Mills, Millers and Millwrights: how the Machine Age came to South Australia

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Introduction

The proclamation of the province of South Australia on the 28th December 1836 by the South Australian Company came at a moment in English history that provided a readily available labour force. By the 1830s the enclosures of common and waste land had been going on for decades and while the rural population was increasing-though not to the extent of the national average-employment opportunities were not, and the 'total workforce employed on the land approximately halved between 1760 and 1840 ... enclosure tended to increase some types of unemployment.' 1 A complex of trends indicates that the rural labour force had a more precarious existence in terms of financial security after 1815 than before. 2 It has been 'shown that seasonal unemployment increased with enclosure and there is also a very close correlation between the proportion of a county enclosed and per capita expenditure on poor relief'. 3 Many of the displaced people, whether they came from forced enclosure, natural population increase or the abandonment of uneconomic farming units, found their way to the emerging industrial towns. 4

Others opted for a new life in Australia, and were actively encouraged to do so. Agents of the Colonisation Committee for South Australia toured villages selling the idea of emigration, 5 letters from earlier emigrants extolled the province's virtues, and funds were set aside from the sale of land in the province to provide free passage. During the period 1836 - 1840, 105 vessels brought a mixture of paying and free immigrants to the province at a total cost of £124,504. 6 The occupations of the migrants included agricultural labourers (56%), building trade workers (20%), tradesmen (12%), mechanics (6%) and miscellaneous (6%), the vast majority of which came from the southern and south-western counties.7 Mortality rates among Cornish miners and their families were 'tragic' in the second quarter of the nineteenth-century, and low wages brought 'the depths of destitution'.8 Thus the trades listed above would, in many cases, have masked the emigrants' true occupation. This did mean, however, that when the rich copper lodes of the central north were discovered in the early 1840s, the necessary expertise was immediately at hand for their exploitation. (The chance discovery of copper ore would soon also see the new steam technology-with which the Cornishmen were well acquainted-used to 'de-water' the Kapunda and Burra copper mines. 9)

South Australia's foundation came at a moment in the history of technological change that both fed the establishment of the province and created opportunities for its development. The colonists embraced new technologies as a way of subduing a harsh and strange land. The first, short-lived, association for the application of science to the needs of the new province was formed pre-settlement in London. Called the South Australian Literary and Scientific Society, it was followed after settlement and in the colony itself by a number of equally short-lived associations, including the Adelaide Mechanics' Institute. 10

The story of South Australia's introduction to the machine age is best told by examining the importance of the flour mills to the infant colony, how they worked and the various power sources that were exploited.

Settlement and Flour

For the infant province of South Australia the availability of flour was of utmost importance. The settlers were used to bread as their staple diet, and when it was in short supply there was understandable concern. The place was isolated and

during the first few years flour had to be imported, sometimes at inflated prices from as far away as New South Wales. 11 'In May 1840 bread was selling in Adelaide at 3/6d per four-pound loaf. The high price was blamed on "the grasping monopolists of the neighboring colonies".' 12 Attempts to obtain flour cheaply met with little success, but before long the problem of providing bread for the people was solved by the local farmers. By 1843 they were producing twice as much wheat as was needed, and the price fell to the extent that it was fed to pigs. (That year the area under cultivation had reached 27,000 acres and 260 bags of flour were exported to Perth at £15 per ton. 13)

By the early 1840s the construction of a flour mill in the city of Adelaide was an absolute necessity. 14 It was not simply a question of finding a power source- although that was daunting enough. The technical know-how and the infrastructure of the province were still fragile, and while the fabric of a mill could be built, finding the machinery for its operation was another matter. When these issues came to a crux, an undercurrent of near panic could be detected in the local press, especially when the superior state of affairs in the eastern neighbour was taken into consideration. (In 1839 two millers had arrived in Port Phillip. One of them, John Dight, set up his watermill on the Yarra River close to the city at the place still known as Dight's Falls; the other, Peter Hurlston, built a windmill close to Port Phillip Bay at Brighton. 15) On 14 March 1840 the *Register*'s report (page one) on a proposed flour mill to be built over the border illustrated the prevailing mood: 'Let not our friends at Port Phillip think we are envious of their progress and success' (although, of course, 'we' were).

Should corn be sent to other colonies to be ground at exorbitant expense? In August 1840 a public meeting discussed the serious situation. 16 There were, it was stated, practical men in the colony well acquainted with the erection of mills, especially watermills which provided the cheapest method of grinding.

From the earliest times wheat had been ground by millstones. The millstones in use in Europe-the 'buhrs' or 'burrs'-were made from very hard siliceous rocks. The best came from France and were usually about 4 feet in diameter. They were formed from wedge-shaped pieces cemented together, which were then bound with iron hoops. Pairs of these 'French burrs' were used in conjunction; only the upper stone turned, and as it did so the wheat was ground and gradually pushed outwards along the radiating ridges and furrows cut into the stone. It was not until about 1840 that millstones began to be replaced by iron rollers, and for the prospective miller in the new province of South Australia in 1836 the acquisition of millstones was a significant logistical problem to be overcome (if only one of many). There was, however, stone present in the colony 'in quality not inferior to that of the French burrs', and the Register urged citizens to take 'immediate steps to secure ... the power of manufacturing their wheat'. 17

Settlement and Steam

As European mills became more sophisticated, the task of constructing and servicing the new machinery went far beyond the capability of the village blacksmith. Materials such as iron and brass were increasingly used. A new artisan made his appearance, the millwright, the forerunner of the mechanical engineer 18 -a man schooled in the mystery of harnessing energy by using gears, shafts and bushes. A man able to provide the steady motive power at the desired speed-where and when it was required.

The steam engines that found their way to South Australia were of James Watt's improved design. 19 Watt's invention-bettering Newcomen's crude and inefficient 'atmospheric' steam engine-led to the vagaries of water and wind being removed from the miller's concern (although in far-removed South Australia this step would take some little time). It is worth saying a little here about the engine that so revolutionised the world and which-through its use in South Australian mining ventures-would consolidate the young colony's emergence from near-bankruptcy. 20

By 1765 Watt had invented a separate condenser so that the spray of water to condense the spent steam no longer occurred in the cylinder (as it did in Newcomen's invention). It was now possible to keep the cylinder hot at all times, so decreasing dramatically the amount of steam used. 21 Watt increased the amount of water raised in mines, for the same amount of coal used in the Newcomen engine, by about four times, 22 without having to deal with the technical problem of substantially increasing steam pressure in the boiler and cylinder. In 1774 Watt entered into a very successful partnership with Matthew Boulton for the exploitation of his patented steam engines, primarily for 'de-watering' copper and coal mines.

The first steam flour mill was erected in London in 1784. The first steam engine in New South Wales began operating in 1815, 23 although as early as 1803 George Caley had advocated the use of steam power in his report to Sir Joseph Banks. 24 The first steam mill in Van Dieman's Land was erected in 1830. 25

The history of South Australia's first mills illustrates the juxtaposition of ancient and modern technology, and is important for that reason alone. The new steam technology had advanced to the point where compact power sources were within the financial range of individual entrepreneurs. The tried and tested sources of wind and water would also be used, but would soon prove to be second best, given the nature of the climate.

The rainfall in South Australia, even over the then settled Adelaide plain, was insufficient to provide a reliable source of power for watermills. Reliable water flow was only available in a few creeks high in the Adelaide hills. Wind power was a viable option, and this is reflected in the table given below. Wind was initially the preferred option, but the advantages of continuous working provided by the steam engine, albeit at the higher unit cost of purchasing wood, soon eclipsed wind as a source of power.

Development of Flour Mills 1843-1845 26

	1843	1844	1845
Steam	5	8	11
Wind	7	7	8
Water	2	2	3
Cattle	2	4	2

The means for milling corn reached the province as early as 1838, when the South Australian Company imported a steam engine and materials for the purpose of erecting a corn mill. It was, however, left unpacked on Kangaroo Island for several years. By March 1840, when the 14,600 South Australians were looking eastwards in envy at the milling developments taking place in Port Phillip, this particular engine was still in storage, and (as the *Register* complained) 'still not leased'. 27 Perhaps envy and antagonism were necessary ingredients in those first steps towards embracing the new technology, for when two enterprising newcomers arrived in Adelaide a month later and prepared to compete with the easterners (and each other), others readily followed their example. Soon the small wheat crop from the thousand or so acres under local production was being ground in the province, not elsewhere.

Messrs Ridley and Kent: the Steam Age Arrives

> Warrior, 478 tons ... from London the 16th and Plymouth the 27th November, with a general cargo. Passengers, Dr. Kent, lady, and 2 children ... Mr. and Mrs. Ridley and 2 children arr. April 17. 28

Chance perhaps saw both John Ridley and Benjamin Kent embark together, each with a versatile steam engine, on the same ship out of London, but their aim was obvious: both of them were archetypal entrepreneurs and used their power sources to the best advantage. In the case of Kent the engine was to be used for making bricks:

> The *Warrior* which arrived last week has brought out some of the most useful and valuable machinery that could possibly be imported into a new colony. By this vessel has arrived a steam, flour and saw mill, and also a patent machine for making bricks. This latter is the property of Dr. [Benjamin] Kent, a passenger by the vessel, and, we understand, a wealthy and enterprising gentleman, who is likely to be quite an asset to the colony. 29

No sooner disembarked in April 1840, Dr Kent made the most of the opportunities presented. Colonel Gawler drew his attention to the lack of a flour mill in the province, and requested he use part of his brick-making steam power for that purpose. This, the doctor did. 30 Ridley's own steam engine appears to have been dual purpose from the start: 'I brought

with me a steam engine, part of the force of which I intended to appropriate to the driving of a saw mill, and part to the grinding of flour,' Ridley wrote to the *Southern Australian* on 13 August 1840 and confidently asserted:

> I have no doubt, in the course of six weeks, of being prepared to grind 500 bushels of wheat weekly, and before the harvest is got in, of being able to increase the quantity to 1000 bushels. [31]

If Kent changed his plans upon arrival, and was now prepared to grind corn as well as manufacture bricks, then-given the competition from Ridley-he had to obtain his burr stones quickly. The obvious place to find them was either in South Australia itself, or more likely Tasmania or New South Wales. (Given his sudden change of direction, there was insufficient time for him to obtain them from the preferred source, France.)

Illustration One: Typical Burr Stone, Thorpe FarmWatermill, Bothwell, Tasmania

On 25 August 1840, the *Southern Australian* published an article entitled: 'Flour and Saw Mills', which reported the erection of a sawmill powered by water. In an interesting juxtaposition of the old and new technology, the newspaper set out what it saw as the priorities-the mill should be converted for the more pressing need:

> We refer to Mr. Cannan's mill, on the first creek, at the foot of the hills. The arrangements of this gentleman are admirable. He has a fine over-shot wheel of 17 feet diameter, driving his machinery. An aqueduct, about 200 yards in length, conducts the water from the dam. ... At present, the mill has only been as a saw mill, but as it is admirably adapted to be employed as a corn mill, we trust this will not be lost sight of. [32]

Speed was vital in dealing with South Australia's abundant harvest and the colonists' pressing needs. Boyle Travers Finniss purchased the First Creek mill at the end of 1840, and completely rebuilt it as a flour mill (as the *Southern Australian* had suggested). It was ready for milling in April 1842. [33]

By November 1840, both the *Southern Australian* and the *Register* were able to report on the encouraging progress made by Benjamin Kent. [34] Antagonism towards other colonies could again be detected ('we are not-as certain alarmists absurdly insinuated-at the mercy of parties in the neighbouring colonies to convert our wheat into flour' [35]). By December Dr Kent's steam works was making the bricks for which purpose he had originally intended his steam engine, and in February he was advertising bricks at £21. 10s. per 1000; [36] his steam (flour) mill came into operation in January 1841, immediately opposite the end of Rundle street in the area now called Kent Town. [37] The doctor's French burr stones had arrived by the *New Holland*, from Sydney; [38] '[t]he original mill-house was constructed of wood', the machinery was a 'beam engine of 9 horse power, [built] by Cottam & Hallen', of London. [39]

The two newly arrived entrepreneurs may or may not have seen themselves as rivals at the start, but soon they were in direct competition. Ridley's mill narrowly won the race to be first by commencing operations on or about 15 December 1840 when Dr Kent's was almost ready to begin. [40] On 25 December, the *South Australian* chastised its rival, the *Chronicle*, for saying that the province had no means of grinding its own flour, [41] for this was patently no longer the case. By February 1841 both enterprises were in full production:

The mills erected by Dr. Kent ... and by Mr. Ridley ... are now in full play. We had the pleasure of visiting the latter mill on Wednesday last, and were much gratified to learn that, since its completion, it has been constantly at work, and at least one thousand bushels of wheat (mostly foreign) have already been ground by it. The usual work per week is 300 bushels, and from the admiral [sic] manner in which the machinery acts, we have no doubt of the continuance of this rate. [42]

Ridley, who later leased the South Australian Company's mill, [43] was making a success of his venture, and in August

1841 he added 'another pair of French burrs to his mill'. 44 (The Ridley engine, '8 horse power, which with high pressure, could be increased to twelve horse', 45 survived into this century; sadly this historic engine now appears to be lost, being last reported at the Adelaide Show-grounds sometime during the early 1960s.)

Illustration Two:
the Ridley Engine.

Not to be outdone, Dr. Kent set about obtaining machinery to better compete with Ridley. In August 1841 'important additions were about to be made' to his flour mill, 'the machinery for this purpose being on its way from Hobart Town'. 46 The additions in question were very probably French burr grinding stones as by September Dr Kent's previously ordered machinery enabled him to grind double the quantity of wheat. 47

Other early competitors

The expected harvest in 1841 was 'variously estimated at from 150,000 to 200,00 bushels', and the province's milling capacity was only 36,000 bushels. 48 Thus Ridley and Kent's combined milling capacity was 'miserably insufficient to meet the demand'. 49

The newfangled steam process required the expense of wood cutters and carters for the ever demanding engine, and it did not stifle the old technology right away (watermills and windmills, after all, could obtain their power free). However, Ridley and Kent's steam-driven initiatives undoubtedly provided the impetus for what happened next. Other would-be millers arose to the challenge of making good the shortfall, and while it is not possible to list all the mills at work using steam, water and wind after 1841, a small selection follows.

The watermill established on First Creek at the foot of the Adelaide hills in 1840 was converted from wood-sawing to flour-milling in 1842. An 1841 report suggests that a horse-driven mill or windmill was to be erected at Echunga; this would work one pair of French burrs. 50
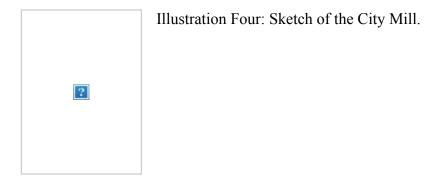
In 1842 three more mills were erected: a steam mill on the banks of the Torrens, using the engine brought out by the 'Company' six years previously and which had been languishing in store on Kangaroo Island; another steam mill at Thebarton; and the province's first windmill (of the tower type), built in Wright Street (off West Terrace) by Job Malin. 51

The earliest type of windmill, the post mill, where the whole of the upper body moves around a massive post to face the wind, 52 was not, as far as we can establish at the time of writing, built in South Australia, although examples were certainly constructed in Van Diemen's Land. 53 South Australia's windmills were the later smock (wooden) or tower (stone or brick) mills in which only the cap moves around to face the wind. 54

Illustration Three: Reproduction of Cap Windmill, Stirling Ranges,
Western Australia

In July 1842 G.S. Kingston was commissioned by Phillips and deHorne (or 'Horne' as he was called in the newspaper report) to design a second tower windmill at West Terrace. Designed on the grand scale, [55] it was an impressive octagonal building upwards of 60 feet high, and built of brick. The machinery, imported from Whitmore's at Wickham Market, Suffolk, cost the princely sum of £3000. There were five floors. Given a fair breeze, the mill proved itself capable of grinding upwards of twenty bushels of wheat an hour with three pairs of stones. [56]

Illustration Four: Sketch of the City Mill.

In 1843, Messrs Phillips and deHorne purchased Malin's windmill in South Adelaide, built the year before opposite the public cemetery in Wright Street (see above). The partners increased the size of the sails and renewed much of the machinery, purchasing a high pressure twenty horsepower steam engine as a further option. They also bought a complete set of mill machinery from Sydney for another mill. [57]

By early February 1843 there were eight flour mills in Adelaide alone. [58] In 1845, when there were twenty in the province, the editor of the *Southern Australian* took pleasure in reminding the readership that 'our braggadocio' friends at Portland Bay and the neighbouring Port Phillip district had only six flour mills between them: three steam, two water and one wind. [59]

Of the mills in existence in 1845 John Dunn's Mount Barker watermill is worthy of note. It was modernised in November 1845 with a steam engine and an additional pair of 'French burr-stones'-these enabled three times as much corn to be ground. [60]

The following decade saw a frenzy of speculation in flour mills in South Australia. By 1854 there were no fewer than sixty, and as late as 1856 the province's capacity was enough to mill the whole harvest in three months. [61] One curious failure was the mill at Port Lincoln. The building of local limestone was started in 1846 but never completed, although the machinery was purchased and three internal floors fitted. The building has been preserved and is Port Lincoln's oldest monument.

Illustration Five: Port Lincoln Mill, South Australia.

Conclusion

Inevitably, in South Australia as in Europe, steam became the prime motive power. With few reliable creeks and a fickle wind, steam was a logical choice. At the time, the decision to enter the steam age was a bold one, none the less, and made possible by two men who came from the centre of the development of steam power-England and Scotland. That

South Australia embraced the steam age so quickly was an important statement about the colonists' willingness to embrace new technologies. Kent and Ridley's application of steam power to the first two flour mills of the province and the rush of would-be emulators promoted an environment where the 'engineer' could flourish, from necessity as well as through any natural flair. (John Ridley was to play another role in promoting a sense of self-sufficiency and entrepreneurship in the province and is credited with the invention of a reaping machine in November 1843. It became known as Ridley's stripper. [62])

During the first critical years of the establishment of South Australia (1836-1840) mechanics functioned in a variety of occupations such as millwrights, brass founders, machinists, boiler-makers, pump-makers, agricultural implement makers and the all-important steam engineers. [63] Within a few short years steam engines, their boilers and all the other equipment necessary, would be manufactured in the province.

One man who made the most of the opening almost before it occurred was John Wyatt. His standing was such in the province that, when the South Australian Company offered their much neglected steam engine for sale or lease in 1841, it was to Wyatt they applied for a recommendation:

> The Engine, Flour Mill, and Saw Mill having been examined by Mr. J. Wyatt, Engineer, are found to be good and substantial in all their parts, and quite capable of driving all the machinery attached to it. [64]

By 1843 Wyatt had metamorphosed from blacksmith, millwright and engineer to be the proprietor of an iron foundry in Grenfell Street, Adelaide. There, with the help of his son, George, his multitudinous skills were put into action for the benefit of 'his friends and the public in general'. [65] By December, 1843 his ingenuity had given birth to a three horse power steam engine named the 'Cyclops', 'the first engine that has been constructed in South Australia'. [66]

Six years later a second generation of Wyatts had taken over and was servicing the Province's flour mills in style:

> On Wednesday last [5 December 1849] Messrs H. and G. Wyatt, of the North-terrace Foundry, cast a bead-mortice wheel for the South Australian's [sic] Company's steam-mill. The wheel is seven feet in diameter, and being 18cwt. In weight, is the largest yet attempted in this colony; but the spirited founders have lately made such additions to their establishment as will enable them to accomplish any description of casting under three tons weight. [67]

As steam power spread out to isolated parts of the country far beyond the Burra Burra copper mine, established in 1845 in the province's mid-north, engineers were called upon to service South Australia's fledgling industries in more demanding ways. The new age had arrived with Messrs Ridley and Kent in April 1840; their enterprise ensured that South Australia, through men like the ingenious Wyatts, would develop a 'critical mass' of technical expertise capable of tackling a range of complex engineering tasks far removed from the relatively simple tasks of sawing wood, making bricks and milling flour.

Illustration Six: New Technology in action:
Dunn's Steam Mill, Nairne.

Endnotes

1. J.V. Beckett, *The Agricultural Revolution,* (Basil Blackwell, Oxford, 1990), p. 43.

2. Ibid, p. 44.

3. M. Overton. *Agricultural Revolution in England: The transformation of the agrarian economy 1500-1850,* (Cambridge University Press, Cambridge, 1996), p. 180.

4. Ibid.;also see M. Turner, *Enclosures in Britain, 1750-1830*, (Macmillan Press, London, 1984).

5. I. Auhl, *The Story of the Monster Mine: The Burra Burra mine and its townships 1845-1877*, (District Council of Burra Burra, Burra, 1986), p. 85.

6. *D. Pike, Paradise of Dissent: South Australia 1829-1857*, (Melbourne University Press, Melbourne, 1957, 1967), p. 184.

7. Pike, op. cit., p.181.

8. J. Rowe, *Cornwall in the Age of the Industrial Revolution*, (University Press, Liverpool, 1953), pp.152 and 153. The burial statistics for the parish of St. Just in the hundred of Penwith for 1840-1849 illustrate the decline in living standards and the rise in mortality.

9. For the rapid exploitation of copper see Auhl, op. cit.

10. M. Talbot, 'A Close Affiliation: Coodination of Institutes in South Australia', in P.C. Candy and J. Laurent, (eds.) *Pioneering Culture: Mechanics' Institutes and Schools of Arts in Australia*, (Auslib Press, Adelaide, 1994), pp. 335-356 (p. 335).

11. T.B. Strangeways, acting colonial secretary, informed the population of the availability of flour imported from Sydney. See Elizabeth Davis, *Flour Milling in South Australia, A History*, (Millers Produce Co. of SA, Adelaide, 1988), p. 3.

12. Pike, op. cit., p. 218.

13. Pike, op. cit., pp. 218-219.

14. *Register*, 8 August 1840, p. 4.

15. E.A. Mackay, 'The First Flour Mills of Port Phillip', *The Victorian Historical Magazine*, vol. 26, no. 4, 1937, pp. 117-120.

16. *Register*, 8 August 1840, p. 4; 15 August 1840, p. 4. This meeting was open to all classes.

17. *Register*, 22 August 1840, p. 8. See also Register, 15 August 1840, p. 4.

18. L. Mumford, *Technics and Civilization*, 1934, (George Routledge & Sons, London, 1947), p. 219.

19. James Watt (1736-1819), born in Greenock on the River Clyde, Scotland.

20. See Pike, op. cit., 310-302 for the beginning of South Australia's mineral boom.

21. See G. Watkins, *The Steam Engine in Industry. Mining and metal trades*, (Moorland Publishing, Ashbourne, 1979, 1994), and H.W. Dickinson, *A Short History of the Steam Engine*, (Cambridge University Press, Cambridge 1938).

22. H.W. Dickinson and R. Jenkins, *James Watt and the Steam Engine: The memorial prepared for the committee of the Watt centenary commemoration at Birmingham 1919, 1927*, (Moorland Publishing, Ashbourne, 1981), p. 357.

23. P.N. Richards, 'Manufacturing Industry' in *Australian Academy of Technological Sciences and Engineering, Technology in Australia 1788-1988*, (Author, Melbourne, 1988), p. 851.

24. Caley noted how inefficient the watermill on the Paramatta was proving to be. It was actually worked by four horses and four men. He stated that 'had they [the Government] sent out by the first fleet, a steam engine and the machinery of a mill, with a man to work it ... it would be one of the most valuable acquisitions to the colony at present'. Quoted by S. Martin. *A New Land: European perceptions of Australia, 1788-1850* (Allen & Unwin, State Library of NSW, St.

Leonards, 1993), p. 8.

25. J. Walker, 'Tasmania's First Steam Mill', *Evening Mercury*, 20 September 1958, p. 6.

26. G.B. Wilkinson, *South Australia its Advantages and its Resources*, (John Murray, London, 1848), p. 54.

27. *Register*, 14 March 1840, p. 3.

28. *Southern Australian*, 23 April 1840, p. 3.

29. *Southern Australian*, 23 April 1840, p. 3.

30. GRG South Australian Research Notes 58/1 (State Records SA).

31. *Southern Australian*, 14 August 1840, p.3.

32. *Southern Australian*, 25 August 1840, p. 3.

33. Finniss calculated that First Creek would provide enough water for the mill to work for nine months of the year, and that for six months it should be able to work twenty-four hours per day. (*Southern Australian*, 21 March 1843, p. 2.)

34. *Register*, 14 November 1840, p. 3; *The Southern Australian*, 17 November 1840, p. 3.

35. *Southern Australian*, 17 November 1840, p. 3.

36. *Southern Australian*, 2 February 1841, p. 1. The clay for the bricks was milled by steam power. The works were located on Section 255.

37. *Southern Australian*, 8 January 1843, p. 1.

38. *Register*, 14 November 1840, p. 3.

39. *Southern Australian*, 14 March 1843, p. 2.

40. Ridley's mill 'has now been in working order for the last ten days' (*The Southern Australian*, 25 December 1840, p. 3).

41. *Southern Australian*, 25 December 1840, p. 3.

42. *Southern Australian*, 5 February 1841, p. 3.

43. *Register*, 31 December 1842, p. 1.

44. *Southern Australian*, 20 August 1841, p. 2.

45. *Southern Australian*, 7 March 1843, p. 2.

46. *Southern Australian*, 20 August 1841, p.2.

47. *Southern Australian*, 14 September 1841, p. 3.

48. *Register*, 11 September 1841, p. 3.

49. Davis, op. cit., p .5.

50. *Southern Australian*, 5 February 1841, p. 3.

51. See Davis for information about these mills. The South Australian Company's engine was advertised for sale or lease with corn and sawmill attached in The Southern Australian, 17 August 1841, p. 1. Further advertisements from September onwards indicate that there was little interest in the engine-or that the price was excessive. The first windmill in Australia began operating in Sydney at Miller's Point in January 1797; by 1809 there were 7 windmills operating in that city. (See D.E. Tribe and L.J. Peel, "Innovation, Science and the Farmer' in *Australian Academy of Technological Sciences and Engineering*, p. 73.)

52. J. Vince, *Discovering Windmills, Shire Publications*, Aylesbury, 1973, pp. 4-7.

53. Freeman Collett Tasmania, *Callington Mill Precinct Oatlands, Tasmania Conservation Management Plan*, vol. 3, illustrated chronology, (Freeman Collett Tasmania, Hobart, 1993).

54. Vince, op. cit., pp. 8-15.

55. The report indicated it would be ready in December 1842 (*Southern Australian*, 23 August 1842, p. 3). See also D. Langmead, *Accidental Architect*, (Crossing Press, Sydney, 1994), p. 247, where the mill is listed among Kingston's commissions.

56. *Southern Australian*, 28 February 1843, p. 2.

57. *Southern Australian*, 28 March 1843, p. 2.

58. *Southern Australian*, 28 February 1843, p.2.

59. *Southern Australian*, 7 February 1845, p.2.

60. *Southern Australian*, 27 November 1845, p. 2.

61. Davis, op. cit., p. 6.

62. While there are other claims to this important advance that allowed large areas of wheat to be harvested by one man, he was awarded a sum of money by Governor Grey in honour of this invention. F. Wheelhouse, *Digging stick to rotary Hoe: Men and machines in rural Australia* (Cassell Australia, Melbourne, 1966), pp. 52-55. Wilkinson op cit., writing at the time, also credits Ridley with this invention.

63. Pike, op. cit., p. 181.

64. *Southern Australian*, 21 September 1841, p. 1.

65. *Southern Australian*, 31 March 1843, p.1.

66. *Southern Australian*, 12 December 1843, p. 2.

67. *Register*, 8 December 1849, p. 1.