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'The Grange', Tasmania: survival of a unique suite of 1874 transit of Venus relics

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Abstract
One of the two US expeditions in Australia for the 1874 transit of Venus was based in Campbell Town, Tasmania. While the transit was observed from this site and some of the photographs taken were used in the subsequent investigation of the solar parallax, its main claim to fame is the physical vestiges of the transit programme that have survived there through to the present day. These comprise foundations for instruments, two piers associated with the photographic telescope, and one of the prefabricated observatory buildings. In addition, a copy of a photograph of the transit is preserved in the Queen Victoria Museum and Art Gallery in nearby Launceston. Collectively these form a unique suite of 1874 transit of Venus relics, and are of international importance.

Keywords: *Campbell Town, Tasmania, transit of Venus, astronomical relics*

1 INTRODUCTION

During the eighteenth century, transits of Venus were seen as ideal tools with which to investigate the value of the solar parallax, and hence that fundamental yardstick of Solar System astronomy, the astronomical unit (or AU). Consequently, expeditions were dispatched to the far reaches of the globe, but conflicting results were obtained. This directed attention to the next pair of transits, in 1874 and 1882.

The Americans mounted one of the most ambitious 1874 transit of Venus campaigns, with expeditions dispatched to three northern stations and five southern ones (Dick *et al.*, 1998). One of the latter was intended for the Crozet Islands, but inclement weather conditions prevented a landing and so a decision was made to relocate to Australia. A US station was already planned for Hobart, Tasmania, and the relocated party eventually accepted an invitation from Dr William Valentine to establish their observing station at his luxurious home, 'The Grange', in Campbell Town, 110 km to the north of Hobart as the crow flies (see Orchiston and Buchanan, 1993; Smith and Jetson, 1994).

Leading the Campbell Town party was Captain C W Raymond from the U.S. Army Corps of Engineers, assisted by First Lieutenant S E Tillman (also from the Corps of Engineers) and three American civilians employed as photographers (Newcomb, 1880). During the transit, they were also aided by three Launceston volunteers. One of these was local school-teacher, Alfred Barrett Biggs, who would go on to become one of Tasmania's most distinguished amateur astronomers (see Orchiston, 1985).

2 THE CAMPBELL TOWN TRANSIT STATION

2.1 The Instruments

Instruments used at the Campbell Town transit station were: a horizontal photographic solar telescope, a transit telescope, a 5-in (127-mm) Clark refractor, a sidereal clock, three box chronometers, a chronograph, five thermometers, a barometer, and equipment for measuring terrestrial magnetism.

The 'heart' of the research effort was surely the solar telescope, which was designed to take three different sets of photographs of the transit: of the ingress contacts, of Venus on the disc of the Sun during the transit, and of the egress contacts. The plate-holder (which supported the photographic glass plates) was mounted on a solid cylindrical metal pier (Figure 1), and protected from the elements by a simple prefabricated flat-roofed wooden 'Photographic House', which also included facilities for preparing and developing the photographic plates.

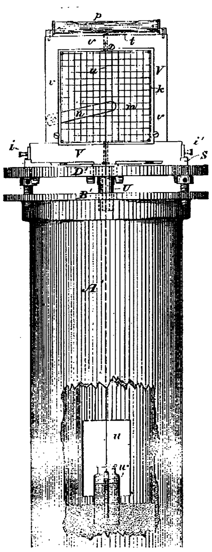


Figure 1. The photographic telescope plate-holder (after Newcomb, 1880).

Precisely 38 feet 6.625 inches (11.75 metres) due south of the photographic plate-holder was another metallic cylindrical pier. This supported a heliostat and collimator lens, which captured the Sun's rays and focussed them on the glass plate in the Photographic

House. Immediately south of the heliostat pier was a tripod containing a weight drive that allowed the heliostat to track the Sun (see Figure 2). Between the heliostat and the photographic plate-holder was a measuring rod (used to determine the focal length of the telescope), and this was supported and protected from the elements by a wooden framework and roof. For part of its length, this simple structure also protected a tube through which the light of the Sun passed while *en route* to the photographic plate. The overall arrangement of this horizontal solar telescope is shown in Figure 3.

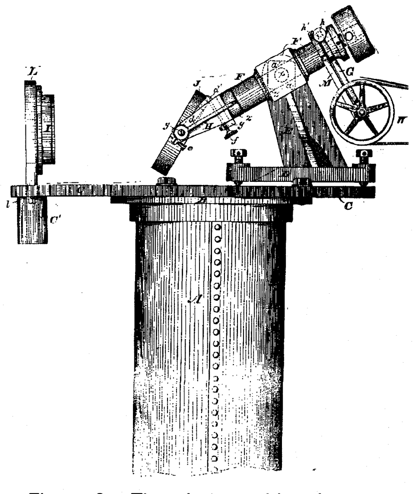


Figure 2. The photographic telescope heliostat and collimator lens (after Newcomb, 1880).

Also located along the N-S axis occupied by the photographic telescope was the Stackpole broken-tube transit telescope, which was mounted on a solid brick foundation inside a simple, wooden, sloping-roofed 'Transit House'. A typical Stackpole transit telescope is shown in Figure 4; this instrument was used to determine the latitude and longitude of the transit station, and also to maintain an accurate local time service.

The third of the prefabricated wooden buildings was the Equatorial House, which housed the equatorially-mounted Clark refractor that was used for visual and micrometric monitoring of the transit, and recording lunar occultations (for longitude-determination purposes) before and after the transit. Unlike the transit telescope, the Clark refractor did not require a brick or stone pier or support, as the base of the metallic column that supported the equatorial head contained three small but sturdy tripod legs that rested directly on the wooden floor of the Equatorial House. Figure 5 shows a surviving 1874 transit of Venus Clark telescope that was on display at the U.S. Naval Observatory in Washington D.C. in 1997.

The entire 1874 US transit of Venus programme was a major logistical exercise, and also involved very considerable expenditure. Even the fitting out of one transit station was financially non-trivial: as Table 1 indicates, the instruments at the Campbell Town site cost well in excess of US$4,200, which in today's currency equates to nearly US$50,000, a truly astronomical sum.

2.2 Setting up the Transit Station

When Raymond disembarked from the US man-of-war *Swatara* at Hobart on 1874 October 1 he had not decided on a new site for his transit station, but after consulting local officials and Dr R L J Ellery, Director of Melbourne Observatory, he accepted Dr Valentine's suggestion of Campbell Town. It offered various advantages:

> It is connected with the city of Hobart Town by one of the finest roads in the world—a solid, smooth, macadamized road, built by convicts in the days when Van Dieman's Land [the original name for Tasmania] was a penal colony—so that instruments and material could be transported to the station with rapidity and safety. It occupied nearly the highest available ground on the island, and is unpleasantly celebrated for dry weather during the summer months, so much so that the inhabitants are sometimes distressed for water, and agriculture is carried on with difficulty. Meteorological records, which I examined at Hobart Town, indicate it as the driest locality on the island … and show clear weather on December 9 for at least nine years preceding. It is separated by hills from Hobart Town, so that local storms are not likely to extend from one place to the other. It is about eighty miles distant from the station at Hobart Town. (Raymond, n.d.:377).

Raymond and Tillman reached Campbell Town by mail coach on October 10, nearly two months before the all-important December 9 transit, leaving ample time to set up the various instruments and prefabricated observatory buildings. These arrived by wagon-train October 13, and by this time a paddock near Dr Valentine's house had been selected as the site for the transit station. It was level, several acres in extent, and was

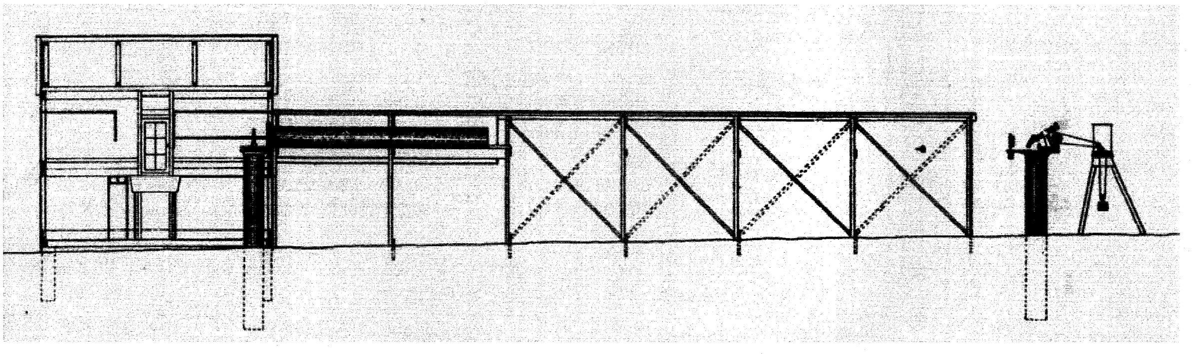


Figure 3. Schematic side elevation of the photographic telescope. From left to right: the Photographic House (with developing room, and the plate holder and pier), superstructure supporting and protecting the measuring rod, the heliostat and collimator lens (with pier) and the tripod and heliostat drive. (adapted from Newcomb, 1880).

Table 1: Instruments at the Campbell Town transit station (adapted from Dick, 2003: 248)

Instrument	Manufacturer	Cost (US$)
Photographic telescope	Alvan Clark & Sons (Cambridge, Mass.)	525
Refracting telescope	Alvan Clark & Sons	1200
Transit telescope	Stackpole Bros (New York)	1370
Chronograph	Alvan Clark & Sons	500
Astronomical clock	E. Howard & Company (Boston)	275
Sidereal chronometer	T.S. & J.D. Negus (New York)	?
Mean time chronometer	Geroge E. Porter (Boston)	?
Thermometers	?	?
Barometer	?	?
Theodolite	Stackpole Bros	200
Engineer's level	Stackpole Bros	175
Dip circle	Edward Kahler	?

> … admirably adapted to our purpose. The ground rose gently towards the west, the direction of the prevailing winds, and on that side a small grove furnished a very efficient shelter without limiting the range of our telescopes. The sky was visible in every direction almost to the horizon. The soil was a firm loam, and beneath it, at a distance of from two to four feet, is the solid bed-rock, a tough volcanic stone consisting of Hornblende, pyroxene, and silicates of alumina, and furnishing a perfect foundation for our piers. (ibid.)

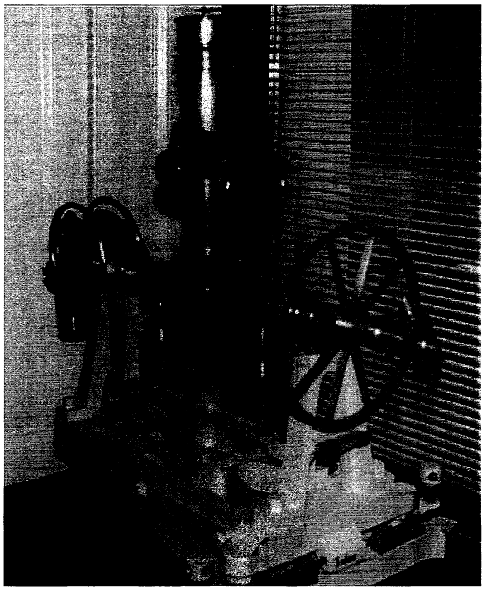


Figure 4. Stackpole broken-tube transit telescope at the U.S. Naval Observatory.

In a detailed, unpublished account, Raymond (n.d.) documents how his party systematically went about setting up the transit station. First to be erected was the Transit House, which was completed on October 19. At the same time, the hole for the transit pier was dug. This was

> … about four feet eight inches [1.42 metres] in depth. All the loose stone was removed from it, and the bedrock was carefully cleaned and leveled with concrete. The pier was then constructed with brick, laid in Portland cement. At first considerable water from the adjacent high ground settled in the pier hole; but this difficulty was obviated by inclosing [*sic*] the pier to the height of about eighteenth inches in a bottomless wooden box and surrounding this box with concrete. (Raymond, n.d.:378).

Figure 6 illustrates the general features of the pier, as outlined by Newcomb (n.d.) in his specific instructions to each of the transit parties. Just one day later (October 20) the transit telescope was installed. The chronograph followed on the 23rd, and was operational on the 26th.

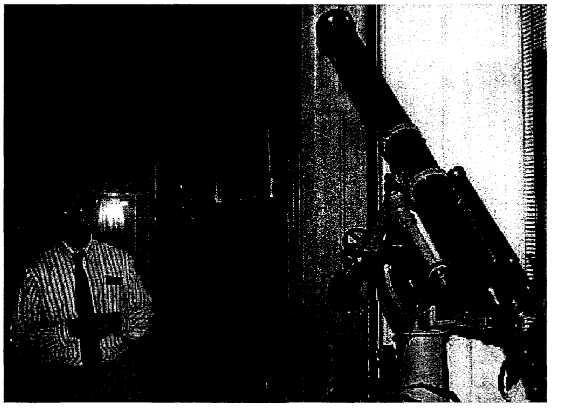


Figure 5. 5-in Clark refractor and US astronomical historian and transit of Venus authority, Steven J Dick, at the U.S. Naval Observatory in 1996.

While some members of the team were busy with the Transit House, others were setting up the Equatorial House. This was also completed on October 19, and the Clark telescope was installed.

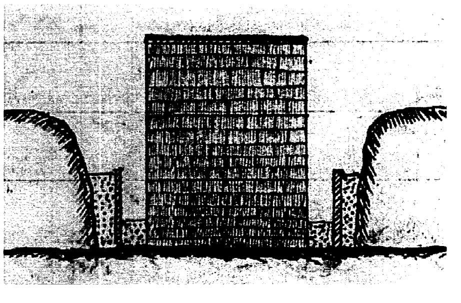


Figure 6. Installation of the transit telescope pier (after Newcomb, n.d.:10).

Finally came construction of the Photographic House and photoheliograph, which proved to be a much more time-consuming and challenging task. On October 20 the positions of the two piers were determined, and holes for them were dug. Raymond (n.d.:380) reports that in excavating these holes,

> … the solid rock was found about three feet below the surface. The piers had therefore to be cut off in order to bring their upper surfaces to the proper levels. Each hole was then lined with a bottomless

> wooden box. The piers were then fastened temporarily in these boxes with wooden wedges … [and] were then accurately adjusted in position. When the adjustment had been perfected, the spaces around the piers were filled with concrete, and finally the piers themselves were filled with concrete to within about one foot of their tops.

With the exception of the bottomless box, which was designed to prevent the inflow of groundwater, Raymond followed closely the instructions and diagram (Figure 7) provided by Newcomb (n.d.:11) in his notes for the different transit parties. On October 24 the Photographic House was erected, and by November 4 the photographic telescope was operational and the first test images of the Sun were taken. Finally, on November 7 the measuring rod and its cover were installed.

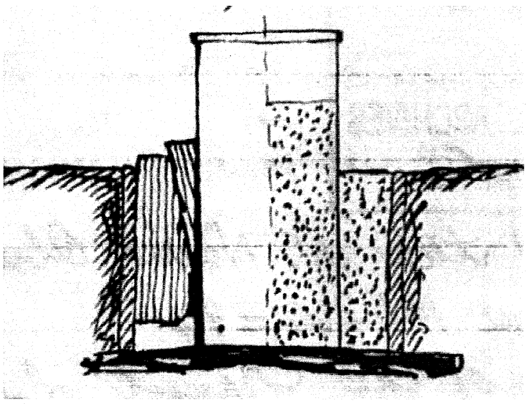


Figure 7. Installation of the photographic telescope pier.

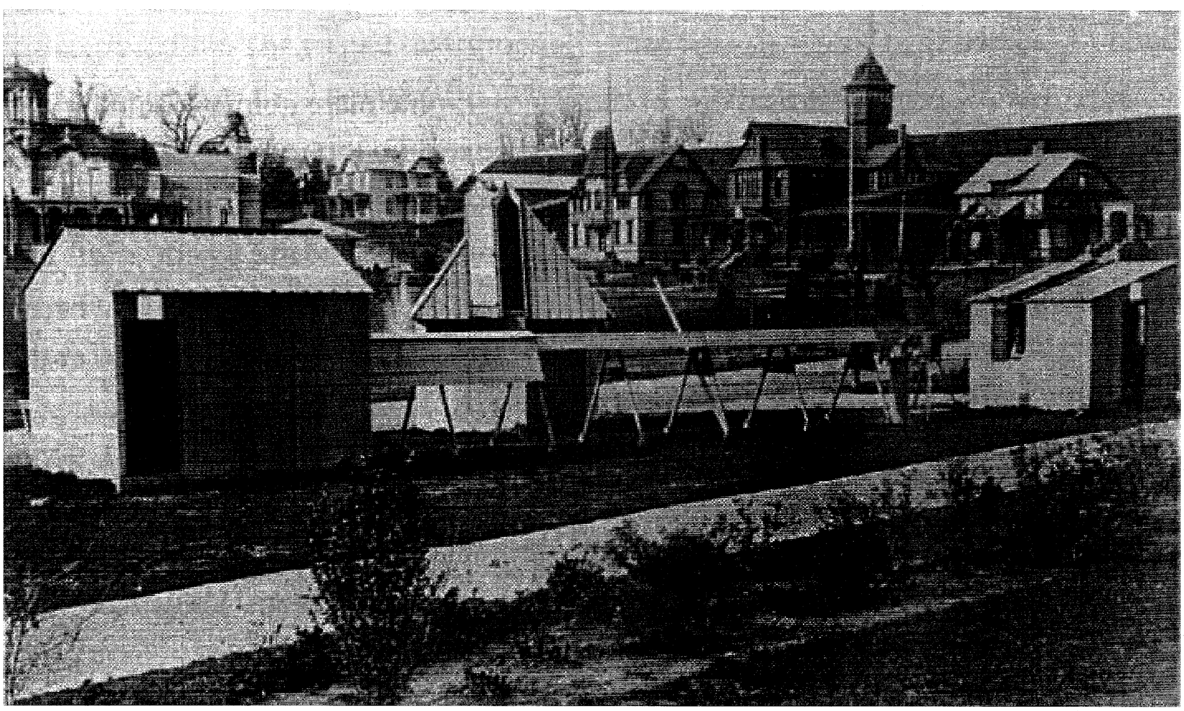
The other transit facility set up at Campbell Town was a Clock Room, which was located in Dr Valentine's house. The house was a substantial brick construction, and since a room was chosen that had just one window and was protected from direct sunlight by a wide veranda there were only small diurnal changes in temperature. On October 16 the sidereal clock was bolted to a thick brick partition wall and set in motion. Also installed in this room were a sidereal chronometer, a mean time chronometer, two thermometers, and the barometer (Raymond, n.d.:380). The Clock Room also doubled as an office for the transit party.

Once the observing station was fully operational, members of the transit party were kept busy right up until the day of the transit monitoring and checking on all the equipment, making practice solar observations, maintaining the time-service, and conducting astronomical observations for latitude and longitude. Derived co-ordinates of the site (after Raymond, n.d.: 379) were:

Latitude $41°\ 55'\ 42.5''$ S
Longitude $9^h\ 02^m\ 25^s$ West from Washington

Elsewhere in his account of the transit expedition, Raymond (n.d.: 390) gives a latitude of $41°\ 55'\ 42''.0 \pm 0.16$ S.

Raymond did not supply a description, so we do not know the precise appearance of the Campbell Town transit station. However, photographs of other US 1874 transit stations exist, and these show what the prefabricated Transit, Photographic and Equatorial Houses looked like. Figure 8 is particularly helpful in this regard, as it shows a 'typical' transit station, which was constructed specifically for the 1876 US Centennial Exhibition in Philadelphia—but with genuine examples of the three Houses, the heliostat and drive mechanism. We can safely assume that the prefabricated Houses at Campbell Town were identical or very similar in overall appearance.



Houses (left to right), and the structure extending from the Photographic House towards the heliostat and drive (after Dick, 2003:252).

Table 2: Contact times of the 9 December 1874 transit at Campbell Town

Contact	Local Time		
	h	m	s
First contact (external contact at ingress)	11	35	27
Second contact (internal contact at ingress	12	04	53
Mid-transit	13	56	01
Third contact (internal contact at egress)	15	46	55
Fourth contact (external contact at egress)	16	16	23

2.3 Observations of the Transit

Campbell Town was ideally placed for observers of the transit, as the entire event was visible (weather-permitting). Table 2 (after Abbott, 1874) indicates the transit began late morning local time, and ended late in the afternoon, but well before sunset. The total duration of the transit was just over 4 hours and 40 minutes.

After all these fine preparations, the transit party awake to a sky full of rain clouds on 1874 December 9, and the time first contact was scheduled it was raining quite heavily. Nonetheless, all members of the party were at their assigned positions as "... the rain was pouring hopelessly outside." (Raymond, n.d.:386), but at 12:15 p.m. local time the rain suddenly ceased and the Sun could be seen dimly through passing clouds. Raymond looked through the Clark telescope, and there was Venus near the limb of the Sun but well past second contact. Meanwhile, Tillman was in charge of the Photographic House, and the heliostat and drive were immediately installed and activated, and then photographs of the Sun were taken whenever breaks in the clouds permitted.

Heavy rain and strong winds terminated all observations at about 1 p.m., and lasted for 50 minutes, when the sky cleared a little. Tillman's team obtained further photographs whenever the Sun was visible, and Raymond managed to obtain some micrometric measures of Venus's position through the Clark refractor. Raymond also observed the third contact. At this time, clouds were drifting over the Sun, and Venus "... seemed to me *gradually* to assume the pear shape ... No shooting out of the planet toward the sun's limb at or near the time of contact was observed." (ibid.). Given the generally inclement weather, this was a positive result, and the photographers fared even better, obtaining 55 full disc photographs of the Sun (Figure 9) and 77 of the third and fourth contacts.

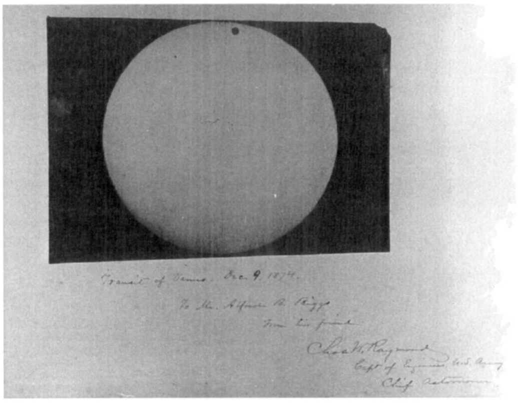


Figure 9. Photograph taken at the U.S. station at Campbell Town, showing the transit in progress (Courtesy: Queen Victoria Museum and Art Gallery).

2.4 Calculation of the Solar Parallax

With the notable exception of the Chatham Islands party, all of the US stations obtained useful transit photographs (see Dick *et al.*, 1998: Table 2), even though most experienced far from ideal weather. Now came the challenge of analysing all of the observations and producing a value for the solar parallax. Visual and photographic observations of the contacts were discarded, largely because of the notorious 'black drop effect' (see Schaefer, 2001), and the focus shifted to the full-disc photographs of the Sun taken in the course of the transit. In 1881, D P Todd from the Nautical Almanac Office published an interim value for the solar parallax of 8″.883 ± 0.034, but for various reasons (summarized in Dick *et al.*, 1998:241-242) the analysis was not completed and the final result was never published.

Instead, William Harkness proceeded to publish a value of 8″.842 ± 0.0118 based on US photographs obtained during the 1882 transit (*Annual Report*, 1889: 424-425), and he and Newcomb were only able to improve on this in the 1890s by re-analysing earlier data on the understanding that the solar parallax was intricately linked to such parameters as the lunar parallax, the constants of precession and nutation, the parallactic inequality of the Moon, the masses of Earth and Moon, and the velocity of light. Their values of 8″.809 ± 0.0059 and 8″.800 ± 0.0038 (Harkness, 1894; Newcomb, 1895) are remarkably close to the currently-accepted value of 8″.794148 ± 0.000007, which was ratified by the IAU in 1976.

3 SURVIVING RELICS

3.1 The photographic telescope piers

When the Americans abandoned their Campbell Town site after the transit, they left the two photographic telescope piers *in situ*, and these exist today as rather novel gate posts at the entrance to 'The Grange' property from the Midland Highway (Figure 10). Reference to Figure 3 reveals that the heliostat pier was of slightly larger diameter than the pier which supported the plate holder, and this is reflected in the relative sizes of the two gate posts: the right hand gate post in Figure 10 has an external diameter of 309 mm (12".2) and is the pier from the Photographic House, while the left hand gate post, with an external diameter of 356 mm (14"), represents the heliostat pier. Both piers are made of riveted 9.5 mm ($^3/_{16}$") plate steel, and extend 1.32m (4' 4") above ground level. The date when the piers were relocated from the 'Observatory paddock' to the driveway entrance has not been documented, but it must have post-dated Valentine's death (which occurred in 1876).

3.2 The 'Observatory paddock'

The gate post piers were originally located in what today is colloquially known as the 'Observatory paddock', which is to the north and slightly east of Dr Valentine's homestead (see Figure 11). This more-or-less level paddock currently contains field evidence of three different structures, that one would automatically hope to associate with the Transit House, heliostat pier (and drive), and the Photographic House, and their approximate positions relative to one another and to the homestead are shown in Figure 11.

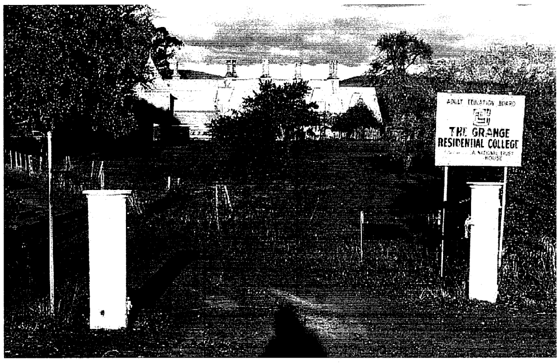


Figure 10. The entrance to 'The Grange', with Dr Valentine's homestead in the background. The novel gate posts are the piers that originally supported the heliostat (left) and the photographic plate-holder (right).

The most northerly of the three structures is a solid brick pier of rectangular cross-section (Figure 12), with the long axis aligned east-west. This pier measures 717 × 616 mm (2' 4".25 × 2' 0".25) and extends 775 mm (2' 6".5) above ground level. Approximately 38 metres (136') to the south there is a conspicuous low concrete foundation, which only extends ~15 cm above ground level and measures 1.47 × 1.07 metres (4' 10" × 3' 6"), with the long axis oriented in the east-west direction. As Figure 13 indicates, the western part of the top of the foundation has been built up with mortar. The most southerly of the three structures is an area of cobblestones measuring approximately 3.05 × 3.35 metres. Very near its northern boundary there is a conspicuous stone-lined depression that is the right diameter to accommodate the larger of the gatepost piers (Figure 14). Moreover, this depression is ~11.75 metres (or 38' 6.625") from the low concrete foundation, which just happens to be the distance that separated the two photographic telescope piers at the US transit of Venus stations.[1]

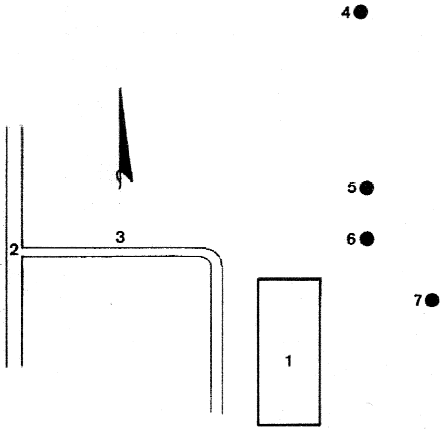


Figure 11. Sketch plan (not to scale) showing The Grange homestead (1), location of the gate posts (2), entrance driveway (3), three structures in the 'Observatory paddock' (4-6) and the summer house (7).

The accumulated evidence suggests that the three structures, from north to south, respectively relate to the Transit House, the Photographic House and the heliostat pier (and drive),[2] and there is little doubt that the most northerly structure is indeed the remains of the transit telescope pier (see Raymond, n.d.; Newcomb, 1880. See, also, Figure 6). But the identification of the second field structure is not so simple. If this low foundation was associated with the Photographic Telescope, then why is there no field evidence of the conspicuous hole that would have been left when the plate-holder pier was torn out of the ground and relocated to the entrance of The Grange's driveway? Perhaps because the built-up cement area of the low foundation represents the remains of the hole, which was subsequently filled in. Unfortunately, we have no close-up photographs of any foundations associated with *in situ* 1874 plate-holder piers, but they would have been similar in general appearance to those found with heliostat piers. Figure 15 shows the heliostat pier and foundation at the Chatham Islands (New Zealand) transit station, and if we mentally remove the pier then the two-tiered foundation bears a close resemblance to the Campbell Town field evidence. Supporting this interpretation is an area of surface boulders just south of the low foundation, which would seem to represent the rocks that Raymond (n.d.) mentions encountering in the course of excavating the holes for the photographic telescope piers.

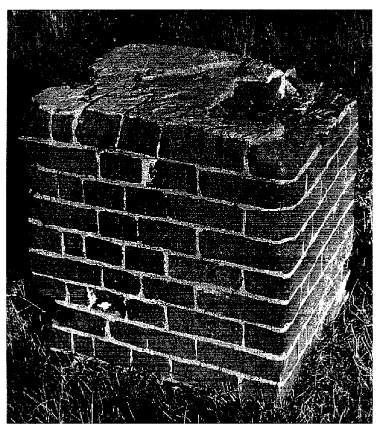


Figure 12. Remains of the pier that supported the transit telescope.

But even if we accept the above identifications—which seem eminently reasonable—there is still a problem, and that is the anomalous positioning of the transit telescope pier. We have no 1874 photographs of the Campbell Town transit station or site descriptions by Raymond (n.d.) or Newcomb (1880) to judge from, so we must be guided by the configurations of other Southern Hemisphere US 1874 transit stations. Scaled layouts of the Hobart and Queenstown transit stations (the latter in neighbouring New Zealand) have been published (Dick, 2003:258; Orchiston *et al.*, 2000:35), and these show a consistent pattern of N-S aligned Photographic House, heliostat pier, and Transit House, *in that precise order*, with the pier of the transit telescope positioned 4.9 metres and 4.2 metres to the south of the heliostat pier respectively. A photograph of the 1874 Nagasaki transit station published by Janiczek and Houchins (1974:370) shows the middle of the Transit House ~4.7 metres from the heliostat pier, while Koorts (2003:201) lists 4.27 metres as the distance of "... a typical southern station of an American observation post in 1882." If these figures are indicative, then the transit telescope pier at Campbell Town should be anywhere from 4 to 5 metres *south* of the heliostat pier hole, not far to the north of this feature and the Photographic House foundation as is in fact the case. If the transit telescope pier is *in situ*, and has not been relocated since 1875 February (when the Americans sailed from Hobart), it's current position cannot easily be explained. In fact it makes absolutely no sense, for to have functioned optimally it was important that the Transit House was close to Dr Valentine's residence, so that the chronometers could be transferred from the Clock Room to the transit telescope whenever observations were to be made.

Figure 13. Remains of the foundation for the pier that supported the photographic plate-holder.

3.3 The Equatorial House

Whereas the relative locations of the Equatorial House, heliostat pier, and Transit House are generally predictable at the American 1874 transit of Venus stations, there was no 'standard' position for the Equatorial House. Sometimes this was located due east or west of the Transit House (as, for example, at Queenstown), while at other sites it was located between the Transit and Photographic Houses, either to the east or the west of the line joining these two structures. Furthermore, because the Clark refractor did not require a subsurface instrument pier or footing, we should not expect to find any field evidence of the original location of the Equatorial House at Campbell Town (or any of the other transit stations). But what we do know is the current whereabouts of this Equatorial House.

Figure 14. Hole associated with the heliostat pier.

It happened that Dr Valentine was a keen amateur astronomer, so when the Americans quit Campbell Town they expressed their thanks for his genial hospitality by giving him the Equatorial House. They also showed their gratitude to Alfred Barrett Biggs, who assisted in the Photographic House, by presenting him with the Transit House. Biggs subsequently relocated to Launceston where he became Tasmania's foremost astronomer (see Orchiston, 1985), and for the next twenty-five years the ex-Campbell Town Transit House served him well as one of two observatories that he operated. Some time after his death in 1900 it was dismantled and no longer exists.

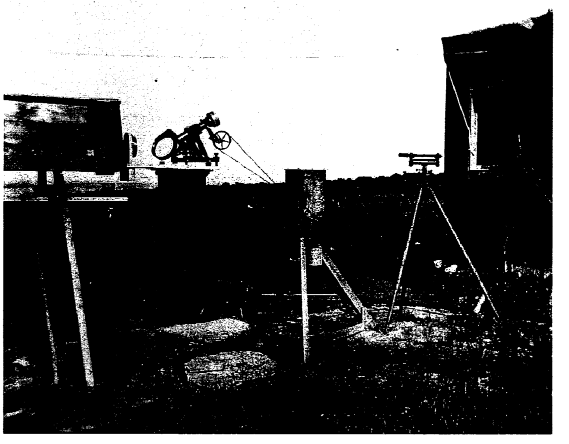


Figure 15. Chatham Islands heliostat, pier and drive, and to the extreme right part of the Transit House photographed by W H Rau (Courtesy: Alexander Turnbull Library, Wellington, New Zealand: F-55746-½).

Valentine also was able to indulge his passion for astronomy after the Americans departed, and he installed an 8.5-in (216-mm) Browning-With reflector in the Equatorial House. By a strange quirk of fate, after his demise in 1876 this instrument found its way to one of Biggs's observatories in Launceston. At some later date, the 3.1 metre diameter Equatorial House was converted into a summer house and relocated to near the tennis court at 'The Grange', which is where it remains today (see Figures 16 and 17). Currently it comprises five of the eight original octagonal wall units, each measuring 1.98 metres (6' 6") high and either 1.27 metres (4' 2") or 1.32 metres (4' 4") in width. The wall units have Oregon (*Pseudotsuga menziesii*) bottom plates, wall plates, studs, noggs and diagonal bracing, and are clad with vertical planks which in 1986 March were identified by staff at the CSIRO's Division of Chemical and Wood Technology as *Pinus lambertiana* or Sugar Pine. Both tree species are endemic to the USA, and common in the mountains of Oregon and California. Some of the pieces of framing timber exhibit incised Roman numerals (Figure 18), a practice which was used by the Americans to help facilitate easy and rapid erection of these prefabricated buildings at the various transit stations. One wall unit differs markedly from the others in that it contains a window. This has a wooden frame measuring 838 mm in height and 508 mm in width. There is no doubt that this is an original feature as a photograph of the US 1882 transit of Venus station at Santa Cruz, Argentina, includes an Equatorial House with an identical window. As with other US Equatorial Houses, the one at Campbell Town originally had a wooden floor, but when the summer house was set up this was removed and replaced by an octagonal concrete slab.

Various surviving photographs of US 1874 and 1882 Equatorial Houses show that these featured a four-sided triangular wooden dome, with a single wooden shutter, but the Campbell Town dome has at some stage been removed and replaced by a modern rustic roof, which during the 1960s was clad externally with wooden shingles (Gary Price, pers. comm., 2004). However, the basic design of the summer house, and the presence of a circular steel dome ring around the wooden plate above the octagonal wall units (Figure 19), betray its original astronomical nature. This dome ring is 3 metres (10') in diameter, and made up of 15 individual neatly butted lengths of track, each with an inverted U-shaped cross-section. On opposite sides of the building, two large metal cleats (Figure 20) have been screwed to the inside of the wall plate, and given Tasmania's windy climate these would have served to anchor the dome when the observatory was not in use, and perhaps to secure the shutter during observing runs.

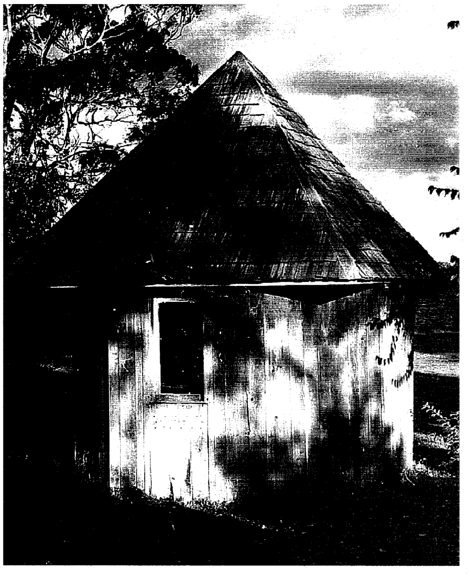


Figure 16. The Equatorial House has been converted into a summer house at Campbell Town.

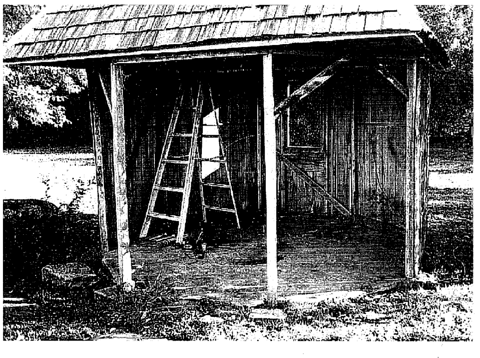


Figure 17. Interior of the summer house, showing constructional details.

3.4 The transit photograph

During the transit, the Campbell Town party succeeded in taking 55 photographs of Venus on the Sun's disc and 77 of the egress contacts, and a print of one of the 'disc' photographs survives in the Queen Victoria Museum and Art Gallery, Launceston, and has been reproduced here as Figure 9. Titled "Transit of Venus, Dec. 9, 1874." and inscribed "To Mr. Alfred B. Biggs From his friend Chas. W. Raymond Capt. of Engineers, U.S. Army Chief Astronomer", this photograph was sent to Biggs as a memento of the transit and to show gratitude for his valued assistance in the Photographic House.

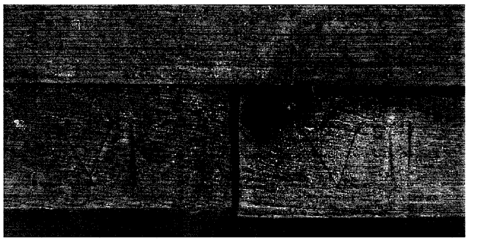


Figure 18. Examples of pieces of framing timber with incised Roman numerals.

4. CONCLUDING REMARKS

Campbell Town, in Tasmania, was the site of one of the eight temporary stations set up by the US to observe the 1874 transit of Venus, and although far from ideal weather was experienced there, photographs taken while the planet was on the Sun's disc and during the two egress contacts played an important part in the overall analysis.

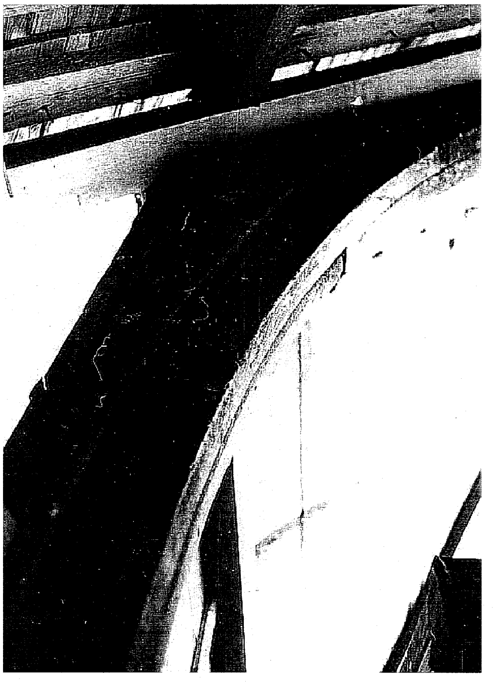


Figure 19. View of the expanded wall plate carrying the metal track upon which the dome originally rotated.

However, Campbell Town has another, even more significant, claim to fame in that an amazing assemblage of transit of Venus relics is preserved at this site. These comprise the two piers associated with the horizontal photographic telescope (and field evidence associated with both of these), the remains of the Equatorial House, and the transit telescope pier (the current position of which is an enigma). While relics at other 1874 and 1882 US transit of Venus stations were still extant in the mid-twentieth century (e.g. see Koorts, 2003), these Tasmanian relics would appear to be the only ones that have survived through to the present day. Furthermore, the photograph of the transit in the Queen Victoria Museum and Art Gallery has special significance as searches of relevant US archives and observatories have failed to reveal the existence of any other photographs of the 1874 transit taken by the various official US transit parties. This print therefore is unique, and as if to further highlight its importance, it would appear that not a single photographic plate from any of the 1874 transit parties has survived.

Tasmania therefore has a unique collection of 1874 transit of Venus relics. These are of international significance, and constitute part of our nineteenth century world astronomical heritage. As such, it is essential that their importance is fully recognized, and that they receive appropriate attention from those trained in the care and maintenance of historical and industrial archaeological remains. While the piers and various instrument foundations are in reasonable condition, and remedial conservation and restoration can be carried out if required, the Equatorial House has suffered serious borer damage and this does not bode well for its long-term survival.

Figure 20. One of the metal cleats used for anchoring the dome.

5 NOTES

1. Gary Price (pers. comm., 2004) reports that in 2002 an exploratory archaeological examination of this cobblestone area suggested that it once served as the floor of a milking shed or byer, a view reinforced by the discovery of a short length of half-field-tile drain that would have carried water away from the building when the floor was washed down. Near the conspicuous 'pier' hole was another slightly smaller hole, suggesting that the heliostat pier and an adjacent post functioned as the two sides of a cow bale.
2. In our earlier preliminary report on these relics (Orchiston and Buchanan, 1993:23-24), we came up with a quite different interpretation, in that we suggested the low foundation shown here in Figure 13 was "... a foundation for the stand that supported the heliostat drive." Meanwhile, at the time of our original field survey of the site (in 1982), the cobblestone area was overlain by a thin cement covering, and we associated this with "... the floor of the Photographic House." This covering, which was disintegrating, has since been removed, exposing what we now believe to be the hole associated with the heliostat pier. Access to archival material (including transit station photographs) in Australia, New Zealand and the United States over the past decade or so has led to a dramatic increase in our overall familiarity with US 1874 and 1882 transit of Venus stations, and we feel confident about the identifications made in the present paper.

6 ACKNOWLEDGEMENTS

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