2.1 The 'Madsen Reflector'

Hans Frandsen Madsen (Figure 2) was a surveyor in the New South Wales Lands Department during the second half of the nineteenth century, and had a passion for astronomy which was shared by a number of other staff members (Orchiston, 1987a; Orchiston and Bhathal, 1991). Between

Figure 2. Hans Frandsen Madsen (1843-1937). (Bembrick Collection)

1882 and 1886 he completed a number of 46-cm mirrors (Madsen, 1886), one of which was made up into a completed telescope. This Newtonian instrument featured an English equatorial mounting, and was housed in a circular stone building with a copper dome, erected at 'Hesselmed', the Madsen residence in Newtown, a suburb of Sydney. However, there is no evidence that it was used for any serious observing, although it did provide local amateur astronomers with views of Mars in 1892 (Biggest not best, 1924). Rather, for Madsen the challenge lay in successfully producing the optics, a task which he undertook with considerable skill and ingenuity.

Walter Gale (Figure 3), a leading Australian twentieth century amateur astronomer (Orchiston, 1988c, 1989b, 1991b), was associated with a number of large telescopes, and the first of these was the 'Madsen Reflector'. On 1894 April 24, he wrote John Tebbutt that "In order to be better able to examine faint objects I am about to engage on the construction of an 18 inch reflector of short focus." (Gale, 1894). Instead he ended up purchasing Madsen's reflector, and by 1895 January this was operational (Innes, 1895b), housed in a roll-off roof observatory. Gale described the primary mirror as "perfection" (C. Tenukest, pers. comm.).

Unfortunately for Gale, in 1896 December he was transferred to Newcastle, and the large reflector was left in Sydney and was eventually dismantled. It was only after he returned permanently to Sydney twenty-five years later that the Madsen Reflector was re-erected, and over the next twenty years this telescope and a range of other large instruments (both reflectors and refractors), were used primarily for planetary observing (see Biggest not best, 1924). Gale claims to have viewed Phobos and Deimos without difficulty through the 46-cm reflector (C. Tenukest, pers. comm.).

By the time of Gale's death in 1945 the instrument had become derelict and it was purchased in that condition from the estate by a Sydney amateur astronomer named McDonall (ibid.), but was never mounted. In 1974, a year or so after McDonall's death, the telescope was located in Sydney by Bill Tyrrell (pers. comm.), a prominent member of the New South Wales

Branch of the British Astronomical Association (henceforth NSW BAA). Tyrrell acquired the telescope and, recognizing its potential, began restoring the mounting. In 1980 he went into partnership with Colin Bembrick (also prominent in the NSW BAA at the time – see Orchiston, 1990b), with the intention of jointly renovating the *f*/8.8 instrument and committing it to serious research. At this stage it was decided that the riveted steel tube was beyond repair, and so the restoration plans were modified to incorporate an *f*/14.4 Nasmyth focus in the new design. A larger secondary flat was also introduced to allow a more accessible (folded) Newtonian focus.

Because of Tyrrell's work commitments, Bembrick assumed sole ownership of the telescope in 1983 and enlisted the help of NSW BAA member, Syd Elwin (now deceased – see Bembrick, 1995), who produced the secondary flat and also refigured the 463-mm clear aperture primary mirror. He commented that the mirror was "very good, near perfect". (pers. comm.). Following Bembrick's new design, the Cassegrain secondary was produced by Nick Loveday of the Astronomical Society of New South Wales Inc. A new 18-point flotation mirror cell based on a design by Barlow (1976) was manufactured, and the refurbishment of the optics and production of a new Serrurier Truss tube are now nearing completion. While there has been considerable restoration of the original English equatorial mounting, further work is required (Figure 4).

When the telescope is operational, Bembrick's plan is to use it for photoelectric photometry, a field in which he has some experience (e.g. see Bembrick and Daggar, 1984; Hollis, Bembrick, Dumont and Miles, 1987; Orchiston, Bembrick, Park and Poppleton, 1985), with the emphasis on variable stars and minor planets. At this stage, the intention is to mount the telescope at Mountain View, near Bathurst, where Bembrick already has a property and a functioning 'dark-sky' observatory (see Bembrick, 1993a).

Figure 3. Walter Gale (1865-1945) is the bearded gentleman sitting in the front row, second from the right (Bembrick Collection)

Notes on the process of Polishing and Figuring 18-in. Glass Specula by hand, and experiments with Flat Surfaces.

By H. F. Madsen.

[*Read before the Royal Society of N.S.W., 7 July, 1886.*]

So much has been written upon the production of glass reflectors for use in astronomical observations, and so many of these being in use at the present time, any improvements in their construction would be difficult if not impossible to attempt; still, as the method which I have followed is not altogether the usual one, and as I am not aware that any mirrors of the size under discussion have been attempted by hand, I have thought it probable that certain notes taken down by me during my experiments might not be altogether void of interest to some of the members of this Society.

It is now more than four years ago since I first began polishing specula-flats, &c., with other optical experiments. During this period several mirrors from 7-in. to 18-in. diameter have been completed with gradually increasing success in the result. As the rough castings for the 18-in. mirrors were somewhat expensive, these have been refined and repolished several times to gain practical information in their construction. They were imported from Chance Bros., Birmingham, and when polished were found to have been well annealed.

A piece of plate-glass 10-in. diameter was cemented to the back of each mirror to suit its intended cell or mounting, and the weight of the whole speculum when finished was about 70 lb. (fig. 1.)

In producing these specula the first thing to consider is naturally the convex tool with which they are ground to the proper curvature; and my first attempt was made by procuring two flat discs of glass of the same size, and grinding them together with emery and sand, the intended speculum occupying the uppermost position until they had attained the desired form; it being well known that two flat discs when ground together will form themselves into spherical surfaces, the overhanging part of the top one producing convexity in the one underneath.

My succeeding trial was made by the usual iron tool turned to approximate curvature in a lathe; but it was found that two of these had to be ground together for a considerable time before