9.03 Cooling & Mechanical Ventilation

a. passive evaporative cooling
b. the punkah
c. the tunnel
d. Parliament House, Melbourne
e. forced ventilation & cooling
f. refrigeration
g. air conditioning
h. the rotary clothes hoist

a. passive evaporative cooling

One of the earliest Australian innovations in the field of ventilation and cooling is 'Scott's Oixianathumator or House Cooler', an invention by Robert and/or Helenus Scott of 'Glendon', New South Wales. The Scotts were of Indian colonial background, and seem to have drawn upon an established eastern tradition, for forms of evaporative cooling had been regularly used in the royal palaces of Persia and India.[1] In colonial times in India doors and windows were fitted with *tatties* or screens made from the fibrous roots of sweet-smelling *khai* grass, and in hot weather servants splashed these with water.[2] Stewart Clark, on *The Hygiene of the Army in India*, recommended tatties of 'khuss', clearly meaning khus-khus, a sweet-smelling grass which was commonly used for this purpose. He calculated that 750 square feet [70 m^2] of tattie would cool 20,000 cubic feet [566 m^3] of air per minute:

> The frames should be inclined at an angle of 25º or 30º, so as to afford greater facility of keeping the tatties wet. For this purpose inch-and-a-half water-pipes should be laid under the floor of the cooling-room; and others, three-fourths of an inch in diameter, screwed on to these at right angles; the latter must extend perpendicularly to within two feet of the top of the tatties, so as to throw a regular shower of water over a given space, say five feet in breadth and the whole height of the room, and thus provide thoroughly for tatties being kept constantly wet without the aid of manual labour.[3]

1 A Karman & H Egli, 'Vernacular Approaches to Passive Cooling in Hot Arid Zones', *Passive Cooling* [International Passive and Hybrid Cooling Conference held at Miami Beach, November 1981] (Newark [New Jersey] 1981), p 242, quoted by Michael Korbel, BBldg, University of Melbourne 1992.

2 A D King, *The Bungalow* (London 1984), p 34.

3 Stewart Clark, *The Hygiene of the Army in India*, p 41, quoted in Great Britain, Office of the Commissioners of Patents for Inventions, *Abridgments of Specifications relating to Ventilation. A.D. 1632-1866* (London 1872) [introduction], p xxxix.

The principle of the Scotts' invention was exactly that of a tattie, kept wet with a spray from a perforated pipe. This tends in turn support a suggestion which will be made below, that it was the Indian flat roof, by way of the Scotts, that inspired George Wyndham at 'Dalwood'. The oixianathumator was the first in a series of passive and semi-passive evaporative cooling systems. It was James Broadbent who located an undated drawing for Scott's Oixianathumator in the Scott papers, and who first drew my attention to it. As Broadbent describes it, 'a curtain of calico suspended before a window was kept moistened by a controlled flow of water fed from a cistern to the rod holding it.'[4] Almost precisely the same thing was suggested in 1859 by the Victorian architect Francis White, as a way of cooling Parliament House, Melbourne. White speaks of hanging coir matting over the windows of the building, and keeping it saturated with water by means of a perforated copper tube over each window, this being fitted with a stopcock to turn the water on and off. There is no suggestion that White had any knowledge of the Scotts' invention, and indeed he freely acknowledges his source, for he refers to it as 'the Indian method'.[5] He was drawing directly upon the same Indian tradition as the Scotts.

It is not that this idea was exclusive to India. One Horsfall, a British authority on dairy management, had also used wet window blinds to reduce the air temperature. R S Burn proposed to improve upon this by using endless belts of calico passing over rollers, which would rise vertically behind the milk shelves, with the lower roller in a trough of water. At intervals the dairymaid would move them so as to wet the whole surface.[6]

White's proposal was in effect to turn Parliament House into a giant Coolgardie safe. There was already in existence a crude evaporative system for the Legislative Assembly chamber, by which during summer a stream of water was allowed to run over the pavements of three transverse passages in the basement . This was supposed to absorb the dust and cool the air, which was then admitted through apertures into the chamber above. The stale air was removed through orifices in the ceiling of the chamber, and air syphons in the smaller rooms.[7] It was also in 1859, and it may well be connected with the work at Parliament House, that T W Badham of Richmond obtained a patent for a method 'by which air entering the room is saturated by being made to pass over wet surfaces.'[8] What these methods do, of course, is to achieve evaporative cooling at the expense of humidification, which is quite different (*pace* Broadbent) from the modern concept of air conditioning, in which both the temperature and the humidity are controlled.

---

4 James Broadbent, 'Aspects of Domestic Architecture in New South Wales 1788-1843' (3 vols, PhD, Australian National University 1985), II, p 419, ref unpaginated sketchbook with Scott plans, ML *D64.

5 Francis White, reported in the *Australian Builder,* 24 December 1859, p 409.

6 R S Burn, *Practical Architecture* (London, no date [c 1875]), p 128.

7 *Argus,* 17 April 1856.

8 Victorian patent no 193 to Thomas William Badham, 12 January 1859; also reported in the *Australian Builder,* 22 January 1859, p 24.

One Teale, who leased the Model Farm near Melbourne in the 1860s, cooled the roof by means of a perforated pipe along the ridge which discharged a spray of water.[9] Loudon had proposed something rather similar as a store for meat, butter or vegetables - a sort of conical frame covered in 'wirecloth', mostly cemented over, and with a container of water or a supply pipe at the top, from which water would trickle down the sides.[10] A particularly interesting surviving example is a farm cool house at Eltham, Victoria, is undated, but probably of the early twentieth century. It is essentially a 1.2 m deep rectangular pit with vertical timber slab sides and a fairly steep sapling-framed roof clad in lapped weatherboards. Outside this and entirely above ground is a large roof which touches at the ridge but spreads out on a much lower slope, and is clad in corrugated iron. Within the coolroom proper there is hessian draped from the ridge out to either edge of the pit, clearly designed to be moistened for cooling purposes.[11]

In the early twentieth century complete structures - not underground, but on the Coolgardie safe principle - were built as coolrooms. One such design was published in *Building* in 1922, a square building with a pyramidal roof, and an inner facing in the form of a wire screen. The outer face of the wall was apparently a woollen fabric, and it was designed to be sprayed with water from pipes with sprinkler holes.[12] A report from A E Ryland, dairy supervisor in Victoria, describes something similar, and is quoted in a South African text as follows:[13]

> A light wooden frame-work is constructed 6 feet [1.8 m] square by 6'6" [1.95 m] in height, with sloping hip-rafters on top to form a square roof. This frame-work is covered with canvas or Hessian cloth down to 9 inches above the (pine) floor. The lower 9 inches is occupied by a fly-proof perflation panel of fly-netting. From the peak of the roof, a vertical ventilating pipe takes off, capped by a cowl. This pipe is about 6 feet long so as to induce a good draught. A framed door, covered with canvas, is provided in one side of the room.
>
> Water is distributed over the roof and walls by perforated lead piping. Surplus water is caught in rain-water guttering, which extends round the walls immediately above the perflation panel, and thence is led away.
>
> The temperature of the room is lowered, and kept low, by continuous evaporation of some of the moisture in the walls and roof.

Yet more sophisticated is a meat house at 'Madowla Park', Victoria, where hessian, soaked from above with water, is placed between two insulated walls of redgum boards,

---

9 *Farmers' Journal and Gardeners' Chronicle,* 2 August 1862, p 408, as advised by Deborah Kemp, 1998.

10 This is one of three surviving buildings at Murray’s Farm, Casuarina Ridge, Eltham North: information from John Clare of Allom Lovell & Associates, Melbourne, 1994.

11 J C Loudon *An Encyclopædia of Cottage, Farm, and Villa Architecture and Furniture* (London 1846 [1833]), § 738, p 366.

12 *Building*, 12 May 1922, p 82. Reference to an article, p 65, CHECK.

13 W S H Cleghorne, *Farm Buildings and Building Construction in South Africa* (London 1925), pp 301-2.

with large vents to allow air circulation through the cavity, and with a heavily insulated roof above.[14]

We have discussed above the bough shed at Innamincka Station, South Australia, of the 1920s, where the walls were watered in a similar way. At 'Thylungra' station in western Queensland in 'the birdcage' clad in hessian over 42 x 1 1/2 x 17 [1.05 m wide, 38 mm aperture, 1.4 mm wire] rabbit netting[15] with taps at intervals around the top, from which water dripped onto the hessian.[16]

Evaporative cooling is satisfactory only in a hot and very dry climate, and would be quite unsuitable in a humid climate such as that of Sydney, whereas in a drier climate it can be very effective. By 1888 the oixianathumator reappeared with Chinese overtones at Hay, New South Wales, where 'Czar Lodge' had 'Chinese curtains' hung in front of the verandah in hot weather, 'surmounted by a perforated pipe from which water is allowed to drip upon the curtains, thereby rendering the atmosphere within delightfully cool as well as shielding the brick walls from the sun's rays.'[17] Such curtains are commonly regarded as Indian in origin, and are known as 'tatties'.

The Adelaide Club is cooled to this day by tatties which are wetted with a drenching apparatus. The first tatties appear to have been ordered in September 1893 through the secretary of the Madras Club, two of 2.25 x 4.95 m, two of 3.45 x 2.78 m, and one of 2.7 x 3.13 m, with the bottom cut away in a large upward-pointing V rising 2.1 metres, presumably to allow for walking underneath. The arrival of these was acknowledged in January 1894 and a further set were ordered to arrive in September-October 1895, then a further order was placed in February 1897.[18] The material of the original blinds, which were replaced from India every year or two, is not known, but it may have been sisal. In recent times coir matting from South Africa has been used, and at the time of inspection the current set had been in place for eleven years.[19]

A remarkable system, the precise nature of which is unclear, was used in the house of Joseph Furphy in the Victorian town of Shepparton. Furphy, proprietor of a well-known foundry, had his roof constructed in sections which could be winched open and filled with water for cooling, presumably by evaporation.[20] The date is not clear, but Furphy lived in Shepparton from 1873 to 1819.[21]

---

14 E A Beever, 'Madowla Park, Victoria' in John Moore et al, *Historic Homesteads of Australia Volume Two* (Stanmore [NSW] 1976), pp 115, 118.

15 42 inches or 1.07 m wide, by 11/2 inch or 38 mm mesh of 17 gauge or ...... wire.

16 Tom Cartwright of Rockhampton, letter of 21 March 1994.

17 M L Gardam, *The Bishop's Lodge* (Hay [NSW] 1993), p 10, quoting *Riverina Grazier*, 2 April 1879, p 2. TO BE CHECKED.

18 Mortlock Library S.R.G.104, processed and unprocessed records of the Adelaide Club, as advised by McDougall & Vines.

19 Information and inspection courtesy of Kate McDougall & Liz Vines, and of the club, 1991.

20 Information from Frederick Furphy, via Penny Lewis, 2001.

21 John Barnes, 'John Furphy (1842-1920), in Bede Nairn et al [eds], *Australian Dictionary of Biography Volume 4* (Melbourne 1972), pp 225-6.

An invention reported in 1876 relied upon water more to clean than to cool the air. External air passed into a vent opening at floor level. Inside the vent was a tray of water, and a curved baffle which forced the air down across the surface of this 'where it leaves behind any extraneous matter'. At the inner face of the wall the air passed into something like a Tobin tube, rising to as height of perhaps 1.5 metres, and with a regulating valve. The air was supposed to continue upwards from the tube until it was deflected downwards by the ceiling, mixing with the air of the room. The emphasis was on purifying the air, and the effect of humidification is not mentioned, though it is said that in hot weather blocks of ice could be placed in the tray.[22] The design of this system was credited to the English engineer James Livesy, but in reality it was merely a combination of well-known principles. It was marketed by the Purified Air Ventilating Company of Westminster, but such reports in Australia usually adumbrate the appointment of local representatives or agents. Whether or not it was the outcome of this quasi-invention, one example of the system appears to be the Lands Office at Hay, New South Wales, where there are ventilating hatches just below floor level, and which are openable, and could take a tray of water.

b. the punkah

The punkah was known in Mogul India, and adopted by Europeans in Bengal in the 1780s,[23] and then in 1820 a steam engine was imported from England to operate the punkahs of the Nabob of Oude.[24] Captain George Weston, who had left the service of the East India Company and settled at 'Horsley', New South Wales, in 1831, brought his Indian servants with him. They included a punkah wallah, Ramdiall, who used to sit on the back porch at meal times, operating the punkah in the dining room by means of a rope between his toes.[25] But he represented an endangered species, for already in 1830 the punkah had been specifically advocated for use in Australia by an old India hand, T W Maslen, who suggested that 'it might be kept in motion by some simple machinery'.[26]

By the mid-nineteenth century the punkah was well-known, but generally machine-operated. It was discussed in D B Reid's *Theory and Practice of Ventilation* of 1844,[27] and Charles Tomlinson's *Warming and Ventilation* of 1850. By this time one Dobson had developed an improved version in which two punkah sails crossed each other at right angles, and the whole apparatus was given a rotatory motion by means of a system of pulleys.[28] In 1855 another improvement, consisting essentially in linking a series of

22 *Town and Country Journal*, 18 November 1876, p 317.
23 A D King, *The Bungalow* (London 1984), p 34.
24 Walter Berman, *The History and Art of Warming and Ventilating, &c* (1845), II, p 108, cited in Great Britain, *Abridgments of Specifications relating to Ventilation* [introduction], p xxiv. This is also mentioned by Tomlinson, *infra.*
25 Suzanne Forge, *Victorian Splendour* (Melbourne 1981), p 21.
26 T W Maslen, *The Friend of Australia* (London 1830), p 272.
27 D B Reid, *Illustrations of the Theory and Practice of Ventilation, with Remarks on Warming, Exclusive Lighting, and the Communication of Sound* (London 1844), pp 105-6.
28 Charles Tomlinson, *Rudimentary Treatise on Warming and Ventilation* (London 1850), p 181.

punkahs together with a horizontal rod, was patented by Lieutenant Thomas Cook of Addiscombe, England.[29]

The government resident at Roebourne, Western Australia, in the 1880s fitted his house with punkahs, consistent with what was seen as its 'semi-Indian' architecture, to which we will refer below.[30] The punkah was fairly widely adopted in the tropical parts of Australia, and in the south in hotels like the Imperial and the Southern Cross in Adelaide, until replaced by electric fans at the turn of the century.[31] It was also was used rather self-consciously by gentlemen's clubs, and is still to be found at the Melbourne Savage Club,[32] the Mildura Club, Tattersall's Club in Brisbane, and other such institutions. Most remarkably, at the Centennial Exhibition of 1888-9, J E Lowe of South Yarra, Melbourne, displayed a 'water-pressure engine for swinging punkahs',[33] which would seem to have been aimed at something of a niche market.

c. the tunnel

In about 1824 the British Army in India experimented with the use of underground tunnels and evaporative cooling in supplying air to buildings,[34] and this probably inspired further developments in Britain. 1835 one Sylvester proposed for the House of Commons at Westminster a ventilation system which he had already tried out at a lunatic asylum in Kent.[35] A feature of this was that fresh air was brought in through a tunnel, with an inlet some distance from the building, and this resembles vernacular techniques later used in Australia. I have been told that there was a tradition in Western New South Wales of ventilating houses with air drawn in through an underground tunnel,[36] though I have been unable to substantiate this. By the 1860s the tunnel was being used in the forced ventilation of British barracks in India, as will be discussed below.

In 1879 John Wilkinson was granted a British patent for sub-earth ventilation as a means of cooling dairies,[37] and the idea was taken up in an American article of 1899 which advocated the ventilation of cheese curing rooms with underground ducts exiting some distance away, with a vent and wind sails.[38] It had already affected Australia. In 1894 a property at Berrigan was reported to have a storeroom and cellar ventilated by pipes which led some distance way underground, then turned upwards, and at the ends were

---

29 Great Britain, patent no 446, to Thomas Cook, 28 February 1855. See also Wyatt Papworth [ed], *The Dictionary of Architecture* (London 1853-92), sv Punkah, ref *Builder,* XIII (1855), p 456.

30 Ray & John Oldham, *George Temple-Poole* (Nedlands [WA] 1980), p 14.

31 Michael Cannon, *Life in the Cities* (West Melbourne 1975), p 117, citing *Australasian Ironmonger,* May 1900.

32 Installed in 1927: Joseph Johnson, *Laughter and the Love of Friends* (Melbourne 1994), p 111.

33 Centennial International Exhibition, Melbourne, 1888-1889, *Official Record* (Melbourne 1890), p 617.

34 Brian Roberts, *The Quest for Comfort* (no place or date [London 1997]), p 31.

35 Tomlinson, *Warming and Ventilation,* pp 238-240.

36 Advice of Professor Graham Brawn.

37 Roberts, *The Quest for Comfort,* p 31.

38 *Farmers' Bulletin* (Washington 1899), p 20, as advised by Deborah Kemp, 1998.

fitted with moveable tops which rotated to face the wind.[39] The Kamereuka cheese factory, in Bega Valley Shire, New South Wales, seems to have at least three underground ducts running out from the cellar where the cheese was matured. The factory was built in about the 1880s, and is set on the crest of a hill, so that a duct running horizontally from the cellar strikes ground level some way from the building. Although the external openings appear small, and the duct ends in a stoneware pipe, I understand that the cellar end is more like a square tunnel.[40]

At the Thoona Butter Factory in northern Victoria, begun in 1889, there is a circular domed underground chamber from which a tunnel leads out on only a slight upward slope to emerge at a significant distance away.[41] This arrangement is perhaps relevant to my next example. In the store complex at Arltunga in Central Australia, is a structure which I take to be the cool room, partly because of the fact that it had an unusual ventilation system. This consisted of an opening at floor level led into a tunnel, roofed with stone slabs and extending about four metres to a wedge-shaped entrance facing south-east to catch the prevailing wind up an adjoining gully.[42]

This idea was taken further by the Rev John Flynn at Adelaide House in Alice Springs, which was built between 1920 and 1926 as a bush hospital, and which was later to become the base of the Inland Mission's Flying Doctor Service.[43] Air was admitted at ground level a little way behind the house into a tunnel containing bags hanging in a staggered arrangement, and which could be wetted. From here it passed into a cellar under the house and entered the ground floor rooms by way of ducts and vents a little above floor level. Surprisingly enough, however, the cooling of the air by humidification was not the major objective of the scheme as explained, doubtless by Flynn himself:[44]

> In calm, hot weather it is hard to keep a medium-sized house free from stuffiness, especially when a verandah spreads low all round: so we have grouped the rooms round a central hall, which rises above the general roof, with a 'lantern' top which allows air to escape freely by natural ventilation. To ease this escape from the rooms there is a special flue direct from each ceiling into the upper part of the hall. Then the arrangement of doors gives a clear blow-through both ways.
>
> This is all very well so long as there is no dust, nor any distressing wind to burn the skin. But when dust blows freely, one has been compelled to shut up the whole

39 *New South Wales Agricultural Gazette*, 1894, p 546, as advised by Deborah Kemp, 1998.

40 So I am advised by Suzannah and Stirling Plowman of Berridale, relying upon memory.

41 Information from Deborah Kemp, and inspection, 1996.

42 Kate Holmes, 'Excavations at Arltunga, Northern Territory', *Australian Journal of Historical Archaeology*, I (1983), pp 78-87.

43 S V Szokolay & M Docherty, 'Passive Cooling: Performance of an Historical Building' (St Lucia [Queensland] 1985), p 7, quoting Graeme Bucknall, *A Place for the People - the Story of Adelaide House* (1982). See also Carol Hardwick, *Register of Significant European Cultural Sites in the Northern Territory* (2 vols, [Darwin] 1984), II, pp 685-9, ref Bucknall, and Richard Allom, *Report on Adelaide House*.

44 *The Inlander*, IV, 1 (July 1920), quoted in S V Szokolay & M Docherty, 'Passive Cooling: Performance of an Historical Building (St Lucia, Queensland, 1985), p 4.

> house and swelter helplessly inside. Hence the new feature in our foundations. Under the central hall is a cellar, just over six feet deep - as the whole floor is two feet six above ground level, this entails really only four feet of excavation - and from this cellar air-ducts lead to the rooms. Supplies of air are to come in by the tunnel, which is sufficiently long to accommodate a series of bags hung right from the ceiling to floor, nearly across, but from alternate sides. These 'stagger' the air, ie. make it reel continually in its lengthened journey from outside to inside; so, by wetting the bags, it should be possible to mop up practically all the dust, not to mention most of the excessive heat, before the fresh air passes into the house above. During a bad wind, the idea is to open windows of the upper lantern on the sheltered side only, and turn the cowl at the outer end of the tunnel to the wind. This provides a push inwards at the entrance, and suction outwards at the exit - due to rush of wind past the lantern.
>
> When the weather is 'not-too-bad', there should be a welcome current of cool air from the nether regions without any worry about wet bags. In stinging winter mornings - for Alice Springs sees water-bags freeze occasionally - incoming air from below would be milder than direct draughts ...

Hence it appears that the wet bags at Adelaide House were designed to dampen the dust, and that their cooling effect was only an incidental benefit. Moreover, in less extreme weather the tunnel would provide cooler air even without the bags, and in winter it would provide warmer air than that admitted directly. It was more a descendant of tunnel vents, like that of the Arltunga store, than of the oixianathumator. However a more immediate source has been claimed, in a 'project' - presumably a hospital - used in the front lines during World War I and seen by a friend of Flynn.[45]

d. Parliament House, Melbourne

The first systems of mechanical ventilation also incorporated evaporative cooling, and one of the most elaborate was devised by J G Knight for the Houses of Parliament in Melbourne. In response to complaints from parliamentarians about the existing arrangements (discussed above) Knight worked out a new system over the Christmas holidays of 1859. Air was brought in from above the roof by means of a 1.2 x 0.3 metre zinc duct lagged with flannel insulation. To the top of the duct was fitted a small water wheel operated by mains pressure (for which the plumbers McKay Dods & Co had received a patent) which sprinkled water into the shaft at the same time as turning a fan to make the air descend. This duct went down to the basement, where surplus water was run off through a waste pipe, then returned upwards and divided into a number of branches which went up the columns of the chamber and emitted the air, cooled, but also humidified, at a height of about 1.5 metres above the members' seats. The registers were ingeniously designed to blend with the decorative cabling of the columns, and there were

[45] Max Griffiths, *The Silent Heart* (Kenthurst [NSW] 1993), p 54.

other vents in the ceiling through which stale air could escape.[46] The remains of Knight's system have generally been removed, possibly in 1983,[47] but at basement level there are doors into the hollow column bases, and in one of these survives a complex sheet metal junction box which may date from his time.

Knight's system seems to have been replaced in about 1885 with a passive one designed by Tayler. It was based upon that which he had installed early in 1884 at the National Bank in Collins Street, where fresh air was drawn from the top of the building through glazed earthenware pipes, and stale air expelled through the dome, said to have been modified for the purpose.[48] In July 1884 Tayler suggested to the Parliamentary Building Committee that the same system be installed in the Legislative Assembly,[49] and in August other proposals were received from Captain Wagemann of Melbourne and Dr Reid of Geelong.[50] Tayler's system must have been chosen, as in July 1886 he was called back to deal with problems in the installation, which he attributed to defects in the windows and doors.[51] In August he wrote a long letter to the *Argus* complaining of the unfair criticism which had been levelled at him. He asserted that the system had not been allowed to operate properly, due to defects in the building and to disregard of his instructions, and that the government architect, Peter Kerr, had interfered in the running of the system.[52]

In 1887 the system was again under review by a panel of four architects consisting of Tayler himself; Albert Purchas, President of the Royal Victorian Institute of Architects; George Inskip; and William Pitt. They reported that the windows in the Assembly chamber were too high to ventilate the room , and that the only other ventilation was by means such as doors to corridors. Though it is difficult to believe, it seems that they were entirely unaware of the inlets which Knight had provided in the columns. They recommended that:

> an engine controlling a fan or fans should be employed to force in fresh air in large volumes of slow velocity and of required temperature in a vertical direction, to be delivered at a number of points in the chamber at about 7 ft. above the level of the floor, and that natural means of exit for heated and vitiated air should be provided at a number of points well distributed over the ceiling, so as to prevent concentration of streams of outgoing air at two or three points only.[53]

---

46 *Australian Builder*, 21 January 1860, p 11. See also the *Argus*, 17 February 1860, for the somewhat disappointing first trial of the system.

47 W G Corlett, 'Report on the Air-Conditioning of Parliament House' (typescript, no date [?1983]), passim.

48 *Argus*, 19 March 1884, p 6.

49 *Argus*, 27 July 1884, p 5.

50 *Argus*, 6 August 1884, p 5. Dr D B Reid of Geelong, son of the famous Scottish ventilating engineer David Boswell Reid.

51 *Argus*, 15 July 1886, p 5.

52 *Argus*, 15 July 1886, p 5.

53 *Australasian Builder & Contractor's News*, 13 April 1889, p 342.

This was apparently done, and by 1889 it had been determined to extend the ventilation system of the Legislative Assembly to the north, east and west corridors of the upper floor, and to the press rooms.[54]

e. forced ventilation & cooling

The fans at Parliament house were far from being unique. Fans had been used in Britain since the eighteenth century to deal with special ventilation problems,[55] but the problem of providing mechanical power would have been the main constraint upon their adoption in Australia for another hundred years. In the mid-nineteenth century small fans powered by mains water pressure were also used as a component of evaporative cooling systems, as opposed to simple air movers. In 1834 one M Motte received a prize for his invention of an archimidean screw fanner, and a British engineer, Combe, seemingly arrived independently at a double helix form.[56] Later the availability of convenient gas engines made fans of these various types viable for large scale installations.

In Barry's Reform Club, London, a large fan had been operated by a five horsepower [3730 W] steam engine, and in India Major J G Medley proposed a bullock-drawn fan (which he called a 'thermantidote') to operate under the centre of a cruciform barracks building, supplying air to the whole. In the process it might be warmed, or be cooled by passing it through tatties.[57] In 1864 a detailed proposal was published by Stewart Clark in which, if the barracks buildings were spread out in a straight line or an échelon, as was commonly the case, the induct vents and fans would be placed approximately axially and to the windward, about ninety metres away. These would be linked to the buildings by underground masonry flues, from which the air would rise in a series of diffusion pipes within the masonry of the walls, and thence be disseminated. It would be discharged into the individual rooms through perforated zinc plates 'of a watch-glass shape, or convex outwardly' so as to diffuse the air like water from the rose of a watering can.[58]

By 1873 a Frenchman, Nezeraux, had combined fan-forced air with evaporative cooling and air washing in his hydro-atmospheric condenser and his *refraichisseur*.[59] This was not so different in principle from the system used by J G Knight in 1859 at Parliament

---

54 *Australasian Builder & Contractor's News,* 13 April 1889, p 342.

55 'Desagulier's Fanner' was the pioneer, and it is illustrated in Reid, *Theory and Practice of Ventilation,* p 342.

56 Reid, *Theory and Practice of Ventilation,* p 109.

57 Peter Scriver, 'Imperial Progress: on the Impracticality of Problem-Solving in Colonial Indian Building', *Fabrications,* XI, 2, pp 28-30, citing *Professional Papers in Indian Engineering,* XI, 7 (1865). Scriver says that Medley got some of his ideas from an article by Major F De Bude, RE, in the same issue, including 'the latest rage of ventilation by "thermantidote"'.

58 Clarke, *The Hygiene of the Army in India,* p 30, quoted in Great Britain, *Abridgments of Specifications relating to Ventilation* [introduction], pp xxxvii-xxxviii.

59 Brian Roberts, *The Quest for Comfort* (no place or date [London 1997]), pp 57-8, apparently quoting N S Billington & B M Roberts, *Building Services Engineering: a Review of its Development* (1982), chapter 6 'Air Conditioning, Heat and Cold: Mastering the Great Indoors'; also B Donaldson & R Nagenait, *ASHRAE* (1994), chapter 11, 'The Early Twentieth Century: 1900/1930'.

House, Melbourne. Almost exactly the same thing was done again in a Melbourne building completed in about 1881, but it is not clear in this case that a fan was used. The identity of the building unfortunately has not been established with certainty, but according to its architect, who proposed to use the same system if he was chosen to design the new Government Offices [Treasury Building] in Brisbane:[60]

> The ventilation is effected by means of pure air drawn from a high elevation, by means of a jet of water, and forced into a receiver from which after reaching a certain pressure it is forced into Trunks under floors, distributing flues being taken from same to each room where desired and discharging 7'-0" [2.1 m] above floor in an upward direction. The air thus obtained is beautifully cool and pure and the pressure can be either promoted or lessened in each room by the occupant.
>
> The vitiated air is taken by shafts to Roof where it is discharged through large circular shafts with cowls fitted to prevent down draft ...

This sounds as if the author might be Lloyd Tayler, and the building in question the mansion 'Rippon Lea', extended by Tayler in about 1881.

In 1883 A B Black of Adelaide took out a patent on a 'hydraulic centrifugal and ventilating fan', which was then manufactured by local tinsmiths A M Simpson & Son.[61] This may have been the same as the 'Verity's patent air propellors' which were used in Adelaide at the Australian Widows' Fund Assurance Building in 1887.[62] It is not known what power was used to drive them, but it seems that they served only the company offices in the building, in conjunction with a cooling system, which will be mentioned below. In the same year three of 'Verity's hydraulic ventilators' were used to extract air from the gallery of Parliament House, Adelaide,[63] which seems to suggest that these were hydraulically powered fans, presumably operating off mains pressure.

The motive power for the Verity's propellors 'of a large size and powerful draught', used to ventilate the basement of the New South Wales Electric Light and Power Supply building in Sydney, of 1888,[64] may have been electricity, but more probably it was the same motor from which the electricity was generated within the same building. At about the same time, however, Barton White & Co supplied two electric fans to the Gaiety Theatre in Brisbane, manufactured by the Electric Power Storage Company of Millwall, England.[65] These were worked by batteries, but as electricity reticulation developed smaller electric fans would have become increasingly viable. In 1892 'Verity's Hydraulic

---

60 ‘New Public Offices: Brisbane: Report Accompanying Plans Bearing Motto’, 30 November 1883 (held by Historic Buildings Branch, Brisbane), p 7.

61 South Australian patent no 374, March 1883, cited in D A Cumming & G C Moxham, *They Built South Australia: Engineers, Technicians, Manufacturers, Contractors and their Work* (Adelaide 1986), p 26. See also *South Australian Register,* 19 March 1883, quoted in E & R Jensen, *Colonial Architecture in South Australia* (Adelaide 1980), p 784.

62 *Australasian Builder & Contractor's News,* 9 July 1887, p 140.

63 *Australasian Builder & Contractor's News,* 3 December 1887, p 490.

64 *Australasian Builder & Contractor's News,* 3 November 1888, p 402.

65 *Australasian Builder & Contractor's News,* 17 November 1888, p 439.

Extractors' were used in selected parts of the Metropolitan Gas Company building in Melbourne.[66]

Although Lloyd Tayler designed Parliament House in Adelaide, it is unlikely that he was responsible for the ventilation system there, as the whole project was taken over by the colonial architect, E J Woods, and completed in 1889. The main inlet was through a tower, nine metres high, at the centre of a light court. From here it passed through a semi-underground tunnel designed to equalise the temperature of the incoming air in hot weather. At the other end of the tunnel a fan driven by a gas engine drew the air down and across trays of water on a system which had been patented by Dr Allan Campbell, a local medico and MLC, or in winter through wrought iron heating stoves designed to maintain a temperature of 17^{o} C. It passed through large ducts in the basement, and entered the chamber by way of louvred openings in the side wall and gratings under the tables in front of the members' benches, each of which were fitted with a control valve. The system had the capacity to effect a complete change of air every twenty minutes. Vitiated air was removed by three large exhausts in the roof and smaller ones over the galleries, the latter with the Verity's fans already mentioned.[67]

In the dining rooms the ventilating openings were beneath the windows and the water trays were within them, each with a deflecting plate to force the air down to the water surface. Each tray was fitted with a waste, and they could be simultaneously refilled.[68] Campbell's was the system which had previously been used in the Australian Widows' Fund Assurance Building of 1887, as mentioned above,[69] and it was patented shortly afterwards.[70] Inlet vents designed for water trays are to be found elsewhere, as at the Lands Office, Hay, New South Wales, and must be assumed to have been carried out under Campbell's patent.

If we are to believe Leonard Dockrill it was only at about this time that the first crude attempts at mechanical ventilation were made in Sydney.[71] At the Scientific and Mechanical Exhibition in Sydney in 1886, Basil Woolley of Bond Street, as agent for the Aeolus Waterspray Ventilating Co, exhibited the company's waterspray and automatic ventilators.[72] This was a British system claimed to be especially suitable for use in public buildings, and in hot climates. The air passing through it was said to be cleansed from dust and all impurities, and it could be cooled by using ice or warmed with a gas furnace.[73] The Aeolus spray was used in first mechanically ventilated theatre, the Criterion, completed late in 1886, but the system proved defective because vitiated air

---

66 *Building and Engineering Journal*, 17 September 1892, p 115.

67 *Australasian Builder & Contractor's News*, 3 December 1887, p 490. See also Susan Marsden et al, *Heritage of the City of Adelaide* (Adelaide 1990), p 248.

68 *Australasian Builder & Contractor's News*, 3 December 1887, p 489.

69 *Australasian Builder & Contractor's News*, 9 July 1887, p 140.

70 *Australasian Builder & Contractor's News*, 23 July 1887, p 171.

71 L J Dockrill, 'Developments in Architecture in New South Wales during the Victorian Period (6 vols, PhD, University of NSW, 1983), I, p 139.

72 *Australasian Ironmonger*, 1 October 1886, p 165.

73 Joseph Gwilt [ed Wyatt Papworth], *An Encyclopædia of Architecture* (London 1899 [1842]), § 2278t, p 745.

drawn up from the basement was being distributed.[74] In the following year G A Morrell used the spray in the ducts of Her Majesty's Theatre.[75] This would seem to have been no more than another device for cooling by humidification - which would have been singularly unsuited to Sydney's climate - rather than a form of air conditioning as suggested by Dockrill.

In 1912 Vincent & Cerutty installed a system of mechanical ventilation throughout the Crystal Palace in George Street, Sydney.[76] Presumably the Vincent in question is George Vincent, of Melbourne and Sydney, who seems to have been the leading installer of mechanical ventilation systems immediately prior to the Great War. He claimed the

> Introduction of pure, washed, cleansed air, warmed in winter, cooled in summer, and distributed and diffused throughout buildings under definite control, both as to velocity and volume, thoroughly changing the inside atmosphere in the building as often as required without setting up any draughts or causing inconvenience to any kind of occupant.
>
> Removal of vitiated, fouled air by action of powerful centrifugal fan, exhausting air through systems of air conduits, changing the inside atmosphere as required, and proportionately removing the air from every part of building.

His many installations included the Britannia Theatre (two systems), Commercial Travellers Association (four systems), Melbourne Hospital (four systems) and strand Cafe, all in Melbourne; Her Majesty’s Theatre and the David Jones drapery store in Sydney; and the New Wondergraph Theatre, John Martin & Co drapery, and Covent Garden Restaurant in Adelaide.[77]

f. refrigeration

Developments in refrigeration and ice-making were associated mainly with the export trade in refrigerated meat, rather than being part of the normal building scene. The term 'refrigerator' initially applied to what would later be called an ice box, with no internal mechanism. A range of types was sold in the United States, especially from about 1880.[78]

---

74 *Sydney Morning Herald*, 24 December 1886, quoted by L J Dockrill, 'Developments in Architecture in New South Wales during the Victorian Period (6 vols, PhD, University of New South Wales, 1983), I, p 139.

75 *Australasian Builder & Contractor's News*, 22 October 1887, p 382, quoted by L J Dockrill, 'Developments in Architecture in New South Wales during the Victorian Period (6 vols, PhD, University of New South Wales, 1983), I, p 139.

76 *Sydney Herald*, 11 June 1912, extract forwarded by John Sellwood, in connection with James Baxter, builder.

77 *The Architectural Students Annual* (Melbourne 1913), p xxviii.

78 Four refrigerator catalogues are listed in Charles Wood, *Catalogue 112* (Cambridge [Massachusetts] 2002), pp 48-60. The Allegretti Refrigerator Co's *Refrigerators and Freezers*, of 1879-80 illustrates wooden refrigerators or ice boxes, some on castors, some with glass doors, &c. Baldwin & White's

In 1888 Charles Coombs of Balmain proudly exhibited his 'Nonpareil' refrigerator, in which several articles of food had been kept for eight days. It was simply an ice chest - a large varnished wooden case about 2.2 metres high, with a hermetically sealed door, and an ice compartment at the top which sloped backward so as to accommodate the most ice with the least reduction of usable storage space. The nature of Coombs's innovation was 'a method of expelling the gases from the chamber' which seems to have been by gravitation. It did not depend upon forced circulation of air like the American machines, and in consequence it cost about 6 s. 6 d. per cubic foot, delivered, as compared with 8 s. 6 d. for imported models.[79] American handymen made simpler 'refrigerators' for themselves, and Australians could learn from the *Farmer & Grazier* how to build a cabinet with an ice compartment at the top lined with zinc, and provided with a drain to remove the water.[80] On the other hand a good quality commercial refrigerator like that of the McCray Refrigerator Co of Indiana specifically excluded zinc, and was lined with porcelain tiles, opal glass, or 'odorless wood'. It now had a patent system of refrigeration, not apparently powered in any way, which was claimed to circulate absolutely dry cold air.[81]

The development of refrigeration in the modern sense, depending upon decompressed gas, related in the first instance to the transportation of frozen meat rather than to domestic food storage, still less the control of temperature in habitable rooms. However James Harrison's 'ether machine' patented in 1857, had originally been envisaged not only as a means of making ice. but 'for the supply of cool air to houses, hospitals, &c' and 'for regulating the temperature of apartments'.[82] Refrigeration for specialised areas such as coolrooms was an established practice in Australia by 1885, when the cellar of the Central Grain and Produce Stores in Sussex Street, Sydney, by the architects Kenwood & Kerle, was equipped with a 'Bell-Coleman' dry air refrigeration system.[83] The Lake's Creek Freezing Works at Maryborough, Queensland, were also equipped with Bell & Coleman's dry air refrigerating machines. there were two of these, each capable of producing 50,000 cubic feet [1,400 m^3] of refrigerated air per hour. By the end of 1888 there was another on its way from London, with a capacity of 70,000 cubic feet [2,000 m^3]. As an auxiliary the company had a Boyle's ammonia ice making machine with a capacity of three tonnes of ice per day.[84]

At the Centennial Exhibition of 1888-9 J B Witt of the Victorian Atmospheric Refrigerating Co Ltd, Flinders Lane West, won a first award for a patent ventilator,

---

The Baldwin Dry Air Refrigerator of 1881 seems to show mainly larger models for grocers &c. The Alaska Refrigerator Co's *The Alaska Dry Air Refrigerators*, of about 1886-7, shows mainly domestic types. L H Mace & Co's *Refrigerators, Woodenware, Children's Carriages, Imported and Domestic Toys*, of 1896, shows twenty-nine models of refrigerator.

79 *Australasian Builder & Contractor's News*, 10 November 1888, p 416.

80 *Farmer & Grazier*, 1892, p 228, quoting the *American Agriculturalist.*

81 G F Barber, *American Homes* (3rd ed, Knoxville [Tennessee] 1905), advertisements, no page.

82 Great Britain, patent no 2362 to James Harrison, 10 September 1857.

83 *Town and Country Journal*, 28 January 1888[?5], p 196, quoted in Dockrill, ‘Developments in Architecture’, p 82.

84 *Australasian Builder & Contractor's News*, 1 December 1888, p 512.

patent refrigerator and patent evaporator,[85] inventions which were reported to be 'purely colonial'. His cooling devices - doubtless those of the 1887 patent referred to above - reportedly consisted of pipes connected with an air distributor which was carried through a chest containing ice and salt. This cooled the air in transit, but kept it perfectly dry, while another method involved drawing the air through an evaporator, patented by Witt,[86] which must have involved humidification. Even the ice system, however, did not actually clean the air.

g. air conditioning

A form of air conditioning - which refrigerated the air without humidifying it - was known in Victoria by 1860 when the engineer Frederick Acheson tried unsuccessfully to patent it. It consisted of:[87]

1st. Withdrawal of vitiated air by means of a descending current of cold air;
2nd. Mode of cooling air in pipes enveloped in wet cloths;
3rd. Corrugated pipe as a conductor of cooling air;
4th. Acceleration of cooling process by current of air passing over evaporating cloth.

Whether this was Acheson's own invention is unclear, but it is by a very long way the first proposal in Australia refrigerating air without humidifying it, for it was nearly three decades before this line of development was pursued further.

True air conditioning, in which the air is cleaned and the temperature and humidity are independently controlled, is regarded as the invention of the American, Willis Carrier, in 1902.[88] This was the year of his plant for the Sackett-Wilhelm lithographic works in Brooklyn, and most subsequent installations were also for industrial purposes. Comfort air conditioning was much slower to develop, but became important in the 1920s for cinemas and department stores. The first completely air conditioned office block was the Milam Building in San Antonio, Texas, of 1927.[89] However, this is less than the full picture. As early as 1922 Golding, Chief Engineer of the Australian Postal Department, had returned from the United States, where he found that a large number of companies were air conditioning their factories 'because they get greater efficiency out of their employees'.[90]

---

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

86 *Australasian Builder and Contractor's News*, 22 September 1888, p 261, quoted by Michael Taylor, 'Marvellous Melbourne's Sky-Scrapers' (2 vols, BArch history research report 1972), p 40.

87 Victorian patent application no 304, not granted to Frederick Acheson, 25 January 1860.

88 Margaret Ingels, *Willis Haviland Carrier Father of Air Conditioning* (Garden City [Kansas] 1952), p 17.

89 Roberts, *Quest for Comfort*, p 31.

90 Australia, Parliament, Parliamentary Standing Committee on Public Works, *Proposed Establishment of an Automatic Telephone Exchange at City South (Sydney)* ([Melbourne] 1922), p 3, evidence of J M Crawford, State Engineer, Post Master General's Department, New South Wales.

By now the Department had already introduced air conditioning in its new automatic telephone exchanges, to protect the equipment. At the City North Exchange, Sydney, there was an air conditioning plant which did not include refrigeration, and it proved difficult to prevent the staff from opening the windows on hot days. This defect had apparently been rectified in all subsequent exchanges, including Perth, Melbourne and Geelong, and most recently Collingwood, which had not yet been in operation long enough to evaluate its impact.[91] It seems to have been in the late 1920s that air conditioning reached Australia more generally, and then almost entirely based upon overseas technology. Crossle and Duff, of Melbourne and Sydney, represented the Melbourne manufacturers D Richardson & Sons and Macintosh & Co Pty Ltd, as well as the [apparently] overseas brands 'Buffalo' and 'Trane'.[92] The first air conditioned office building in Melbourne dates from about 1927 - the same year as the Milam Building - and the first flats, at 628 St Kilda Road, Melbourne, date from 1936.[93] In Sydney the first fully air conditioned office block was the City Mutual, completed in 1936.[94] The first fully air conditioned hospital in Australia was that at Broken Hill, designed by Leighton Irwin in 1938.[95]

Another pioneer example of thoroughgoing air conditioning in Australia was the Australia Hotel in Melbourne, of 1938-9. The basement was air conditioned, each area (the two theatres, the two bars and the Silver Grill) with its independent fan and conditioning equipment, but with the refrigerating and heating from a central service. The air conditioning plant was installed by three Melbourne firms, A E Atherton & Sons, Crossle & Duff, and J Wildridge & Sinclair. The cooling system was referred to as 'inverted thermal storage'. The refrigerating compressor was in the basement, and the compressed refrigerant passed to an evaporative condenser on the lower roof level, and hence into the liquor receiver, before expanding into evaporative coils submerged within a thermal storage tank. This tank was also in the basement and contained 36,400 litres of water. In it ice formed on the immersed pipes at the rate of 1.5 tonnes an hour to maintain a stock which could be melted at the rate of three or four tonnes per hour as soon as the demand arose.

Water cooled by this ice was pumped to the various conditioning units, where it passed through air cooling and moisture removing coils, through which the warm air passed to be cooled. Each plant room contained a filter, copper extended fin coils, and a fan. The fan drew air from the outside across the filter to remove dust and impurities, and then over the copper coils to lower its temperature and humidity. The fans were capable of handling up to 127,000 cubic metres per hour, and the air passed through a total of 900 metres of ducting. The winter cycle was similar, except that hot water from the central heat exchanger circulated through the coils of each unit. The coal-fired boilers were fed

---

91 Committee on Public Works, *Automatic Telephone Exchange at City South,* Report, p vi.

92 W H Hallam, *Building Costs* (1st ed, Melbourne 1939), inside front cover.

93 *Building,* LIX, 352 (12 December 1936), p 50.

94 Ian Stapleton & Maisy Stapleton, 'C. Bruce Dellitt 1900-1942 and Emil Sodersten 1901-1961', in Howard Tanner [ed], *Architects of Australia* (South Melbourne 1981), p 126.

95 *Age,* 5 July 1938, from RVIA press cuttings 1938.

by two Vale Automatic Underfeed Stokers supplied by Vale Stokers Pty Ltd of Melbourne, and they provided reticulated hot water and general heating by means of radiators for the whole building, as well as the hot water and the steam for the kitchen appliances.[96] Domestic air conditioning was hardly an issue until after World War II, and could be achieved only at considerable cost using ducted systems, or rather unsatisfactorily with individual room units. But in the 1960s larger capacity units like the Westinghouse 'Weather Wall' were introduced, with the ability not only to cool up to four rooms adjoining that in which it was installed, but also to heat them when required.[97]

In the 1950s 'air curtains' were introduced at the entrances of department stores - at the Myer Emporium, Melbourne, in 1956, and at Farmer's, Sydney, in 1957. Warm air was expelled from the top of the opening, and drawn down through a grille in the floor, so as to isolate the air conditioned interior from the external environment. At Farmer's the opening was 7.8 metres wide and 2.6 metres high, and the air blast was 900 mm deep.[98]

h. the rotary clothes hoist

The rotary clothes hoist has achieved a mythic status in Australian culture, so that most people believe it to be characteristically Australian, and to have been invented locally by Lance Hill, neither of which beliefs is even remotely true. Hill was a very late player in the field, but his company became the most prominent maker, and 'Hill's hoist' has become synonymous with 'rotary clothes hoist'. Moreover there may have been some folk memory of the early American maker called Hill to suggest the antiquity of the type.

The present form of hoist is the result of evolutionary development. The first known example was the 'clothes drying machine' invented by James R Higgins of Rockport, USA, which was described and illustrated in the *Scientific American* in 1855. The drying frame resembled that of a modern hoist in that there were four arms at right angles, and parallel lines between, but it seems to have been rather small in proportion to the thick central post, which was a hollow column of timber containing the pulley mechanism by which the frame was raised when a crank handle was turned at the base. The frame itself was able to rotate freely.[99] In the 1860s there appeared in Britain another 'clothes-dryer', the proportions of which more resembled those of a modern hoist, except that the four arms sloped upward to create an inverted pyramid shape. A double pulley attached to the top of the shaft enabled the arms to be lowered for attaching the clothes, and to be raised again , and when not in use they could be folded against the shaft. The collar at which

---

96 *Hotel Australia Melbourne, 1939* (Melbourne 1939); 'Hotel Australia, Collins Street', *Journal of the RVIA,* XXXVII, 7 (September 1939), pp 191-201.

97 *Australian Home Beautiful,* December 1965, p 101.

98 *Cross-Section,* no 58 (August 1957), p 3.

99 *Scientific American,* X, 23 (17 February 1855), p 180, kindly supplied by Justin Murphy of the ABC, 2004.

the arms gathered would descend to the base of the post as they folded in, and they would finish lying against the post and pointing upwards.[100]

In 1890 the American William Curtis received a patent relating to 'that species of clothes-driers in which a folding web or umbrella-like frame slides upon an upright post'. In principle it was much the same as Kent's hoist, but there were six spokes rather than four, and instead of the post being rigidly upright, the top was held in place by guy ropes running off on all sides, but joining at a collar which allowed it to turn, while the bottom end was journalled so that it could also turn.[101] The improvements do not seem significant, but it is interesting that the wording recognises the existence of a general class of umbrella-like hoists, as distinct from others. The Hill's Champion Clothes Dryer as advertised in the United States in 1914 had a number of arms - at least five - which sloped up from the centre rather like an umbrella which has been blown inside-out. The top revolved, but it seems to have been a device which was put up as required rather than left in place. The manufacturers were the Hill Dryer Company of Worcester, Massachusetts, who advertised that it could be put up in one minute.[102]

The first evidence of a rotary clothes hoist in Australia is irritatingly vague. It is a photograph, said to date from about 1900, but possibly much earlier, of the vicinity of Bay and Graham Streets, Port Melbourne. In the foreground, standing in the backyard of one of the properties, is what looks like a hoist, four arms at right angles on a vertical pole, a slenderer rod continues up past the arms as if to hold the wire stays, which cannot themselves be seen.[103] Of course, it could be some other device entirely, and if it is a clothes hoist, there is nothing to say that it rotates. A clearer example was Harley's patent improved rotary and tilting clothes rack, made by 1914 by the Adelaide ironfounders A C Harley & Co, but as it was described as 'improved' there must have been an even earlier one. The 1914 version was made mainly of timber, but with the mechanical parts of iron. The upper part was similar to a modern clothes hoist, with four arms at right angles, each stayed back with wire to the central spindle, in a sort of pyramid form. There were two parallel lines for hanging clothes, fairly close together on the outside. Although it could rotate, there was no machinery to make it do so, nor to go up and down. However the whole clothes rack could be tilted, to give access to the lines, and the tilting was controlled by a hanging loop of chain.[104]

Thus all these earlier hoists were of wood: they rotated, and in most cases they folded like an umbrella but could not be lowered to assist in the loading of the clothes. There was to be a change to hoists made partly or wholly of metal hoists, and which lowered, either by tilting the whole hanging frame, or by moving it in a vertical direction, by

---

100 *Cassell's Household Guide. Being a Complete Encyclopædia of Domestic and Social Economy &c* (4 vols, London no date [c 1865]), IV, pp 72-3.

101 United States Patent no 434,921, to William Curtis, 26 August 1890.

102 *Country Life in America,* August 1914, p 101, kindly supplied by David Wixted.

103 *Herald,* 20 November 1985. June Toscano of 42 Champion St, Brighton, has advised me that the photo is dated 1873 in an apparently original inscription on the mount.

104 A C Harley & Co, *"Sun" Foundry Illustrated Catalogue* (Adelaide 1914), p 125.

turning a handle. Later improvements included enclosing the gears of the raising and lowering mechanism, and then the use of hydraulic power.

Gilbert Toyne is said to have built his first hoist in 1921 and it is still in place at 44 Walker Street, North Geelong.[105] Toyne patented his invention in 1925,[106] but what the invention actually was is unclear, unless it was the construction of the hoist for the first time entirely out of metal. He is said to have manufactured his hoists in a shed behind a house at Frewville, South Australia.[107] It appears that he then sold the manufacturing rights for South Australia to L L Lambert of 48 Fisher Street, Fullarton, and Lambert continued to manufacture them until 1947.[108] In 1936 Toyne's hoist, with a wind-up handle, was advertised and illustrated in *Ramsay's Architectural Catalogue.*[109] Toyne's all metal Clothes Hoist was advertised in Melbourne in 1926. It was raised and lowered by turning a handle, and was made in two sizes, twenty and sixteen feet [6 & 4.4 m] diameter, by A J McKirdy of Mont Albert.[110] By 1931 it was Toyne's All Metal Rotary Clothes Hoist Coy, and McKirdy was styled as Manager.[111] By 1948 Toyne's hoist came in the 'Super Standard (Beaufort Model)', presumably from some connection with the Beaufort bomber factories, as well as the 'Hydraulic (De Luxe Hoist).[112]

Meanwhile the Drywell Clothes Hoist was advertised by James Hardie & Company in 1925. A wooden post was fixed into the ground, and the metal pole carrying the arms and lines was attached to it in such a way that it could tilt to give access for hanging the clothes.[113] The rack with the lines did not tilt separately as in the Harley hoist, and in form it was like an inverted pyramid, rather like the American hoist already described. Hardies were the only company listed as suppliers of clothes hoists in the *Architects and Builders' Index* of 1928.[114] However, during the 1930s various people built their own hoists in the 1930s, at least one of which was operated hydraulically from the domestic

---

105 *Herald,* 28 November 1985. In 2004 Justin Murphy of the ABC confirmed that the Walker Street hoist was still in place.

106 Brenda Warburton of Kingswood, South Australia, in a letter in the Adelaide *Advertiser,* 21 October 1995, no page, reports her hoist bears the patent number 21553/25, the name 'Toynes' and the maker, L Lambert, Fullarton, SA..

107 Howard B Galvin of Frewville makes the claim for a shed behind his own house, and says that he possesses Toyne's first wind-up clothes hoist, of that year, which is in good working order: letter in the Adelaide *Advertiser,* 21 October 1995, no page. R L Maschmedt sent to the *Advertiser* a receipt of 19 March 1928 for a hoist which his father bought from Toyne as patentee and maker, 1 Queen St, Frewville: *Advertiser* **,** 13 September 1995.

108 Catalogue illustration reproduced in the Adelaide *Advertiser,* 21 October 1995, accompanying a letter by M W Hansen of Findon.

109 H C Wright, letter in the Adelaide *Advertiser,* 21 October 1995, no page. The date when Lambert acquired the rights is unclear. Wright says that he bought one of Lambert's in 1935, and enclosed the receipt.

110 *Australian Home Beautiful,* 12 January 1926, p 9. The mechanism is illustrated on 1 April 1931, p 65.

111 *Australian Home Beautiful,* 1 April 1931, p 65.

112 *Australian Home Beautiful,* October 1948, p 73.

113 *Australian Home Beautiful,* 12 November 1925, p 12.

114 J S Gawler [ed], *The Architects' and Builders' Index (Victorian Edition)* (Melbourne 1928), p 17.

water supply.[115] Amongst those later credited with the invention of the rotary clothes hoist at about this time was one 'Pop' Kaessler of the Barossa Valley.[116]

Lance Hill was claimed to have developed his hoist shortly after his return from World War II, when washing on the clothes line at his house in the Adelaide suburb of Glenunga was repeatedly snagged on a lemon tree.[117] According to another account it was orange trees, and Hill constructed this hoist for his wife Sherry in 1945, using water pipe, wire and pieces of motor cycle and car engines. In February 1946 he entered partnership with his neighbour Harold Ling and began production. The early model used levers and for this reason was known as the 'chin-wacker' or the 'gut-thruster'.[118] Hill is claimed to have devised a steel rotary hoist, by contrast with an earlier wooden type made by a Victorian company, which had failed some years earlier.[119] However, if this is a reference to Toyne's it is misleading, for Toyne had developed a metal hoist much earlier. Toyne is said to have initiated legal action when he heard of Hill's hoist, but abandoned the case for personal reasons, after his twin sons died of pneumonia.[120] In 1954 the Hills Hoist came in a 'Standard', a 'Supa' and a 'Trustee' (non-elevating) model.[121] Hill himself retired for health reasons in 1956 and under his brother-in-law, R D Ling, the company went public in 1958. Subsequently Ling's son, R D Ling, became managing director of a company with an annual turnover of $100 million.[122]

Just after the Hill's hoist, three other makers emerged. Arcweld Ltd's 'Rotaline' probably dates from 1947, the year when a test was done by the Engineering Laboratories at the University of Adelaide on the pipes used for the arms. In 1954 it was being advertised in the 'popular windup', 'lever action' and 'non-elevating' models.[123] R T Products was making the Windmill rotary clothes hoist by 1948. The rack was octagonal in plan, with a pattern of wires rather like the section of a quarter-sawn log, and the hoist was supplied

---

115 *Herald,* 31 October 1985 & 13 November 1985, p 2: Bert Hawksworth of Moonee Ponds recalled that his brother, an engineer, and his father, a fitter and turner, built a hoist using a bicycle chain, a wheel and a ratchet, and it was still in existence at the time of the report (Hawksworth corrected the published references to his uncle, which should have been his brother). His father later helped a neighbour to build one. In the *Herald,* 2 November 1985, R T Cowling reported that he himself built a hoist at South Camberwell, hydraulically powered to rise two metres.

116 The claim was apparently made by W P Shemmeld in the Angaston *Leader,* to judge from a response submitted by Eric Wilksch on 22 August 1994: copy held in the Willoughby City Library, Chatswood, NSW, and passed to me by Justin Murphy, 2004.

117 *Herald* 10 March 1986.

118 John Kerin, 'Fifty Years On, the Humble Hills is raised to Stardom', *Weekend Australian,* 24-6 February ?1990, np, citing David Harris, *What a Line,* a history of the Hill's hoist. Cutting supplied by Justin Murphy.

119 *Herald* 10 March 1986.

120 *Herald,* 28 November 1985.

121 F W Ware & W L Richardson [eds], *Ramsay's Architectural and Engineering Catalogue* (Melbourne 1954), §18/6.

122 *Herald* 10 March 1986.

123 *Ramsay's Catalogue* [1954], § 18/1.

in both geared and hydraulic models.[124] The Austral Wire Fence & Gate Co clothes hoist, with enclosed gears, was available by 1949.[125]

124 *Australian Home Beautiful*, November 1948, p 68.

125 F W Ware & W L Richardson [eds], *Ramsay's Architectural and Engineering Catalogue* (Melbourne 1949), § 18/1.