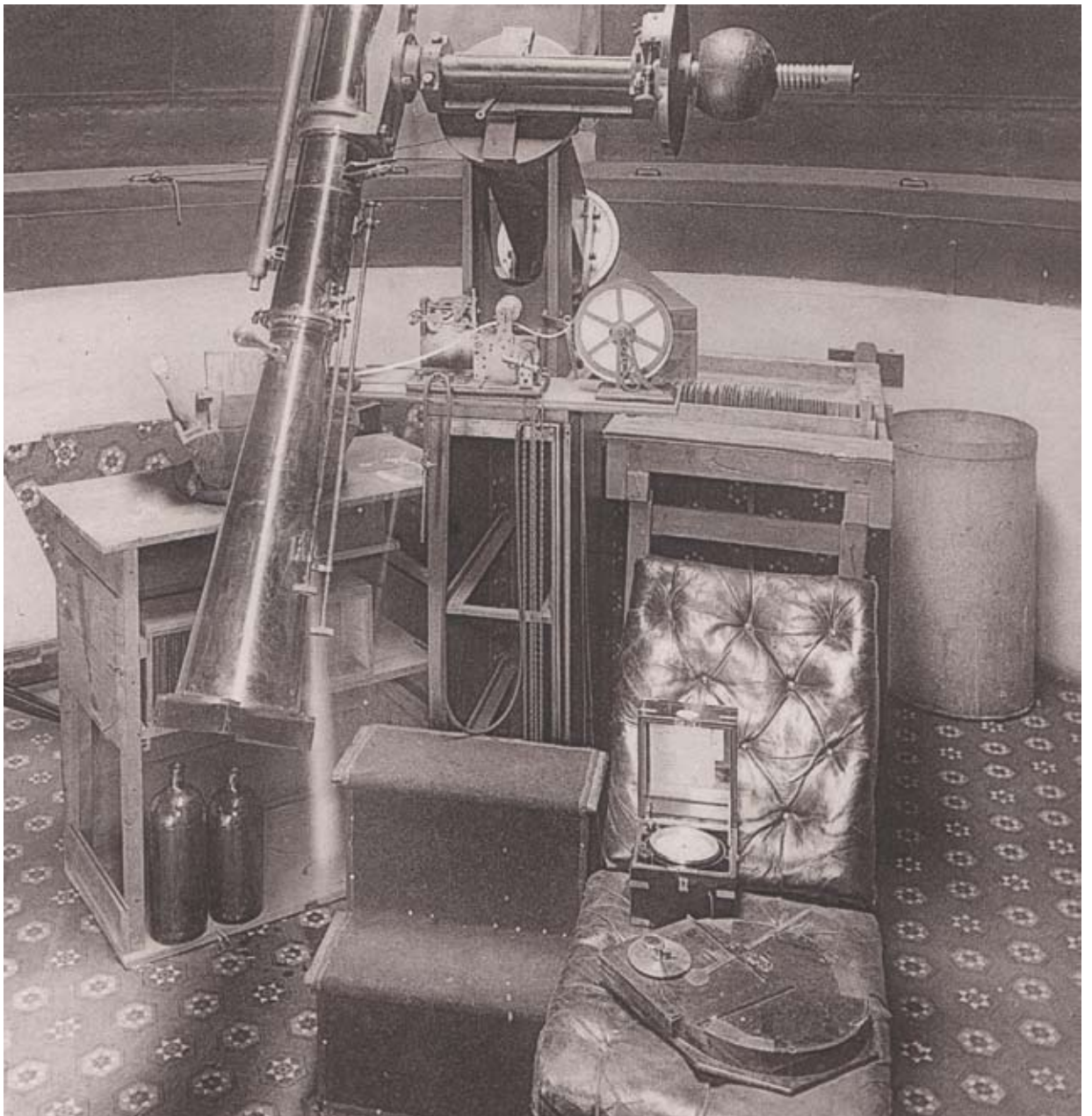


CURATORIAL RESEARCH SERIES Vol 1 : 2

# SYDNEY OBSERVATORY

Nineteenth Century Scientific  
Instrument Makers



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Written & Compiled by Geoffrey Barker ©PHM 2007

Cover Image: Dallmeyer Astrographic Telescope and Equipment, 1874, collotype from 'Observations of the Transit of Venus, 9 December, 1874; made at Stations in New South Wales,' 1892

# Scientific Instrument Makers

## Alvan Clarke

Alvan Clark (1804-1887) was one of the most famous telescope makers produced by the United States in the nineteenth century. Originally a portrait painter he built his first reflector in 1844 and two years later established a business with his sons Alvan Graham and George Bassett Clark. Together they made over 75 objectives which were over 6 inches in aperture each of which was considered to be nearly optically perfect and amongst the best produced at the time.

Among their many achievements were the building of an 18.5 inch telescope for Evanston, two 26 inch lenses for observatories in Washington and Virginia, a 30 inch lens for Pulkowa in Russia, a 36 inch lens for the Lick Observatory and the largest lens in the world at that time, a 40 inch for the Yerkes Observatory in Chicago.<sup>1</sup> Making telescope lenses was an exacting and time consuming skill, the Washington lens for instance took over a year to grind and polish.

## Cooke & Sons

In the nineteenth century Cooke & Sons Ltd established a reputation as one of the most reputable optical instruments makers in Britain.<sup>2</sup> Thomas Cooke started his business in York in 1837 and by 1855 had established his reputation as a maker of fine lenses for telescopes by winning a First Class medal for his 7 1/4-inch equatorial telescope.<sup>3</sup> In 1860 he was commissioned by Queen Victoria's husband Prince Albert to construct a telescope for Osborne House in the Isle of Wight.<sup>4</sup> The quality of their work was such that a lens and mounting completed in 1871 was still being used at the Cambridge University in the 1950s.<sup>5</sup>

In 1879 some time after the death of Thomas Cooke in 1868 the firm was taken over by his sons Thomas (Jnr.) and Charles.<sup>6</sup> The firm continued to supply many British Government institutions including the Admiralty, the War Office, Board of Works, and

the Post Office.<sup>7</sup> In 1894 Frederick retired from the business which was taken over by the Director Alfred Taylor and in 1897 it was reformed as a limited liability company.<sup>8</sup> In 1922 T. Cooke & Sons brought out their rivals Troughton and Simms becoming Cooke, Troughton & Simms.<sup>9</sup>

## Cooke, Troughton & Simms

In 1782 John Troughton purchased Benjamin Cole's shop in Fleet Street, London enabling him to sell his own signed products.<sup>10</sup> His instrument making business supported several dynasties of Troughton's before becoming Troughton and Simms and later still Cooke Troughton & Simms. This firm was one of the most well respected firms of instrument makers of the 1800s.<sup>11</sup>

While his brother enjoyed some early success the business really expanded once Edward Troughton (1756-1835) took over the business in 1807.<sup>12</sup> Edward and his brother John were both designers and manufacturers of instruments and the quality of their work won them contracts with the leading Government bodies of the time. These included The Royal Society, the Greenwich Royal observatory, the Board of Longitude, the Board of Ordinance and the East India Company.<sup>13</sup>

One of the main factors in the success of the business was the use of a dividing engine which could speed up the laborious process of marking the small divisions of measurement necessary for scientific instruments. This machine was based on that designed by Jesse Ramsden (1735-1800) which had won a prize from the British Board of Longitude in 1775. As a result of this the Board of Longitude was allowed to instruct Ramsden to allow up to ten other instrument makers to copy his machine. One of these was John Troughton and the new machines established both Ramsden's and Troughton's reputations.<sup>14</sup> The dividing engine speeded up both accuracy and production and rather than spending 12 weeks, six days a week and eight hours a day graduating two meridian circles this machine

1 Todd p.355

2 Todd, David, P., *Stars and Telescopes*, Sampson Low, Marston, and Co., 1900, p.331

3 McConnell p.51

4 McConnell p.52

5 McConnell p.57

6 McConnell p.57

7 McConnell p.61

8 McConnell p.65

9 McConnell p.47

10 Taylor, W.E., & Simms, J., *At the Sign of the Orrery – The origins of the Firm of Cooke, Troughton & Simms Ltd.*, pp15-17, cited in King, H., C., *The History of the Telescope*, Dover Publications, New York, 1955, p.232

11 Clercq p.54

12 McConnell p.6

13 McConnell p.10

14 McConnell p.8

enabled the same job to be completed in around 10 hours.<sup>1</sup>

The workshop produced a broad range of instruments from large telescopes and theodolites through to smaller mathematical instruments. Before 1835 most of the optics appear to have been supplied by Dollond as Edward Troughton was reputed to be colour blind.<sup>2</sup> It is also important to note that from the early years the precision engineering of castings and turnings of their instruments were mainly outsourced to Maudslay Field & Donkin or Ransome's & May.<sup>3</sup>

One of Edward Troughton's apprentices William Simms was taken into partnership in 1826 and after Edward died in 1835 Simms became the manager of the establishment and company became Troughton & Simms.<sup>4</sup> Under Simms the company continued to expand and produced instruments for Britain and her colonies as well as for markets in Europe and America. When William Simms died in 1860 the estate was worth around £80,000. The company was next managed by William Simms (junior) and his cousin James who carried the firm into the industrial age.<sup>5</sup>

The 1860s they moved the company from Fleet St to two acres of land at Charlton on Woolwich Road and by 1866 the factory employed 61 men and 20 boys.<sup>6</sup> For the 1874 transit Troughton & Simms made only five transits and four portable azimuths but did refurbish some older telescopes loaned for the occasion. Telescopes and transits of the period were often hybrids with the structure ordered from Grubb's or Troughton & Simms with lenses from Cooke.<sup>7</sup>

However by 1887 the company was able to produce all the parts necessary for their instrument and the company employed nearly 200 people. James Simms died in 1915 and the company was turned into a limited liability company by his two sons William and James. Things however were not so easy for the two sons and in 1922 the business was brought out by their rival T. Cooke & Sons becoming Cooke,

1 Clerq p.72

2 Memorial, Royal Astronomical Society, 9, 1836, p. 288, cited in King, H., C., *The History of the Telescope*, Dover Publications, New York, 1955, p.232

3 MacConnell p.32

4 MacConnell p.30

5 MacConnell p.40

6 MacConnell p.42

7 MacConnell p.45

Troughton & Simms.<sup>8</sup>

### **Fraunhofer**

The company of Merz and Mahler was a direct inheritor of the, 'Optical Mechanical Institute' of Munich, previously operated by the German opticians Fraunhofer and Reichenbach. Fraunhofer was not only a highly regarded optical instrument maker he also was the first to accurately measure many of the dark lines crossing the prismatic spectrum at definite distances. He measured these in 1815 and they were subsequently known as Fraunhofer lines and were of great import in the measuring of astronomical distances. Fraunhofer also made improvements to the equatorial telescope and modified the parallactic stand into the German mounting adopted by many observatories.

### **Sir Howard Grubb**

Thomas Grubb entered the scientific instrument business in the 1830s and quickly gained a name in the construction of telescopes. Largely self taught he ran his firm from Charlemont Bridge in Dublin where he developed both his mechanical and optical skills.<sup>9</sup> As the market for telescopes was fairly limited it is likely Grubb made most of his money from his appointment as Engineer to the Bank of England and from his patented cheap lenses.<sup>10</sup>

The commission for the huge 48-inch reflector in Melbourne led Grubb to set up a separate workshop at Rathmines, Ireland. This workshop was developed by his son Howard Grubb after the retirement of his father in 1870.<sup>11</sup>

In 1887 astronomers from around the world embarked a massive new enterprise; known as the Carte du Ciel (Mapping the Stars) project it involved photographing and measuring the stars in both hemispheres.<sup>12</sup>

British institutions preferred to patronize a British maker Howard Grubb of Dublin who took on the

8 MacConnell p.47

9 Glass, I. S., *Victorian Telescope Makers, the Lives and Letters of Thomas and Howard Grubb*, Institute of Physics Publishing, Bristol and Philadelphia, 1997, p1

10 Glass, I. S., *Victorian Telescope Makers, the Lives and Letters of Thomas and Howard Grubb*, Institute of Physics Publishing, Bristol and Philadelphia, 1997, p3

11 Glass, I. S., *Victorian Telescope Makers, the Lives and Letters of Thomas and Howard Grubb*, Institute of Physics Publishing, Bristol and Philadelphia, 1997, p3

12 Glass, I. S., *Victorian Telescope Makers, the Lives and Letters of Thomas and Howard Grubb*, Institute of Physics Publishing, Bristol and Philadelphia, 1997, p.133

work of constructing seven of the astrographs needed.<sup>1</sup> Melbourne and Perth requested Grubb telescopes but Sydney only wanted the lens. Ordered in 1888 Melbourne and Sydney's equipment arrived in 1890.<sup>2</sup> The Perth telescope arrived in 1897.<sup>3</sup>

Contracts for large telescopes began to dry up in the later part of the nineteenth century and Howard Grubb shifted the businesses focus to military optics.<sup>4</sup> Following the end of the First World War the business became insolvent and was brought by Sir Charles Parsons and this firm continued as Grubb Parsons until 1985.<sup>5</sup>

Making precision instruments like telescopes is a highly specialised activity. It requires not only the engineers, draughtsmen and opticians but also any number of unusual machines and workshops for their construction and assembly.<sup>6</sup>

### **Adam Hilger Ltd.**

The German born instrument maker Adam Hilger opened up his premises at 192 Tottenham Court Road, London with his brother Otto in 1875.<sup>7</sup> By the end of the nineteenth century Hilger had a well established reputation for the making of high quality optical instruments, especially spectrosopes and rangefinders.<sup>8</sup> In 1916 the rival instrument maker Cooke's purchased 6,000 shares in the firm giving them a six-tenths holding in Adam Hilger Ltd., and most of these were in turn owned by Vickers. In 1926 the combined business reformed as Cooke, Troughton and Simms.<sup>9</sup>

### **Merz and Sons**

The company of Merz and Mahler was a direct inheritor of the, 'Optical Mechanical Institute'

1 Glass, I. S., *Victorian Telescope Makers, the Lives and Letters of Thomas and Howard Grubb*, Institute of Physics Publishing, Bristol and Philadelphia, 1997, p.153

2 King, H., C., *The History of the Telescope*, Dover Publications, New York, 1955, p.300

3 Glass, I. S., *Victorian Telescope Makers, the Lives and Letters of Thomas and Howard Grubb*, Institute of Physics Publishing, Bristol and Philadelphia, 1997, Appendix C, p.251

4 Glass, I. S., *Victorian Telescope Makers, the Lives and Letters of Thomas and Howard Grubb*, Institute of Physics Publishing, Bristol and Philadelphia, 1997, p3

5 Glass, I. S., *Victorian Telescope Makers, the Lives and Letters of Thomas and Howard Grubb*, Institute of Physics Publishing, Bristol and Philadelphia, 1997, p4

6 Glass, I. S., *Victorian Telescope Makers, the Lives and Letters of Thomas and Howard Grubb*, Institute of Physics Publishing, Bristol and Philadelphia, 1997, p1

7 Clercq p.89

8 McConnell p.76

9 McConnell p.76-77

of Munich, previously operated by the German opticians Fraunhofer and Reichenbach. From 1826 Merz managed the 'Optical Mechanical Institute' with J. Mahler and in 1845 Merz took sole charge of the business.<sup>10</sup> At the 1851 exhibition Merz and Sons were awarded with a Council Medal, the highest award, for their equatorial telescope.<sup>11</sup> His sons inherited the business and when one of them Sigmund died ownership passed onto Sigmund's cousin Jakob Merz who sold it to Paul Zschokke in 1903.<sup>12</sup>

Merz optical lenses combined flint and crown glass lenses and were used in some of the largest refracting telescopes in Europe and America. German opticians dominated the optical business for much of the nineteenth century as the best optical glass, free of imperfections, was made there.

### **Carl Zeiss**

In 1846 Carl Zeiss (1816-1888) started his instrument making business in a small town of Jena in Germany.<sup>13</sup> He quickly became interested in optics and by 1848 was making and designing microscopes. By 1866 Zeiss realised that to expand his business he needed someone with a greater understanding of optics. Zeiss found the right person in Ernst Abbe (1840-1905) and by 1870 they had devised a new way for computing the manufacture of optical lenses which would improve performance by eradicating much of the colour and spherical distortion of the lens.<sup>14</sup>

In 1879 they produced the homogenous immersion objective but the flint and crown glass which they used to make their lenses needed to be improved before they could perfect their lenses.<sup>15</sup> Optical glass made from silica, soda and potash was supplied by manufacturers who used the same recipes for much of the nineteenth century.<sup>16</sup> It was only after Zeiss and Abbe teamed up with the glass maker Otto Schott in 1881 that they were able to produce a better quality glass without so much of the

10 Clercq p.145

11 Clercq p.64

12 Clercq p.145

13 Auerbach, F., *The Zeiss Works and the Carl Zeiss Foundation in Jena*, W. & G., Foyle, London, England, about 1925?, p.5

14 Auerbach, F., *The Zeiss Works and the Carl Zeiss Foundation in Jena*, W. & G., Foyle, London, England, about 1925?, p.12

15 Auerbach, F., *The Zeiss Works and the Carl Zeiss Foundation in Jena*, W. & G., Foyle, London, England, about 1925?, p.24

16 Auerbach, F., *The Zeiss Works and the Carl Zeiss Foundation in Jena*, W. & G., Foyle, London, England, about 1925?, p.17

characteristic green or yellow tinges.<sup>1</sup>

In 1886 Zeiss and Abbe produced the apochromatic (achromatic) microscope lens. Consisting of ten lenses it effectively removed secondary spectra distortion and spherical aberration.<sup>2</sup> Using the new glass and Abbe's formulas the Zeiss factory began producing their famed anastigmatic photography lenses in 1890. It was around this time that the Zeiss works began constructing eye pieces and objectives for telescopes.<sup>3</sup>

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1 Auerbach, F., *The Zeiss Works and the Carl Zeiss Foundation in Jena*, W. & G., Foyle, London, England, about 1925?, p.23

2 Auerbach, F., *The Zeiss Works and the Carl Zeiss Foundation in Jena*, W. & G., Foyle, London, England, about 1925?, p.28

3 Auerbach, F., *The Zeiss Works and the Carl Zeiss Foundation in Jena*, W. & G., Foyle, London, England, about 1925?, p.58

