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# Thomas Greenough's

## FOUR-VANED THEODOLITE

*This is the second in a series of articles that highlight and compare unusual and seldom-seen survey instruments.*

The first article of this series on unusual 18th century surveying instruments discussed at length the patented “Theodolite” (1735) made by Rowland Houghton, who worked in the Boston area. It was designed to serve a dual functionality as a theodolite and circumferentor. Houghton’s patent would have expired seven years later or by 1742. Recently, an instrument by Thomas Greenough (who worked in Boston from 1730-1785) has surfaced, possibly having the same dual purpose unique to the Houghton. When this instrument was found, its sight vanes were missing. Instead of two vanes as on the patented Houghton, this Greenough instrument was designed for four sight vanes—two fixed and two moveable. *continued >*

>> By Jeffrey Lock



The two fixed sight vanes were easy to reconstruct using an established Greenough pattern, and were attached to the existing sliding male dovetails riveted to tabs on the horizontal circle. Initially confusing, however, was how the second set of sight vanes attached to the moving alidade since they were not of a simple, slide-on, dovetail construction. In their places were intricate openings filed out at the extremities of the moveable alidade. I then discovered the remains of a small wooden dowel inserted into a drilled hole at the attachment point of the second set of sight vanes. This suggested that these were folding sight vanes and were attached to a hinged block assembly that would be removable from the alidade. This hinged block assembly is what would enable the folding sight vane to accurately clear the glass and glass ring of the compass box assembly, aligning its slot with the needle in the compass box, thereby doubling the instrument's use as a theodolite and circumferentor, similar to the Rowland Houghton instrument. The block assembly also gives the required clearance when the

moveable alidade would have been swung in a full 360-degree circle (Figure 2).

If one compares the horizontal circle of both instruments side by side, the similarities are obvious and the possibility exists that they were divided and engraved by the same craftsman (Figure 3). You will notice certain characteristics—such as the double zero (“00”) mark—that are com-

mon to both scales. This method of marking the double zero was somewhat unusual. The Greenough instrument diverged from Houghton's design by the use of a second set of sight vanes that attached to a moveable horizontal alidade rotating under the fixed compass box. The rotation of this moveable alidade allows for an accurate watch reading to be taken by placing the fixed sights located at 0 and 180 on the horizontal scale as backsights, then rotating the second set of sights to the object as the foresight and reading the angle between the two sets of sights directly off the horizontal scale. By

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folding the sight vane and aligning its slot with the needle in the compass box, the Greenough instrument performs in the same manner of a circumferentor as the Houghton, but uses the folding vanes to



**Figure 1:** Detail of inscription: “Made by Thomas Greenough, Boston, N. England”

reference the needle instead of the window in the alidade of the Houghton design (Figure 4).

Considering this early time period, the four-vane Greenough instrument is extremely well constructed. The workmanship of the divided circle and the rotating alidade shows a very high level of engineering, casting, fabricating, and engraving. The rigidity necessary to allow the movable alidade to clear the fixed compass box above and the fixed horizontal circle below shows a level of workmanship that is seldom seen in colonial instruments of this early period. Due to the fact that most Thomas Greenough instruments were simple wooden circumferentors with paper cards, this particular instrument had to have been incredibly expensive in comparison to the common circumferentors.



Figure 3: (Left) Rowland Houghton's horizontal circle; (Right) Thomas Greenough's horizontal circle

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The complexity of the four-vane Greenough, both in design as well as construction, far exceeds the Rowland Houghton instrument. It is possible that Thomas Greenough had to go to these great lengths to compete with the Rowland Houghton instrument during Houghton's period of patent protection. Instruments constructed by Thomas Greenough of Boston are very rare; his brass instruments are virtually unattainable. There are less than six existing brass circumferentors (Figure 5), one semi-circumferentor, and two theodolites known to date by Thomas Greenough. The four-vane theodolite that is the focus of this article is the only one known.

The fabrication cost differences between the two-vane Houghton and four-vane Greenough most likely factored into the phasing out of his early four-vane design once the Houghton patent had expired. The next in this series of articles will be a Thomas Greenough two-vane theodolite

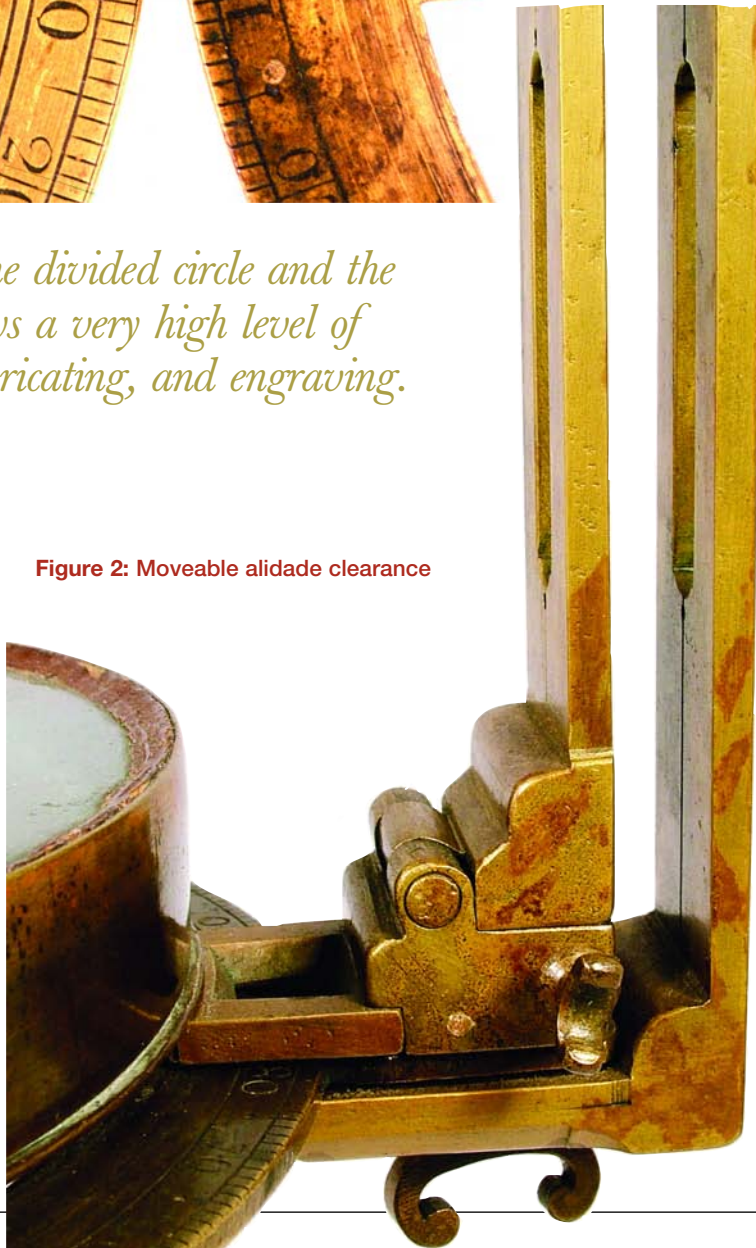
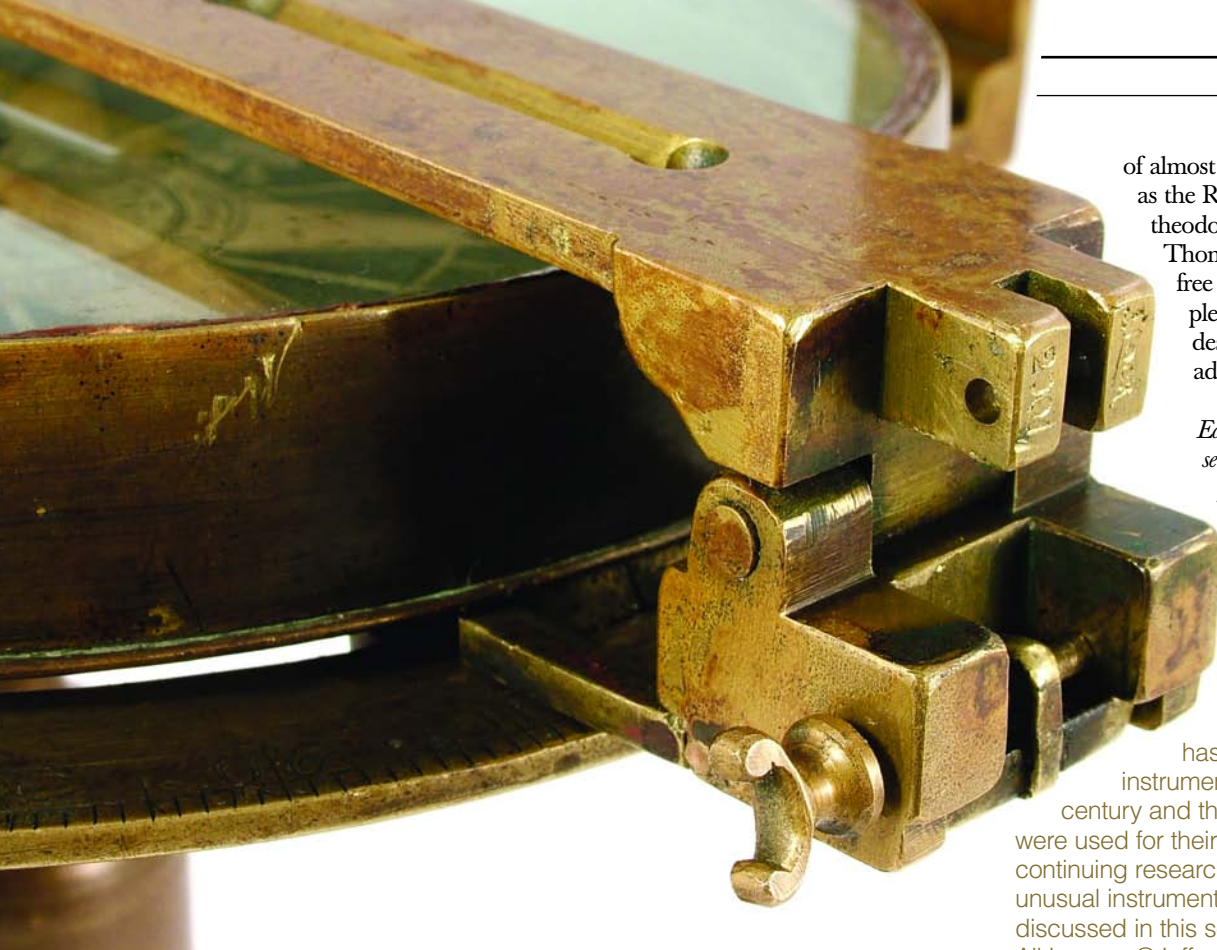


Figure 2: Moveable alidade clearance



of almost identical construction as the Rowland Houghton theodolite, inferring that once Thomas Greenough was free to copy the much simpler Rowland Houghton design, he took that advantage. *A*

*Editor's Note: Articles in this series are part of Lock's forthcoming book, The Art of Colonial Surveying Instruments.*

Drawing on 30 years' experience in the restoration field, Jeffrey Lock has focused on colonial instruments from the 18th century and the techniques that were used for their construction. His continuing research has uncovered unusual instruments that will be discussed in this series. All images ©Jeffrey Lock

**Figure 4** Restored folding sight vane assembly. (As in the case of responsible restoration, all of the replaced pieces on this instrument have been signed and dated so as not to provide any confusing historical data to future research. Under no circumstances should restoration affect the originality of existing pieces of an instrument.) **Figure 5** (below) Detailed engraving on a Greenough circumferentor



**Figure 6** (Left) Rowland Houghton's "Theodolite"; (Right) Thomas Greenough instrument