



## An unsuccessful mount

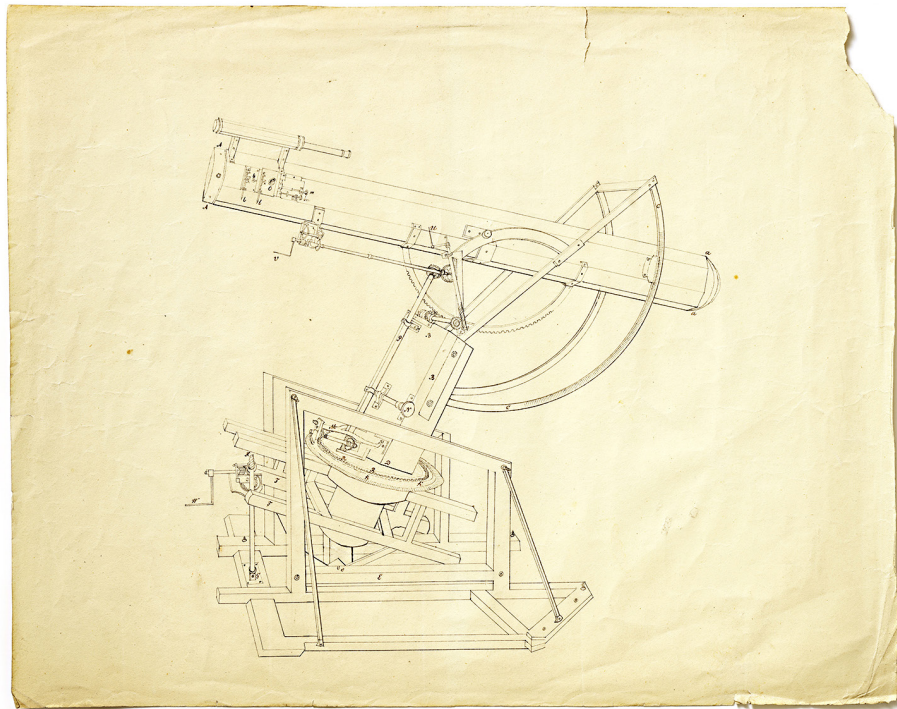
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◀ SPECULUM MIRROR,  
cast, ground and  
polished by William  
Herschel.

Brass, steel and mahogany and, at the heart of the telescope, a speculum mirror moulded and polished by none other than William Herschel. With an aperture of 16 cm and a focal length of 210 cm, the Academy of Sciences' Herschel telescope remains an impressive piece (see picture on p. 477). But, as we shall see, the astronomers who would eventually work with the instrument were of another opinion. Instead, the telescope, and especially the mount on which the tube was originally placed, became a constant headache.

When the optics were ordered, in the mid-1780s, Herschel was one of the fixed stars in the astronomers' heavens. A few years previously, he had discovered the planet Uranus (1781), which soon brought him international recognition and royal patronage. Subsequently, he and his sister Caroline launched one of the most ambitious observation projects in the history of astronomy, which would eventually give the heavens a natural history and result in a complete re-evaluation of the objects that astronomers registered under the collective designation of nebulae. Alongside all this, he had also established himself as Europe's leading manufacturer of reflecting telescopes. If you wanted a reflector with a large aperture, no better ones could be purchased than those from Herschel's workshop.

The optics – i.e. mirror, secondary mirror, lenses for the finderscope and five eyepieces – were delivered in December 1790. The bill was over 31 pounds, at that time a very considerable sum. The archive is silent about the circumstances surrounding the deal, but it is clear that the Academy had members who were interested in the Herschelian telescopes. At the end of the 1780s, instrument maker and baron Peter Niclas von Gedda spoke at the Academy on “Herschelian or Newtonian tubes and their benefits” and a letter to the Academy's secretary, physicist Johan Carl Wilcke, makes it apparent that he had tried to mould a speculum mirror himself using the



**DESIGN FOR THE ORIGINAL MOUNT** drawn by I. I. Tavaststjerna.

**THE ACADEMY OF SCIENCES' Herschel telescope** on its new mount.

Herschelian method. It is probable that it was von Gedda who initiated the purchase.

But optics alone do not a telescope make. Herschel's business idea was to manufacture and sell the optics, but normally the buyers would be responsible for the manufacture of the tube, mount and assembly. In this case, therefore, the Academy approached instrument maker, lieutenant *mechanicus*, Carl Apelquist. This is where our story begins.

Instrument makers had begun to assume a more central role in the scientific culture of the 18<sup>th</sup> century, and the Academy had been quick to recognise their value. Not least, they affiliated the exceptionally skilled Daniel Ekström to the Academy and for several years, until his all too early death, his workshop was in the cellar below the observatory. Carl Apelquist belonged to the next generation of instrument makers and was one of those who were to fill the space left by Ekström. With the Academy's blessing and a travel grant from the government, Apelquist trained as an instrument maker in London, where he was apprenticed to Jesse Ramsden. On his return to Sweden, he opened his own workshop in Stockholm in 1790.



In 1788, when Herschel's mirrors were ready to be shipped from England, the matter was registered with the treasury inspection, the *Inspectura ærarii*. At the same time as the inspection granted the payment, von Gedda offered "to also attend to the Mount itself", i.e. to ensure that the optics were mounted in a telescope. The good baron appears to have taken a generous amount of time. As stated, the mirrors arrived in 1790, but minutes show that it was first in 1795 that von Gedda gave the task of building the mount to the still fairly untested Apelquist.

And then the records go silent – the years passed and, with time, the order seems to have been forgotten. Much later, in 1804 to be precise, an inventory was made of the equipment in the Academy's observatory. When the results were known, they stated that everything was "in good order and nothing was missing, excepting the Mirrors to a Hershel's [sic] tube which is in storage with Mr Major Apelquist". The forgotten telescope was naturally a little troublesome, so it was decided that Apelquist should immediately be visited and an on-site inspection carried out.

A few weeks later the situation was clear. The mount was "half complete" and "so clumsily and roughly made that it surely required the work of four people to move it forwards and backwards over the floor". Apelquist had also requested 650 riksdaler for the assembly work that had been done, which, after comparison with a price list, turned out to be more than the purchase price of a complete telescope of the same size from England. The Academy decided to send the matter back to the *Inspectura ærarii*. The inspection's decision arrived a few months later: the Academy was to demand the mirrors' return so they could be mounted by someone else.

A new visit to Apelquist was made in October that year, now with the intention of collecting the mirrors. However, the issue became more complicated when the envoy was informed that the clumsy assembly was not Apelquist's idea, but that it had been constructed in accordance with a drawing in a book provided by Wilcke himself. As it was therefore not possible to hold Apelquist culpable, he was given the option of either buying the mirrors or completing the mount in a reasonable time. Apelquist's response came a few weeks later: he was not interested in the mirrors himself, but if the Academy so wished, he could complete the telescope in two years. If they preferred to take the half-finished mount, he would reduce the price to 300 riksdaler. The Academy then decided to undertake a new inspection of the mount and determine whether it was worth the effort to complete its construction.

Here, the matter once again stalled, first reaching a resolution in 1811. To judge from a long statement in the minutes, the Academy's poor financial circumstances were what prevented an outright purchase. However, in the meantime the treasury inspection had succeeded in reaching an agreement with Apelquist and had bought the still incomplete mount for 333 riksdaler.

They had also commissioned another instrument maker, optician and microscope specialist Peter Hellström, to construct the tube and complete the telescope. “The R. Academy could thus hope to eventually see a considerable scientific need soon fulfilled, the completion of which would well be costly for the R. Academy, but its honour demanded it.” It was indeed costly, but financial support arrived from an unexpected source; at the same meeting, it was announced that the king would donate 500 riksdaler of his own money to save the deal. With funding secured, Hellström was finally able to deliver the completed instrument in December 1812.

Simon Anders Cronstrand had just assumed the position of Academy astronomer when the Herschel telescope was incorporated into the observatory’s instrument park. Cronstrand was to dedicate his life to geodesy, but up until 1819 he ran operations at the observatory. Just a few months after the telescope was delivered, Cronstrand submitted a technical report to the Academy. This states that the telescope was now situated in the “Observatorii Salen” [observatory hall] and ready for use. An appended sketch – incidentally the only depiction of the original mount – provides some substantiation for the comments regarding the device’s clumsy appearance (see p. 476). Somewhat surprisingly, Cronstrand does not say a word about the telescope’s performance – perhaps he had not yet had the chance to test it.

So, it took more than two decades to completely assemble the Herschel tube, and it is natural to ask whether it was worth it. One could also ask what “this instrument, so necessary for the making of Astronomical observations”, as it is described in the minutes, was actually going to be used for. Answers can be sought in the observation journals that were kept during Cronstrand’s tenure, which stretched to 1828. Here it is apparent that the majority of all observations that were recorded relate to timekeeping, i.e. the Sun’s midday transit through the meridian, essential for setting the clocks. There were fewer nocturnal observations, but both solar and lunar eclipses were observed, some lunar and Jupiter occultations, as well as a comet or two – all types of observations for which the Herschel telescope was suitable. Despite this, it is notably absent from the journals. Instead, the workhorse – apart from the large meridian circle used for determining time – seems to have been the “Dollondian tube”, a three-metre achromatic refractor purchased from England in 1763 and normally operated by Cronstrand. Additionally, several other telescopes, used by various colleagues, are named. For example, during a solar eclipse the “Big Greg.[orian] Reflector” was used, and a lunar occultation of a star in the Gemini constellation was observed with a “Big Reflector”. It appears that this latter instrument is the Herschel telescope and, if this is correct, this is the only time in the fifteen years covered by the journals that the instrument is recorded, and then to establish that the star was occulted at  $9^{\text{h}} 12' 29''$ .



But why invest so much time and money in an instrument that was not used? The beginnings of an answer are found in an enquiry conducted when Cronstrand, in 1819, approached the Academy Board with a request for funding to modernise the observatory's instrument collection. The enquiry found, among other things, that lunar and nebula astronomy was neglected at the observatory, because:

[...] such Observations especially require strong Reflectors, of which the Academy unfortunately own none that are adequate. We mention this with true regret, as regards the costs the Academy has borne for the acquisition of the *Herschelian* 7-foot reflector; but unfortunately this is exceptionally poor, and far worse than both the Academy's previously owned large *Gregorian* reflector, and the better of its Achromatic tubes.

Exceptionally poor and far worse, these are harsh words in the context. And it should be emphasised that it was not the optics that were the problem; the complicated construction process had taken its toll. Acquiring a scientific instrument was always a complicated business, in which various stakeholders with somewhat differing interests were forced to pull in the same direction to make something happen. But in this case, there were not only too many cooks making the broth – no less than three instrument makers, as well as a number of physicists and astronomers – they had also chosen to build a mount with an untested construction. Even minimal experience of telescopes is enough to establish that the construction would have been both awkward to use and – even more troublesome – particularly sensitive to vibrations. And so it turned out: in practice, the instrument was unusable in the dark.

Incidentally, that the mount was the problem was confirmed much later, specifically in 1842, when Cronstrand chose to scrap the telescope's "failed old parallactic mount" and had a new one made. It is this mount that holds the telescope today.

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The Herschel telescope, which is housed at the Center for History of Science at the Academy of Sciences, is briefly described in Carl Pipping's *The Chamber of Physics: Instruments in the History of Sciences Collections of the Royal Swedish Academy of Sciences* (Stockholm, 1977). It is also discussed in Olov Amelin's *Medaljens baksida: Instrumentmakaren Daniel Ekström och hans efterföljare i 1700-talets Sverige* (Uppsala, 1999), 148–150. The Herschel family has primarily been studied by Michael Hoskin, see for example his *Discoverers of the Universe: William and Caroline Herschel* (Princeton, 2011). Herschel's prices are discussed in Hoskin's essay "Herschel telescopes for sale", *Journal for the History of Astronomy*, vol. 46:3, 2015. Carl Apelquist's story is told over a few pages of Sten Lindroth's *Kungl. Svenska Vetenskapsakademiens historia 1739–1818* (Stockholm, 1967), 807–808. The depiction of the Academy's dealings

with Apelquist is based on the minutes of the *Inspectura ærarii* (29 February 1788, Section 3), and those of the Royal Swedish Academy of Sciences (9 September 1795, Section 5; 4 April 1804, Section 7; 16 June 1804, Section 8; 5 September 1804, Section 3; 24 October 1804, Section 14; 14 November 1804, Section 3; 4 December 1811, Section 2; 13 January 1813, Section 11). Receipts for the optics and the completed telescope are found in *Verifikationer* 1790 (no. 217) and 1812 (no. 56). Von Gedda's letters are preserved in Wilcke's letters (*Inkomna brev*, E01:2). The observations mentioned are noted in Simon Anders Cronstrand's *Journal: 5/10 1813–25/5 1819*, and in *Observationsjournal: 1820 8/1–1828 30/12*. The enquiry quoted from at the end is available as an appendix to the minutes of the *Inspectura ærarii*, 15 October 1819. Information about the new mount is from the inspection report for 1842 (12 April 1843). All handwritten documents are stored at the Center for History of Science, the Royal Swedish Academy of Sciences.