

6.01 Brick Making

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pioneering

Ten thousand bricks and ten brick moulds were brought to New South Wales on the First Fleet in 1788,¹ but this in no way obviated the need for local manufacture. By February, according to the surgeon, George Worgan, there had been found 'a Soil, which is seemingly fitted for making bricks'.² In April David Collins recorded a gang of convicts making bricks about a mile [1.6 k] from the settlement,³ which was in fact where Broadway is today, and on 13 May Worgan visited the site which, 'from the 'Number of little Huts and Cots' had 'a villatick appearance'. Between twenty and thirty thousand bricks had been made, and they were claimed to be as good as those made in England.⁴ In fact considerable quantities of bricks were burnt within the first months of settlement,⁵ and in July Arthur Phillip was able to report, 'we now make very good bricks'.⁶

The first substantial brick building completed was the barracks.⁷ However production did not increase from 10,000 bricks were made per month, until a kiln was built capable of burning 30,000 at a time, which the overseer agreed to produce.⁸ This is confirmed by Watkin Tench, who reported that Samuel Wheeler, one of the master brickmakers at Brickfield Hill, had been set before June 1790 to make 30,000 tiles and bricks per month, with twenty-one hands to assist him in digging clay, cutting wood &c. From June the target rose to 40,000, and another brickmaker, John King, was achieving 11,000 a week. The bricks were moderately good by London standards, but the tiles inferior, both because the clay was unsuitable, and because it was only trodden rather than ground.⁹ The reference to a kiln is interesting, if it is correct, for clamp burning was the Australian norm for the whole of next century. In 1791 a suitable clay was discovered at Rose Hill (Parramatta) and a brickmaker was

¹ 'List of articles sent by First Fleet', *Historical Records of New South Wales*, II, p 388, cited in Helen Proudfoot, 'Fixing the Settlement', in Graeme Aplin [ed], *A Difficult Infant: Sydney before Macquarie* (Kensington [New South Wales] 1988), p 58.

² G Worgan, *Journal of a First Fleet Surgeon* (Sydney 1978), p 39, cited in Proudfoot, 'Fixing the Settlement', p 60.

³ David Collins [ed Maria Collins, James Collier], *An Account of the English Colony in New South Wales* (Christchurch 1910 [2 vols, London 1798 & 1802; 1804]), p 28.

⁴ Worgan, *Journal*, p 44, cited in Proudfoot, 'Fixing the Settlement', p 61.

⁵ Watkin Tench [ed L F Fitzhardinge], *Sydney's First Four Years* [North Sydney 1979 (1961), being an edition of Tench's *Narrative*, of 1789, and *Complete Account*, of 1793], pp 71-2.

⁶ Governor Phillip to Lord Sydney, 9 July 1788, in F M Bladen [ed], *Historical Records of New South Wales*, II, part II (Sydney 1893), p 147.

⁷ Collins, *The English Colony in New South Wales*, p 46.

⁸ Collins, *The English Colony in New South Wales*, p 57.

⁹ Tench, *Sydney's First Four Years*, pp 192-3.

sent there to make bricks for a proposed storehouse and a range of barracks, though these bricks did not prove to be as good as those made at Sydney.¹⁰

Henceforward virtually every settlement made its own bricks, and even when Sydney bricks were sent to the Corinella settlement in Westernport Bay, in 1826, bricks were also made on the spot, and were thought to be better than those from Sydney.¹¹ Ten thousand bricks were brought by settlers at the Swan River [Perth], on HMS *Sulphur* in June 1829,¹² but brick and pottery clay was found to be abundant, and in 1830 bricks were being made 'in many places', and looked set to displace wood as the main material for building.¹³

At Adelaide the first bricks were burnt at the South Australian Company's kilns on the Torrens, to the east of the settlement, in October 1837.¹⁴ Amongst the brickmakers who followed were George Gandy, a group known as the Cowlandillah Brick Company, John Morphett, and George Shearing. Gandy began making bricks in mid-1838 on Colonel Light's section adjoining the west parklands, but continued for only three years. The Cowlandinnah company was an enterprise involving three brickmakers from about August 1838, and then employing others, but was poorly located on the south-western plains rather distant from the settlement, and seems to have gone out of business during 1841.¹⁵ Morphett was a gentleman investor, and the works seem to have been in the hands of J T Scown, of which more below. On the other hand Shearing, who began making bricks and tiles at Hindmarsh soon after his arrival in 1839,¹⁶ was to be the founder of a local ceramic dynasty. After these individual enterprises the industry concentrated with Shearing at Hindmarsh Village, where there were at least fifteen brickworks by 1841.¹⁷

In country areas bricks were commonly burnt to order for individual houses using clay from the site, whether by a professional brickmaker or by the owner himself. Near Adelaide Robert Thomas was making bricks in October 1838 on his country sections, about three kilometres from the centre.¹⁸ Even the Reverend J R Wollaston, at the Australind settlement in Western Australia in 1842, was 'making clay bricks and with my own hands and William [his son] for my hod-man'.¹⁹

¹⁰ Collins, *The English Colony in New South Wales*, p 100.

¹¹ Keith Bowden, *The Western Port Settlement and its Leading Personalities* (Cheltenham [Victoria] 1970), pp 4, 14, 14-15.

¹² D Markey, *More a Symbol than a Success*(1977), p 39, quoted in Jenny Mills, *The Timber People* (Perth 1986), p 3.

¹³ G F Moore, *Diary of Ten Years Eventful Life of an Early Settler in Western Australia* (London 1884), quoted in John Hale [ed], *Settlers* (London 1850), p 153.

¹⁴ Noris Ioannou, *Ceramics in South Australia 1836-1986: from Folk to Studio Pottery* (Netley [South Australia] 1986), p 6.

¹⁵ Ioannou, *Ceramics in South Australia*, p 103.

¹⁶ Ioannou, *Ceramics in South Australia*, pp 82, 105, ref *South Australian Register*, 1 November 1839.

¹⁷ Ioannou, *Ceramics in South Australia*, p 105.

¹⁸ Ioannou, *Ceramics in South Australia*, p 103, ref E K Thomas [ed], *The Diary and Letters of Mary Thomas, 1836-1866* (Adelaide 1925), p 111.

¹⁹ J R Wollaston [ed A Burton], *Wollaston's Picton Journal* (Nedlands [Western Australia], 1975), p 112.

preparation

Methods of preparing the clay varied enormously in different parts of the world, and even within Britain, but there is enough information to suggest in broad terms what was done in Australia. In northern Europe it was traditional to dig the clay and then leave it to stand in piles over winter so that it would be broken down by frost. But this did not apply in Australia, and even in Britain it had generally ceased by the nineteenth century, and the clay went straight to a tempering pit. Water, and other materials if necessary, were added to the clay, and a harrow was dragged through it from an arm turned by horsepower. The tempered clay then went to a pugmill,²⁰ which was like a wooden stave bucket or barrel with a vertical spindle up the centre, off which branched horizontal knives to chop the clay as the apparatus turned.²¹ In Britain Henry Ward considered that once a brickyard had three stools [brickmakers' benches] it became worthwhile to use steam rather than horse power to operate this equipment.²² For the drier pressed bricks which were developed later in the century the clay might be ground by heavy pairs of wheels rotating in a pan, almost like the Chilean mill used in gold extraction.

In Victoria, at least, tempering and moulding were often completed on the same day that the clay was extracted, and grinding was entirely omitted,²³ which explains the lumps and pebbles which Smyth reported in the 1850s as being as common in local bricks. The pugmill was not normally used, though it is interesting that the architect Thomas Watts actually specified the use one for making the bricks of the country house 'Bontharambo', and actually drew it up for the benefit of the builder. In Adelaide Morphett (or Morphett and Scown), in about 1838 obtained an advantage in quality by introducing a pugmill, so that their rivals were forced to do the same including, by late 1839, one made of iron rather than timber. This must have been very advanced. In Britain, timber pugmills were normal, but a cast iron cylindrical type, driven by steam, was in use in Staffordshire.²⁴ This type is illustrated in the later editions of Dobson's famous treatise,²⁵ but not the first.

hand-moulding

In 1871 the average Victorian brickyard still employed only four hands and produced 250,000 bricks per annum,²⁶ and this might or might not have been done with the assistance of some small scale machinery, for plenty of yards were still entirely manual. Handmade bricks naturally persisted longer in rural areas and in the smaller

²⁰ Henry Ward, *Brickmaking* [offprint from Institution of Civil Engineers, *Minutes of Proceedings*, LXXVI, iv (1885-6) (London 1886), p 6.

²¹ Edward Dobson, *A Rudimentary Treatise on the Manufacture of Bricks and Tiles* (2 parts, London 1850), part II, pp 14-15, 52.

²² Ward, *Brickmaking*, p 6.

²³ C B Mayes, 'Essay on the Manufactures more immediately required for the Economical Development of the Resources of the Colony', *Victorian Government Prize Essays 1860* (Melbourne 1861) p 279.

²⁴ Dobson, *Bricks and Tiles* (1854), p 27.

²⁵ Edward Dobson, *A Rudimentary Treatise on the Manufacture of Bricks and Tiles* (8th ed, London 1886), p 213.

²⁶ N G Butlin, *Investment in Australian Economic Development 1861-1900* (Cambridge 1964) p 264.

colonies. In Western Australia Ian Molyneux has found handmade bricks at Cook's Park, Australind, of about 1862, and at Dewar's House, Gingin, of 1878. The former measure 63 x 110 x 232 mm and have a deep slot-like frog made with the thumb. The latter measure 75 x 107/110 x 216/232 mm and have a shorter frog.²⁷ Although by the turn of the century most works already used a considerable amount of machinery, even if only in the excavation and preparation of the clay, just as in Britain the term 'hand made' can reasonably be used so long as the actual moulding is done manually.

Even in Melbourne, as late as 1888, the Upper Hawthorn brickworks of A Spears & Son was entirely hand operated, producing 35 to 40,000 bricks a week.²⁸ In Sydney steam moulding works appeared in 1870 and, according to Gemmell, fully superseded hand moulding by about 1890. In country areas hand moulding was practised as late as 1920,²⁹ and in some locations in New South Wales even into the 1930s.³⁰ Similarly, at Sawyer's yard at Horsham, Victoria, the clay was at first carried or wheeled from the pit, while later on horse power was used to extract it and to 'roll' it before moulding, but mechanical presses were not introduced until the 1930s.³¹

Much has been written elsewhere about the process of hand moulding bricks, but there is not a great deal of information specifically related to Australian practice. It appears, however, that Sydney bricks were generally sand moulded and Melbourne bricks slop-moulded, as is apparent from their respective surfaces. Markings on the exposed faces are rare, though there are bricks in Hobart with a small and neatly stamped broad arrow identifying them as government property. It is often assumed that a handmade brick will not have the frog, or depression in the large face, which is common in a machine pressed brick. This is not true at all. The frog is created by a projection, or 'kick', in the stock over which the maker places the mould and clay. It may, and often does, contain (in mirror image) the maker's brand or initials, for example 'S.A.C.' on the first bricks produced in Adelaide by the South Australian Company.³² Occasionally one finds a frog which has not been formed in this way, but has been deliberately scooped out with two fingers, as with bricks from the old Albany Gaol, Western Australia. Some New South Welsh bricks have a large broad arrow as a frog,³³ while others, also generally taken to be convict-made, have it in the form of a diamond, heart, or other such symbol, presumably to distinguish the product of one moulder from another. These are also found in Tasmania, but rarely elsewhere.

One aspect which has been the subject of controversy is the reason for the appearance of thumbprints in bricks. It has been variously contended that they serve to identify the work of a particular moulder; that they are tally marks to assist in keeping a

²⁷ James Cowell, 'Pioneers of Brickmaking: History of Horsham Works', typed extract from the *Horsham Times*, 23 June 1936 (held by the Horsham Historical Society), p 2.

²⁸ Alexander Sutherland et al, *Victoria and its Metropolis* (2 vols, Melbourne 1888), II, p 655.

²⁹ Warwick Gemmell, *And So We Graft from Six to Six* (North Ryde [New South Wales] 1986), pp 5, 12.

³⁰ Gemmell, *And So We Graft*, p 15.

³¹ Ward, *Brickmaking*, p 2.

³² Ioannou, *Ceramics in South Australia*, p 10.

³³ Robert Irving, 'Mostly about Walls', in Robert Irving [ed], *The History and Design of the Australian House* (Melbourne 1985), p 195.

running count of production; that they are made by accident when a wet brick is picked up; or when it is forced out of the mould; or that they result from using the thumb to force the clay into an empty corner of the mould, perhaps when it had been pulled away by the action of 'striking off' the superfluous clay. A S Kenyon asserted that thumbprints were made by convict brickmakers to enable their work to be tallied,³⁴ which makes little sense when the thumbprints of two men would often be indistinguishable (and in any case such marks are by no means confined to convict-made bricks). However, G C Scandrett had looked at convict-made bricks at Premaydena, near Port Arthur, Tasmania, which he believed to support this interpretation. He found specimens marked with hearts and diamonds, as discussed above, and one with a thumbprint on one side and four fingerprints in the face. He thought that every thousandth brick was marked with a symbol of some sort. This makes no sense at all if the hearts and diamonds are formed by a kick, and should occur in every brick by the same moulder, and if the face was marked it was clearly an accident. The mark of the thumb finger prints, of the brick having been picked up while soft.

Freeland favoured the last explanation³⁵ - that of forcing the clay back into the corner of the mould - and it is certainly a reasonable one in at least some cases: one can see that the clay might easily be pulled away in the manner suggested, and that the use of the thumb is the simplest way to restore the integrity of the faces which will be exposed, whilst marking only a surface which will be concealed. There are, however, a number of instances where the evidence is rather different, for rather than a single thumbprint on a single large face, there are two at diagonally opposite corners. If one holds such a brick with one's thumbs in the prints, it is clear that they must have been made while forcing it down out of the mould. This can be checked by examining the adjoining faces: if they have not bulged outwards at all under the pressure, then the imprints were made before the brick left the mould.

An important figure in Victoria was John Glew, whose bricks would in due course prove crucial to the emergence of polychrome architecture. He arrived in 1849, registered as an agricultural labourer and aged twenty-four.³⁶ Having left the Immigrants' Depot still unemployed, he obtained work in the brickfields for some weeks, and then bought land of his own and set up as a brickmaker at Phillipstown (West Brunswick). He worked alone for six months, then employed two men, and by 1851 was able to exhibit and to obtain a first prize for his bricks and tiles at the Great Exhibition in London.³⁷ He again exhibited at the Melbourne Exhibition of 1854.³⁸ His Phillipstown Brickworks was in Union Street in 1859,³⁹ but in 1860 he moved to a new yard in Brunswick, and in 1865 won first prize for terra cotta ware at the Dublin Exhibition. By the time of the move he seems also to have been making what

³⁴ A S Kenyon in the *Sun* [Melbourne], 28 February 1934.

³⁵ J M Freeland, *Architecture in Australia* (Melbourne 1968), p 14.

³⁶ Information from the State Archives (now PRO) conveyed to me in a letter by Mr J Berends of Beaumaris, 25 September 1971.

³⁷ Alexander Sutherland et al, *Victoria and its Metropolis* (2 vols, Melbourne 1888), II, p 638.

³⁸ Melbourne Exhibition 1854. *Official Catalogue &c* (Melbourne 1854), p 10.

³⁹ C B Mayes, *The Victorian Contractors' and Builders' Price Book* (Melbourne 1859), p xvi. The actual location of the brick pits, about the position of the present Temple Park, is shown on Victoria Geological Survey quarter sheet, North-West Melbourne, no 1 (c 1864).

were described as the first 'fancy white bricks' in the colony.⁴⁰ He sent samples to England, according to Freeland, and obtained testimonials from brickmakers and architects, in an uphill battle for recognition, which was successful only when Joseph Reed began to use the bricks for polychrome work⁴¹ (in about 1864).

extrusion

The first mechanical brickmaking in Australia was done by extrusion. In 1836 the Marquis of Tweeddale had invented the first significant machine of this sort, which ground and kneaded the clay, then pushed it out in a continuous strip which could be cut off in sections. The shape of the strip was determined by the die used, and it could produce not only bricks but roof and drainage tiles, both flat and curved.⁴² This was the sort of machine that would be useful to a large landowner, and by 1843 a smaller model was available which was suited for use by unskilled labour on a private estate, and produced fifteen bricks a minute.⁴³ In 1838 Tweeddale obtained a further patent 'to extend to the colonies only',⁴⁴ and it appears that the machines were being made by the London engineers and ironfounders Cottam and Hallen.⁴⁵ In 1839 Cottam and Hallen were advertising brick and tile machines in books aimed at emigrants to South Australia.⁴⁶ Tweeddale was not alone. It appears from a later account that at about the same time one Murray, manager of the Garkirk Coal Company, invented a machine in which the clay was pugged and then extruded at the bottom in a form which could be sliced off to make tiles. A number of later machines similarly combined pugging and extrusion, and it was predicted in the 1850s that this approach would supersede all others in the larger brickyards.⁴⁷

In 1843 two brothers arrived from England at the Australind settlement in Western Australia with machinery for brickmaking,⁴⁸ and this seems likely to have been a Tweeddale machine. However, as Australind was by now moribund the venture did not proceed, and what became of the apparatus is not known. By this time an

⁴⁰ Sutherland, *Victoria and its Metropolis*, II, p 638. The biographical note does not date the introduction of these white bricks, but it may be deduced from two other sources. In 1860 Charles Mayes wrote that 'superior samples of white and cream coloured colonial bricks are to be had': Charles Mayes, 'Manufactures for the Economical Development of the Resources of the Colony', in *Victorian Government Prize Essays 1860* (Melbourne 1861), p 281. Dressings of white bricks stamped 'J.G.' were used in a house at 3 Elm Grove, Richmond, for which a *terminus ante quem* is established by newspapers found in the structure, including the *Irish Catholic Tablet* of 1858.

⁴¹ J M Freeland, *Architecture in Australia* (Melbourne 1968), p 145.

⁴² *Mechanic's Magazine*, XXXI, 829 (27 April 1839), p 62; XXXI, 831 (13 July 1839), pp 241-8; *Penny Magazine*, XII, 723 (8 July 1843), p 264. For an earlier but unimportant extrusion machine; a slightly later French one; Hunt's improvements to the Tweeddale machine; and other machines by Hatcher and Ainslie, see Lewis, 'Victorian Building', I, 191-3 & notes.

⁴³ *Builder*, I, 16 (27 May 1843), p 195.

⁴⁴ *Mechanic's Magazine*, XXIX, 786 (31 August 1838), p 318.

⁴⁵ Cottam delivered a paper on the manufacture of bricks by Tweeddale's machine at the Royal Institution in April 1839. *Mechanic's Magazine*, XXXI, 820 (27 April 1839), p 61.

⁴⁶ John Stephens, *The Land of Promise* (London 1839), advertising sheet, no page; Henry Capper, *Capper's South Australia* (3rd ed, London 1839), advertisements p 14.

⁴⁷ *The Farmer's Magazine*, V (1854), p 195.

⁴⁸ John Wollaston [ed A Burton], *Wollaston's Picton Journal* (Nedlands [Western Australia] 1975), p 274.

improvement to Tweeddale's machine, devised by Hunt, had been adopted by the Tweeddale Brick Company itself, and it seems probable that extrusion machines reaching Australia after this time were of the improved Tweeddale type. There was, however, another extrusion machine patented in 1843 by William Irving, and one cannot rule out the possibility that it also reached the Australian colonies. Irving had already, in 1841, patented a machine which used a rack of wires to cut a great slab of moulded clay into tiles,⁴⁹ and he may have been responsible for the addition of wire racks to extrusion machines, to cut the emerging strip of clay into brick sized pieces. From Victoria John Cotton wrote to his brother in 1844 'The plan of the machine for making bricks I should very much like to have'.⁵⁰ It does not appear that Cotton received a plan or a machine, but in 1845-6 Langlands & Fulton's Foundry in Melbourne manufactured a Tweeddale machine for the Richmond brickmaker J J Peers.⁵¹

On 17 April 1840 Dr B A Kent reached South Australia with a steam engine and brickmaking machinery under Lord Breadalbane's patent, to which he had exclusive Australian rights. It is unclear what the system was, except that it was powered with a nine horsepower [6.7 kW] beam engine made by Cottam & Hallen of London, but it seems likely to have been some form of extrusion. Kent took up the area east of Adelaide which subsequently became known as Kent Town, set up his machinery in August 1840, and seems to have produced the first bricks with it by October. By May 1841, however, the local economy was in recession, and Kent seems to have abandoned the venture.⁵²

Many other extrusion machines followed Tweeddale's and Irving's, most of them larger and more suited to commercial brickmaking. One was patented by Henry Clayton of London in 1844⁵³ and shown at the Great Exhibition in 1851. It was described as a 'patent double action machine', and worked on either a horizontal or a vertical 'principle', screening the clay before moulding it into drainage pipes and tiles, roofing and paving tiles, or solid or hollow bricks.⁵⁴ This was probably the machine reported in the *South Australian Observer* in 1848, in which the process of homogenisation, usually carried out by a pugmill, was combined with that of extrusion.⁵⁵ Clayton's machine was put to use in Australia in 1855 at the new brickworks in Ballarat started by Richard Baker and his brothers,⁵⁶ and it was later used for drainpipe manufacture, as discussed below.

Clayton, Howlett & Venables, presumably a successor company, was still making extrusion machines in the 1880s.⁵⁷ Another extrusion machine shown at the Great

⁴⁹ Akira Satoh [ed Ralph Morton], *Building in Britain, the Origins of a Modern Industry* (Aldershot [Hampshire] 1995 [1986]), pp 161 & 164, fig 7.4, ref *Civil Engineer and Architect's Journal*, V (1842), p 8, and Hudson, *Building Materials*, p 32.

⁵⁰ John Cotton to William Cotton, August 1844, in George Mackaness [ed], *The Correspondence of John Cotton* (2nd ed, 3 vols, Dubbo [New South Wales] 1978), II, p 4.

⁵¹ *Port Phillip Patriot*, 8 December 1845; *Port Phillip Herald*, 29 January 1846.

⁵² Ioannou, *Ceramics in South Australia*, pp 107, 110.

⁵³ *Builder*, II, 65 (4 May 1844), p 273.

⁵⁴ Great Exhibition of the Works of Industry of all Nations, 1851, *Official Descriptive and Illustrated Catalogue* (3 vols, London 1851), I, p 369.

⁵⁵ Ioannou, *Ceramics in South Australia*, p 111, ref *South Australian Observer*, 25 March 1848.

⁵⁶ Alexander Sutherland et al, *Victoria and its Metropolis* (2 vols, Melbourne 1888), II, p 459.

⁵⁷ Ward, *Brickmaking*, pp 15-16 & fig 10.

Exhibition was Randell & Saunders's Brick, Tile, and Pipe Machine, in which the clay passed through a horizontal screw, and was extruded and chopped into bricks by a continuous process - that is, it was not necessary to stop the extrusion process, bring down the cutters, and then restart the extrusion.⁵⁸ The first local development of the extrusion principle was perhaps that of Alfred Cornwell, discussed in the context of tile manufacture, below.

At the Sydney Exhibition of 1870 Thomas Field of George Street showed a tile and pipe making machine - necessarily an extrusion machine - which had been manufactured entirely on his premises, but whether this was to a local or an overseas design is not apparent.⁵⁹ In the 1880s W G Ainsworth of York Street, Sydney, was advertising a 'Drain-pipe, Tile and Brick Machine' made by E Page & Co. This was an extrusion machine which used a new type of die to lubricate the clay as it passed through, and ensure clean sharp angles. Although Ainsworth referred to Page & Co as the inventors, this was not the case. A British patent of 1855 in the name of William Williams had been acquired by Pages, who had begun manufacturing the machine by the 1860s.⁶⁰ By the 1880s extrusion machines were out of favour with professional brickmakers in Australia, and had become a glut on the secondhand market. They produced soft moist bricks which, just as with handmade bricks, required a long period of drying in hack, with all the attendant difficulties. It was known that the Americans had extrusion machines in which the clay passed through a very strong double casing with steam heating coils running around it, and by this means could use much drier clay, and produce something approaching the quality of semi-plastic pressed bricks. But no such machines seem to have reached Australia.⁶¹

pressing

Brick pressing machines were developed earlier than extrusion machines,⁶² but their impact in Australia was later, and it is harder to know which ones were used here. The mechanical details of the overseas presses need not concern us, but an important development, as the available pressure increased, was that drier and drier clay, sometimes even a dry powder, could be used. The bricks could be burnt virtually without any preliminary drying, which saved space and labour in the yard. Because they were not drying out in the kiln they did not distort as much as other bricks, and they might also be made extremely dense and strong. The first such machine seems to have reached Australia in the 1850s.

In 1852 four Victorians, Boyle, Boag, Harris and Smith, went to the United States and obtained a modern press, probably of the type which had been invented by J E Holmes and was in operation on Staten Island.⁶³ They established the machine first at Mount Martha, and then at West Melbourne, where in 1856 they produced bricks

⁵⁸ Great Exhibition, 1851, *Official Catalogue*, extract supplied by Janet Beeston 1999.

⁵⁹ *The Industrial Progress of New South Wales* (Sydney 1871), p 144.

⁶⁰ Alan Cox, *Brickmaking a History and Gazetteer* (Bedford 1979), pp 39-40.

⁶¹ *Australasian Builder & Contractor's News*, 13 August 1887, p 218.

⁶² For some account, see Lewis, 'Victorian Building', I, pp 197-202.

⁶³ *Builder*, XI, 528 (19 March 1853), p 182; XII, 616 (25 November 1854), p 608, quoting the *Scientific American*, and Joseph Whitworth's report on the American Exhibition.

said to be 'superior to anything ever made or even imported into the colony,' and to be perfectly fireproof.⁶⁴ There followed an extraordinary story of swindling and incendiarism before the Phoenix Brick Works re-opened in December.⁶⁵ The machine weighed 25 tonnes and processed clay which had been dried in the air and pulverised. A high pressure horizontal steam engine of 27 kilowatts gave the clay two blows with a 1,800 kg hammer, followed by a cam pressure of 600 tonnes. The bricks that resulted were of the American size, smaller than the local, but machines to make larger bricks were on order.⁶⁶ An idea of the magnitude of this enterprise is conveyed by the fact that the cost was nearly £3,000,⁶⁷ as compared with the £14 to £30, inclusive of dies, of the extrusion machines shown at the Great Exhibition.⁶⁸

Such a massive machine, powered by steam, was an exception. There were other steam works in Melbourne,⁶⁹ and according to Dennis Jeans a steam operated American brickmaking machine called 'The Favourite', brought to Australia in the 1850s, was capable of producing 8,000 bricks a day,⁷⁰ though this is much less than the capacity of the Holmes machine, 50,000 per day. There was, however, another machine made by Mower & Woodstock of Boston, which produced 3,000 bricks an hour or about 30,000 in a ten hour day. It was therefore in the same league as the Holmes machine, and as it is reported to have been introduced in Britain in 1852⁷¹ it must have been close in date. The local use of American machinery is not surprising, for despite the many British inventions in the field, it seems that machinery was not much used in British brickyards. It has been claimed that machinery was introduced to Manchester yards only in 1861, and the first two machines were blown up by hands who felt that their jobs were threatened:⁷² after this machines were not reintroduced until 1867 or later.⁷³ The first machines appeared in Nottingham only in 1868, and in the 1870s hand moulding still predominated in Birmingham.⁷⁴ By contrast nearly all Glasgow bricks were machine-made by 1867.⁷⁵

But Britain did have some impact. In mid-1853 the recently arrived architect Charles Maplestone wrote to Frederick Ransome of his (Maplestone's) home town of Ipswich to send out a brick machine and a steam engine. This was apparently to be on some sort of speculative basis and, as Maplestone had no capital and was regarded by his own family as completely feckless, Ransome was wise in ignoring the proposal. In April 1854 Maplestone sulkily remarked that he now expected a brickmaking

⁶⁴ *Australian Builder*, 9 (30 April 1856), p 72.

⁶⁵ *Australian Builder*, 17 (26 June 1856), p 175.

⁶⁶ *Australian Builder*, 14 May 1859, p 144.

⁶⁷ *Argus*, 22 December 1856.

⁶⁸ *Illustrated Exhibitor*, 19 (11 October 1851), pp 350-351.

⁶⁹ For example, David Mitchell's Victoria Steam Brick Works, Burnley Street, Richmond: C B Mayes, *The Victorian Contractors' and Builders' Price-Book* (Melbourne 1859), p xxxii.

⁷⁰ Dennis Jeans, 'The Building Industry: Materials and Styles', in Judy Birmingham, Dennis Jeans & Ian Jack, *Industrial Archaeology in Australia: Rural Industry* (Richmond [Victoria] 1983), p 103.

⁷¹ Satoh, *Building in Britain*, p 162.

⁷² Marion Bowley, *Innovations in Building Materials* (London 1960), pp 64-5.

⁷³ Satoh, *Building in Britain*, p 172.

⁷⁴ Satoh, *Building in Britain*, pp 176, 177.

⁷⁵ Satoh, *Building in Britain*, p 181.

machine and steam engine any day. and no longer wanted one from Ransome.⁷⁶ This was probably mere braggadocio, for nothing more is heard of any such machine in connection with Maplestone, though in 1854 it was reported that 'two very superior brick machines, with steam engines attached' and capable of producing 60,000 bricks a day (whether separately or between them is unclear) were to be sent to Melbourne. They were constructed 'on a new principle' and were to be shipped from Howden Dyke to London and thence to Melbourne.⁷⁷ To whom they were consigned is a mystery. As early as 1858 the Ballarat architect Henry Caselli advertised for machine-made bricks to be used in a local building,⁷⁸ which suggests that more than one machine must already have been at work in or near this provincial town.

In 1860 Charles Mayes stated that brick machines capable of tempering the clay and turning out a thousand bricks an hour were imported from England, but were being worked by horsepower to little advantage: moreover, as labour was only a small proportion of the total cost of brickmaking, the machines were economic only for the production of large quantities.⁷⁹ Brayton & Berry of Brunswick had just imported an American machine which was worked by two horses,⁸⁰ and for which they obtained a Victorian patent.⁸¹ Another local patent was taken out for a machine which was hand operated, and produced only two bricks at a time,⁸² and there are other reports of machinery which seems to be very small scale.

Small machines were still being widely used. For the construction of the house 'Harewood' on Westernport Bay, Victoria (completed in 1868), William Lyall imported an English machine which can be assumed to have been a press, as bricks were made 'with the William Lyall mould'.⁸³ In 1871 the *Town and Country Journal* (widely read in rural New South Wales) illustrated an imported 'self acting brick machine',⁸⁴ and in 1881 the *Sydney Mail* reported a 'hand-power brick-making machine' which was available from Lassetter's of George Street. It could produce 5,000 bricks per day 'and should be useful in country places where skilled labour is scarce'.⁸⁵

In 1879 A C Evans was granted a South Australian patent for a machine in which:

... There is a shaft six feet [1.8 m] long having fourteen blades, which force the clay through a hole in the cylinder. The clay is then received by one of eight moulds found upon a round table, which moves upon a tramway raised

⁷⁶ Charles Maplestone to Marianne Miller, 24 July 1853 & 27 April 1854, in [Charles Maplestone], 'Diary and Letters of Charles Maplestone on the Outward Voyage and in the Colony of Victoria' (compiled c 1934, Archives, Melbourne City Council, no 2353/1), pp 35, 55.

⁷⁷ *McPhun's Australian News*, 15 (March 1854), p 5.

⁷⁸ Dorothy Anderson, *The Tradesmen of Gazelle* (South Yarra [Victoria] 2000), p 103.

⁷⁹ Charles Mayes, 'Manufactures for the Economical Development of the Resources of the Colony', in *Victorian Government Prize Essays 1860* (Melbourne 1861), p 382.

⁸⁰ *Australian Builder*, 21 January 1860, p 9.

⁸¹ No 301 to William Henry Brayton & Charles Edward Berry, 4 January 1860.

⁸² No 274 to Frederick Poeppel, 29 October 1859. For Poeppel see Miles Lewis, *The Essential Maldon* (2nd ed, Melbourne 1988), pp 72-3.

⁸³ B I Ricardo, 'Extracts Collected from the Diaries of William Lyall Esq' (typescript 1956), p 23.

⁸⁴ Peter Freeman, *The Homestead - a Riverina Anthology* (Melbourne 1982), p 78.

⁸⁵ *Sydney Mail*, 2 September 1882, quoted in Peter Freeman, *The Homestead - a Riverina Anthology* (Melbourne 1982), p 78.

two thirds of its course. Under each mould is a leg, which when it comes upon the raised part of the tramway, forces the clay out of the mould and a person takes away the brick that has been formed ... it is calculated that a single machine will produce 15,000 bricks a day ... [and] ... six or eight hands will be required to work each machine.

Four such machines could be worked simultaneously from one sixteen horsepower [12 kW] engine. The Carron Iron Works at Port Adelaide received the contract to build the first.⁸⁶ The principle of the revolving table with moulds raised on pistons, is exactly that of the pioneering machine patented by Edward Jones in 1835,⁸⁷ and it sounds as though Evans's machine was neither a substantial innovation nor a timely development in a market now turning to the semi-plastic and dry processes.'

Shale clays called for semi-dry processing, and it was the introduction of this technology that enabled the deposits in the Mount Lofty Range, near Adelaide, to be exploited from the 1870s.⁸⁸ The local engineer G E Richardson developed his own semi-dry brickmaking machine, which he exhibited in 1884, and for which he sought a local patent the following year.⁸⁹ In 1871 Goodsell & Tye began making 'shale plastic' bricks at Newtown, Sydney, using a machine 'embodying a circular revolving table'⁹⁰ - again the Jones principle - and in 1879 John Kealman & Son opened a brickworks at Queanbeyan, using a Whittaker semi-plastic machine which produced four thousand bricks a day.⁹¹

There was probably a revival of more massive dry-pressing machinery with the establishment of the Hoffman works at Brunswick, Melbourne, in 1870, for the resultant bricks were very dense from the first. The works opened with a 25 horsepower [18 kW] steam engine, a grinding pan and a Bradley & Craven press, with John Craven junior himself in attendance. Other Bradley & Craven presses followed, though there were problems, such as when the company sent out a driving shaft lacking a centre bearing and block, until in about 1875 Hoffmans supplemented their Bradley & Cravens with Platt presses of a somewhat similar character.⁹² The Northcote Brick Company was similarly established with Bradley & Craven machinery which, as it advertised in its prospectus of 1882, had been selected by the architect Lloyd Tayler when on a visit to England in 1877.⁹³ The South Brunswick Company's works, opened in 1886 beside the Merri Creek, also had a Bradley & Craven machine.⁹⁴

In Sydney, similarly, steam driven machines were appearing in some works by 1870, typically costing \$4,000-\$5,000 and producing 15,000 bricks daily.⁹⁵ By 1883 Sands's directory listed twelve steam works out of a total of fifty-seven. Bradley &

⁸⁶ Ioannou, *Ceramics in South Australia*, p 123.

⁸⁷ Andrew Ure, *Dictionary of Arts, Manufactures and Mines* (London 1839), pp 188-9.

⁸⁸ Ioannou, *Ceramics in South Australia*, p 123.

⁸⁹ Ioannou, *Ceramics in South Australia*, p 124.

⁹⁰ Gemmell, *And So We Graft*, pp 67-8.

⁹¹ Gemmell, *And So We Graft*, p 83

⁹² Iain Stuart, 'The History and Archaeology of the Hoffman Brick and Tile Company, Melbourne, Australia', *Industrial Archaeology Review*, XVII, 2 (Spring 1995), pp 130-1.

⁹³ *Argus*, 22 February 1882, p 7.

⁹⁴ *Argus*, 8 March 1886, p 7; 31 August 1886, p 10m.

⁹⁵ Gemmell, *And So We Graft*, p 6, ref *Sydney Morning Herald*, 17 June 1870.

Craven semi-plastic and Platt dry presses were again popular, the Platt especially because it turned out four bricks at a time rather than two.⁹⁶ The machinery at the Hoffman works - as described at the end of the century - was re-pressing the bricks with great force after they had initially been formed on a revolving table⁹⁷ - again on the Edward Jones principle. A Bradley & Craven press answering this description was illustrated by Dobson, and could be used either with plastic or with dry clay.⁹⁸ Bradley & Craven received a first order of merit at the Centennial Exhibition in Melbourne, and their machinery was singled out by the jury for its compactness.⁹⁹

Although dry pressed bricks had great advantages in eliminating hacking, shortening burning time, and reducing distortion, their quality was not necessarily good, and a writer of the 1880s argued strongly that semi-plastic manufacture was to be preferred.¹⁰⁰ It was true that dry pressed bricks were not necessarily superior, and it was said that it was an accepted fact in the Colonial brick trade, 'that a slop business cannot contend with the machines as regards financial success, but as regards quality the slop brick is far superior, especially when properly pressed.'¹⁰¹ The machinery itself was not necessarily different, for some machines had the capacity to deal as required with plastic, semi-plastic or dry clay. In Brisbane the two main works differed, for in 1887 J Campbell & Sons were using the semi-plastic method, and Petrie's the plastic.¹⁰² At One Mile Creek, East Maitland, Fred Baker's yard is believed to have used semi-plastic machines from 1880, but introduced dry press machines in 1907.¹⁰³ At Goulburn Francis Gulson introduced dry pressing in 1913,¹⁰⁴ while at Bathurst no dry press bricks were made until 1921.¹⁰⁵

Substantial machines which could turn out bricks in large quantities were being made locally from 1881, when Machar and Teal were established at Abbotsford, Victoria,¹⁰⁶ but leading English brands continued to be imported, for example a Bradley & Craven machine for the South Brunswick works in 1886.¹⁰⁷ However one Bradley & Craven press at the Hoffman works was manufactured locally by the Langlands Foundry Company, presumably under licence.¹⁰⁸ The Northcote Brick Company, after two years obtained a second machine made by the Langlands Foundry,¹⁰⁹ and the Box Hill works had one Bradley & Craven machine and two from Langlands,¹¹⁰ though whether these were also of the Bradley & Craven pattern is unclear. In 1888 it was reported that several of Craven's machines, capable of

⁹⁶ Gemmell, *And So We Graft*, p 6.

⁹⁷ *Leader*, 4 March 1899, p 34.

⁹⁸ Dobson, *Bricks and Tiles* (1886, pp 227-8. A somewhat different Bradley & Craven machine, with sixteen radial recesses for bricks in the revolving wheel, is described and illustrated in Ward, *Brickmaking*, p 18 & pl 2, figs 13 & 14.

⁹⁹ Centennial International Exhibition 1888-1889, *Official Record* (Melbourne 1990), pp 835, 836. *Australasian Builder & Contractor's News*, 13 August 1887, p 219.

¹⁰⁰ *Australasian Builder & Contractor's News*, 13 August 1887, p 218.

¹⁰¹ *Australasian Builder & Contractor's News*, 22 October 1887, p 387.

¹⁰² Gemmell, *And So We Graft*, p 78.

¹⁰³ Gemmell, *And So We Graft*, p 82.

¹⁰⁴ Gemmell, *And So We Graft*, p 81.

¹⁰⁵ James Smith, *The Cyclopaedia of Victoria* (3 vols, Melbourne 1903, 18904, 1905), I, p 582.

¹⁰⁶ *Argus*, 8 March 1886, p 7.

¹⁰⁷ Stuart, 'Hoffman Brick and Tile Company', p 131.

¹⁰⁸ *Argus*, 23 August 1884, p 7.

¹⁰⁹ *Australasian Builder & Contractor's News*, 15 December 1888, p 541.

producing 10,000 bricks a day, were in use in the Australian colonies.¹¹¹ Similar machines were made by another local maker called Anderson, and continued to be produced by the Austral Otis Company when they took over the business in 1923.¹¹² In Queensland the engineers Clark & Fauset claimed to be the pioneers of steam brickmaking during the 1880s.¹¹³

The large brickyards commonly imported their machinery directly from leading British makers like Bradley & Craven. Other sources included T C Fawcett of the White House Engineering Works, Leeds, who were awarded a first order of merit at the Centennial Exhibition.¹¹⁴ Mason Brothers of Sydney maintained an active agency for Fawcett's equipment, and advertised that they had an expert from Fawcett's factory on hand to give information. The Fawcett range included plastic and semi-dry presses, Gill's patent brick and tile presses, wire-cut brick machines, and patent clay grinding pans.¹¹⁵ The same combination of a Fawcett machine - probably a semi-dry press - followed by a 'Gilles' (doubtless Gill) press, was used at the Blackwood or Eden Hills plant of the City and Suburban Brickmaking Company, Adelaide, in 1883.¹¹⁶

Platt Brothers of Oldham supplied a machine to the Standsure Brickworks at Marrickville, Sydney, and probably also their grinding pan, which had a diameter of 2.85 metres and was said to be the largest in the colony.¹¹⁷ Another presumably imported machine was the Davies's patent dry press which was proudly demonstrated by the director of the South Brunswick Brickworks, Melbourne, in 1889,¹¹⁸ whereas the Naylor & Williams patent semi-plastic machine, demonstrated later that year by Jaques & Co of Richmond,¹¹⁹ was probably made by them under licence. Somewhat out of the ordinary run of imported English machinery is an undated press in South Australia, bearing the brand of J Coombe & Sons of Kilkenny.¹²⁰

brick sizes

The relationship of Australian bricks to those of Britain, Europe and America, is generally illuminated by the question of size. The effect of the brick tax in Britain between 1784 and 1850, because it was levied by number of bricks, was to encourage an increase in size. This seems to have been the reason for examples of abnormally large bricks, some of which are close to what later became the standard Australian size. As brickmakers brought moulds with them it was inevitable that Australian sizes would at first reflect British ones. However the variation is considerable, and it is

¹¹¹ *Building, Engineering and Mining Journal*, 28 July 1888, quoted in Ian Evans, *Restoring Old Houses* (South Melbourne 1979), p 42.

¹¹² Stuart, 'Hoffman Brick and Tile Company', p 140.

¹¹³ Donald Watson & Judith Mackay, *Queensland Architects of the 19th Century* (Brisbane 1994), p 36.

¹¹⁴ Centennial International Exhibition, *Official Record*, p 836.

¹¹⁵ Charles Mayes, *The Australian Builders' Price-Book* (5th ed, Melbourne 1886), advertisements, p xxxvi.

¹¹⁶ Ioannou, *Ceramics in South Australia*, p 124.

¹¹⁷ *Australasian Builder & Contractor's News*, 9 July 1887, p 141.

¹¹⁸ *Australasian Builder & Contractor's News*, 24 August 1889, p 172.

¹¹⁹ *Australasian Builder & Contractor's News*, 28 September 1889, p 300.

¹²⁰ Inspected 1990 (?at the former James & Co brickworks, Woodville).

perhaps only towards 1860 that bricks approaching the modern Australian size take a significant share of the market. Some of the smaller bricks may be due to the use of imported American machinery as in the case of Boyle, Boag, Harris and Smith's machine at the Phoenix works. Basically, however, it seems that the standard Australian size, 9 x 4 1/2 x 3 inches, though today larger than the typical English brick, is that which Dobson describes in 1850 as the 'usual form' in England,¹²¹ possibly referring to London and its neighbourhood in particular. There is no reason to look any further for its origin.

The following table clarifies the range of sizes overseas and in Australia:¹²²

brick type	l in	w in	d in	l mm	w mm	d mm	vol cm ³
American bricks							
Am common [Scott]	7 1/2	3 3/4	2 1/2	190.5	95.3	63.5	1153
East US comm [Radford]	7 3/4	3 3/4	2 1/2	196.9	95.3	63.5	1191
West US comm [Radford]	8 1/2	4 1/8	2 1/2	215.9	104.8	63.5	1438
US stand bldg [Radford]	8 1/2	4	2 1/2	215.9	101.6	63.5	1393
US stand prssd [Radford]	8 3/8	4	2 3/8	212.7	101.6	60.3	1303
French bricks							
[Ure, <i>Dictionary</i>]	9	4 1/2	2 1/4	228.6	114.3	57.1	1492
[<i>Penny Cyclopaedia</i>]	8	4	2	203.2	101.6	50.1	1034
[Chabat, <i>Dictionnaire</i>]	8 2/3	4 1/3	2 1/6	220.1	110.1	55.0	1332
English bricks							
statute 1736 [Papworth]	9	4 1/2	2 1/4	228.6	114.3	57.1	1491
C18th stock [Papworth]	9	4 1/2	2 1/4	228.6	114.3	57.1	1491
Act, 17 Geo III [Gwilt]	8 1/2	4	2 1/2	215.9	101.6	63.5	1393
early C19th [Dobson]	9	4 1/2	2 1/2	228.6	114.3	63.5	1659
1850 London [Dobson]	9	4 1/2	3	228.6	114.3	76.2	1991
lrgst Nottingham [Dobs]	9 1/2	4 5/8	3 1/8	241.3	117.5	79.4	2251
1936 N England [Scott]	8 3/4	4 3/16	2 7/8	222.3	106.4	73.0	1727
1936 S England [Scott]	8 3/4	4 3/16	2 5/8	222.3	106.4	66.7	1578
Australian: Old Government House, Parramatta [Freeland]							
1790	9 1/4	4 1/2	2 3/4	235.0	114.3	69.9	1878
Hunter's 1800	8 7/8	4	2 3/8	225.4	101.6	60.3	1381
1815 Macquarie addns	8 3/4	4 1/2	2 1/2	222.3	114.3	63.5	1613
Other Australian							

¹²¹ Dobson, *Bricks and Tiles* (1850), p 33.

¹²² Pierre Chabat, *Dictionnaire des Termes Employés dans la Construction* (2 vols, Paris 1875 & 1878), I, sv 'Brique'; Dobson, *Manufacture of Bricks and Tiles*; Freeland, *Architecture in Australia*; John Gwilt [revised Wyatt Papworth], *An Encyclopaedia of Architecture* (London 1888 [1842]); Mayes, *Australian Builders' Price-Book* (1862); Wyatt Papworth [ed], *The Dictionary of Architecture* (London 1853-1892), svv 'Brick, Size of'; 'Stock Brick'; *Penny Cyclopaedia*, XII, 722 (8 July 1843), p 263; J S Scott, *A Dictionary of Building* (Harmondsworth [Middlesex] 1964), sv Brick; James Steele, *The Early Days of Windsor New South Wales* (Sydney 1910), as quoted by Gemmill, *And So We Graft*, p 71; Ure, *Dictionary*, sv 'Brick'. Early English bricks range from 10 x 4 1/2 x 2 1/2 [254.0 x 114.3 x 63.5] at Eastbury House, Essex, of the 1560s, down to 8 x 4 x 2 [203.2 x 101.6 x 50.1] at Ince Court, Cornwall, of the early seventeenth century: Malcolm Airs, *The Tudor & Jacobean Country House: a Building History* (Godalming [Surrey] 1998), p 116.

Greenway's [Freeland]	8 ³ / ₄	4 ¹ / ₂	2 ¹ / ₂	222.3	114.3	63.5	1613
Cstlmne (Poeppel) 1859	9 ¹ / ₄	4 ³ / ₈	3	235.0	111.4	76.2	1995
Brunswick patent 1862	9 ¹ / ₄	4 ¹ / ₂	2 ³ / ₄	235.0	114.3	69.9	1878
Phillipstown 1862	8 ⁵ / ₈	4 ¹ / ₈ *	2 ⁵ / ₈	219.1	104.8	66.7	1532
Modern Aust standard	9	4 ¹ / ₂	3	228.6	114.3	76.2	1991

* Phillipstown bricks are listed by Mayes 1¹/₈" wide, but this must be a misprint