

7.06 *Blocks*

- a. concrete blocks**
- b. New Zealand**
- c. Australian block manufacture**
- d. the Midget Giant & the Emu**
- e. sand-lime bricks**
- f. later concrete blocks**
- g. mechanisation**
- h. breeze blocks**
- i. tiles & slabs**

a. concrete blocks

Concrete blocks were far more widespread than either mass or reinforced concrete houses, but the technology was entirely imported. It has recently been demonstrated that, while there were various experiments in casting blocks in during the nineteenth century, the modern concrete block industry is not the result of a gradual evolution out of these experiments. Rather it began abruptly with the invention of a machine with removable cores and adjustable sides, which enabled blocks readily to be cast hollow.¹ Solid Concrete blocks had been used as early as 1832 by the builder William Ranger of Brighton, England, who patented his version as 'Ranger's Artificial Stone'.² Subsequently a number of other, but more or less sporadic, uses of concrete block occurred, such as a lighthouse in Jersey in 1874, designed by Sir John Coode,³ and similar lighthouses in Australia at Jervis Bay (1897-9) and Cape Byron (1901), both designed by Charles Harding of the NSW Public Works Department.⁴ At Darwin the Wesleyan Church of 1876 seems to have been built on piers made of concrete blocks, for when it was replaced in 1897 these blocks were re-used.⁵ Most mysteriously, at the Centennial Exhibition of 1888-9, the Alkermade Brothers of St Kilda, Melbourne, displayed 'concrete brickwork'.⁶

It was only with hollow blocks that concrete block construction became really viable, but this development was to take decades. By the 1860s it was reported that 'hollow blocks [of] cement, or artificial stone are now being introduced into practice for the building of walls in a cheap and ornamental form, and perfectly free from damp.' By this time also a 'continental architect' had devised a system of construction in rather

¹ P H Simpson, 'Cheap, Quick, and Easy: the Early History of Rockfaced Concrete Block Building', in Thomas Carter & B L Herman [eds], *Perspectives in Vernacular Architecture, III* (Columbia, Missouri 1984), pp 108-115.

² *Mechanic's Magazine*, XVIII, 484 (17 November 1832), p 112; Wyatt Papworth [ed], *Dictionary of Architecture* (in parts, London 1848-92), sv Ranger; Thomas Potter, *Concrete: its Use in Building* (new ed, 2 vols, London c 1894 [c 1877]), p 88.

³ Potter, *Concrete*, I, p 21.

⁴ Ingrid Anderson, Joan Kerr & Catherine Peake, *Designing Lights: Drawings for Colonial Lighthouses, 1817-1899* (Sydney 1983), no 37, pp 15, 31.

⁵ Miles Lewis, *Former Wesleyan Church, 57 Knuckey Street, Darwin* (mimeograph report, Melbourne 1988), p 8.

⁶ Centennial International Exhibition 1888-1889, *Official Record* (Melbourne 1890), p 620.

geometrically complicated concrete blocks, some of which were hollow.⁷ No more is heard of these, and it is unlikely that they proved to be practical. In 1877 J C Sellars, a manufacturing chemist at Birkenhead, England, patented a system using units not so much like cored blocks as thin-walled, open-bottomed hollow concrete boxes, designed to be laid without mortar and subsequently filled up with rough concrete.⁸

The critical appearance of the true hollow core came when Harmon S Palmer received his first American patent for 'Machinery for Molding Hollow Concrete Building Blocks' on 27 December 1887 and others in 1899 and 1903,⁹ after which he sold the rights to other manufacturers.¹⁰ Palmer claimed to have begun manufacture in 1889,¹¹ and it is said that by 1902 he had himself had already built a number of structures, and his plant had made about four hundred block machines.¹² By 1904-5 he was complaining of the numerous machines which were being made in infringement of the patents, and was engaged in extensive lawsuits to suppress them.¹³ In 1907 there were about a hundred companies making block machines, many apparently in breach of Palmer's patent.¹⁴ Thus the mail order house of Sears, Roebuck & Co took the precaution of assuring buyers of concrete block machinery: 'We bind ourselves to protect every customer in every way as to any claimed infringement of patents, trade marks, or copyrights on any goods bought from us in the past, or that may be bought from us in future.'¹⁵

The Ideal Cement Stone Company is a good example. It was established in 1904 by four 'masons', three of whom, were engaged in making the blocks and one in laying them. Because of the unfamiliarity of bricklayers with the material, and their hostility towards it, the enterprise could only succeed if the manufacturer would also undertake the laying. They had one machine, producing two hundred 8 x 8 x 16 inch [200 x 200 x 400 mm] blocks a day.¹⁶ It is not clear whether the company was associated with the Ideal Concrete Machinery Co of South Bend, Indiana, or simply used one of its

⁷ E S Eyland, Francis Lightbody & R S Burn, *Working Drawings & Designs Architecture and Building* (Edinburgh no date [c 1863]), essay 3, p 27.

⁸ Potter, *Concrete*, II, p 91.

⁹ US patent nos 375,377 of 12 December 1887; 623,686 of 25 April 1899; 727,427 and 727,428, both of 5 May 1903: *Concrete*, I, 1 (March 1904), p 31. However, P H Simpson, H J Hunderman & Deborah Slaton, 'Concrete Block', in T C Jester [ed], *Twentieth-Century Building Materials* (Washington [DC] 1995), name US patent no 674,874 of 1900, and cite H K Dyson, 'Concrete Block Making in Great Britain', *Concrete and Constructional Engineering*, III, 3-6 (1908-9), pp 224-30, 291-8, 463-6; William Torrance, 'Types of Hollow Blocks used in the United States and their Patents', *Concrete and Constructional Engineering*, (July 1906), pp 206-214; Joseph Bell, *From Carriage Age to Space Age: the Birth and Growth of the Concrete Masonry Industry* (National Concrete Masonry Association, Herndon [Virginia] 1969).

¹⁰ *Clay Record* (Chicago), XXVI, 10 (21 May 1905), p 28.

¹¹ *Concrete*, I, 1 (March 1904), p 7.

¹² Simpson, 'Cheap, Quick, and Easy', pp 108-115.

¹³ *Concrete*, I, 1 (March 1904), p 32; *Clay Record* (Chicago), XXVI, 10 (21 May 1905), p 28. He also wrote about the principles of block-making, arguing the need for the mould to taper in depth, so that the mix would consolidate well as it was tamped from the top, and criticising those systems in which the cores were withdrawn from the top, and therefore the thickness was greatest at the bottom. *Ibid*, XXVI, 12 (30 June 1905), p 25.

¹⁴ Simpson, 'Cheap, Quick, and Easy', pp 108-115.

¹⁵ Sears, Roebuck & Co, *Sears, Roebuck Home Builders Catalog* (New York 1990 [Chicago 1910]), p 152.

¹⁶ *Building and Construction and Cazaly's Contract Reporter*, 3 August 1926, quoting *Concrete*, May 1926.

machines (or whether the name was coincidental). The machinery company was able in about 1915 to illustrate a wide range of structures in the United States built of its blocks.¹⁷ By 1926 the Ideal Cement Stone Company had grown into two separate plants, one of them at Omaha, Nebraska, turning out a total of 6,500 blocks a day, as well as other products such as lintels and flowerpots.¹⁸

A Concrete Block Machine Manufacturers Association was established in the United States in 1905, and a Concrete Block Manufacturers Association in 1919. In 1924 the latter established standard sizes, and by 1930 their nominal 8 x 8 x 16 inch [200 x 200 x 400 mm] unit was the commonest. However, block forms and sizes were much more varied in earlier years, and this variety is reflected in Australia.¹⁹ The Normandin Concrete Building Block Machine was made by the Cement Machinery Co of Jackson, Michigan,²⁰ which claimed that hundreds were in operation in the United States, Canada and England.²¹ As advertised in 1905, it produced not only rectangular blocks with two cores, but L-shaped ones with three cores for use at corners, and they were finished either smooth, rock-faced, with raised margins, or with raised margins and an ornamental device in the face panel.²²

Another type was that of the Miracle Pressed Stone Company of Minneapolis, whose blocks contained two parallel rows of cores, staggered so as to prevent any direct connection from the outer to the inner face, and hence produce 'a frost proof and damp proof wall'.²³ By January 1909 the machine was being sold in Australia by the sole agents, Lewis & Co of Sydney.²⁴ The Hercules Block Machine, made by the Century Cement Machine Company of Rochester, New York, was advertised in both the United States and Britain.²⁵ Pettyjohn Brothers of Terre Haute, Indiana, made a portable block-making apparatus, which produced a rock-faced block with the standard two cores.²⁶ There were a number of other machines,²⁷ including four made in Michigan.²⁸

¹⁷ C B Wood, *Catalogue 112* (Cambridge [Massachusetts] 2002), p 63, notes on *Ideal Concrete Machinery Co. Builders of the Famous Ideal Concrete Block Machines, Face Down, Horizontal Cores* (South Bend [Indiana], no date [c 1915]).

¹⁸ *Building and Construction and Cazaly's Contract Reporter*, 3 August 1926, quoting *Concrete*, May 1926.

¹⁹ P H Simpson, 'Concrete Block', p 80.

²⁰ *Concrete*, I, 1 (March 1904), p 31.

²¹ *Clay Record* (Chicago), XXVI, 6 (30 March 1905), p 31, including a view of a plant equipped with Normandin machines, that of the Lancaster (Ohio) Concrete Block & Paving Co. The company was apparently not in breach of Palmer's patents, for it advertised specifically that no decree or judgement had ever been obtained against it: *Concrete*, II, 6 (December 1904), p 32.

²² *Clay Record* (Chicago), XXVI, 1 (16 January 1905), p 51. A house at Columbus, Ohio, made of these blocks is illustrated in *ibid*, 6 (30 March 1905), p 30.

²³ *Concrete*, II, 6 (December 1904), p 31. Illustrated in *Concrete Products* [International Correspondence Schools] (Scranton [Pennsylvania] 1919), part I, p 32, and in P H Simpson, 'Concrete Block', p 82.

²⁴ *Building*, 15 January 1909, p 93.

²⁵ *Concrete*, II, 2 (August 1904), p 31; *Concrete and Constructional Engineering*, I, 4 (September 1906), p xvii.

²⁶ *Concrete*, II, 6 (December 1904), p 33; *Clay Record* (Chicago), XXVI, 1 (16 January 1905), p 53.

²⁷ The 'Winget' machine was advertised by A D Mackay & Co of Chicago in *Concrete*, I, 1 (March 1904), p 31. Others advertised in *Concrete*, II, 6 (December 1904), were the Hayden Automatic Block Machine, from the company of that name in Columbus, Ohio (p 28); the Frost Machine of the Frost Concrete Stone Co of Waterloo, Indiana (p 29); the 'Iowa' Cement Block Machine

Britain was far behind the United States. The Winget machine, which as we have seen was being made in Chicago by 1904, seems to have reached Britain in 1906. It was subsequently made there under licence, and could make rock-faced blocks.²⁹ The 'Pioneer' was another stationary block machine in use in Britain.³⁰ The Dri-Crete machine, also illustrated, seems more primitive, and is of unknown origin. There was also a special type, the 'Anchor' block, which consisted of two separate slabs of concrete linked by steel bars, so that it would create a true cavity wall.³¹ Though Magny illustrates a moulding machine by V Zondervan of Paris,³² there seems to have been even less interest in blocks on the Continent than there was in Britain. There is certainly no evidence of any Continental European influence in Australia.

Meanwhile in the United States, Sears Roebuck were advertising two makes of machine, the Triumph and the Wizard, of which the latter particularly deserves attention. The Triumph machine was normally supplied with plates to produce a rock finish, and could be bought as part of a kit which included a 'Badger Adjustable Sill and Cap Machine' - really little more than a mould within which to cast these elements. The Wizard machine was capable of a greater output, and it cast the blocks face down on the moulding plate - making it easier to cast a perfect face - then tipped them back to release them in the upright position. The cores were elliptical, which made the tamping of the concrete easier, and they were removed automatically in the process of tilting the mould up. Both the Triumph and the Wizard machines could be provided with plates for finishes other than rock face - tool marginal rock face, four inch course block, broken ashlar, tool marginal bushhammer face, plain face, cobblestone face, rope face, and whirlwind scroll face.³³ By 1920, 110,000 houses had been built of blocks in the United States,³⁴ and by 1924 ninety percent of the manufacturers had standardised on the modern size of 8 x 8 x 16 inches [200 x 200 x 400 mm].³⁵

b. New Zealand

by the 'Iowa' Cement Block Machine Co of Waterloo, Iowa (p 32); and an unnamed machine by Cutshall & Flagg of Brazil, Indiana (p 33).

²⁸ The 'Simplex' machine, made by the Simplex Cement Machinery Co of Detroit, Concrete, I, 4 (June 1904), p 32; an unnamed apparatus made by the Michigan Cement Block Machinery Co of Union City, Michigan, *ibid*, p 34; the Miles machine, by the Miles Concrete Building Block Machine Co of Jackson, *ibid*, II, 2 (August 1904), p 33; the Coltrin moulds made by the Knickerbocker Company of Jackson; *ibid*, II, 4 (October 1904). p 34.

²⁹ 'First in the Field in 1906': H L Childe, *Manufacture and Uses of Cast Concrete Products and Cast Stone* (3rd ed, London 1927), p 241. It is illustrated in *The Everyday Uses of Portland Cement* (3rd ed, London 1913 [1909]), p 116, and B E Jones [ed], *Cassell's Reinforced Concrete* (2nd ed, London 1920 [1913]), p 406

³⁰ Illustrated in *The Everyday Uses of Portland Cement*, p 115.

³¹ Jones, *Cassell's Reinforced Concrete* (1920), pp 405-410. See also the earlier note on the Winget machine in Chicago.

³² A V Magny, *La Construction en Béton Armé* (Paris 1914), p 577.

³³ Sears, Roebuck, *Home Builders Catalog* (1910), pp 154-7.

³⁴ *Australian Home Builder*, November 1922, p 50, quoted in Paul Roser, 'Concrete House in Victoria 1900-1940' (GDPD, University of Melbourne, 2000), p 15.

³⁵ Simpson, *Cheap, Quick and Easy*, p 21.

In October 1906 the New Zealand journal *Building Progress* reported on the rapid development in hollow concrete block production over the past five years. According to Geoffrey Thornton there is no mention of any such blocks in New Zealand,³⁶ but this is far from true. A number of varieties of block were made in the country, some of which are known to have been hollow, while others may be presumed to have been. The so-called 'Stone House' at 108 Derby Street, Westport, was built in 1903 of rock-faced concrete blocks. By 1910, and perhaps as early as 1904, W T Cowperthwaite was manufacturing 'Cowperthwaite Concrete Blocks'.³⁷ Thornton refers to an Invercargill house built of blocks made on the site, and to blocks made by inmates of the Invercargill Prison.³⁸

Another rock-faced block building is 64 Knights Road, Lower Hutt, of 1907, built by E J Ible, and today somewhat truncated, as a result of earthquake damage in 1942. Ible seems to have been a pioneer of concrete block manufacture, and surviving photographs of his operation, apparently near Wellington, show what is unmistakably a 'Miracle' block machine (not the same as the 'Miracle' blocks discussed above), producing a distinctive form with two round hollow cores in each block. Whether this was the form of block he used at 64 Knights Road seems uncertain, as the size appears to be smaller.³⁹ However, Ible's connection with the Miracle machine is beyond doubt, as he was trading in Lower Hutt under the name 'Miracle Hollow Block Co' in about 1905.⁴⁰

c. Australian block manufacture

Things were not so advanced in Australasia as in the United States, but there was probably more activity than in Britain. While some British machines were available,⁴¹ many of them came from America⁴² which produced a range of machinery and moulds suitable for use even by an individual builder on site. In 1904 (the year after Harmon Palmer's last patent) there appeared a local report of this invention - a machine 'which will turn out hollow blocks of concrete of any desired pattern', and which could be made with removable sides 'so that each block as formed can be taken out and dried'.⁴³

³⁶ Geoffrey Thornton, *Cast in Concrete* (Auckland [New Zealand] 1996), pp 122-3.

³⁷ The business was established in 1908 and moved to Auckland in 1908, but it is unclear whether concrete blocks were made from the outset: *Building Progress* (Auckland), II, 8 (August 1937), p 19. Jeremy Ashford, *The Bungalow in New Zealand* (Auckland 1994), p 46, gives the date as 1910.

³⁸ Thornton, *Cast in Concrete*, p 124.

³⁹ Information supplied 1996 by Mrs Una Whittle, née Ible, consisting partly of reports by Wayne Nelson for the Historic Places Trust, and material compiled by R J Grigg, whose firm occupies 64 Knights Road, who has researched E J Ible.

⁴⁰ Information from Mr R J Grigg, 1997.

⁴¹ For example the 'Pioneer' machines of the Concrete Machinery Co of Liverpool: *Concrete and Constructional Engineering*, I, 4 (September 1906), p vi.

⁴² See H H Rice & W M Torrance, *The Manufacture of Concrete Blocks and their use in Building Construction* (New York 1906), and Ann Gillespie, 'Early Development of the Artistic Concrete Block: the case of the Boyd Brothers', *APT Bulletin*, XI, 2 (1979), pp 30-52.

⁴³ *Building, Engineering and Mining Journal*, 1 May 1904, quoted in *Gippsland Illustrated, 1904* (Melbourne 1904), p 78.

The American Hollow Concrete Wall Co of Port Melbourne, which in 1905 was managed by Richard Taylor,⁴⁴ produced blocks of an unconventional type, though not so outré as to escape the general survey of concrete block types published by the International Correspondence Schools in 1919,⁴⁵ nor the British survey by Childe, published in 1927, showing a refined form in which the ends return slightly at right angles.⁴⁶ A typical block was a broad 'T' in plan, and was laid so that the head of the T formed the wall surface and the stem ran inwards. The opposite face was formed by similar Ts, so that the stems ran across the wall alternately from either side. A very attenuated, short-stemmed version of the T was laid in a similar fashion to create a thin partition, and the larger Ts could be laid in more complicated patterns to create thicker walls and piers. The system was claimed to be patented 'in all civilised countries', amongst which Australia was apparently included. These details come from a brochure produced by the company in about 1907, by which time it was offering to supply metal moulds and special licence to those wishing to manufacture and build with the blocks themselves, and could also supply portable machines. Built examples in Melbourne and Bendigo are illustrated.⁴⁷

This conflicts marginally with the claim that the Methodist Church at Snake Valley, Victoria, of 1908, was the first in the country built on 'the concrete hollow wall principle'.⁴⁸ The church survives, and the blocks are manifestly of the same type as Taylor's, though simplified in form. They lack the serif-like return at the ends of the arm, and measure 590 x 300 mm on the face, and 60 mm thick at the end, with the stem at the back tapering to a minimum of 80 mm. They were apparently cast locally, and contain coarse pebble aggregate. Not far away, St Paul's Church hall at Linton, of 1909, is much better built, with more finely cast blocks measuring 610 x 295, in thickness from 45 to about 60 mm, and with a stem 80 mm long by a minimum thickness of 50 mm.⁴⁹

By about 1907 Burges & Curtis of London were advertising in Australia their Hampton Universal Block and Slab Machine, which appears to have been used not only for rock-faced concrete blocks, but also for paving slabs and channels, described as granite-faced. The paving slab had a grid of incised lines, to encourage the surface to dry quickly after washing, and they were said to be useful for 'motor houses' and ideal for cowsheds and yards.⁵⁰ Tyree Ltd. of George Street, Sydney, advertised themselves in 1908 as the agents for the 'Tyree Building Block Machines', specifically

⁴⁴ *Journal of the Royal Victorian Institute of Architects*, III, November 1905, p 163.

⁴⁵ International Correspondence Schools, *Concrete Products Parts 1-2* (Scranton [Pennsylvania], no date [c 1919]), p 23, fig 8, & text p 24.

⁴⁶ H L Childe, *Manufacture and Uses of Cast Concrete Products and Cast Stone* (London 1927), p 111.

⁴⁷ *The American Hollow Concrete Wall Company of Queen Street, Melbourne* [brochure] (Melbourne c 1906-7), held in the Reinforced Concrete and Monier Pipe Construction Company records, Melbourne University Archives, file 47, 'Concrete Building Blocks', cited and extracts reproduced in Roser, 'Concrete House in Victoria', pp 16-17, 33-4.

⁴⁸ The claim was reportedly made in a document placed under the memorial stone in August 1908, when the nave was part-built. It was quoted in a report in the *Ripon Shire Advertiser* of 31 October 1908, and is transcribed in the Heritage Victoria file on the building.

⁴⁹ Both buildings inspected 2002.

⁵⁰ Walter Jeffries, *The Australian Building Estimator* (Sydney no date), front endpaper advertisement. This edition is in most respects identical with that dated 1907, in which the advertisement does not appear.

stating that 'any country builder can make his own blocks on the spot'.⁵¹ There is no indication of the origin of the Tyree machines, but as they were described as the 'cheapest line on the market' they cannot have been only ones.

In 1914 Mayes illustrated the 'Standard' machine, branded in the picture 'U.S. Standard', which came in sizes for both 16 inch [400 mm] and 24 inch [600 mm] blocks, and the 'London' machine,⁵² while F A Winter of Sydney was one of those advertising as suppliers of block machinery.⁵³ In about 1919, in a reversal of the usual relationship, an Australian Concrete Block Machine Syndicate was marketing in Britain a 'single-hand machine for making semi-dry concrete blocks, for use by unskilled labour'.⁵⁴

Considering the apparently wide acceptance of block-making machinery, references to concrete block structures are somewhat scanty. The old Sydney Sanatorium Hospital at Wahroonga, of about 1902, is reported to have large weatherboards on the outside and an inner leaf of concrete blocks,⁵⁵ but whether they are original, and of what type, are matters which require further investigation. In Victoria a country architect, W P Knights, was an early user of concrete blocks, the earliest known example being Doyle & Kerr's Building in High Street, Terang, of 1906, while a somewhat later house of the same material survives at 2 Lawrence Street, Camperdown.⁵⁶ In Melbourne a building permit was sought in 1908 for a concrete block house at Dover Street, Flemington,⁵⁷ and about four years later a concrete block house with hollow walls was built at the bayside suburb of Black Rock.⁵⁸

In New South Wales one of the first known concrete block houses was built at Kurrumbede, near Gunnedah, in 1907-8 for Dr C K [later Sir Charles] Mackellar, MLC, using a hand operated machine and sand and gravel obtainable nearby. In this case there were smooth faced blocks of various sizes used in the main building, except that the lintels, sills and quoins were rock faced. In the kitchen wing this arrangement was reversed.⁵⁹ Peter Freeman illustrates 'Glenbower', a selector's homestead near Temora built of hand-made concrete blocks, which he dates to about 1910.⁶⁰ These scattered examples exemplify the pioneering phase of concrete house building, but it was after World War I, as we shall see, that some of the more ingenious developments took off on a large scale.

⁵¹ C E Mayes, *Australian Builders & Contractors' Price Book* (7th ed, Sydney 1908), op cit, p xiii.

⁵² C E Mayes, *The Australian Builders & Contractors' Price Book* (8th ed, Sydney 1914), p 100.

⁵³ Mayes, *Australian Builders Price Book* (8th ed, 1914), advertisement p 14.

⁵⁴ R B White, *Prefabrication* (London 1964), p 112.

⁵⁵ The design of the hospital is based on one at Battle Creek, USA, which might likewise have inspired the construction. Information from Bruce Judd.

⁵⁶ Allan Willingham has told me that these are of cinder concrete, but this does not appear to be documented, and I suspect that they are in fact based on the local scoria from Mount Leura, adjoining the town.

⁵⁷ Melbourne City Council building permit application no 1104, 1908. The owner was J Jones, and the builder J Murray of Sandringham.

⁵⁸ *Argus*, 21 September 1918, p 3: this is an auction notice for the house, 'Greenock', Eliza Street, Black Rock, said to have been built six years earlier under the owner's supervision.

⁵⁹ *Building*, I, 6 (18 February 1908), p 51.

⁶⁰ Peter Freeman, *The Homestead: a Riverina Anthology* (Melbourne 1982), p 88.

d. the Midget Giant and the Emu

By 1906 the Durable Cement Block Machine Co of Flinders Street, Melbourne, was marketing the Midget Giant Block Making Machine, which produced blocks of 12 x 6 x 6 inches [300 x 150 x 150 mm] in both a plain and a sort of stylised rock finish. Each block had two elliptical hollow cores rising vertically through it. The machine consisted of a single block mould resting on a stand like a sewing machine base, but with a large lever at one side which caused the two core moulds to rise and fall as required. The four faces of the mould were all hinged to the edges of the base plate, and folded down separately. It appears that after they were raised into place, two roughly U-shaped bars swung up from either end to hold them together.⁶¹ It cost £12.10s, and was said to make serviceable blocks out of sand, gravel, tailings or other gritty material, and to be already in use by many farmers throughout Australia. It had also been used to produce blocks for building a coffee palace in the Victorian town of Maffra, commissioned by the local landowner A M Foster.⁶² This building still exists at 67-71 Johnson St, with the date 1908 on the parapet, and it exhibits the characteristic vermiculated blocks as well as plain ones, and others with a sloping face to suggest shingle hanging. Another surviving structure which appears to be of these blocks is the rear skillion of a house 'Goller's Court' at Hillside, near Sydenham, Victoria, which also appears to be of early twentieth century date.⁶³

By 1910 the machine was advertised by its own company, the Midget Giant Block [sic] Making Machine Pty Ltd of 59 Queen Street, Melbourne.⁶⁴ This was the public company which in March-April 1911 acquired the Australian and New Zealand patent rights for the machine of the parent company, the Midget Giant Cement Brick Machine Company of Flinders Street, Melbourne. It was short-lived, being wound up in August 1915.⁶⁵ Meanwhile in 1911 the machine was being sold by Anthony Hordern & Sons of Sydney, whose advertisement shows the blocks being used in the construction of a silo.⁶⁶

In 1909 E H Jones and T W B Halliday, of the Emu Engineering Works in the Melbourne suburb of Fitzroy, applied for a patent for a concrete block machine. Although they claimed to be the inventors, the fact that the patent was not granted would tend to indicate that their contribution was at best confined to some marginal improvement on one of the overseas types. In fact Jones and Halliday's machine is a version of the Midget Giant, and the blocks are of the same form with two elliptical cavities, and were similarly moulded one at a time. The stand is the same in

⁶¹ Postcard in the author's collection, showing a building of these blocks under construction, and inscribed 1906.

⁶² *Leader*, 21 March 1908, quoted in the *Bulletin of the Maffra & District Historical Society Inc and the Stratford & District Historical Society Inc*, XXIII, 85 (June 1995), pp 14-15.

⁶³ The rock finish blocks appear similar to those of the postcard illustration, and they are used in a comparable way as highlights in a generally smooth faced wall. Photographs supplied by Lorraine Huddle, 1999.

⁶⁴ By the Midget Giant Concrete Block Making Machine Pty Ltd of 59 Queen St, Melbourne: *Sixth Australian Exhibition Souvenir Catalogue* (Melbourne 1910), p 33. See also *Building*, 12 April 1911, p 28.

⁶⁵ Information from Paul Roser, 2002, derived from VPRS 932, unit 244, file 4776, Public Record Office, Victoria.

⁶⁶ *Building*, 12 April 1911, p 28.

appearance, and it seems that the cores were raised in the same way from the bottom of the mould when hollow blocks were to be cast. The difference was in the mould. One of the end faces was permanently fixed to the base plate, and the other faces hinged off this, and when closed together were fixed with a locking pin. The inner face plates of the mould were removable.⁶⁷

This was marketed as the 'Emu Brick Machine', and two or possibly three examples are known to survive. One of these is in the possession of Mr Mike Butcher of Bendigo, and another was at last report on a property in western Victoria. The third is at the Kilmore Court House Museum, and is thought to have come from the terra cotta lumber works of the Australian Seasoned Timber Company at Wandong, though this seems intrinsically improbable. All bear an incorrect patent application number [11,497] and have a mould size of 300 x 150 x 150 mm [12 x 6 x 6 in]. The western Victorian machine had a plate with the name of the sole agents, D & W Chandler, Fitzroy,⁶⁸ perhaps suggesting that Jones & Halliday had ceased to trade. In about 1930 McLean Bros & Rigg, of Perth and Kalgoorlie, were stocking the Emu machine which, they said, could make various patterns of block, including rock face, presumably by changing the removable inner face plates.⁶⁹ There is no obvious way of identifying these blocks by their external appearance in a wall, but loose examples are occasionally found.⁷⁰

e. sand-lime bricks

Concrete bricks, in the sense of brick-sized units made of conventional concrete, were known in Britain,⁷¹ but not in Australia. Sand-lime bricks are something quite different. The first British patent for sand-lime bricks appears to have been taken out by one Kent in 1810, but these bricks required to be hardened in the open air for seven months.⁷² The 'mortar bricks' developed by an Englishman in the 1840s may have been of a similar character, and required six to eighteen months seasoning.⁷³ In the United States, similarly, sand-lime bricks used in Alabama were said to have been hardened over several months.⁷⁴ In 1866 the problem of drying time was removed when Von Derburg obtained a British patent for a steam autoclave which would harden them, but there is no indication that even these bricks achieved any degree of acceptance. In the 1870s Spencer Hayward, an architect, received a British patent for a system of casting concrete blocks in the size of normal bricks,⁷⁵ but these must still have been a low-grade material, very different from the sand-lime bricks later

⁶⁷ Evan Hoskins Jones & Thomas William Baster Halliday, patent application 14,497/09, 12 May 1909.

⁶⁸ Information from David Watson of Melbourne University, about 1985, and Mike Butcher of Bendigo, 1995.

⁶⁹ McLean Bros & Rigg Limited, *Catalogue: General Hardware &c* (Perth, no date [c 1930]), p 23.

⁷⁰ A batch at the property 'Boldrewood' at Lake Bega is believed to have come from the property 'Castle Donington' at Lascelles: information from Keith Livingstone of Boldrewood, 1997.

⁷¹ *The Everyday Uses of Portland Cement* (3rd ed, London 1913 [1909]), p 118-121.

⁷² Marian Bowley, *Innovations in Building Materials* (London 1960), pp 81-2, citing National Building Studies Bulletin No 4, *Sand-Lime and Concrete Bricks*, p 1.

⁷³ Potter, *Concrete*, II, p 88.

⁷⁴ W A Radford, *Radford's Brick Houses, and How to Build Them* (Chicago 1912), p 41.

⁷⁵ Potter, *Concrete*, II, p 88.

invented in Germany. The first satisfactory machine for pressing the bricks in moulds is said to have been the 'Hercules', invented by Alexander in 1895.⁷⁶

It seems remarkable, in comparison with these overseas developments, that a Victorian farmer, Walter Malcolm Scott, should have patented a sophisticated form of sand lime- block in 1857. He mixed free unslaked lime with sand which was sufficiently moist to slake the lime, yet ultimately to result in a dry mixture. Then he raked and watered it until the lime disappeared. A single brick was formed at a time, using cam pressure, in a mould which might contain a core so as to create a hollow block. If required, a steel plate was inserted near one face and a layer of crushed marble put behind it, and then when the rest of the mould was full the plate was slid out and the pressed block was left with a marble finish. The purported novelty of the invention lay in the form of the press, the use of near dry materials, and the creation of a marble face.⁷⁷ It is hard to believe that it was Scott's own invention, and it may well have been either the extension or the piracy of an overseas patent.

Sand-lime bricks in the modern sense began to be manufactured in Germany in the 1890s, were in extensive production in the United States by 1905, and were made in Australia by 1907. In 1881⁷⁸ or 1889 Dr Wilhelm Michaelis of Berlin had patented the process of hardening a sand-lime brick in a cylinder under heavy steam pressure,⁷⁹ which was reportedly similar to Von Derburg's. There is evidence also of a concrete brick of a different type being made in Holstein about the turn of the century, containing three hollow cores and not apparently subjected to great pressure. Thus it was more like a concrete block in principle, though it was a brick in size.⁸⁰ This achieved no prominence, whereas Michaelis's bricks became a major building product. By 1896 there were five factories in Germany, and by 1904 two hundred.⁸¹ The *Tonindustrie-Zeitung* of Berlin in 1905 published figures showing a significant fall in German unit production costs from 1899/1900 to 1904.⁸² By 1912 there were about seventy-five manufacturers in the United States.⁸³

The sand-lime brick is not merely a small concrete block, but a quite different material in principle, a fact somewhat obscured at later dates when machines were produced suitable for moulding both products. The difference, however, is underlined by the fact that A B Searle, the authority on clay bricks, deals with sand-lime bricks in his *Modern Brickmaking* and his 1911 edition of Dobson's *Bricks and Tiles*. Quicklime was ground with sand sufficiently fine to pass through a no 50 sieve, and the mixture adjusted to contain about 6 to 10% of lime. Water was added in the

⁷⁶ Bowley, *Innovations in Building Materials*, p 82; William Kinniburgh, *Dictionary of Building Materials* (London 1966), p 230, gives 'Van Durbergh'.

⁷⁷ Victorian patent no 18 to Walter Malcolm Scott, 3 April 1857.

⁷⁸ Martin Hammond, *Bricks and Brickmaking* (Aylesbury [Buckinghamshire] 1981), p 29. Kinniburgh, *Dictionary of Building Materials*, p 230, gives the date as 1880, and Radford, *Brick Houses*, p 18, as about 1880.

⁷⁹ *Concrete*, II, 5 (November 1904), p 12.

⁸⁰ Charles Dobson, *The History of the Concrete Roofing Tile* (London 1959), p 29, illustrates Justus Peter Jorgensen at one of his factories, with a workman removing bricks from Jorgensen's patent machine. The machine doesn't look as if it incorporates any mechanism for exerting substantial pressure, and there are bricks stacked behind in which the cores can be seen.

⁸¹ *Concrete*, II, 5 (November 1904), p 12.

⁸² *Tonindustrie-Zeitung* [Berlin], XXIX, 20 (1905) p 186.

⁸³ Radford, *Brick Houses*, p 20.

mixing process, and one to three days allowed for tempering before the material was moulded. The bricks were then moulded under very heavy pressure, and placed in a 'hardening chamber' to be steamed for 8-10 hours. Clinker bricks, using the waste from refuse destructors, were made in a similar way.⁸⁴ Silica bricks, which were used principally for refractory purposes, were somewhat different, both in the manufacturing process and in the smaller proportion of lime that was used.⁸⁵

In 1901 the first sand-lime brick plant in the United States was built at Michigan City, Indiana, presumably under licence, but by 1904 the patents had expired, and there were about fifty American plants in operation, producing twenty million bricks per year.⁸⁶ In 1905 a brick produced by the Rochester Composite Brick Company was loaded to failure at the Chicago Mechanics Institute to 70,900 lb (32,200 kg), as compared with 400-600 lb (180-270 kg) for a common clay brick and about 4,000 lb (1,800 kg) for a pressed brick.⁸⁷ By now a number of sand-lime brick machines were advertised by American makers,⁸⁸ most of whom believed that pressure was important in the manufacture of the brick, contrary to the practice in concrete block manufacture, though a few disagreed.⁸⁹

From some time in the first decade of the century, until 1918, sand-lime bricks were made at Tainui, on Anderson's Bay outside Dunedin, New Zealand. The Tainui Sand-Lime Brick Syndicate operated a quarry of soft crumbly white trachyte, which is believed to have been crushed to provide the sand constituent of the mix, while lime was obtained from the Milburn Lime and Cement Company. The bricks were made under steam pressure, and considerable numbers were produced for use in foundations, string courses, buttresses and ornamental work on churches and houses.⁹⁰

At Lithgow, New South Wales, Sandford's Silica Brickworks is said to have been established before 1900, becoming Newbold's Silica Firebrick Co in 1912, and moving to Mayfield West, Newcastle, in 1918.⁹¹ By 1907 sand-lime bricks were being made by John L Rosenbaum of Sydney.⁹² The first substantial building using such bricks - probably imported from New South Wales - was reportedly the four-storey factory of Hoadley & Co in St Kilda Road, Melbourne, of 1911.⁹³ Surviving

⁸⁴ Edward Dobson [ed A B Searle], *A Rudimentary Treatise on the Manufacture of Bricks and Tiles* (12th ed, London 1911), pp 207-210. See also F E Kidder & H S Parker [eds], *Kidder-Parker Architects' and Builders' Handbook* (18th ed, New York 1931 & 1935), pp 1959-60.

⁸⁵ A B Searle, *Modern Brickmaking* (London 1911), pp 390-392. See also Evelyn Drury et al [eds], *Architects', Builders' and Civil Engineers' Reference Book* (London 1950), p 74.

⁸⁶ *Concrete*, II, 5 (November 1904), pp 12-13.

⁸⁷ *Clay Record* (Chicago), XXVI, 6 (30 March 1905), p 30.

⁸⁸ The American Sand-Lime Brick Co of Chicago; the Schwarz System Brick Co of New York; the Semisteel Co of Cleveland, Ohio; and the H Huennekes Company of New York (using 'Huennekes System'): *Clay Record* (Chicago), XXVI, 1 (16 January 1905), pp 55-6. The Semisteel Company, which advertised that its bricks had been used for the tallest sand-lime brick building in the United States, used 'Samson' presses: *Clay Record*, XXVI, 7 (15 April 1905), p 46.

⁸⁹ *Concrete*, I, 1 (March 1904), p 8.

⁹⁰ Information from Hardwicke Knight of Dunedin, 1995.

⁹¹ Warwick Gemmill, *And So We Graft from Six to Six* (North Ryde [New South Wales] 1986), p 82.

⁹² *Building*, September 1907, p 51.

⁹³ *Building*, 12 January 1911, p 46.

examples, presumably of Rosenbaum's manufacture, can be found in the Coast Hospital at Matraville of 1912.⁹⁴ In Western Australia these bricks were made from 1914 by the West Australian Brick Company, but this operation disappeared before the end of the Great War, and nothing more seems to have happened in Western Australia until after World War II. However, sand-lime bricks were not restricted to factory production for, like concrete blocks, they could be made on small hand-operated machines. One of these, capable of moulding nine bricks at once, could be had in 1914 for £65⁹⁵ and in 1938 for £95.⁹⁶

Information about the spread of sand-lime bricks in the east is scanty, but they were probably favoured in those country areas where clay bricks were not readily accessible. One early example is a house in Moree, New South Wales, of 1920-21. Later they were to become a material of choice rather than necessity, favoured in domestic work by progressive architects, until after World War II they again became a matter of necessity. Now the issue was not so much the absence of clay in particular areas as the overall building backlog and materials shortage. The result was that amateur builders proliferated, and they were advised that a machine could be bought for £10 capable of producing seven hundred perfect cement bricks in a day, or else a machine with a capacity of three thousand could be hired.

The recommended larger model was the 'E.C.' brickmaking machine, made by F C True and A P Anderson-Stuart of Surry Hills, Sydney. It was claimed to have a capacity of up to four thousand bricks a day when worked by three men in conjunction with an electric concrete mixer. There was also the 'E.C. Junior', costing a little over £10, with an output of one hundred per hour, the 'Rapid', by Hall & Pyne of Marrickville; and the 'Truline', by A M Duncan & Son of Alexandria.⁹⁷

It may be objected that the home-made cement brick lacks the attraction and colour of face bricks. Granted. But the house built of cement bricks is usually washed over cream, with woodwork and guttering picked out in green or blue, and looks just as attractive as the face-bricked cottage.

An interesting development was a form of brick patented by A M Duncan, which had a continuous frog and two one inch [25 mm] holes through the wide face. The idea was that the bricks were to be stacked in place without mortar, and then liquid cement grouted in down the holes.⁹⁸ The idea was tested by the Commonwealth Experimental Building Station at North Ryde, Sydney, apparently with successful results,⁹⁹ and a 'Special Truline Brick Machine' was marketed to produce bricks of this type.¹⁰⁰ Another development was that of H R McSkimming of Melbourne, a

⁹⁴ Information from Don Godden.

⁹⁵ C E Mayes, *The Australian Builders and Contractors' Price Book* (8th ed, Sydney 1914), p 89.

⁹⁶ C E Mayes, *The Australian Builders and Contractors' Price Book* (10th ed, Sydney 1938), p 144.

⁹⁷ *You Can Build Your Own Home!* (2nd ed, Sydney 1948 [1946]).

⁹⁸ *You Can Build Your Own Home!*, pp 22-4.

⁹⁹ The company's advertisement refers to CEBS Technical Record No 20: George Topham, *Be Your own Builder* (Sydney 1952), p 78.

¹⁰⁰ G F G Mackey, *Gregory's Modern Building Practice in Australia* (Sydney, no date [1940s]), p 32; *ibid* [c 1951], p 32.

machine which he first developed in his own back yard for his own use. It was a very compact apparatus which either could produce high grade bricks, to be cured in the normal way, or could form the brick directly in place on the wall.¹⁰¹

The more professional level of sand-lime brick manufacture can probably be traced to the development of the relevant British standard specification in 1934,¹⁰² and the example of British types like the 'Arrow' brand of the Standard Brick Company, Surrey.¹⁰³ In Britain specialised manufacturing equipment was developed, in which the bricks were subjected to about 100 tonnes pressure each, and the autoclaves could each accommodate as many as 80,000 bricks at a time.¹⁰⁴ In Australia nothing significant happened until after World War II. In 1954 Colortone Brick Limited bought a site at Frankston, near Melbourne, and built a sand-lime brick factory. two grades were produced, one of a darker colour which could resist soil acidity, and was used in footings, and the other for above-ground work, which came in nine colours.¹⁰⁵ In 1955 Calsil Pty Ltd opened a small sand-lime brick factory at Jandakot, Western Australia,¹⁰⁶ and in 1967 Calsil took over Colortone, which had experienced financial difficulties. This created Calsil Colortone Brick Pty Ltd, which continued to operate in Victoria until it closed in the late 1970s.¹⁰⁷

What would seem to be an early use of these bricks is the classroom block at Melbourne Grammar School of 1954, designed by Mockridge, Stahle & Mitchell, where a grey tinted brick was chosen to harmonise with the bluestone of the older buildings. Amongst the later examples were a notorious pair of flat blocks in Pasley street, South Yarra, built in 1971, one of which was subsequently demolished by order of the Supreme Court. It was said in this context that they were 'the bricks one uses generally if one paints outside brick, if one bags mortar over them and paints them.'¹⁰⁸

f. later concrete blocks

We have seen above that concrete blocks and block-making machines were well-known in Australia before World War I. In the post-war period there was something of a boom in the use of concrete blocks generally,¹⁰⁹ just as there would again be during the building materials shortage following World War II. In 1914 the *Settlers' Handy Pamphlet*, issued by the West Australian Department of Lands and Survey, illustrated a rather primitive double mould, with removable cores designed to be filled

¹⁰¹ W A Shum, 'Cement Bricks - 3-a-minute', in W A Shum [ed], *Concrete, Mud, Stone and how to use them* (Melbourne, no date [c 1950]), pp 18-20.

¹⁰² *British Standard Specification No. 187/1934*. A revised version was issued in 1948: B H & R G Knight, *Builders' Materials* (London 1948), p 12.

¹⁰³ J E Sears & J E Sears [eds], *The Architects' Compendium and Annual Catalogue* (London 1936), inside front cover.

¹⁰⁴ Knight, *Builders' Materials*, pp 11-12.

¹⁰⁵ Angelo Martino, 'History Essay' (BPD History of Building Construction essay, University of Melbourne, 1994), quoting information from Darrel Smith and Stan Chapman.

¹⁰⁶ Bryce Moore, *From the Ground Up* (Nedlands [Western Australia] 1987), p 193.

¹⁰⁷ Martino, 'History Essay' p 8, quoting Stan Chapman.

¹⁰⁸ Attorney-General v. Taylor Christie & Watson James, Supreme Court 1973, transcript p 809.

¹⁰⁹ C E Mayes, *The Australian Builders & Contractors' Price Book* (9th ed, Sydney 1927), pp 149-50.

and used entirely by hand. It produced blocks 18 x 10 x 6 inches [450 x 250 x 150 mm] with a single core per block.¹¹⁰ In 1925 Australian Cement Limited issued a booklet on the use of concrete, directed mainly at farmers, and in it gave detailed instructions for hand moulding simple concrete blocks, as well as naming the retailers from which hand operated machinery could be obtained.¹¹¹ The Australian Cement Manufacturers' Association, which took over this promotional role, devoted one of its useful pamphlets to the subject of concrete block and brick manufacture, dealing with everything from simple hand moulding to quite sophisticated machinery.¹¹² Unfortunately the pamphlet is undated, and appears to be a rewrite of an American publication, for the machines illustrated have little to do with Australian practice. Australian Cement Limited published its own booklet in 1925 with a section on concrete blocks, including instructions for making them using simple carpentered moulds.¹¹³

In about 1921 the Melbourne engineer A C Matthews designed a block-making machine,¹¹⁴ and by 1924 he was making the blocks at his own factory, measuring 2 ft x 1 ft 6 in x 1 ft [600 x 450 x 300 mm].¹¹⁵ In 1925 George Purdy of Melbourne began building houses on his patent system, in which two leaves of narrow concrete blocks were used to create a cavity wall. Purdy's patent machine was the 'None-such', and it is not clear how it was novel except that hoop iron ties to bridge the cavity were cast integrally into the blocks, somewhat like the 'Anchor' machine referred to above. He had already built a house of this construction in Gnarwyn Road, Murrumbeena, and another designed by Archibald Ikin won a prize at the Herald Ideal Homes Exhibition. The blocks were exposed (though painted) in parts of the interior, a novelty at the time.¹¹⁶ During 1925 G E Emery, General Manager of the State Savings Bank of Victoria, made a visit to Britain to investigate housing, in the course of which he inspected examples of both poured concrete and block construction at Becontree in East London. After this the bank experimented with both types.¹¹⁷

The 'triangular concrete block' does not seem to have reached Australia, despite its prominence in England and the fact that an Australian company marketed it in New Zealand. The British manufacturer was the Triangular Concrete Construction Company, of Thames Ditton,¹¹⁸ and in Britain a government committee in 1924 recommended its use, in preference to the various steel systems, for the construction of a proposed 2½ million houses.¹¹⁹ This is presumably the same as the 'Trianco' block which the Hume Pipe Company was selling in New Zealand in the 1930s. It was triangular in plan, with hollow cores running through it vertically, and the hypotenuse was designed to form the wall face, so that blocks could be lined up head

¹¹⁰ P Whicken, *Settlers' Handy Pamphlet* (Perth 1914), p 147.

¹¹¹ *Concrete: How it is Made* (Melbourne 1925), pp 17-33, and inside rear cover.

¹¹² Australian Cement Manufacturers' Association, *Concrete Blocks, Bricks and Slabs* (pamphlet no 6, Sydney, no date [c 1930]).

¹¹³ Australian Cement Limited, *Concrete: How it is Made* (Melbourne 1925), pp 19, 23.

¹¹⁴ *Australian Home Beautiful*, 1 June 1927, cited in Roser, 'Concrete House in Victoria', p 17.

¹¹⁵ David Moloney, research notes, National Trust; also *Herald*, 5 March 1924, both cited in Roser, 'Concrete House in Victoria', p 17.

¹¹⁶ *Australian Home Beautiful*, 15 January 1925, pp 4-5, 53.

¹¹⁷ Roser, 'Concrete House in Victoria', p 6.

¹¹⁸ John Burchard, 'Survey of Efforts to Modernize Housing Structure', in A F Bemis [ed], *The Evolving House*, vol III, *Rational Design* (Cambridge [Massachusetts] 1936), p 376.

¹¹⁹ *Australian Home Builder*, 15 May 1925, p 26.

to toe to create the wall. Half triangles were provided to close wall ends. One standard block was said to be equivalent to six standard clay bricks in volume but only three in weight, as they were made of either shingle or coke breeze concrete. The wall could be reinforced by running rods vertically through the cores and grouting them. These blocks were used for various buildings around Auckland and for the Melanesia Mission Hospital in the Solomon Islands,¹²⁰ but the company seems to have outgrown them, for by the 1940s 'Trianco' equipment was designed to produce blocks of a more conventional shape. These machines were marketed in New Zealand by T B Hampton & Co of Christchurch, but are not known in Australia.¹²¹ Trianco blocks produced in England around 1950 also appear to be of a normal rectangular shape, measuring eighteen by nine inches [450 x 225 mm].¹²²

An unusual form of concrete block construction, in some respects resembling F L Wright's 'Textile Block', has been found in a house in the Melbourne suburb of Chelsea, dating from about 1927. The external walling is a cavity system built of small slabs stacked on edge. They are two inches [50 mm] thick, and the cavity is the same dimension. The face dimension is one foot by two [300 x 600 mm] with an appearance resembling conventional blocks, and are laid in stretcher bond. Some have a raised or fielded panel resembling that of margin drafted masonry, either smooth or rock-faced, and are used in quoins and elsewhere. The corner blocks are L-shaped, to bond into both faces. Internal partitions are also of two thicknesses of blocks, but without a cavity. The distinctive feature of the system is the lateral connection between the units. The vertical and horizontal edges each contain slots measuring about 100 x 6.5 mm by 13 mm deep, into which a small metal plate is inserted, passing between one slab and the next. Local tradition has linked the building with W B Griffin, who was active in the area and whose client, the estate agent W A Towler, was responsible for the subdivision of the site in question. However, the system in no way resembles Knitlock, and the documentary evidence instead links the house with Eliab Box, a minor 'architect' (and the City of Caulfield Building Surveyor), who was joint owner with J W Cooper when it was built.¹²³

In 1931 R V F Eldridge published a new type of concrete block which was recommended for use in small buildings. The face dimension was 18.75 x 9.75 inches [476 x 248 mm], and behind the face there was not a complete block, but simply three vertical ribs, so that the plan resembled a capital E. A half block was made with two ribs, and these half blocks could also be used in pairs, back to back, to create a square column, with concrete and reinforcement placed inside. In many ways it was like a poor relation of Griffin's Knitlock system. The blocks were cast in timber moulds which could be made by a carpenter, rather than in any sort of machine.¹²⁴ No actual examples have been identified.

¹²⁰ Hume Pipe Co. (Aust.) Ltd., *Modern Building Construction* (Auckland 1932), pp 1-3.

¹²¹ *Building Progress* [Auckland], XIII, 1 (1 January 1948), p 39.

¹²² Drury, *Architects' Reference Book* (1950), p 82.

¹²³ The address is 23 Fraser Avenue, Edithvale, and my information comes from correspondence with a former owner, Ms Winifred Brosnan, in 1985, and from the application in 1990 by the present joint owner, Mr Frank McGuire, to have the house added to the Register of Historic Buildings.

¹²⁴ R V F Eldridge, 'A New Type of Concrete Block', *Australian Home Beautiful*, 1 January 1931, pp 20-21.

Generally concrete blocks appear to come late to Western Australia, and the first reported example is the Anglican church at Carnarvon, of the 1930s.¹²⁵ In about 1930 McLean Bros & Rigg of Perth and Kalgoorlie were stocking not only the 'Emu' concrete block machine, as has been mentioned, but also the compact 'Lightning' machine, and various systems of silo construction using curved blocks.¹²⁶ Both the Emu and the Lightning machines have a pair of tapering oval cores in each block, and one finds such blocks in country areas.¹²⁷

In 1938 the 'Phoenix' concrete building block machine was described in Mayes's *Australian Builders Price Book* as having a vertical acting core and a face of the block in the bottom of the mould, which facilitated the use of a finer 2:1 mix in the face, with coarser concrete for the balance.¹²⁸ After World War II Hall & Pyne of Marrickville Sydney, sold the 'Rapid' machine, which could be used for both brick and concrete block.¹²⁹ In the 1940s the Standards Association of Australia developed the first local standards for concrete blocks.¹³⁰ But while the general trend was towards standardisation, the Snider Construction Company of Melbourne began producing a range of specialised and sometimes complicated shapes of 'Hollowrock' blocks for particular purposes such as the building-in of door frames.¹³¹ Another variation was the Monier brick, which was a conventional brick size of 9 x 4⁵/₁₆ x 3 inches [230 x 110 x 76 mm], and of concrete (not sand-lime). A clinker brick was also produced in this size.¹³²

g. mechanisation

Power tamping is reported to have been introduced in the United States in the 1920s.¹³³ One such machine produced there was the Ideal Automatic Tamper, designed for use with the Ideal Concrete Block Machine, with the tamps worked from an overhead shaft in the manner of the stampers in a crushing battery. There were four flat and six blade or web tamps, the feet of which could easily be changed to suit different models of block.¹³⁴ By 1926 the Ideal Cement Stone Company of Omaha (probably unconnected with the machine of that name) was using a total of sixteen machines to turn out 6,500 blocks, as well as other products.¹³⁵ Australia must have

¹²⁵ Information from Robin Campbell and Ingrid van Bremen.

¹²⁶ McLean Bros & Rigg Limited, *Catalogue: General Hardware &c* (Perth, no date [c 1930]), p 23.

¹²⁷ As at 'Boldrewood', Lake Boga, Victoria, where there are a number of such blocks of unknown but local provenance.

¹²⁸ C E Mayes, *The Australian Builders & Contractors' Price Book* (10th ed, Sydney 1938), p 102.

¹²⁹ Hall & Pyne Pty. Ltd., *Rapid Concrete Moulding Machines* (Sydney, no date [c1950]); George Topham, *Be Your Own Builder* (Sydney 1952), p 102.

¹³⁰ 'Alternatives to Clay Bricks', *Australian Housing Bulletin*, 9 (9 July 1946), p 115, quoted by Roser, 'Concrete House in Victoria', p 16.

¹³¹ F W Ware & W L Richardson [eds], *Ramsay's Architectural and Engineering Catalogue* (3rd ed, Melbourne 1954), §7/3.

¹³² Ware & Richardson, *Ramsay's Catalogue* [1954], §7/4.

¹³³ Simpson, *Cheap, Quick and Easy*, p 28.

¹³⁴ Waldo Bros. and Company, *Building Materials and Construction Equipment* (Boston, no date [c 1920]), p 269. Another unidentified machine is illustrated in *Concrete Products* [International Correspondence Schools] (Scranton [Pennsylvania] 1919), part 1, p 35.

¹³⁵ *Building and Construction and Cazaly's Contract Reporter*, 3 August 1926, p 15, quoting *Concrete*, May 1926.

adopted the technology quickly, for production power tamping replaced hand tamping in commercial block production in about the decade 1914-1924.¹³⁶ The 'stripper' machine, which has fixed rather than removable sides, but is fully mechanised and extrudes the block, was also introduced in the United States in the 1920s.¹³⁷ The stripper machine was introduced in Australia in 1924.¹³⁸

Steam curing was first suggested in the United States in 1908, and had become standard by the 1940s.¹³⁹ In 1934 the Joltcrete machine was developed by Louis Gelbman and the Stearns Manufacturing Company of Adrian, Michigan, to make three blocks simultaneously and nine blocks a minute.¹⁴⁰ By 1940 most aspects of manufacture were automated. There were now 6,600 manufacturers in the United States, mainly because it was uneconomical to ship either the blocks or the raw materials for long distance. Most plants were therefore situated beside sandpits and close to a major highway. They served local markets, and they varied in size, shape and quality. In 1939 a scheme was put forward to standardise block manufacture by using standard machinery, manufactured by the Cementstone Corporation, with each local producer using the equipment and marketing its products under the 'Cementstone' brand. Whether this proposal had any direct effect is unclear, but the corporation's machinery was very much state of the art. It was said to depend upon three principles, mass production, vibration and testing. The blocks were cast in large steel-framed banks of moulds on a moving belt, and were vibrated and steamed from underneath.¹⁴¹

Amongst other advanced machinery, the Vibrapak was made by the Besser Manufacturing Co of Alpena, Michigan, cost about US \$28,000, and produced six hundred blocks an hour. Next best was the Trianco K2 machine, made by Trianco Ltd of East Molesley, England, at a cost of about S£1,000, including an electric motor and ancillary equipment such as palettes. It produced about 370 blocks an hour. Third best was the 'Stearns Joltcrete No 9' vibrating machine made by the Stearns Manufacturing Co of Adrian, Michigan, producing six hundred blocks an hour. A new Stearns machine was due out soon and promised to be better than the Vibrapak, producing nine hundred blocks an hour and costing about US \$50,000.¹⁴²

In 1949 it was reported that the concrete block industry was comparatively small and new in Australia (though the latter was not really true) and there was an opportunity to establish it on sound lines. Machine manufacture using vibratory plant was preferable - a Besser 'Vibrapak' plant in the United States was illustrated - and this would require the use of fork lift trucks to shift blocks to the curing kilns and thence to the stockyard. A block should weigh no more than 30 lb [13.6 kg], and for Australia this size could be achieved only by using lightweight aggregate.¹⁴³ The

¹³⁶ N J R Christie, *Australian Concrete Masonry Construction* (Sydney 1976), cited by Aphideth Daravong, *History of Building Construction*, Melbourne University 1994.

¹³⁷ Simpson, *Cheap, Quick and Easy*, p 28.

¹³⁸ Christie, *Australian Concrete Masonry Construction*.

¹³⁹ Simpson, *Cheap, Quick and Easy*, p 28.

¹⁴⁰ Simpson, 'Concrete Block', p 83.

¹⁴¹ 'The Concrete Block takes steps toward Standardization. A New Production Method', *Architectural Forum*, LXX, 5 (May 1939), p 376.

¹⁴² Isaacs & Drysdale, *Building Technique and Research*, pp 54-5.

¹⁴³ D V Isaacs & J W Drysdale, *Building Technique and Research* (Sydney 1949), p 44 & fig 39.

Australian post-war revival of the industry began with a Besser Vibrapac [*sic*] plant, which was established by Jaywoth Tiles Ltd at Rosewater, Adelaide, in 1954.¹⁴⁴ The Snider Construction Co blocks referred to above were made by the 'Snider Vibration Process'. By 1959 the Besser blocks were in wide use, and a factory was opened at Dandenong, Victoria, using a machine with a capacity of fifty thousand blocks a day.¹⁴⁵ By 1966 there were forty-nine plants in Australia, producing blocks in great variety.¹⁴⁶

h. breeze blocks

Cinder concrete, long used in mass applications and particularly in fireproof flooring, appeared in block form early in the twentieth century. The most mysterious example is the extension of about 1910 to 'Yooralbyn', Richmond, Victoria, in the form of two long wings to convert it into a guest house. The larger blocks of the external walls measure 200 mm wide by 300 mm wide, by something in excess of 360 mm long. They have at least two cores through them vertically, each starting as an ellipse of about 100 x 50 mm, and tapering through the height of the block.¹⁴⁷ By 1913 the Permasite Company of Melbourne was advertising a number of products including 'Permasite Coke Breeze Plate Walls', 'Permasite Hollow Blocks', and 'Permasite Insulation Plates' for butter factories and cooling chambers.¹⁴⁸ The nature of the coke breeze plates is not apparent, but it appears that they were probably precast elements of some sort. The 'insulation plates' probably contained coke breeze as well, and even the blocks may have done so. This uncertainty is unfortunate because the appearance in Australia of lightweight concrete blocks with coke breeze aggregate is not well documented. In 1923, however, Permasite hollow concrete blocks were used in the concrete floors of the Herald building in Flinders Street, Melbourne.¹⁴⁹

By 1914 'concrete breeze slabs' were being made by Richard Taylor Ltd at Marrickville, Sydney, in standard sizes of 28 x 18 x 2¹/₂ or 3 inches (711 x 457 x 64 or 76 mm),¹⁵⁰ and it must have been these blocks that were used for some of the public housing at Daceyville.¹⁵¹ Otherwise they seem to have been used mainly for partitioning commercial buildings, and hardly at all as a principal walling material, but with that important qualification, they seem to have been adopted fairly quickly. The other major use was as a fixing block at door jambs and elsewhere, when joinery was to be attached, and they were specified in this way in the contract for completing the Government Offices ['Treasury'] Building, Brisbane, in 1924.¹⁵²

¹⁴⁴ *Cross-Section*, no 19 (1 May 1954), p 1; no 26 (1 December 1954), p 1.

¹⁴⁵ *Cross-Section*, no 80 (1 June 1959), p 1.

¹⁴⁶ Diane Hutchinson, 'The Post-War Cement Industry' in Miles Lewis [ed], *Two Hundred Years of Concrete in Australia* (Sydney 1988), p 119.

¹⁴⁷ Tanya Hancock, *Australian Architecture B*, University of Melbourne 1997.

¹⁴⁸ *The Architectural Students Annual* (Melbourne 1913), p xxv; see also *Australian Homes* (Melbourne 1927), p 10.

¹⁴⁹ Allom Lovell & Associates, *Preliminary Comment on the Proposed Registration of the Herald and Weekly Times Building* (Melbourne 1995), p 4.

¹⁵⁰ C E Mayes, *The Australian Builders & Contractors' Price Book* [8th ed, Sydney 1914], p 239.

¹⁵¹ Information from Professor Ken Wyatt.

¹⁵² 'Specification, Completion of Treasury Building, Queen and George Streets, Brisbane' (typescript, 1924, held by the Historic Places Branch, Brisbane), p 4.

In the United States Francis J Straub received a patent for a cinder block in 1917, and there were various experiments with lightweight aggregates in the following years.¹⁵³ Straub's own plant was established at Lancaster, Pennsylvania, in 1919, producing twenty-five thousand blocks in the first year, rising to more than seventy million in 1926.¹⁵⁴ Manufacturers using Straub's patent formed the National Cinder Products Association, and in 1925 published a booklet, *Straub Cinder Building Blocks*, which referred to the prominence achieved by the product in ten [*sic*] years. It was said to be as good as wood for nailing, and capable of being chased, and cut to size.¹⁵⁵ The product did not achieve any degree of prominence in the United States until the 1920s and 1930s, when it began to replace the conventional concrete block,¹⁵⁶ while in Australia breeze blocks never had any prospect of doing this.

In Victoria a new breeze block, apparently influenced by the American developments, was introduced by W H Swanton under the name 'Cindcrete' at some time after World War I. It was probably about 1922, when a house was built at Gisborne of 'cinder blocks' for Swanton.¹⁵⁷ In 1925 the *Australian Home Builder* was discussing the possible use of brown coal residue to make breeze blocks, but still made no mention of any existing product,¹⁵⁸ although it was in the same year that an advertisement for Cindcrete appeared. The material was described as 'selected blast furnace slag thoroughly cleansed and crushed ... mixed with Portland cement and moulded under pressure', then cured. The blocks measured eighteen by six by three inches [450 x 150 x 75 mm] and weighed thirteen pounds [5.9 kg], replacing four clay bricks weighing thirty-six pounds [16.3 kg].¹⁵⁹

The puzzling thing about this description is the use of blast furnace slag, for according to Helen Swanton (granddaughter-in-law of the founder) he saw the material in America, and set up a plant in Port Melbourne to take advantage of the free cinders available from the local gas company. He leased Crown land in Ingles Street; imported the machinery from Germany, where breeze blocks had an established role in the building industry; and engaged a manager to run the operation. The company supplied the material for more than two hundred houses in the State Bank's nearby Garden City development,¹⁶⁰ with walls of eighteen by six by three inch [450 x 150 x 75 mm] blocks with a two inch [50 mm] cavity.¹⁶¹ A house at 68 Cooalongatta Road, Camberwell, of about 1928, was built by S J Cumming, who did

¹⁵³ P H Simpson, 'Cheap, Quick, and Easy: the Early History of Rockfaced Concrete Block Building', in Thomas Carter & B L Herman, *Perspectives in Vernacular Architecture, III* (Columbia, Missouri 1984), p 112.

¹⁵⁴ Simpson, 'Concrete Block', p 82.

¹⁵⁵ *Straub Cinder Building Blocks* [brochure] (no place, 1925), pp 3, 8. It appears (p 7) that patent no 1,212,840 was issued to Francis J Straub, but it is not apparent whether he was a United States Citizen, or perhaps a German.

¹⁵⁶ Simpson, 'Cheap, Quick, and Easy', p 112.

¹⁵⁷ *Australian Home Builder*, November 1922, p 51, cited by Roser, 'Concrete House in Victoria', p 19.

¹⁵⁸ *Australian Home Builder*, 15 April 1925, p 48.

¹⁵⁹ L M Perrott, *Concrete Homes* (Melbourne, no date [1925]), advertisements, no page.

¹⁶⁰ Roser, 'Concrete House in Victoria' cites *Building and Construction*, 27 April 1926, giving the number of houses as two hundred, and 18 August 1930 and 31 May 1932, pp 5-6, quoting H A Beiers, manager of Swanton & Barrett, giving the number as over 250.

¹⁶¹ *Australian Home Beautiful*, 1 June 1929, cited by Roser, 'Concrete House in Victoria', p 21.

much building work for the State Savings Bank,¹⁶² and has Cindcrete walls of exactly the same dimensions, galvanised wire ties, and strip expanded metal [that is, Bricktor or Expamet] bonding at intervals in the horizontal beds.¹⁶³ Apart from these, there are a number of Swanton family houses and a few others built largely the material.¹⁶⁴ In 1932 the *Australian Home Beautiful* ran a promotional article on Cindcrete, illustrating, amongst others, a house in Preston by the architects R M & H King.¹⁶⁵ Cindcrete was also used more generally as inserts in walls of other materials, to serve as nailing blocks around doorways, so that architraves could be fixed easily, as well as for other fixtures. The company also made precast blocks for chimneys.¹⁶⁶

Cindcrete dominated only the Melbourne market. The Duralite Concrete Products Co of Pyrmont, Sydney, advertised an innovative range of cinder concrete products including hollow blocks for floor construction, partition blocks for walls, and 'Fume-Vent' blocks with a continuous open core so as to create a chimney flue within the wall thickness.¹⁶⁷ They were made from 'seasoned coke breeze' in a size with the face dimension of four ordinary bricks and in thicknesses from two to six inches [51-152 mm].¹⁶⁸ In the late 1940s the 'Denaro' airflow building block, which had apparently been used elsewhere in Australia for several years, was introduced in Western Australia. It was made of electrically vibrated concrete in a 4³/₈ inch [110 mm] thickness for internal walls and a six inch [150 mm] for external ones, said to be the equivalent of six and twelve inch brickwork respectively. In the six inch blocks the webs between the inner and outer leaves were said to be waterproofed.¹⁶⁹

By 1948 Cindcrete was being produced by Swanton & Barrett Pty Ltd of Port Melbourne,¹⁷⁰ and they marketed four main products. These were solid Cindcrete 'bricks' in two thicknesses, and with a face area equivalent to four standard bricks plus mortar joints [476 x 162 mm], each with three hollow cores; hollow floor blocks; 'industrial blocks'; and precast chimney sections which interlocked and were to have rods threaded through to lock them together.¹⁷¹ After World War II Cindcrete blocks

¹⁶² Roser, 'Concrete House in Victoria', p 20, citing tender advertisement in *Building and Construction*, 3 July 1928, and *Suburban Building Record*, 28 August 1928.

¹⁶³ Inspected, 2000, with Paul Roser, who discovered the house.

¹⁶⁴ W H Swanton's own house 'Caversham', 20 Stawell Street, Kew, allegedly uses the material though it is not apparent exteriorly, and even the garden fence is said to be Cindcrete, stuccoed over. The house is undated, but I judged it to be about 1920, besides which Swanton is at the north-east corner of Stawell Street and Sir William Street in the directory of 1920, which seems too early for Cindcrete. Helen Swanton is able to name also 'White Lodge', his holiday house at Mount Macedon; 12 Highton Grove, Balwyn, of 1927, designed by the architect Keith Cheetham for Theo, eldest son of H L Swanton, and his wife Kathleen; a house in Glenbervie Road, Toorak, identified by Kathleen Swanton; 12 Keam Street, East Ivanhoe, built in 1958 to the design of Joseph Strong, an architect regularly used by the company, for Theo's son Michael Swanton and wife Helen, who extended it and still own it.

¹⁶⁵ *Australian Home Beautiful*, X, 3 (March 1932), p 45, quoted by Peter Cuffley, *Australian Houses of the '20s & '30s* (Fitzroy [Victoria] 1989), pp 39-40, 140, 142.

¹⁶⁶ F W Ware & W L Richardson [eds], *Ramsay's Architectural and Engineering Catalogue* (2nd ed, Melbourne 1949), §10/4.

¹⁶⁷ Mayes, *Australian Builders Price Book* (1938), advertisement p 17.

¹⁶⁸ Mayes, *Australian Builders Price Book* (1938), pp 321-3.

¹⁶⁹ Royal Australian Institute of Architects WA Chapter, *Exhibition 1949 Catalogue* (Perth 1948), p 33.

¹⁷⁰ *The 50 Best Practical Homes for 1948* (no place or date [Melbourne c 1948]), p 62.

¹⁷¹ Ware & Richardson, *Ramsay's Catalogue* [1949], § 10.4. By 1954 the chimney blocks had ceased to be advertised: Ware & Richardson, *Ramsay's Catalogue* [1954], §7/1.

were used more extensively for non load-bearing partitions in commercial buildings, and in the Children's Hospital, Melbourne. The founder of the company, W H Swanton, died in 1951, leaving the business to his four children, who finally closed it in 1975 due to falling profits and competition from products like Monier and Besser. Copies of later trade brochures, undated but from about the last ten years of operations, show the company marketing solid and hollow concrete masonry blocks for general building purposes, conduit blocks, flue blocks, paving slabs, stumps, hollow blocks for concrete floor slabs, and partition blocks in (according to the aggregate) 'Cindcrete', 'Brikcrete', concrete and 'Shalite'.

i. tiles & slabs

Amongst other cement-based building products introduced before the Great War, though apparently with much less impact, were eight inch [205 mm] square cement tiles claimed to be of beautiful colours and designs, and more durable than ceramic.¹⁷² After World War II the Cindcrete Brick Co was marketing a range of colourful cement tiles, some of a single colour, plain or mottled; some variegated; some inlaid, so that a single 200 mm square carried a chequer of four apparent tiles; some of terrazzo; and some with a non-slip texture.¹⁷³ 'Mack' slabs, which are discussed below as plaster components, came also to be made in Britain in concrete, and better known as 'King's partition blocks'. They were apparently based on pumice concrete, and their main rivals (by the 1940s) were to be J Wright & Co's hollow and solid blocks, and Frederick Jones & Co's 'Hercules' solid block.¹⁷⁴ Neither type is known in concrete in Australia.

¹⁷² Stone, *Reinforced Concrete Construction*, p iv.

¹⁷³ Ware & Richardson, *Ramsay's Catalogue* [1949], § 28/4.

¹⁷⁴ W R Jaggard & F E Drury, *Architectural Building Construction* (4th ed, 3 vols, Cambridge 1945, 1946, 1947), II, pp 185-6.