9.05 Sanitation

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the pit closet

The normal means of sanitation for any reasonably permanent dwelling was at first a pit, usually with a privy building which could be moved when it was filled and a new pit was required, and sometimes built on skids so as to provide for this eventuality.[1] The first documentary reference to a pit closet seems to be that of W N Chapman in 1795 to the 'temple' as he called it, some way detached from his house on Norfolk Island.[2] Later, and in urban situations, there might be a fixed closet connected to a properly built cesspit which would be regularly emptied. The excavations of the first Government House at Sydney have revealed something between the two: a single circular pit belonging to an early, if not the original privy, in a northern outbuilding. It is cut through natural sand and weathered bedrock, with the upper part formed in brick bonded with sand and charcoal, and the absence of lime is said to indicate an early date. However, given that charcoal is not a bonding agent, it must have been intended as a filter to let the liquid effluent seep out of the pit, which is consistent with the fact that there was sand packed around the outside of the brickwork.[3] This was really a deliberately leaking cesspit, anticipating the illegally leaking cesspits which were to be such a major urban problem in the later nineteenth century.

In the nineteenth century common privies, not unlike Roman latrines, were quite acceptable for the lower orders. At the Kangaroo Point Immigration Depot near Brisbane the immigration barracks designed in 1848 had a privy building for men measuring 4.2 by 1.5 metres and one for women of 3.3 by 1.5, each built over a cesspit and containing a seat formed of a continuous board pierced with holes. Some of the holes, Jim Kerr speculates, were made smaller to prevent children from falling through.[4] For a new building designed at the depot by J J Clark in 1885 the privy accommodation was marginally more sophisticated. There were again two blocks, one for single men and married couples, and one for single women and married couples. In each there was a central passage, with the single accommodation backing

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1 Harry Hodge, *The Hill End Story* (3 vols, Sydney 1964), p 148, quoted in John Archer, *Building a Nation* (Sydney 1987), p 120.

2 Robert Irving, 'Georgian Australia' in Robert Irving [ed], *The History and Design of the Australian House* (Melbourne 1985), p 46, ref letter from William Neate Chapman to his brother, 20 November 1795, Mitchell Library.

3 Helen Proudfoot et al, *Australia's First Government House* (Sydney 1991), p 51.

4 J S Kerr, *Yungaba Immigration Depot* (Brisbane 1992), pp 4-5.

onto one side and the married onto the other, and, as is suggested by the passage, there must have been some sort of pan system rather than a cesspit. In each block the single accommodation was a continuous bench containing eight orifices, possibly separated by a partial division above the bench. The married accommodation consisted of five cubicles, each containing a full-size hole and a small one next to it, presumably so that an adult and child could use them simultaneously.[5] It cannot necessarily be inferred from this that multi-orifice privies of later dates were intended for simultaneous use by more than one person.

There is little of mystery about the pit and the portable privy, which are still to be found occasionally, but there is a rich lode of folklore. Legends concentrate particularly on the accommodation provided in the country dunny, which is designated appropriately a three-, four-, or five-holer. Often some of the accommodation is in the form of low seats with small orifices, clearly designed for children, as is also common elsewhere. Lucinda Lambton illustrates a number of British examples,[6] and in the United States the Bishop White house in Philadelphia has two privy chambers back-to-back: one contains two orifices in the bench and the other - perhaps for women and children - has a standard height bench with one orifice, and drops to a lower bench with a smaller one.

Whereas public conveniences were used in common - Lambton cites one at the Belfast Cattle Market in 1937, used by six farmers simultaneously[7] - it is unlikely that this was true of domestic privies. The American publication, *The Specialist*, by Chic Sale, of 1929, speaks of 'an average eight family three holer',[8] which suggests on the one hand more accommodation than could possibly be required under normal circumstances and, on the other, not enough for use by the whole family simultaneously. Given that he makes great play of the alleged modesty of the females about even being observed en route for the privy,[9] it is likely that they were never used simultaneously, but that one hole was designated solely for use by the children, and the other two were reserved for each parent, or alternatively for all adult males and all adult females respectively. *The Specialist* provoked an Australian response, *The Amateur*, which speaks of the drawback of the two-holer - that the children would be inside talking, two at a time, but as for adults 'it isn't as if couples could go together and hold hands friendly-like.'[10]

At Old Government House, Sydney, by the time that Mortimer Lewis drew it up in 1845, the chamber over the pit contained three seats,[11] but it is difficult to believe that the governor excreted in communal state *à la Louis XIV*. Similarly, Ian Jack reports a

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5 Kerr, *Yungaba Depot*, p 8.

6 A two seater at Haddon Hall, Derbyshire; the remains of an early seventeenth century five holer at Staindrop, Durham; a six seater at Chilthorne Dormer House, Somerset, which is no later than the mid-eighteenth century, and appears to have four adult and two child seats; and two examples in east Anglia, one with two seats and one with two adult and one child seat. Lucinda Lambton, *Temples of Convenience* (London 1978), plates 10, 11, 13, 17, 18.

7 Lambton, *Temples of Convenience*, plate 13.

8 Chic Sale, *The Specialist* (St Louis [Minnesota] 1936 [1929]), p 11.

9 Sale, *The Specialist*, p 16.

10 'Mrs E F Bosworick' [Edeen Finlay], *The Amateur* (Melbourne 1949), pp 10-12.

11 Proudfoot, *First Government House*, p 53.

seven-holer at 'Hobartville', Richmond, New South Wales, where the seats occupy three sides of the chamber. In the middle are two large high seats and one small one, and on either side two further small ones.[12] This gives us the clue that these spaces were not used communally, as is popularly imagined, but rather that each seat was assigned to a particular member of the family, no doubt so that that person would be responsible for its hygiene. Pit closets began to be superseded in the country by septic tanks during the twentieth century, and in more urban locations by pan services or, in due course, a reticulated sewerage system. In Sydney such a system was proposed by Francis Greenway,[13] though it did not eventuate until some time later.

the water closet

The water closet - that is, a privy with provision for waterborne removal of the waste - has a history of thousands of years, but for practical purposes it can be dated to Alexander Cumming's patent of 1775, just three years before European settlement in Australia.[14] The pan closet, requiring a D-trap and container, was the early form in England, but from about 1800 had begun to be superseded by Bramah's more hygienic valve closet apparatus,[15] as patented in 1788.[16] More primitive forms were to remain common for a long time yet in rural locations.[17] Surprisingly enough water closets seem to have been rarer in the United States, prior to 1840, than they were in Australia.[18]

Government House at Parramatta had a water closet in 1813,[19] and an inventory in 1821 refers to it, and to the existence of a cistern.[20] But otherwise explicit references to water closets in Australia seem to begin in the 1830s, and most of these would probably have been linked to cesspits.[21] In 1833 Frederick Peterson, a Sydney painter, plumber and glazier, illustrated in his advertisement both the pan closet and the valve closet.[22] Whereas the house 'Lyndhurst' at Glebe had no indoor

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12 R I Jack, *Exploring the Hawkesbury* (2nd ed, Kenthurst [NSW] 1990 [1986]), p 157.

13 Peter Bridges, *Foundations of Identity* (Sydney 1995), p 66.

14 Roy Palmer, *The Water Closet* (Wellington 1973 [1972]), pp 31, 36-8.

15 Wyatt Papworth [ed], *Dictionary of Architecture* (London 1848-1892), sv Water Closet. For good illustrations and explanations see W P Buchan, *Plumbing* (London 1899), pp 102-113, and John Gwilt [revised Wyatt Papworth], *An Encyclopaedia of Architecture* (London 1888), pp 686-690. For a modern account see Roy Palmer, *The Water Closet* (Wellington 1973 [1972]), pp 32-45.

16 C D Elliott, *Technics and Architecture* (Cambridge [Massachusetts]), p 219.

17 See Loudon's illustrations: J C Loudon, *An Encyclopaedia of Cottage, Farm and Villa Architecture* (London 1846 [1833]) [§ 464], p 233; [§490], p 243.

18 A circular email from David Cornelius, in the United States, of 5 November 1997, indicates that apart from buildings by John Haviland (his subject of research), he is aware of only four others, beginning with the Walnut Street Penitentiary House of 1795.

19 Terence Lane & Jessie Serle, *Australians at Home* (Melbourne 1990), p 263, citing Helen Proudfoot, *Old Government House* (Sydney 1971), p 28.

20 Bigge Report Appendix vol 130, endorsed 21 March 1821.

21 For a typical arrangement see Loudon, *Cottage, Farm and Villa Architecture*,[§38] pp 18-18.

22 Frederick Peterson's advertisement in the *New South Wales Calendar and Directory ... 1833*, reproduced in Barrie Dyster, *Servant & Master* (Kensington, NSW, 1989), p x.

plumbing,[23] 'Lindesay' had two water closets, to which the water was pumped.[24] There was provision for two water closets at 'Camden Park' in 1835,[25] and 'Aberglasslyn' at Maitland was exceptionally well equipped, for 1842, with both an upstairs and a downstairs bathroom with what has been referred to as 'a septic service'.[26]

'Yarra Cottage' in Melbourne, designed by Robert Russell in 1839, may have been one of the exceptions, for the water closet shown on the plan may have had a pipe or tunnel leading to the Yarra,[27] as did the Melbourne Club in the 1850s, from as far away as Collins Street. One may surmise that a tunnel which led to the beach from C H Ebden's 'Black Rock House' at Sandringham, Victoria, of 1856, served a similar purpose, notwithstanding the more romantic stories of smugglers and convicts with which it is associated. In the country such things were managed in a more rudimentary way. Andrew Learmonth wrote to his brother Tom in 1859 about their proposed homestead:

> *Water closet* without proper plumbers apparatus, you will find difficulty making this indoors. So you can either build it or not as you like. John had one at [...] Park which could not be used. I would advise you closing with creeper and covered passage to the present one, but if you must have one I can suggest no other plan than having a brick channel under the seat leading with great slope to a pit in the garden which channel should be sluiced with water every day. make it 6 inches wide and 9 deep - and have a wide tin pipe passing far under the seat to the roof to carry off gasses.[28]

At 'Martindale Hall' in South Australia, of 1878-80, there were water closets the sewage from which was piped away a distance of 1.5 kilometres.[29]

There were also portable water closets, such as the 'Patent Portable Water Closets on Wigs and Hawkin's Principle' advertised in 1839 as suitable for emigrants to South Australia,[30] presumably in reference to the self-acting portable water closet which had been patented some years earlier by William Hawkins or S Hawkins of London.[31] There was a portable water closet at Hannibal Macarthur's 'The Vineyard' in 1848,[32]

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23 Barrie Dyster, *Servant & Master* (Kensington, NSW, 1989), p 106.

24 *Australian,* 24 June 1841, cited in Barrie Dyster, *Servant & Master* (Kensington [NSW] 1989), p 106.

25 Terence Lane & Jessie Serle, *Australians at Home* (Melbourne 1990), p 263.

26 C J Mitchell, *Hunter's River* (Sydney 1973), p 9.

27 Plan in the University of Melbourne Archives, reproduced in Miles Lewis, 'The Victorian House', in Robert Irving [ed], *The History and Design of the Australian House* (Melbourne 1985), p 66.

28 Specification notes accompanying Andrew Learmonth to Tom Learmonth, 8 April 18579 Learmonth Papers, State Library of Victoria, quoted by Hanut Dodd in Australian Architecture B, Melbourne University, 1995.

29 Elizabeth Warburton, *Martindale Hall* (Adelaide 1979), p 80.

30 Henry Capper, *Capper's South Australia* (3rd ed, London 1839 [1837]), advertisements p 10.

31 According to John Pudney, *The Smallest Room* (London 1954), p 76, S Hawkins, of 167 Fleet Street, advertised it in Pigot & Co's *Commercial Directory of London* for 1826-7. According to Lawrence Wright, *Clean and Decent* (London 1960), p 104, William Hawkins of Fleet Street in 1824 advertised a newly invented self-acting portable water closet.

32 Terence Lane & Jessie Serle, *Australians at Home* (Melbourne 1990), p 263

and a model was being advertised in 1859 by the Melbourne coppersmith and plumber William Robison.[33] When the contents of the brig *Gazelle* were sold at Geelong in January 1854, they included two water closets, which must have been for use on the voyage out.[34]

Both valve and pan closets were on sale in Melbourne in 1842.[35] One emigrant from England in 1853 wrote a memorandum in his journal, of what seems to be the valve closet that he brought with him:

> J.C. Stokes - Improved W. Closets. London Agent (sole) W. Patten. No.22 Old Fish Street, Drs. Coms. - apparatus complete - for cash
>
> Brass Sunk Handle Stoneware Trap + basin glazed white inside Round Valve Cranks Lever + wire complete for £1.10- suitable for Private + Private (sic) Blgs Public Instns. Offices Ships and Exportn.[36]

Two more advanced closets had been developed in Britain. One was the 'washout' closet, which had a shallow bowl retaining a few centimetres of water, and an outlet at the back, but which tended to have an insufficient flow of water to clean it out properly. The other was the 'washdown' closet which had an S-trap high enough to ensure that a reasonable depth of water remained in the bowl.[37] In Melbourne in 1859 John Hood argued that every dwelling should have a proper closet, by which he did not mean

> the antique combination of pulleys, levers, and valves, so dear to plumbers and their customers, but the common syphon trap, stoneware pan, and bason, which at this time can be purchased in London for 7s.6d., and is insisted upon by authorities acting under the Board of Health throughout England[38]

Hood would seem to be arguing against the pan closet and in favour of closets such as were now being made in stoneware by Doulton and Co,[39] possibly of the washout type.

However, water closets could not make a major impact in urban areas until the development of reticulated sewerage systems, beginning late in the nineteenth century. One exception was the Fremantle Gaol, which had its own sewerage system, and had water closets installed by 1856, one to each of the associated wards, supplied

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33 C B Mayes, *The Victorian Contractors' and Builders' Price-Book* (Melbourne 1859), p D.

34 Dorothy Anderson, *The Tradesmen of Gazelle* (South Yarra [Victoria] 2000), p 104.

35 *Port Phillip Patriot*, 18 August 1842.

36 Journal of Samuel Vaughan, manuscript, La Trobe Collection, State Library of Victoria.

37 Elliott, *Technics and Architecture*, p 221.

38 John Hood, 'Suggestions for a System of Drainage for Melbourne', article V in *Transactions* of the Philosophical Institute of Victoria, II, part I (January-August 1859), p 54.

39 Doulton and Co advertised enamelled stoneware registered closet pans, with syphon, or with both syphon and patent valve. C B Mayes, *The Australian Builders' Price-Book* (Melbourne 1862), p 95. The 'siphonic closet' as such, which had the outlet at the front, was invented only in 1870: see Roy Palmer, *The Water Closet* (Wellington 1973 [1972]), pp 43, 51. The washout closet is the only standard type that incorporates a syphon trap and no valve, though Palmer is unable to date its invention.

with water from a cistern on the roof of the main prison.[40] Because the sewerage system relied upon the wood stave pipes referred to above, which leaked, earth closets were installed in 1868. In 1874 it was reported that there were fourteen remaining water closets which discharged into cesspits in the garden, and it was determined that all should be replaced with earth closets.[41] In France valve closets, very like those advertised in Melbourne in 1860, were still on sale at the beginning of the twentieth century, together with simple pans, and the floor closets characteristic of that country.[42]

In Sydney Alfred Lance had apparently developed by 1870 a 'self acting closet cistern':

> Designed to obviate the waste of water in ordinary closets, the cistern only containing enough water for once using; and as the water is being used the further supply is discontinued until the outlet pipe is again stopped.[43]

Towards the end of the century Clark's patent automatic latrines were installed in about seventy public schools in New South Wales, at the Darlinghurst Gaol and the Woolloomooloo and Newcastle lock-ups, and elsewhere, all under the direction of the local agent, Robert Lee. It was in the form of a trough, which could be adjusted to any desired length, and fitted with any desired number of seats.[44] Another technical innovation - though it is not clear what it did - would seem to be the 'self-acting closet with gas attachment' exhibited in 1888 by G M Henderson of South Yarra, Melbourne.[45]

the cesspit

The cesspit, used more commonly in more urban areas or grander establishments, would be brick or stone lined, and could be emptied and re-used. Major Mitchell is particularly informative on the design of privies and cesspools, though there is reason to suppose that his comments derive from English sources rather than bear any specific relation to colonial practice. He says, writing in about 1828:

> If the privy adjoin any other building, the walls of the cesspool ought to be hollow or double, and either puddled or lined with Roman cement to make it watertight. When a drain is required it should have a trap; from the underside of the seat, a trunk or flue should be constructed to carry off, above the roof, any smell that may arise -; if, however, the cesspool is airtight, so that no air may be

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40 References supplied by Michal Bosworth from the data base on Fremantle Gaol. Royal Engineers Half Yearly Report of Public Works, 1 July - 31 December 1856, *British Parliamentary Papers.*

41 References supplied by Michal Bosworth from the data base on Fremantle Gaol. BL ACC1156 C9 (Clerk of Works Letterbook, 1871-1874), PD 332: Broomhall, 27 June 1874.

42 Comptoire de l'Industrie, L Laurent & Carrée, *Tarif des Fournitures Générales pour l'Industrie* (no date [c 1890]), brochure bound in, *Tarif No.3, Extrait du Tarif des Fontes des Bâtiments.*

43 *The Industrial Progress of New South Wales* (Sydney 1871), p 45.

44 *Australasian Builder and Contractor's News,* 8 October 1892, p 187.

45 Centennial International Exhibition 1888-1889, *Official Record* (Melbourne 1890), p 894.

> admitted below the seat, whh. always ought to have a cover, the air would then be stagnant and the smell not likely to ascend.[46]

The implication is that if a cesspit is not too close to a building the sides need not be waterproofed and the contents may be allowed to seep out - thus in the early years of each settlement the cesspits tended to be distant from the buildings and of fairly rudimentary construction. In Adelaide the new Bank of South Australia in 1841 was provided with a cesspit twelve metres from the building.[47] At the Presbyterian schoolhouse in Melbourne, of 1839, the pit was specified to be three feet by six, and six feet deep [0.9 x 1.8 x 1.8 m], but nothing specific was said about its construction.[48] By contrast, James Blackburn's specification for the Melbourne Town Hall in 1850 provides for a circular 'cesspool' of 1.25 metres diameter and 1.8 metres deep, steined with two thicknesses of brick and resting on bluestone footings.[49]

The problem of overflowing cesspits was most acute in Melbourne, or at least it was most sharply highlighted there by the sudden increase in population at the time of the gold rushes. Clement Hodgkinson spoke in 1852 of a considerable area in the block between Swanston, Bourke, Elizabeth and Little Bourke Streets as occupied 'by a green putrid and semi-liquid mass, partly formed by the outpourings of surrounding privies'. In the blocks to the north and south 'the very passages and rights-of-way are similarly saturated.'[50] In 1854 the council offered a £50 prize for the best system of refuse disposal, apparently to include sewage, and this was won by the engineer A K Smith. Smith stressed the need to have all cesspits lined with brickwork and cemented inside, not only to so as to prevent the contents seeping out, but so as to prevent groundwater coming in and making the nightsoil more difficult to process. In view of the scarcity of cement he suggested that slate tanks might be used as an alternative. Smith further proposed that the nightsoil should be removed by what he called a 'cess-pit and tank cleaner', and this represents the first local proposal for a pneumatic system, as discussed below.

It appears, from correspondence to the University of Melbourne from their architects Reed & Barnes in 1878, that these defects were not appreciated, and that even Major Mitchell's principles had not yet been understood at the university. There were two cesspits which had been condemned by the local Board of Health. The architects

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46 Sir Thomas L Mitchell Memoranda Book, 1827-1829, Mitchell Library manuscript ML C38. microfilm reel CY 1992.

47 E & R Jensen, Colonial *Architecture in South Australia* (Adelaide 1980), p 23, citing *South Australian Register,* 23 January 1841, 30 January 1841, 1 May 1841, and *South Australian Gazette*, 30 January 1841, 1 May 1841.

48 [Joseph Burns], 'Specification of sundry works required to erect and complete a School-house, in connection wth the Presbyterian Church, Melbourne, according to the accompanying plans' in Michael Cannon [ed], *Historical Records of Victoria,* III (Melbourne 1984), p 516.

49 James Blackburn's specification for Melbourne Town Hall, 1850, copy kindly supplied by George Tibbits.

50 Victoria, *Votes and Proceedings of the Legislative Council, 1852-3,* II, 'Report from the Select Committee on the Sewerage of and Supply of Water to Melbourne', Appendix F, p 71, Clement Hodgkinson to Chairman, 16 November 1852.

volunteered to have them domed over and made thoroughly watertight. When this was rejected they proposed to adopt 'the Pneumatic principal [*sic*], the same as in use at the Melbourne Hospital', though at the hospital, even with a resident engineer to attend to it, the system was frequently out of order. This proposal too was rejected, and the Board would under no circumstances allow a tank for night soil to be below ground level.

The architects then proposed an above-ground iron tank, and the Board did not positively forbid this, though they indicated that it would be closely watched by the inspector. It was to have an airtight cover which could be removed so that it could be emptied out in the manner of a cesspit, and this emptying would necessarily be frequent and expensive because of the amount of water which would enter. To minimise this problem bathwater would be diverted elsewhere, and the four closets which were to drain into it would be adjusted to use less water. These four must have been those of the professors' houses, where a water closet may have been demanded for reasons of status and convenience, for, as will appear, the architects also recommended that a number of other existing privies be replaced with earth closets.[51] By 1884 Professor Nansen was complaining of smells from his closet, and the architects, now Reed, Henderson & Smart, were called upon to deal with the problem. The iron tank, they concluded, was exposed to the afternoon sun, and gas was generated as a result. This gas was kept from the house only by the trap of the closet itself and (because the tank was airtight) often built up enough pressure to force its way through. It was therefore recommended that a Reynolds or similar ventilating trap be fitted to the soil pipe which led to the cesspool, with a ventilating pipe carried up to eaves height.[52]

In fact the problem should never have arisen in the first place, for the need to ventilate soil pipes and drains was generally well understood. S S Hellyer, for example, had stated clearly in 1877 that 'All soil-pipes should be properly ventilated by a pipe, whose size, while varying with circumstances, should in no case be less than 2 in. internal diameter.'[53] 'The drain to every house', according to Hellyer, 'should have *two ventilating-pipes at least,* one at the lowest, and the other at the highest point, or as near these points as possible, so that a constant current of air may pass throughout the drain to keep it wholesome.'[54] Thus good practice called for three vents between the closet and the tank, whereas Reed & Barnes, perhaps befuddled by the concept of a pneumatically sealed cess tank, had provided none at all.

In more sparsely settled parts of Australia the cesspit might be deliberately designed so as to overflow, and not unreasonably so. The drawings for 'Titanga' homestead in Victoria, by the architects Davidson & Henderson in 1870, show a well-considered arrangement of a cesspool and a filter pit. The sewerage enters the cesspool from just above the water line, and there is ample depth for solids to settle to the bottom, which

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51 Reed & Barnes to the Vice Chancellor, Melbourne University, 10 June 1878, Central Registry file 1878/32, office no 566.

52 Reed, Henderson & Smart to the Council, Melbourne University, 8 April 1884, Central Registry file 1884/28 part 1, office no 492.

53 S S Hellyer, *The Plumber and Sanitary Houses* (London 1877), p 55.

54 Hellyer, *The Plumber and Sanitary Houses*, p 67.

is sloped to one end, doubtless so as to collect the matter together and facilitate cleaning. An outlet, a little lower than the inlet, gives onto a pipe which sloped down to enter the bottom of the filter pit. The liquid then has to rise through the filter - the precise nature of which is unclear - to reach an outlet which discharges below ground level.[55] As both pits were covered, they may well have functioned almost as a septic tank. At 'Boisdale', Victoria (though the drawings regrettably do not survive) a cesspit measuring 450 x 450 x 450 mm was called for, built of brick and 'clear rendered inside in Cement', including a housed grating of galvanised iron. This can hardly have served as more than a sump within the more general disposal system, which is known to have included interceptor traps.[56]

nightcarts

The cesspit as generally superseded by the nightcart system, in which the seat was above a pan which could be removed by way of a hatch in the wall, and emptied by the nightman - so-called because his activities were usually nocturnal. An improvement was the two-pan system, in which the pan was taken away to be washed, and a clean pan substituted. The contractors commonly took the nightsoil to market garden land, where it was spread as fertiliser, but it was notorious that when time was short they might tip it off a convenient bridge or dispose of it in some other illegal and antisocial way. This problem was ameliorated by the establishment of depots at central locations to receive the material. In Melbourne the 'Manure Depot' in Royal Park dried and treated nightsoil, and in Sydney the New South Wales Poudrette and Ammonia Manufacturing Company took contracts for the removal and deodorisation of nightsoil.[57]

sewers and drains

The larger Australian towns all suffered to a greater or lesser extent from inadequate sanitation, and most made a number of false starts before remedying the situation. In Sydney there drains and sewers were constructed on a largely ad hoc basis, but this did not save the Tank Stream, the original source of water and focus of settlement, from becoming by 1850 little more than an open sewer.[58] City Council had been in existence from 1842 but had failed to deal with the drainage of the city, and the government therefore dissolved it in 1853, appointed three commissioners in its stead, and authorised them to borrow money and to commence a sewerage scheme. Five outfall sewers were quickly constructed, discharging into the harbour at Blackwattle Bay, Darling Harbour, Sydney Cove, Bennelong Point and Woolloomooloo Bay. But the sewers also carried stormwater and surface drainage, they were generally laid at too shallow a depth to drain basements, and of course direct discharge into the

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55 Davidson & Henderson, contract drawings of a house for A Buchanan ['Titanga'], October 1870, in the possession of Chris and Val Laing at the property.

56 Guyon Purchas, 'Estimate for New Residence and Stabling Boisdale Estate near Maffra Gippsland for A.M. Foster Esqre' (Melbourne 1892) [held at the property], p 5.

57 *Australasian Builder & Contractor's News*, 18 June 1887, p 87.

58 W V Aird, *The Water Supply, Sewerage and Drainage of Sydney* (Sydney 1961), pp 1-4.

harbour was not a satisfactory long-term solution. It was only when the new Board of Water Supply and Sewerage took over in 1890 that these defects began to be systematically remedied.[59] In Melbourne also there were some publicly built drains, but there were nevertheless severe sanitary problems which resulted in the appointment of a Board of Commissioners of Sewerage and Water Supply in 1853.[60] The water supply was established within a few years, but it was to be almost four decades before a sewerage system was constructed. In Adelaide there was call in 1856 for a system of pipes to take the sewerage to 'disinfecting tanks' in the adjoining parkland, but the scheme did not proceed.[61]

The Adelaide sewerage proposal of 1856 would have required 61,300 metres of glazed pipes, a potential demand which stimulated local potters. Trewenack's pottery at Magill, supervised by Alfred Cornwall, began making glazed stoneware pipes in eight and ten inch [200 & 250 mm] diameters.[62] However Cornwell himself soon left the pottery and in 1859 established his Brunswick Potteries near Melbourne.[63] Trewenack proceeded with the drainpipe business, though a report in 1857 stated that the inside of a his pipe was 'left in a rather rough condition'. In the later 1850s he bought a manually operated machine consisting of a vertical iron cylinder with interchangeable bases containing apertures for the extrusion of pipes of various diameters. The emerging pipe was cut off at the required length, usually two feet [600 mm], and the socket was then formed manually on a potter's wheel.[64] This was probably a Clayton's Tile, Brick and Pipe-Making Machine, made by Henry Clayton of the Atlas Works, Dorset Square, London. It had been shown at the Great Exhibition in 1851, and appears to have conformed to this description, with the addition that there were two cylinders, so that one could be recharged while the other was in use.[65]

Henry A Cawkwell of Gardiner [Malvern] had migrated to Victoria in 1853 and began manufacturing agricultural and garden pipes in the following year.[66] In the years 1858 to 1861 the official statistics show Victoria as having between one and four drainpipe and tile factories. William Marshall's important pottery for tiles and pipes was established in Power St, Richmond, in about 1858.[67] In 1859 A Cheale was advertising stoneware drainpipes, bends and junctions, from two to eighteen inches

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59 F J J Henry, *The Water Supply and Sewerage of Sydney* (Sydney 1939), pp 156-8.

60 *Australian Home Builder,* 15 June 1925, p 10.

61 Noris Ioannou, *Ceramics in South Australia 1836-1986: from Folk to Studio Pottery* (Netley [South Australia] 1986), p 60.

62 *Australian Builder,* 32 (9 October 1856), p 264, quoting the *South Australian Register;* Ioannou, *Ceramics in South Australia,* p 60, quoting the *Observer,* 20 September 1856.

63 Ioannou, *Ceramics in South Australia,* p 60, has him exploring the Murray for about four years, then settling in Victoria, and dates the Brunswick Potteries to about 1859. This sequence is incorrect. Alexander Sutherland [ed], *Victoria and its Metropolis Past and Present* (2 vols, Melbourne 1888), II, p 633, has him arriving in South Australia in 1853 and exploring the Murray for four years (which would take in his time with Trewenack), reaching Victoria in 1857, being employed on a building contract, and starting at Brunswick in about 1860.

64 Ioannou, *Ceramics in South Australia,* pp 60-61.

65 *Illustrated Exhibitor,* no 19 (11 October 1851), p 350.

66 Sutherland, *Victoria and its Metropolis,* II, p 596.

67 Donald McLeod, *Melbourne Factories* (Melbourne 1868), p 53.

[50-450 mm] diameter[68] at prices less than imported products[69] Guthrie & McColl of Bendigo were producing pipes by 1859.[70] One Smith of Footscray, probably A K Smith, made what was said to be a very superior drainpipe, equal to any imported, though slightly dearer than the English equivalent.[71] At the 1861 exhibition glazed drainpipes of a good quality were shown by Michael Emery of Preston,[72] and others by Cawkwell, Thomas Kelly of Brunswick, and William Gray of Phillipstown.[73] At Castlemaine Hirschi & Lenni were making drainpipes as early as 1858.[74] . Subsequently Luke Nolan, of the Gillbrook Pottery in the Melbourne suburb of Brunswick, showed drainpipes at the 1875 Exhibition.[75]

The South Australian emigré Alfred Cornwell, enjoyed considerable success from about 1860 at his Brunswick Pottery and Brick Works, where he initially employed four hands.[76] In 1862 he was refused a patent for an invention designed to eliminate the line of weakness in hollow extruded objects, caused by the bridge required to hold the centre of the die in place,[77] and in 1863 he was refused another for a machine which forced the clay through the dies by means of an Archimidean screw.[78] However he won medals for his glazed earthenware at the Dublin Exhibition of 1865,[79] and at a number of colonial exhibitions subsequently.[80] In 1876 he opened a branch in Tasmania, which also made drainpipes and other clay products.[81]

The Melbourne agency of Doulton and Co, of England, imported from the parent company[82]

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68 *Australian Builder,* 18 June 1859, p 152.

69 *Australian Builder,* 23 July 1859, p 225.

70 *Australian Builder*, 22 January 1859, p 24, quoting the *Bendigo Mercury.*

71 *Australian Builder,* 10 December 1859, p 391.

72 Victorian Exhibition 1861, *Catalogue with Prefatory Essays* (Melbourne 1861), p 190. Sizes &c for Emery's pipes are given in Mayes, *Australian Builders' Price-Book* (1862), p xxxv.

73 Victorian Exhibition 1861, *Catalogue*, pp 198, 223, 203. Mayes, *Australian Builders' Price-Book* (1862), p xxxv, gives details of the Phillipstown and the Brunswick products, presumably Gray's and Kelly's.

74 Victoria Industrial Society, *Catalogue of the Eighth Annual Exhibition* (Melbourne 1858), pp 9-10. Mayes, *Australian Builders' Price-Book* (1862), p xxxv, mentions J Hirschi.

75 Victorian Intercolonial Exhibition, Melbourne, 1875, *Official Catalogue of Exhibits* (Melbourne 1875), p 16.

76 Sutherland, *Victoria and its Metropolis*, II, p 633. For Cornwell's contribution to various exhibitions see Lewis, 'Victorian Building', III, pp 604-5.

77 No 573, not granted to Alfred Cornwell, 22 September 1862.

78 No 646, not granted to Alfred Cornwell, 14 August 1863.

79 Sutherland, *Victoria and its Metropolis*, II, p 633.

80 He showed assorted stoneware at 1866-7 exhibition; stoneware, terra cotta goods, earthenware pipes and other items at the Intercolonial Exhibition of 1875; a patent hydraulic stone for building purposes in 1880; and sanitary drainpipes and general pottery ware in 1888-9. Intercolonial Exhibition of Australasia, 1866-67, *Official Record* (Melbourne 1867), p23; Victorian Intercolonial Exhibition, Melbourne, 1875, *Official Catalogue of Exhibits* (Melbourne 1875), p 15; Melbourne International Exhibition, 1880, *Official Catalogue of the Exhibits* (2nd ed, 2 vols, Melbourne 1880), I, p 53; Centennial International Exhibition 1888-1889, *Official Record* (Melbourne 1890), p 607.

81 Ioannou, *Ceramics in South Australia,* p 60.

82 C B Mayes, *The Victorian Contractors' and Builders' Price-Book* (Melbourne 1859), p viii.

> stoneware drain pipes, water closet pans, square and angular urinals, glazed and unglazed paving tiles, 12 inches, terra cotta chimney tops ... the segmented block pipe (for large sized drain pipes).

The segmented block pipe was the subject of a Victorian patents in the name of James Doulton, described as being for stoneware and earthenware pipes constructed in segmental blocks.[83] These were of an ovoid cross-section and had originally been patented in England in 1847, though the shape itself was an even earlier invention, by Francis of Manchester.[84] By the 1920s Doultons no longer made the complete components of ovoid drainpipes, but instead supplied an extruded hollow tile with an invert arch on top, from off which an ovoid pipe could be built in brick. They also manufactured sections which could be built into the sides of the oval to facilitate the connection of tributary pipes.[85]

Around 1870 more advanced pipe extrusion machinery came into general use in Australia. In that year Goodlet & Smith of Sydney installed and had ready to operate 'a fine plant of drainpipe-making machinery upon the latest principle adopted in England'.[86] In South Australia by 1868 George & William Shearing's Hindmarsh Pottery had installed a machine said to be similar to Trewenack's,[87] though if so it was probably one of the later machines on the same principle.[88] Other machinery followed, including iron rollers and crushers to pulverise the clay, and a second extrusion machine. All this, however, was developed in an ad hoc way, so that the plant was still considered primitive compared with those in Victoria, where 'the machinery and appliances are so complete as to reduce labour by hand to a minimum.'[89] By 1868 Davis & Piercy's South Australian Pottery at Woodforde, near Magill, was also producing earthenware pipes on an extrusion machine capable of diameters from 1½ to 14 inches [38-355 mm].[90] However in 1880 this pottery, now in the hands of William Piercy, submitted sample drainpipes to the Government Engineer, and they failed the tests applied to them. The issue was again an Adelaide drainage system, and the rival makers, Shearing, Marks and Trewenack, were more successful.[91]

George Marks, who for twenty years had been making pipes at his Ballarat Pottery, Victoria, was able to satisfy the South Australian authorities of the quality of his work, and his Adelaide Pottery and Drainpipe Works soon became the largest pottery in the colony, and drove imported English pipes off the market. He invented his own horse-driven moulding press, but by 1884 used a steam operated moulding press which could turn out up to 1,500 four inch [100 mm] pipes a day, or smaller

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83 No 232 to James Doulton, 28 January 1864.

84 *Builder,* V, 24 (18 December 1847), p 607; VI, 258 (15 January 1848), p 28.

85 Doulton & Co. Ltd., *Drainage and Sewerage Appliances, &c* (Lambeth [London] 1926), pp 24.9-11.

86 *The Industrial Progress of New South Wales* (Sydney 1871), p 458.

87 Ioannou, *Ceramics in South Australia,* p 87, citing the *South Australian Advertiser,* 20 June 1868.

88 For example, that illustrated in Dobson, *Bricks and Tiles* (1886), p 206.

89 Ioannou, *Ceramics in South Australia,* p 87, citing the *Observer,* 19 July 1879.

90 Ioannou, *Ceramics in South Australia,* p 78.

91 Ioannou, *Ceramics in South Australia,* p 78.

quantities of sizes up to twelve inches [300 mm]. The larger sizes were produced with flanges, but the smaller ones had to be hand formed on a wheel.[92]

pneumatic systems

A K Smith's proposed 'cess-pit and tank cleaner' of 1854 was to be an airtight cart made of light boiler plate and angle iron, fitted with an air pump and a long suction pipe which could be inserted into a privy to suck out the contents. The cart would be emptied into an airtight lead-lined iron barge floating on the Yarra, and that would be taken into Port Phillip Bay to dump is contents or, in Smith's ideal scheme, to a treatment plant at a place such as Stony Creek.[93] This system was of course not put into effect any more than were those proposed in succeeding years by John Hood, Smith himself, and others,[94] but pneumatic systems were installed within some building complexes, notably the Melbourne Hospital.

The most influential pneumatic system of the nineteenth century was that of Captain Charles T Liernur, of the firm of Liernur, De Brugh, Kops & Co of Frankfurt, Germany.[95] The system was explained to English readers in the journal *Public Health* of 16 October and 2 November 1874. Liernur proposed to make the existing sewers impermeable, and restrict their contents to sullage and rainwater; to drain the soil with porous pipes, discharging into the sewers; to require manufacturers and others to purify their wastes before also discharging these into the sewers; and to set up a separate pneumatic system to deal with the sewage itself.[96]

The distinctive character of the pneumatic system was that it involved sucking out the sewerage to a central location at regular intervals, usually once every twenty-four hours, by means of air pumping engines. There would be a large tank beneath each building, linked by pipes or mains to a sub-tank or reservoir under the street, and in turn to the central plant. The system was devised to create equal barometrical resistance in all the branch pipes, and each main was fitted with a stopcock. The suction was maintained all day at the centre, and men walked the streets turning each stopcock in turn so as to evacuate each street reservoir and the individual tanks linked to it. The sewerage was not water-borne, which greatly simplified its subsequent treatment, and the dry closets were claimed to be inoffensive and free of smell. At the central tank a small amount of sulphuric acid was added, to prevent the loss of

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92 Ioannou, *Ceramics in South Australia,* p 162, citing South Australian Chamber of Manufactures, *15th Annual Repor*t (Adelaide 1884), p 14.

93 *Argus*, 17 July 1854, p 3.

94 John Hood, 'Suggestions for a System of Drainage for Melbourne', article V in *Transactions* of the Philosophical Institute of Victoria, II, part I (January-August 1859), pp 43-60; A K Smith, 'Surface and Underground Drainage of Melbourne', article XXXIX, in *Transactions and Proceedings* of the Royal Society of Victoria, 1861-4, IV (1865), pp 107-203; also 'On the Surface and Underground Drainage of Melbourne', article XXX in same, pp 122-3.

95 *Pneumatic Drainage: being Some Account of the Pneumatic System of Drainage invented by Captain Liernur* (Sydney 1884), p 1.

96 *Pneumatic Drainage*, p 2.

nitrogen during evaporation, and then the material was transferred to a drying apparatus and reduced to a powder, which was then sold as manure.[97]

Liernur's system was first adopted in central Amsterdam, at a date which is not clear, and then by a decision of November 1872 extended to the newer parts of the city. In 1871 it was adopted in Leyden, and it was subsequently used in Utrecht and in a number of smaller towns. It was also recommended for a number of larger European cities, though it is unclear whether was ultimately put into effect in any of these.[98] Within two decades the system was more or less obsolete. It was still regarded as successful in Holland, where wastes other than nightsoil were not treated, and about seven litres per closet was an appropriate allowance. But this was not acceptable in America and elsewhere, and there was no demand for the system.[99]

It seems that Liernur's system was condemned by the Local Government Board in London, in July 1876, because of its cost. On the strength of this it was also rejected by the Sewage and Health Board in Sydney,[100] but it re-entered the local debate when Sir James Martin wrote to the *Sydney Morning Herald*, apparently in about 1880, objecting to the official plan to discharge water-borne sewage into the sea at Bondi. Subsequently the New South Wales Sanitary Reform League was formed, largely through the efforts of Benjamin Backhouse, with Martin as President.[101] The honorary secretary, John Plummer, wrote to various overseas authorities for information and in response received a detail proposal from Liernur's company.[102] Liernur's company appointed a Sydney agent, Kirchner, through whom proposals were made for installing the system in Sydney or elsewhere, though nothing seems to have eventuated.

The Liernur system was one of those mentioned in 1888 as a possibility for Sydney, but not recommended by him,[103] and it does not seem that it was adopted - at least on any substantial scale - anywhere in New South Wales. However, as late as 1889 a pneumatic system was advocated for the town of Maryborough in Queensland by Victor Carandini, architect to the Eureka Sanitary Co, who must have been marketing it. At the Melbourne Hospital, according to Professor H B Allen in 1891:

> Vertical soil pipes receive the contents of closets in the various stories of the building. The closet pipes are not trapped. The soil pipe runs down into the ground, and after making a slight bend, which serves as an imperfect trap, it passes with very slight fall to an underground tank. A valve prevents the contents of the pipe from passing uninterruptedly to the tank. The excreta accumulate in the horizontal section of the pipe, giving off effluvia which are supposed to escape at the open top of the soil pipe above the roof, but which really pass largely into the closets. As we have seen, the closets either open directly into the wards ... or are imperfectly disconnected from them. At least

97 *Pneumatic Drainage*, pp 2-5.
98 *Pneumatic Drainage*, pp 5-11, 18.
99 G E Waring, *Sewerage and Land-Drainage* (New York 1889), p 227.
100 *Pneumatic Drainage*, p 16.
101 *Pneumatic Drainage*, pp 1, 16.
102 *Pneumatic Drainage*, p 1.
103 *Australasian Builder & Contractor's News*, 24 November 1888, p 463.

> once in twenty-four hours, the tank is exhausted, the valve is then raised, and the night-soil is sucked into the tank. It is very improbable that the exhaust can be so perfect as to thoroughly cleanse the walls of the soil pipe.

According to Allen the earth closet in the new infectious diseases block was infinitely preferable to this tank system.[104] Another system, the Shone, was occasionally mentioned in the Australian context[105] and like the Liernur was amongst those reviewed by Henson.[106] It was well established in the United States,[107] but was not adopted anywhere in Australia, and there is no need to consider it here.

cistern and pan design

It is easier to find descriptions of the lusher models of water closet than to establish their technical details, as at 'Martindale Hall', South Australia, for which George Jennings, of the Sanitary Depot, supplied:

> 1 trapless valve water closet, with eware sunk dish cut glass handle, white and gold eware basin, & with French polished mahogany seat, riser, skirtings, & moulded frame complete ... £10 less disc.; one ditto with blue eware basin & mahogany work as above ... £10; 1 ditto with blue eware basin ... etc. £7.15s; 1 ditto with white email basin, deal riser, seat, etc. £4.15s. ... white eware angular urinal, etc.[108]

Ernest Bramah's valve closet, and variants upon it, were in use in Australia in the early to mid-nineteenth century, but these were complicated and unhygienic. The outlet chamber did not fully flush, and the overflow became foul.[109] The washout closet was simpler in construction, and not liable to any sort of mechanical failure, but tended to get soiled near the overflow at the back, and had a trap in an inaccessible location below.[110] A patented wash-out closet was marketed by James Woodward of Swadlington, England, apparently from the 1870s, and was being advertised in Australia by 1883.[111]

The major advances of the late nineteenth century were the separation of the wc pan from the water supply, the development of the syphon closet in succession to the valve and washout types, and the design of the closet as a single piece of glazed ceramic ware known as a 'pedestal closet'. All were English developments, but they

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104 H B Allen, *Final General Report on Hospital Construction and Management* (Melbourne 1891), p 25.

105 *Australian Engineering and Building News,* 1 October 1881, p 62.

106 *Australasian Builder & Contractor's News,* 24 November 1888, p 463.

107 *'Sweet's' Indexed Catalogue of Building Construction* (1st ed, New York 1906), p 465.

108 Elizabeth Warburton, *Martindale Hall* (Adelaide 1979), p 141.

109 Waring, *Sewerage and Land-Drainage,* p 274.

110 Waring, *Sewerage and Land-Drainage,* p 274. Waring goes on, pp 275-7, to describe his own particular version, The Dececo, which was claimed to solve the various problems inherent in the other types.

111 Charles Mayes, *The Australian Builders' Price-Book* (4th ed, Melbourne 1883), p 190.

are not recorded in complete detail,[112] and the speed of their acceptance in Australia is even more problematic. In 1881 Bolding & Son displayed a range of closets at the Sanitary Exhibition, South Kensington, London, one of which was the invention of one Banner, and was made 'entirely out of white earthenware' and able to be dismantled for inspection and cleaning.[113] Twyford's 'Unitas' of 1885 is claimed to be the first pedestal closet, but Palmer has convincingly shown that the first pedestal washdown closet was that of Edward Humpherson.[114]

The 'wash down' differs from the 'wash out' closet, and the drain leaves the pan from the front, giving a slightly cumbersome appearance. S S Hellyer claimed to have invented and patented the idea, and claimed as advantages that it flushed better, and that the outlet was not normally visible.[115] George Jennings of London made wash out closets specifically for the Australian market, bearing the brand of his Melbourne agents, James McEwan & Co.[116]

J.McEWAN & CO. LTD.
AGENTS
G. JENNINGS
LONDON
MELBOURNE
RD NO 6300

The syphonic closet was regarded as a considerable improvement, and is associated most closely with the eponymous Thomas Crapper, who was not so much its inventor as its improver and promoter.[117]

The term 'water waste preventer' was used to describe the invention of George Jennings Junior of Lambeth, which involved an arrangement of discharge valves, and was shown at the Melbourne Exhibition of 1880-1 and published locally.[118] However Doulton & Co had a patent 'Vacuum' water waste preventer, which they showed at South Kensington, and which may or may not have been similar.[119] By 1883 Frederick Braby, of London and elsewhere, was advertising 'Water Waste Preventive and Supply Cisterns', with or without after flush, in the 'Croydon', 'Deptford' and 'Torquay' patterns, with no indication that these were patented or otherwise novel, in addition to his own patented 'Niagara' waste water preventer.[120] All were of galvanised iron. In 1894 T & W Farmiloe of London advertised a range of such devices - Lambert's waste preventing closet valve was suitable for fixing under the seat of a self-acting closet, so that when the user rose the valve would open, deliver the necessary flush of water, and then close. J Tylor's patent regulator closet valve

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112 Hellyer, *The Plumber and Sanitary Houses*, pp 134-6; W P Buchan, *Plumbing* (5th ed, London 1889 [1876]), pp 109-111, 291-301; Lawrence Wright, *Clean and Decent* (London 1960), p 205; Roy Palmer, *The Water Closet* (Wellington [New Zealand] 1973 [1972]), p 52.

113 *Australian Engineering and Building News*, 1 November 1881, p 69.

114 Palmer, *The Water Closet*, pp 50, 52, 55.

115 Hellyer, *The Plumber and Sanitary Houses*, pp 86-7.

116 An example survives at 'Carranballac', near Skipton, Victoria.

117 Wallace Reyburn, *Flushed with Pride* (London 1969), pp 13-14, 40.

118 *Australian Engineering and Building News*, 1 April 1881, p 190.

119 *Australian Engineering and Building News*, 1 November 1881, p 69.

120 F W Braby & Co, *F.W. Braby & Co. No. 9* (London 1883), pp 56-8, 131.

was similarly designed for installation beneath the seat. However Tylor also marketed patent 'Waste-Not' cistern valves, as did Lambert.[121]

Tylor also made a water waste preventer which was reported in Australia in 1889 and was something quite different - a 'hydrophone' or stethoscope-like instrument by means of which to listen to pipes and detect unwanted water flow.[122] This confusion makes it hard to determine the meaning of the phrase when it appears in Australian use, but it seems clear that it usually refers to an ordinary cistern or discharge valve. Mayes's price book of 1883 refers unequivocally to the '*w.c. cistern* (as adopted by the Sydney Corporation) of best gal. iron, water waste preventer, ball tap'.[123] This implies a different meaning, and by 1886 Mayes has it as 'copper ball tap *or* waste water preventer'.[124]

By now Mayes lists Doulton's stoneware closet pans in addition to the old Taylor's closet apparatus.[125] Tylor's took the step of opening their own branch in Sydney in 1889, as Doulton's earlier had in Melbourne, which helped them to improve their share of the Australian market. It was in Castlereagh street, and under the management of A Eastwood. Here they showed their 'Compound' closet, which was a single piece of glazed ware, claimed to serve as a closet, urinal and slop sink in one, entirely smooth and effectively flushable. The cistern recommended for it was their 'A.T.B. patent valveless, and waste preventing, fitted with their two gallon Syphon flush', and it is clear in this context that 'waste preventing' is not referring their earlier hydrophone. They stocked other models of closet, including at least one with the old Heath Robinson assemblage of exposed cranks and levers which was so notoriously difficult to keep clean.[126]

At the Australian Club in Melbourne, in the ladies lavatory, is a ceramic wc pan made in England specifically for the Australian market. It apparently dates from the extensions of 1891-3, and is branded:

JOHNSON BROS
(HANLEY) LTD
ENGLAND
[crest with lion and kangaroo, and motto 'ADVANCE AUSTRALIA']
THE ANTIPODEAN
RD. NO. 203814

The Scottish brand, Shanks, was become prominent in Australia in the early twentieth century, especially at the more utilitarian end of the market. Two outside lavatories at 'Mount Rothwell', Victoria, undated, contain interesting Shanks suites. The pans are branded

[upward arc:
SHANKS PATENT

121 T & W Farmiloe, *T. & W. Farmiloe's Miniature Catalogue* (London 1894), pp 151-6.
122 *Australasian Builder & Contractor's News*, 8 June 1889, p 532.
123 Charles Mayes, *The Australian Builders' Price-Book* (4th ed, Melbourne 1883), p 104.
124 Charles Mayes, *The Australian Builders' Price-Book* (5th ed, Melbourne 1886), p 119.
125 Charles Mayes, *The Australian Builders' Price-Book* (5th ed, Melbourne 1886), p 119.
126 *Australasian Builder & Contractor's News*, 8 June 1889, p 546.

]
UNUS
COMBINATION
[downward arc:
WASH DOWN
]

The cistern is a low-level type with a handle which one pulls forward, and is branded:

SHANKS & CO
SANITARY ENGINEERS
BARRHEAD
SCOTLAND
PATENT LEVERN

Australian manufacture of closet pans was sporadic. In Adelaide from 1884 George Marks produced wheel-thrown salt-glazed pans said to be equal in quality to the English product, but production was discontinued after two years.[127] The first indication of any local improvement was the 'Three-s-co' noiseless flushing cistern, reported in 1925. It was totally Australian made, supplied by the eponymous Simes' Scientific Supplies of South Melbourne, and claimed to produce a violent flush with almost no noise.[128] Its appearance was little different from the conventional overhead cast iron cistern, and whether it was taken up to any extent is not clear.

In about 1910 the Kaustine system of chemical treatment was invented in the United States, and it reached Australia about a decade later, when it was installed at the Botanic Gardens, Melbourne, and demonstrated that it could completely sanitise the sewage within six months. It was marketed by the Kaustine Company of Victoria, and within five years had become well-known and accepted by all the authorities.[129] By mid-1925 the company claimed to have completed over five thousand installations, and had agents in all states except Tasmania. The installation appears, to judge from a published diagram, to have consisted basically of a large horizontal drum, one end of which was below the closet and the other outside the building. A horizontal axle within the drum carried propeller-like blades, no doubt to mix the material and accelerate the chemical reaction.[130]

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127 Ioannou, *Ceramics in South Australia,* p 1672.

128 *Australian Home Builder,* 15 July 1925, p 8, 15 August 1925, p 10.

129 *Australian Home Builder*, 15 June 1925, p 10.

130 Miles Lewis, *Melbourne: the City's History and Development* (2nd ed, Melbourne 1995), p 47.