

weight. By contrast, the engraving machine, using a small-gauge drill to rout a line, created a vertical-walled trench of uniform line-weight. A skilled hand-engraver such as Myron King could begin and end lines cleanly. By contrast, lines produced with the engraving machine terminate with thick dots. One final dating clue is provided by Myron King's tendency to include a curved line over "N.Y. (in earlier instruments this was a continuation of the "y" in "Troy"). In all cases, the trenches were filled in with black wax.

Gurley also used the engraving machine to take in work, probably at a reduced rate, in competition with hand engravers. An 1883 memorandum book kept by Charles Laprease, a Gurley engraver, lists many outside jobs, from police badges to paperweights for the Meneelys (bell founders and formerly mathematical instrument makers founded by Andrew Meneely). Laprease also notes engraving the names of Gurley sales agents like J.W. Queen, F.W. Lincoln, and C.C. Hutchinson, on instruments.

Gurley purchased another "engraver" in 1882, a "figuring" machine in 1883, and two "figure engravers" in 1892. There is no contemporary descriptions of the 1882 and 1883 machines, but the two "figure engravers" are pantographs set up for figuring circular work.⁷ None of these machines still exist, and all of the templates have been lost except for a partial Gurley signature and a north star figure.

1. William Gurley, *Letters from Europe in 1875*, in letters and photographs relating to the family and descendants of William and Maria Kenney Gurley, New York State Library.

2. "Sir Howard Grubb's Works, Dublin," *Engineering* 46 (1888): 571, quoted in I.S. Glass, *Victorian Telescope Makers. The Lives and Letters of Thomas and Howard Grubb* (Bristol and Philadelphia, 1997), pp. 24-6.

3. C.P., "Thomas Cooke," *Monthly Notices of the Royal Astronomical Society* 29 (1868-1869): 130-5. *The History, Achievements, and Products of Cooke Troughton & Simms Limited* (1936), p. 6.

4. "Engraving-Machine" in Edward H. Knight, *Knight's American Mechanical Dictionary* (New York, 1876), p. 804.

5. Troy City Directories, 1829-1877.

6. William Gurley, *Personal Day book*, 1876, collection of the author.

7. Edward W. Arms, *1883 Memorandum Book*, collection of the author.

GURLEY'S ARCHITECT'S LEVEL

William Skerritt

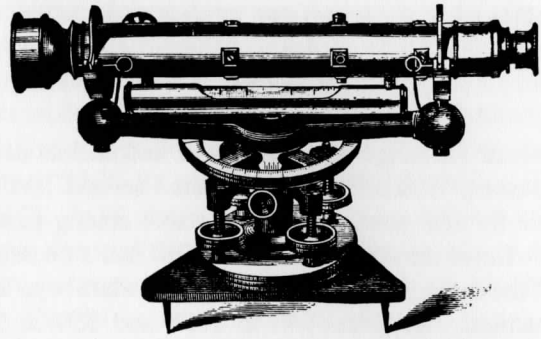
In addition to their full range of sophisticated instruments designed for engineers and surveyors, W.&L.E. Gurley offered several less expensive instruments suitable for less precise work. Notable among these was the inexpensive Builder's Level introduced in 1855. This had a telescope of 14" to 16" and, while of the same general form as their standard wye levels, was of cheaper construction. Its price--\$45 in 1856 and \$50 in 1857--was substantially less than the \$135 that Gurley charged for a standard wye level with a 16" to 22" telescope.¹

Gurley introduced their New Builder's Level in 1862. The illustration in the *Manual of Instruments* shows a Gravatt or dumpy level such as had been used in England since the 1830s. Gurley's original model had the telescope, 11" to 15" long, held in fixed octagonal supports with the level attached to its left side. Later illustrations show the level above the telescope. The instrument originally cost of \$30; this was soon raised to \$60 (but now including the adjusting tripod).²

Gurley's Architect's Level made its debut in 1874. It cost \$35, and was equipped with an 11" telescope in wye supports and a small horizontal circle with which angles can be roughly turned.³ Gurley displayed this instrument at the Centennial Exhibition of 1876, and must have been pleased with the report of the Exhibition judges:

*The moderate cost of this little instrument, which we understand to be only thirty-five dollars complete, is not its only recommendation, but it is really a most simple, compact, and excellent level, amply sufficient for the uses of architects, millwrights, and builders generally. It has a telescope of eleven inches, having the usual cross-wires and adjustable arrangement of the object and eye tubes for focussing upon near and remote objects, and mounted in wyes, made also adjustable. Besides the ordinary appliances of a leveling instrument, it has also a horizontal circle by which angles may be set off with great facility.*⁴

The Architect's Level was apparently copied from instruments that William Gurley saw in Paris in 1875. In a letter to his brother Lewis, William mentioned his visit to Chevalier's "old established shop" and his purchase (for 3 francs) of their Catalogue, "well illustrated wood cuts & giving the later patterns of French Levels, with and without divided circles."⁵



Gurley's Architect's Level.

From *The Illustrated Catalogue of the Centennial Exhibition* (ca. 1877), p. 310.

William's letters also discuss the issue of promoting the new instrument: "I like the term Architects Level as being a little more grand, "magnifique" as many of our French guides & Vicars put it when showing a fine church. I have great faith in printer's ink and am glad when you print & advertise the new inst[rument], of course, direct circulars are cheapest & best & with the Comm'l records & other sources, we can reach most of the builders and Architects at once. Then, I think, Agricultural papers can be used to good advantage, drainage, irrigating ditches, a large item in Colorado & the farther West territories."

One of William's goals on this trip was to find a supply of inexpensive telescopes for Gurley instruments, and his letters contain numerous comments on the European optical trade. In Carlisle he found an "Optician" who was more a dealer than a maker; in Liverpool he found that all the shop keepers were "anxious to be called Manufacturers;" and in Paris he found "a multitude of Opticians...of all grades, little shops of ten feet deep & ten to fifteen feet front in many of the finer streets, selling Opera Glasses, Graphoscopes of all kinds from 5 francs up to 75 or 80, Stereoscopes & Photos of Paris etc." Alex Lebruns "had cheap telescopes on exhibition at the Palace d'Industrie," but "would not take an order for special sizes, such as we wanted 11 in., of the cheap telescopes."

William was more impressed with the Société des Lunettes, which he described as "the most extensive establishment, in the optical way, I have found in Paris, in so far as a store is concerned." William went on to say that this firm had "factories with steam & water." Although they "would not give me the catalogue, nor would they give me a price for the 11 inch telescopes which I am investigating for our cheap levels, unless in quantities of one or two gross & then will not sell the Obj[ective] G[lass] & Eye Piece separately,

but must mount them. I finally determined to humour them & left the French eye piece which they will send to the factory & will give [an] estimate for a tel[escope], one draw, with eye pieces of two kinds, one double convex lenses (cheaper) & one plano convex, like sample, & will send estimate & Eye Piece to my hotel in three or four days."

I don't yet know if the Gurleys actually purchased lenses from the Société des Lunettes. If they did, however, it was probably through J.W. Queen & Co. in Philadelphia. In one letter from Paris, William mentioned that the French agent did not want to sell to him directly, as that might interfere with his business relationship with Queen. In the early 1880s the Gurleys purchased 106 lenses for their "7in Arch. L." from B&L (which I assume to be Bausch & Lomb or Rochester, N.Y.), and another 41 from SL&Co. (which I assume to be Sussfield, Lorch & Co., an optical house in New York City that offered Bardou telescopes and other French optical instruments to American customers). SL&Co. also provided Gurley with a number of 1 1/2-inch telescope objectives.⁶

Gurley modified their Architect's Level in 1883, and the new instrument remained in production until about 1940. Gurley explained the details of the 1883 modification thus:

The Architects' Level, as first made by us nine years ago, had a rough iron bar on which the level was fixed. The telescope, furnished with common lenses, revolved in the Ys, resting only on the telescope tube, and the whole instrument was made to meet a demand for a cheap level suitable for architects, builders, millwrights and farmers. We have been making constant and steady improvement in the material, the finish and the accuracy of the instrument, until now the Architects' Level has a turned bar. The level is attached to the telescope and has a carefully ground vial and scale. The lenses are selected and are equal in quality to those furnished with our transits. The telescope revolves in the Ys on carefully turned and concentric rings of bell metal. All the adjustments are precisely like those of the larger leveling instruments; they are not liable to derangement and will require ordinarily but little attention. In fact, the instrument, as now made, is accurate enough for any leveling or grading, except the finest railroad or canal work. On account of these improvements and the necessarily increased expense, the price of the Architects' Level has been advanced to \$45, and the instrument is, we think, cheaper at that price than the one first introduced was at \$35. We shall not make any more Architects' Levels at \$35. APRIL, 1883.⁷

Bill Skerritt

*The Kellner Eye-piece, the main feature of which is the use of a compound amplifying lens, in place of the single one heretofore employed, has sensibly increased the brilliancy of the object and secured a better field. This is now applied to all our transit telescopes.*¹

With this statement made in 1883, W.&L.E. Gurley introduced the Kellner eyepiece to their customers. The new eyepiece, which consisted of a plano-convex field lens and a cemented doublet eye lens, was both achromatic and orthoscopic. That is, it produced a color-free image that was equally magnified over the whole field of view.² The orthoscopic design originated with Carl Kellner, a young optician in Wetzlar who produced his first telescope eyepiece in 1848 and his first microscope eyepiece in 1851, and whose publication, *Das orthoskopische Okular*, appeared in 1849.³ It's difficult to know how much attention Kellner's eyepiece attracted before his untimely death in 1855, but it's clear that it was relatively well known in microscopical circles by the mid-1860s.⁴ In 1875, William Gurley found that the Kellner eyepiece was "no novelty" in Europe; moreover, every optician in Paris "knows all about its value, but, as it costs twice as much as the other, it is not so much used."⁵

The Gurleys' interest in improved eyepieces seems to have been sparked by Heller & Brightly, a Philadelphia firm that, in 1874, began touting the increased power and range of the telescopes in their engineers' instruments.⁶ In the words of William Gurley, "The advertisements of H & B have given a special importance to high power in our country, which we must meet & surpass, as we shall surely do. Whether their extremely high powers are best or not is to be settled hereafter, but that the Kellner Eye Piece gives better light & larger field is surely concluded. We must have it in all our best instruments hereafter."

One of the reasons for William Gurley's trip to Europe was to locate an optician who could and would produce lenses for Gurley instruments. In one letter to his brother Lewis, William stated: "I shall not come home until we are all out of the woods on telescopes and Eye Pieces. We must not & cannot allow any one to say that they can furnish better glasses than the Gurleys."

In London William visited the prominent microscope firm of R.&J.Beck, whose "Orthoscopic Eyepieces, giving a very large field" had

The Drainage Level that the Gurleys introduced in 1883 was also inspired by William's trip to Paris in 1875. This instrument was even simpler than the Architect's Level, and it sold for a mere \$15.⁸ In a letter following his visit to the Société des Lunettes, William noted that he "saw one thing that I think is a very good idea & worth adapting." This was "a simple cast iron frame with a fine level set in it." William described it "entirely new here" and "the best level, by all odds, I have ever seen, without a telescope." Although not a precision instrument, "It will do work good enough, I think, for many men who won't buy our 'Architects Level'." William closed by saying: "And we may get a run on them before other parties get hold of them, either by making or importing them."⁹

1. W.&L.E. Gurley, *A Manual of the Principal Instruments Used in American Engineering and Surveying* (Troy, N.Y., 1855), p. 65. See also 1859 edition.

2. W.&L.E. Gurley, *A Manual of the Principal Instruments Used in American Engineering and Surveying* (Troy, N.Y., 1862), pp. 117-8. See also 1865, 1868, and 1871 editions.

3. The 1874 date comes from the 1883 insert, cited below. The first advertisement appears as an insert in W.&L.E. Gurley, *A Manual of the Principal Instruments Used in American Engineering and Surveying* (Troy, N.Y., 1876).

4. *Illustrated Catalogue of the Centennial Exhibition* (ca. 1877), p. 310.

5. William Gurley, Letters from Europe, August- December, 1875, in letters and photographs relating to the Family and Decendants of William and Maria Kenney Gurley, in New York State Library. I have not seen this Chevalier catalog, but a similar instrument appears in Lerebours et Secretan, *Catalogue et Prix des Instruments d'Optique, de Physique, de Chimie, de Mathématiques, d'Astronomie et de Marine* (Paris, 1853), p. 170.

6. William Gurley Daybook for 1885, in possession of the author.

7. W.&L.E. Gurley, *Illustrated Catalogue and Price List of Civil Engineers' and Surveyors' Instruments* (Troy, N.Y., 1880), April 1883 insert.

8. W.&L.E. Gurley, *Illustrated Catalogue and Price List of Civil Engineers' and Surveyors' Instruments* (Troy, N.Y., 1883), insert between pp. 18 and 19. The design for the Drainage Level was covered by patent (#286,606) granted on October 16, 1883.

9. For instruments of this sort see in Lerebours et Secretan, *Catalogue et Prix des Instruments d'Optique, de Physique, de Chimie, de Mathématiques, d'Astronomie et de*