland 1994), p 59.
88 Mayes, *Australian Builders' Price Book* (1938), p 323.
89 *Every Man's Home,* II (October 1922), p 13. See also *Book of Australian Bungalows* (Sydney, no date [c 1923]), p 108.
90 *Architectural and Building Journal of Queensland,* I, 3 (7 September 1922), p 35. The board is identified as being from the United States in Drury, *Architects', Builders' &c Reference Book* (1950), p 225.

locally by 1927 in sheets which measured up to 4 x 16 feet [1.23 x 4.92 m x 11 mm].[92] In 1937 there were agents throughout New Zealand for a board called 'Treetex',[93] which was apparently imported from Britain,[94] but does not seem to be known in Australia. By the 1940s New Zealand was producing its own wood fibre board, 'Pinex', claimed to be stronger than the board previously imported to that country[95] - presumably Treetex - but there seems no evidence that this product reached Australia either.

Masonite

Masonite and its successors can be seen as being the fulfilment of an American dream, for in 1833 J A Etzler, a German living in Philadelphia, put forward a utopian vision for the United States, in which something of the sort was envisaged. The monotonous forests would be 'ground to dust' then 'cemented by a liquor' to create 'a universal building material'. This substance could be moulded to any shape, and could be vitrified to make it virtually indestructible and to give it a 'crystal-like brilliancy.'[96]

In 1858 one Lyman discovered a process for separating wood fibres by the expansion of hot water, steam or compressed air, and this was developed by William Horatio Mason, a collaborator of Edison, who established the Mason Fibre Company plant at Laurel, Missouri, in 1926 to produce a wood pulp board by the explosion process.[97] He and his fellow-investors were able to take advantage of the massive amounts of wood waste then being generated by the local timber industry, using equipment for which Mason received a series of patents in 1925-8.[98] It seems that the timber was initially broken into small pieces by mechanical means, and was than passed through a steam gun to explode it,[99] and it was said

> clean wood chips are exploded under high steam pressure, so that the wood is reduced to fibre. The pulp thus produced consists entirely of long cellulose fibres, with their strength unimpaired and the lignins, or natural cementing structure of the wood, entirely retained. No chemicals are used; the exploding process is purely a physical one.

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91 *Sweet's Architectural Catalogue* (1922), pp 1124-5.

92 S. A. Burns Ltd., *Price List* (Sydney 1926), p 19. A C Saxton and sons of Sydney marketed it: *Book of Australian Bungalows* (Sydney, no date [c 1923]), p 2.

93 *Building Progress* [Auckland], II, 5 (Wellington edition, May 1937), p 7.

94 It was advertised in a number of forms by Treetex Limited of London: Drury, *Architects', Builders' &c Reference Book* (1950), pp 227-8.

95 *Building Progress* [Auckland], VIII, 1 (January 1943), inside front cover & p 15; VIII, 2 (February 1943), p 15.

96 John Carey, *The Faber Book of Utopias* (London 1999), p 229, quoting J A Etzler, *A Paradise within the Reach of All Men, &c* (2nd ed, [?Pittsburgh (Pennsylvania)] 1842 [1833]).

97 Turnbull, *Fibre Boards*, p 9.

98 Carol Gould, 'Masonite: Versatile Modern Material for Baths, Basements, Bus Stations, and Beyond', *APT Bulletin*, XXXVII, 2-3 (1997), p 64.

99 *Architect and Builder's Journal of Queensland*, 10 March 1931, p 17.

At later dates waxes and water-compatible resins such as phenol formaldehyde were added to improve the strength and moisture resistance of the material.[100] In addition to the wood product a wheat straw board and a cornstalk strawboard, were produced respectively in Missouri in 1928, and Iowa in 1929.[101]

'Masonite' was made in both an insulation board, 'Masonite Structural Insulation'[102] and a wallboard grade, 'Presdwood', which was more durable and was formed under hydraulic pressure. By 1931 it was on the market in Australia.[103] In 1932 a patent was obtained for 'Tempered Presdwood', in which liquid and heat treatments made the surface more resistant to abrasion and moisture, and the finished panels were soaked in oils and baked at high temperatures. The original boards were of a natural brown colour, finished smooth on one face and with a fine mesh imprint on the other, but by 1939 prefinished panels in oyster white, ivory, green and buff were being manufactured. The Mason patents governing the hardboard (Presdwood) material were sufficiently powerful to protect it and to enable the company to sell it on to others such as Celotex, the Johns Manville Corporation, the Armstrong Cork Company, the National Gypsum Co, and the Certain-teed Co, which marketed it under their own brands.[104] It was also manufactured in Sweden and exported to England.[105]

By about 1936 the CSIR estimated the Australian market for fibreboard at approximately 56 million feet [5.2 million m^2] per annum.[106] The Colonial Sugar Refining Company experimented at their Macknade mill in Queensland in about 1936-7 with hardboard made from Australian hardwood fibre, but did not proceed to full-scale manufacture because the Masonite Corporation of the United States was building a factory at Raymond Terrace near Newcastle to produce its own board.[107] In March 1937 J H Thickens, the Masonite Corporation's vice-president in charge of production, came to Australia to investigate the possibility of setting up a plant, and as a result Masonite Corporation (Australia) Ltd was established in September. The products to be manufactured were 'Masonite Constructional Insulation', for wall sarking and roof insulation; 'Quatrboard', a 'semi-hard' board for interior surfaces, which would take paint well; 'Presdwood', a dense smooth-surfaced board; 'Tempered Presdwood'; and 'Temprtile', with the mock tile finish.[108]

It appears that the Masonite factory came into production towards the end of 1938,[109] and Masonite was distributed by CSR for five years, until that company began manufacturing its own version, 'Timbrock' in 1947.[110] In 1949 the Masonite Corporation of Australia was advertising in its own right, with branches in most capitals and a factory at Raymond

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100 Gould, 'Masonite', p 64.
101 Turnbull, *Fibre Boards*, p 9.
102 *Specifications and Details. Masonite Manufactured Lumber* [brochure, Avery Library, Ross no 76] (Chicago, no date [after 1926]), p 1. A far more comprehensive account of the manufacturing processes, not specific to Masonite in particular, is given in Turnbull, *Fibre Boards*, pp 10-16.
103 *Architect and Builder's Journal of Queensland*, 10 March 1931, p 17.
104 Gould, 'Masonite', pp 64-5.
105 Kinniburgh, *Dictionary*, p 165.
106 *The Story of Masonite* (Sydney, no date [c 1937]), unpaginated.
107 A G Lowndes [ed], *South Pacific Enterprise* [Sydney 1956], p 212.
108 *The Story of Masonite*, passim.
109 Mayes, writing in 1938, says the event is scheduled for October or November: Mayes, *Australian Builders' Price Book* (1938), p 37.
110 Lowndes, *South Pacific Enterprise*, pp 212, 219.

Terrace, New South Wales, which made use of Australian hardwoods to produce Presdwood, Tempered Presdwood and Temprtile, but not, it would seem, Quatrboard . In 1948 'Woodtex' was also being advertised in Melbourne, as a material light, strong, borer and fungus-proof, unaffected by moisture, steam, rain or sun,[111] but the precise nature of this material is unclear.

Masonite 'Temprtile' was finished in imitation tile finish, a idea which had been introduced in America by Beaver Board at least by 1922,[112] and by the Upson Company even earlier.[113] In 1923 the Upson Fibre Tile was described as[114]

> made of clean, strong, wiry wood fibers, mostly spruce, formed under enormous pressure into panels nearly a quarter of an inch thick, four feet wide, and from six to twelve feet long. It is permanently embossed in two tile-like patterns, oblong and square, giving the same beautiful effect that is produced by ceramic tile ...
> Upson Fibre-Tile is finished with flat paint and enamel after being applied to the walls.

The Upson tile had been sold in New Zealand,[115] and doubtless also in Australia. In the 1950s Masonite was available locally in sheets measuring 4 x 12 feet [1.23 x 3.69 m], and had been augmented by 'Masonite Primecote' with a surface prepared for painting.[116]

cane boards

In 1907 a 'bagasse fibrous composition for ceilings and walls' was available in Australia in the form of plain panels with cover moulds, ready for fixing, as well as ornamental panels and cornices.[117] The source of this is a total mystery, but it is likely to be American and it foreshadows the development of 'Celotex'. The system for producing Celotex insulation board from bagasse (sugar cane waste) was developed by a United States company, Texal Ltd,[118] and a patent taken out in 1921.[119] The Celotex company established a plant at Marrero, Louisiana, in 1921,[120] and the material was marketed from 1922.[121] In 1924 propaganda began to be put out by the company about its plans to establish a Celotex mill in the Australian sugar cane districts[122] and, though this project lapsed, Celotex came onto

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111 Ashley, loc cit, citing Australia: Council for Scientific and Industrial Research, *Fibre Boards* (Melbourne 1932) [Australian National Library Technical Paper 6].
112 *Sweet's Architectural Catalogue* (1922), p 1122.
113 Waldo Bros. and Bond Company, *Building Materials and Construction Equipment* (Boston, no date [c 1920]), p 349.
114 *The Upson Company. Fibre Board Authorities* (Lockport [New York] 1923) [brochure, Avery Library: Ross cat 9 no 20], pp 3-4.
115 Ashford, *The Bungalow in New Zealand,* p 70.
116 Phillip Mayes, *The Australian Architects, Builders and Contractors Price Book and Guide* (11th ed, Glebe [New South Wales] 1951), p 88; advertisement p 2.
117 Walter Jeffries, *The Australian Building Estimator* (Sydney 1907), p 209.
118 Bowley, *Innovations in Building Materials,* p 351; Kollman, 'Fiberboard', p 553.
119 Gordon Temple, 'Utilising Waste', *Science Progress,* XXII, 1927-8, p 476, quoted in Jolly, 'Solomit', p 153.
120 Kollman, 'Fiberboard', p 553. Jolly, 'Solomit', p 153, refers to a factory in New Orleans in about 1922.
121 Turnbull, *Fibre Boards,* p 9.
122 *Australian Home Builder,* 15 January 1925, pp 54-5, referring also to the previous December issue, not yet sighted.

the Australian market from the United States, and a product from Hawaii called 'Canec' was expected to join it.[123] An early Celotex brochure indicates that Burns Philp & Co were agents for New South Wales and Queensland, V B Trapp & Co for Victoria, Elder Smith & Co for South Australia and Western Australia, and A C Webster & Sons for Hobart.[124]

'Celotex' was the best-known fibreboard internationally, and was made not only in the United States but soon in Britain, where an existing group of companies was reorganised as Celotex Ltd in 1937.[125] By 1950 Celotex Ltd of London were making six different versions of the product.[126] The material became well established in Australia during the 1920s,[127] and was apparently made from either bamboo or cane fibre,[128] though generally taken to be the latter. Augustus Aley wrote of it in 1929 as 'a new building board of sugar cane fibre, which is claimed to have good insulating properties.'[129] It was promoted as an insulation material for sheathing the outer face of a timber building frame, prior to cladding it with weatherboard or asbestos cement, finishing it in metal lath and roughcast, or encasing it with a veneer of brick.[130] This sort of construction is more typical of the United States than of Australia, and there is no clear evidence that it was in fact implemented here.

Celotex was also promoted for sarking roofs, insulating floors, as a substrate for linoleum, as a base for plastering, and as a self-finishing wall and ceiling lining, generally with straps at the junctions, but otherwise with V- or round-edged butt joints.[131] In these latter uses, and in various acoustic forms, it seems to have achieved general acceptance, especially in Brisbane. It was used with apparent success in 1929 to line the roof of the Presbyterian Church at Enoggera Terrace,[132] and in 1930 to line the 37.5 m diameter dome of Brisbane City Hall,[133] claimed by Florence Taylor to be 'the biggest Celotex job in the world'.[134] This was in the form of Acousti-Celotex tiles.[135] It was also used for the lining of the police station built in 1928-9 at the remote South Australian settlement of Innamincka.[136] An issue of *Celotex News*, probably of 1930, reports the use of the material in a range of houses and churches, wine cellars, cool stores, and the T & G Building and British Medical

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123 Turnbull, *Fibre Boards*, p 9: the 'propaganda' is cited to the *Industrial Australian and Mining Standard* (1924), 72, pp 428, 725 and 772. Turnbull does not name the company which had this plan, but it is identified in C E Mayes, *The Australian Builders & Contractors' Price Book* (9th ed, Sydney 1927), p 370; advertisement p 15.

124 *Celotex Insulating Building Boards* [trade brochure] (Sydney, no date [c 1930]), inside rear.

125 Bowley, *Innovations in Building Materials*, p 351.

126 Celotex insulating board, a low density cane fibre insulating board; Celotex utility board, a cane fibre building board; Celotex roof insulation, a low density insulating board; Celotex standard hardboard, a high density compressed fibreboard; 'Flexcell' expansion jointing, an impregnated cane fibre board; and Acousti-Celotex cane fibre tiles: Drury, *Architects', Builders' &c Reference Book* (1950), pp 227-8. See also Kinniburgh, *Dictionary*, pp 9, 65, which refers to 'Celobestos', an incombustible board containing asbestos and other mineral fibres.

127 Mayes, *Australian Builders Price Book* (9th ed, 1927), advertisement p 15.

128 Mayes, *Australian Builders Price Book* (9th ed, 1927), p 370.

129 Augustus Aley, 'Constructing the Home', in Bebarfalds Ltd, *Safe Home Planning* (Sydney, no date [1922]), p 39.

130 *Ramsays Architectural Catalogue* (1931), pp 496-8.

131 *Ramsays Architectural Catalogue* (1931), pp 419-511.

132 *Building*, 12 September 1929, p 33: reference supplied by Michael Kennedy.

133 Illustrated in *Celotex Insulating Building Boards*, p 11.

134 F M Taylor, *A Pot-Pourri of Eastern Asia* (Sydney 1935), p 45.

135 RVIA *Journal*, XXXI, 3 (July 1933), advertisements p xxiv.

136 H M Tolcher, *Innamincka* (Innamincka [South Australia] 1990) p 26, where it is referred to as 'sellotex'.

Association Hall in Sydney. It reports its use in the Burns, Philp headquarters at Suva and in many other of the company's stores and houses on the islands, including a cool store on the island of Salamoa, which is illustrated. The material had also been used to insulate railway carriages, containers for taking butter from cool stores to ships, and even a chicken incubator.[137]

A particularly interesting application was the reconstruction of the Melbourne Town Hall in 1928, after it had been largely destroyed by fire. Large panels of Celotex were placed along the side walls of the auditorium for acoustic reasons, and decorated by the artist Napier Waller with the murals that survive to this day. The artist explained:[138]

> The conventional line decoration has been adopted because of the limitation of the material as a painting surface - as no sizing or skin of paint can be put on the panels without probably interfering with the acoustic qualities of these panels; hence by the line treatment all but a very small part of the panels will be uncoloured. No binder is necessary as the stain becomes fixed in the absorbent celotex. The decorative effect will depend on the warm tone of the celotex itself with the play of the umber line and the suggestion in small quantities of a powder blue background.

'Canec', the Hawaiian board whose arrival was adumbrated by Turnbull in 1932, duly appeared, and was marketed by George Hudson Limited as sole agents for New South Wales, but it is unclear when it arrived and how long it stayed on the market. It was said to be 'registered' by the United States Patent Office, and was presumably of US manufacture.[139] It was on sale locally by 1936 as a 'structural insulation board'. It was claimed to be 'the only 100% Sugar-cane Fibre Insulating Product, and came in sizes three and four feet [0.9 and 1.2 m] wide by six to sixteen feet [1.8 to 4.8 m] long, and in thicknesses from 1/4 inch to eight inches [6.4 to 200 mm].[140] By about 1935 'Donnacona' insulating building board was being advertised by the New South Wales agents A C Saxton & Sons of Sydney.[141] Its source was unstated, and it bore an Indian head brand suggestive of North America, but in New Zealand it was advertised as a British product[142] - this probably means that it was made in Canada, a British dominion, as in other such instances. It was available in lengths of twelve feet [3.6 m] and in 1/2 and 3/8 inch [13 mm and 9.5 mm] thicknesses, in a 'standard board' or roughcast, or in 'burl board' or smooth finish.[143]

The first locally made board was a CSR product, made on a pilot basis at the company's Macknade plant in about 1936-7, and launched into full production at Pyrmont as 'Cane-ite' in 1939,[144] though it was listed already in Mayes's price book of 1938 in two thicknesses and a number of sizes.[145] A 'Masonite-Cane-ite House' was shown at the House and

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137 *Australian Celotex News*, no 3012-3 (Sydney, probably 1930), passim.
138 M Napier Waller to Stephenson & Meldrum [architects], 10 August 1927, copy kindly supplied by Allom Lovell & Co.
139 George Hudson Pty. Limited, *Price List* (Sydney 1938), pp 41-4.
140 Andrew Cook & Sons Ltd., *Price List* (Newcastle [New South Wales] 1936), no page.
141 J P Brogan, *101 Australian Homes*(Sydney, no date [c 1935]), p 112.
142 *Building Progress* [Auckland], II, 5 (Wellington edition, May 1937), pp 7, 11.
143 Mayes, *Australian Builders' Price Book* (1938), advertisements p 27 & pp 87-8.
144 Lowndes, *South Pacific Enterprise*, pp 209-10.
145 Mayes, *Australian Builders' Price Book* (1938), p 37.

Building Exhibition, Melbourne, in 1939.[146] Cane-ite was made from megass or sugar cane fibre residue (later diluted with waste paper and hardwood pulp.[147] By 1938 Slade, Allen & Co as local agents were advertising the Stanley Company's new fibre board tools, a cutter and a beveller.[148]

Meanwhile in 1930 the Council for Industrial and Scientific Research, in cooperation with the Forestry Commission of New South Wales and the Forests Department of Western Australia, tested the suitability of three local timbers for fibre board manufacture, the outcome of which was a report by R F Turnbull published in 1932. Turnbull's conclusion was that there were no major technical obstacles to the production of either insulating or hard-pressed boards from local material.[149] The annual consumption of fibre board in Australia was an average of 1.4 square feet per head, compared with 7.7 in the United States (and 1.3 in England). Imports were currently being received from the United States (Beaver, Upson and Pacific Boards), Canada (Ten Test), Britain (Pabco) and Germany (Schumacher and Schumite Boards).[150]

During the 1940s, when supplies of Cane-ite were inadequate, similar products such as 'Finnboard' were imported from Europe.[151] In mid-1948 it was announced that Paper Makers Pty Ltd, a subsidiary of Australian Pulp and Paper Mills Ltd, was to establish a hardboard plant in Tasmania. The plant superintendent had recently investigated manufacturing methods in Sweden,[152] and this was presumably to be the basis of production.

A semi-flexible insulating board had been produced from flax straw in Minnesota in 1909,[153] and a wheat straw board and a cornstalk straw board were produced respectively in Missouri in 1928 and in Iowa in 1929.[154] Of more direct relevance to Australia was the European development of a board made of compressed and treated straw, between strong paper faces, which appeared on the British market in about 1945. Interestingly, it was described as 'licence-free'.[155] It was a wheat straw board developed in Sweden by Theodor Diedin in 1933-5 and then, after the patents had expired, developed in Britain in the late 1940s by Torsten Mossesson as the commercial product 'Stramit'.[156] It is described as consisting of compressed straw faced with an impregnated paper, fabric, aluminium foil, or hardboard.[157] By 1950 it was being manufactured in England by Stramit Boards Limited.[158] Meanwhile, in July 1937 Dieden, with Nils Ryberg (both of Carlsbund)

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146 *Australian Home Beautiful*, XVII, 4 (April 1939), p 28, cited by Peter Cuffley, *Australian Houses of the '20s & '30s* (Fitzroy [Vic] 1989), p 145.
147 Lowndes, *South Pacific Enterprise*, p 210.
148 Mayes, *Australian Builders' Price Book* (1938), advertisements pp 15, 34.
149 Turnbull, *Fibre Boards*, pp 9-10.
150 Turnbull, *Fibre Boards*, p 23.
151 Peter Cuffley, *Australian Houses of the Forties and Fifties* (Knoxfield [Victoria] 1993), p 83.
152 *Commonwealth Engineer*, 1 June 1948, p 451.
153 Kollman, 'Fiberboard', p 553.
154 Turnbull, *Fibre Boards*, p 9.
155 H B Newbold, *Modern Practical Building* (2nd ed, 4 vols, London, no date [1946]), I, fig 207, p 350.
156 Jolly, 'Solomit', p 8, refers to Alex Wilson, 'Straw, the next great building material', from *Environmental News*, IV, 3 (May-June 1995): http://www.ebuild.com /Archives/Features/Straw, p 8.
157 Kinniburgh, *Dictionary*, p 187.
158 Drury, *Architects', Builders' &c Reference Book* (1950), p 328; see also p 787.

applied for and apparently received an Australian patent for an 'Improved method of and apparatus for the manufacture of boards for building and insulating purposes.'[159] In Australia during 1950s Stramit, 54 mm thick, was introduced for use in ceilings, partitions, and even as a roof surface when coated with bitumen.[160]

Solomit

A form of strawboard had been pioneered in the nineteenth century when B Nicholl of Piccadilly developed a 'fireproof slab' which he showed at the Paris Exposition of 1867. A 'framework' of wire about 1/8 inch [3 mm] in diameter contained a mass of straw or other fibrous material 'woven by the aid of a powerful machine', saturated with a fireproofing solution and subjected to great pressure. The faces were finished in cement, normally imitating the appearance of stucco on the outside, and providing a plain surface on the inside for decorating. The thickness was 4 1/2 inches [115 mm], and it was claimed to be as strong as nine inch brickwork.[161] The idea of a strawboard was raised in the United States in a patent granted to Judd Cobb in 1871 but nothing seems to have come of it, and it is unlikely to have been a structural material.[162]

The true successor of Nicholl's invention was 'Solomit', the history of which has been researched by Bridget Jolly of South Australia.[163] It appears to have been the invention of Serge Tchayeff, a Russian Jew living in Paris, and was first reported in 1925. Tchayeff's patent was extended to Australia in 1927, for 'Plastic masses of straw, reeds and similar materials, compressed and reinforced and method and apparatus for the production thereof'. The drawings show the straw packed tightly with the strands lying parallel, and bound around with wire to create a compact slab, which was then faced on either side with sheet material. This might be steel, plywood, asbestos cement, millboard &c (or different combinations on the inner and outer face), but the patent also allowed for running material such as asbestos cement directly into the face of the straw, impractical as this might seem.

The business seems to have been based in Germany, where the patentee was Dr Willi Schacht, a cellulose chemist, and it was the Solomit Strohplatten G.m.b.H. of Berlin which entered an agreement with an Australian company set up to manufacture the product, the Modern Economic Construction Co. The Australian company was represented by Robert W Viney, a draftsman by profession. However, the German lawyers involved in the project were apparently Jews, and were interned by the Nazis, while for their part some of the Australian parties were subsequently interned in Australia as aliens.

Notwithstanding these problems Viney obtained an Australian patent in his own name in 1936 for 'Improvements in and relating to the construction of buildings with infilling plates or sheets fitted to skeleton frames'. In that year demonstration houses were built at Gepp's

159 Jolly, 'Solomit', p 17, refers to patent no 104,569, accepted 12 July 1938.
160 Cuffley, *Australian Houses of the Forties and Fifties*, p 85.
161 R S Burn, *Modern Building and Architecture* (London, no date [c 1870]), p 77.
162 Gould, 'Fiberboard', p 120, citing US patent 111, 611 to Judd Cobb, 7 February 1871.
163 Bridget Jolly, 'Solomit in Australia and its European Context' (PhD submission, University of Adelaide, 1998). This is the source of what follows, except where indicated to be derived from correspondence with Jolly or from other sources.

Cross, South Australia, using Solomit plates imported from Germany. Local manufacture now seems to have begun, with the involvement of James Bradley of Adelaide, who was possibly already established as the maker of 'Impervia'.[164] The Australian Government seems to have been actively supportive, for in November 1937 tenders were called for six railway employés' houses at Port Pirie. By 1938 the South Australian Government had built twelve Solomit cottages at port Pirie.[165] In 1938 the prospectus of Solomit (S.A.) Ltd. was issued, and it was claimed that the material had been used already in South Australia and at Nhill and Horsham in Victoria. The factory was at Freeling, South Australia, where two wood-framed Solomit houses were built in the 1940s, with the outer faced cement rendered by hand.[166] In at least one of these, the Schuster house, the surface was scored and painted fawn in imitation of freestone.[167]

In Sydney several Solomit houses were built (five are known) with a Gunite cement finish.[168] In Victoria fifteen or twenty houses of using of Solomit faced with concrete, were proposed in 1939 to be built at Altona, allegedly costing 20% less than brick construction.[169] They were designed by Marcus Barlow, and in the event only twelve were built, though they were meant to be the first of a much larger number - reportedly 1,200, though 120 may have been meant - on land which had been bought for the purpose. Before 1941 one Solomit house was built at Coburg, and two in the country - one at Horsham for F Langlands, and one at 'Blackwood' near Penshurst (designed by Leighton Irwin & Ferries of Melbourne).[170] In about 1938 a Solomit factory had been established in a converted flour mill at Murtoa, though presumably not brought into production in time to supply the Altona houses.

The house at 34 Jessie Street, Coburg, was built by the brothers Baden and Jack Levings for Jack Morris, using Solomit plates imported from Adelaide. According to Baden Levings the carrier, when asked what they were for, replied that they were mattresses for horses. The house frame was of two inch [50 mm] angle steel, so that the two inch straw plates fitted in to leave a flat surface. The house was completed in 1940 at a total cost of about £1000.[171] The house at Blackwood still stands in good condition, with a nearly horizontal skillion roof, and a rendered surface which conceals the construction, though Robin Ritchie reports that it too is steel framed. The best account of the framing of these houses is that of a man who worked as a labourer in the construction of one at Wilpena, South Australia, in 1941. He recalls the uprights as being 4 by three inch [100 x 75 mm] steel tees, giving two inches [50 mm] of support to the panels on either side. To the stem of each tee were welded at intervals lugs measuring about 75 x 25 mm, which would be bent down over the face of the panel, then hammered down to secure it.[172]

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164 See also John Dallwitz & Susan Marsden, *Heritage of the Lower North* [South Australian Department of Environment and Planning] (no place, 1983), p 200.

165 *Age*, 28 February 1939, from RVIA Press Cuttings, 1934-9, SLV.

166 See also John Dallwitz & Susan Marsden, *Heritage of the Lower North* [South Australian Department of Environment and Planning] (no place, 1983), p 200.

167 Bridget Jolly, 20 September 1994.

168 Bridget Jolly, 11 August 1994.

169 *Argus*, 23 & 28 February 1939.

170 Bridget Jolly, 6 September 1994.

171 Baden Levings to the Coburg Historical Society, 3 October & 14 November 1989, kindly provided by Laurie Burchell.

172 Bridget Jolly, 29 September 1994.

By 1939 a company had been formed in New South Wales, one was almost established in New Zealand, and another was proposed for Queensland. By mid-1940 Solomit had been used - not necessarily for complete buildings, but for partitions and other purposes - in 162 dwellings in South Australia, Victoria, New South Wales and the Northern Territory. From about 1936 the material was marketed in Britain as 'Thatchboard' by Newall's Insulation Company of Durham. Data on its thermal transmission properties for the insulation of reinforced concrete walls was presented in a Newnes data sheet which was forwarded to Australian military engineers in 1941.[173] In 1946 a steel framed Solomit house was built in Sydney with a Gunite finish, and three other houses are known of in the state, though whether Gunite finished or not is unclear.[174]

In the post-war period Solomit was put to a new use. The architect Robin Boyd, always innovative and always influential, used it in 1946-7 to roof his new house in the Melbourne suburb of Camberwell, with the upper surface finished in bituminous felt and gravel.[175] The idea was taken up by the operator of the New South Wales factory at Molong, upon which the Sydney agents, Cropper Andrew, sought advice from the Commonwealth Experimental Building Station on the appropriate spacing for battens. The upper surface was finished with one eighth inch [3 mm] thickness of Colas and sand in the ratio 1:2, and/or with three ply bituminous felt bonded with Colas sand to the upper surface.[176] In the event it seems to have been a more general practice to clad the roof over with steel decking, and it soon became fashionable to expose the straw surface as a naturalistic ceiling. It continued to be used by Boyd,[177] as well as by designers such as Alistair Knox of Eltham, near Melbourne, in a continuous layer extending out to the edge of the eave. The result was that it was saturated whenever the gutter overflowed, and the effect of this was that the straw sprouted and grew, a characteristic which became notorious.

In 1952 Solomit was used to infill the walls of a steel frame structure prefabricated by the Wiles company of South Australia, in the process of converting it for St John's Lutheran School, Highgate, and it was also used for the roof, beneath a layer of tiles.[178] Another later way of using Solomit was sandwiched between perforated masonite sheets as an acoustic material.[179]

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173 Jolly, 'Solomit', p 168, citing 'Newnes (London) Modern Building Practice. Builders' Data Sheet No. 29'.

174 Bridget Jolly, 6 September 1994.

175 Geoffrey Serle, *Robin Boyd: a Life* (Melbourne 1995), p 87.

176 Bridget Jolly, 20 September 1994, citing 'Programme of work for physical testing of Solomit slabs for roofing' [Commonwealth Experimental Building Station confidential Office Record no 77, [?February] 1949; D Dalgleish, 'Loading Tests on Solomit Roofing Panels' [CEBS Confidential Technical Memorandum No. 168, March 1949].

177 As in the Baker house, Bacchus Marsh, of 1964: Robin Boyd, *Living in Australia* (Rushcutters Bay [New South Wales] 1970), p 37.

178 Bridget Jolly, 20 May 1995.

179 Bridget Jolly, 20 September 1994.