

and included a focused plastic lens and once again included a geared drive for the Moon's rotation. This model was produced from about 1962 to 1992 or 1993. Although the current models demonstrate revolution of the Moon around the Earth, they no longer provide gearing to illustrate the Moon's rotation on its axis. The globes on the Trippensee tellurians have been plastic covered, rather than paper-covered, since the late 1980's.

Since the 1960's, the company has also produced some simpler and less expensive models for lower grade school use. These use thinner and less expensive parts but still demonstrate many concepts for a low price. These still keep the Earth's axis pointing northward, but the Moon must be pushed around the Earth manually.

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#### **Also Seen:**

The *Journal for the History of Astronomy* (32, August, 2001 pp. 189-222) includes a substantial paper by Sara Schechner, now curator of Harvard's instrument collection. The title "The Material Culture of Astronomy in Daily Life: Sundials, Science and Social Change" hints at her emphasis on sundials as 3-dimensional evidence of the importance of sundials to users and this is soon born out. Divisions cover topics from "time consciousness and time discipline" to "church time" to "merchant time", the latter two sections with a number of subsections. There are a large number of illustrations to accentuate her arguments and these are well produced though regrettably not in color. Though these are all European in origin most are currently held in the Harvard and the Alder Planetarium's collections. Further illustrations come from the Smithsonian. The time period covered is classical times to the late 18<sup>th</sup> century. Sundial enthusiasts will enjoy her analysis of how sundials were perceived and used in society for 2 millennia.

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## **SOME NOTES ON THE TWO EXTANT ROWLAND HOUGHTON NEW THEODOLATES**

**Raymond V. Giordano**

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Recently the second known example of the important very early American surveying instrument, Rowland Houghton's "New Theodolite", has come to light. The Smithsonian's National Museum of American History (NMAH, 1985.860.01) acquired an example in 1985 (Fig. 1a). It was described in this journal in 1987 by Silvio A. Bedini,<sup>1</sup> but the instrument was, until then, only known from Houghton's

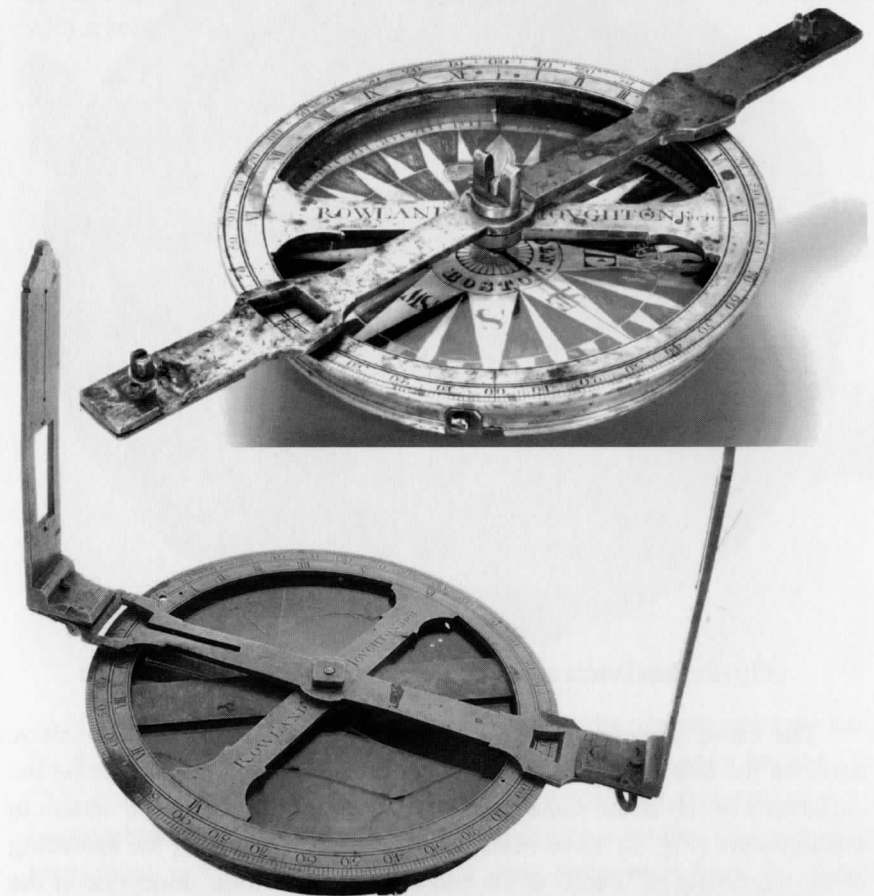


Fig. 1a (top) NMHA example, courtesy of the NMAH.

Fig. 1b (bottom) Newly uncovered Rowland "theodoate".

advertisements<sup>2</sup> and the notice of his 1735 patent in the Massachusetts Bay Colony "Province Laws".<sup>3</sup> Bedini describes Rowland Houghton (c.1678-1744) as a talented Boston mechanic, merchant and public official who was known for his water pumps, portable fire fighting equipment, and his "New Theodolite". With a second example (Fig. 1b) of the first patented American surveying instrument available for study, comparative observations on Houghton's instruments are now possible. Understanding the form and function of this, the earliest of American brass surveying instruments, should shed light on what has been a sketchy developmental history of the early period of the subject.

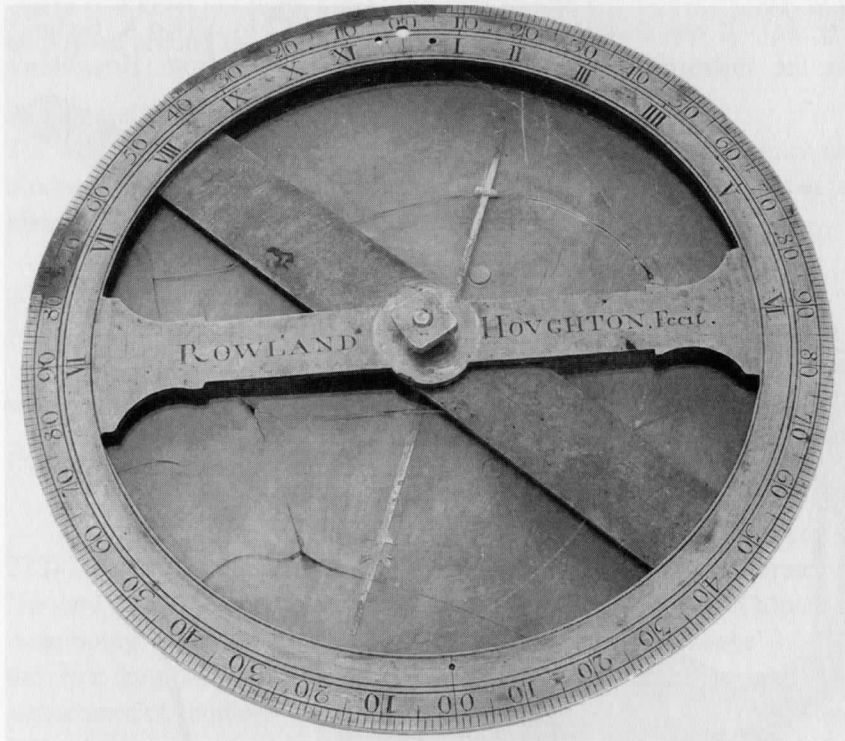


Fig. 2 Rowland's signature. Also note the compass needle

The close correspondence of the engraving on the divided circle between the two examples suggests the possibility that both were on the engraver's bench at the same time. On the present example the letters in the signature (Fig. 2) have been reduced in size correcting the crowding of the engraving of "Fecit" at the end of the line. On the underside of the divided circle, and not previously described, are small holes and slots for fixing thread indicators intended to run from the "00" points on the scale

to the central pivot point. These thread indicators are viewable through the 1 3/8" x 1/8" window, an extension of the larger of the two windows cut along the alidade. This function is obscured in the NMAH example because of extensive old repairs to its alidade

The repairs and changes to the NMAH example also alter the original relationship between the compass box, the divided scale, and the alidade. On the present example (Fig. 3), the pivoting screw is mounted at the center of a 13/16" wide cross bar, which itself passes over the compass glass, is let into the top of the compass box wall, and is screwed to the outside of the compass box. The divided circle and the alidade each freely pivot on this central screw post. The altered NMAH example has, with its cross bar removed, the pivoting screw mounted at the center of the divided circle. The divided circle is now fixed to the compass box with a solder addition, and thus, only the alidade can rotate.

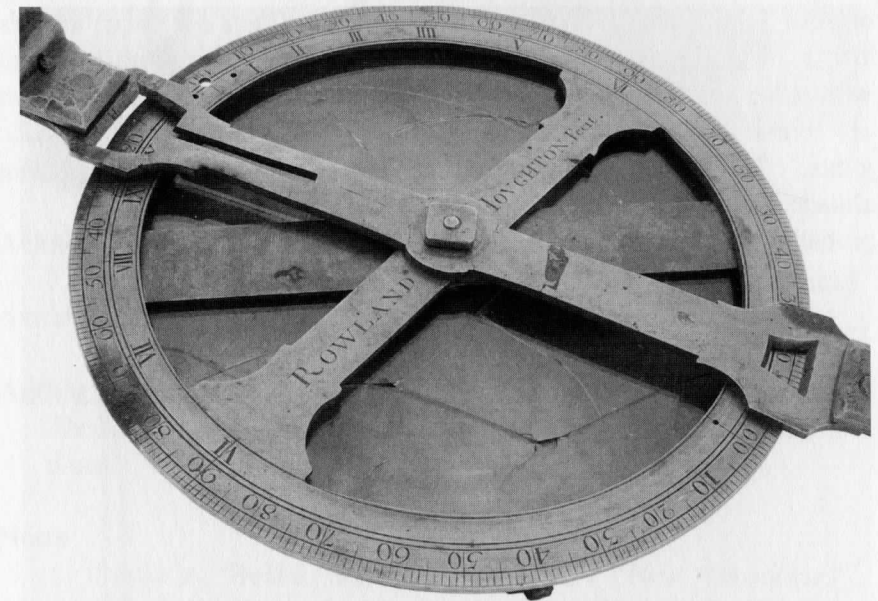


Fig. 3 Note the screw pivot with nut and fixed cross bar.

Both divided circles have two guide holes (the present example has a third larger central mounting hole as well) at the "00" point between the "XI" and "I" of the sundial scale. What these holes are designed to accept is still unknown, but they may be involved with a sundial function of the instrument in which case a gnomon may have been fixed by screws through these holes. Though Houghton included the dialling function on his "New Theodolite", it, like the navigator's quadrant backsight may

have been found to be cumbersome or difficult to use or unnecessary in the field.

The NMAH example has the later compass card of J.R. Lincoln of Boston (first quarter 19<sup>th</sup> c) loosely fitted in the instrument's compass well. The present example has no complete card and very likely never had one. There is no sign of the mounting of a paper compass card in either example, and the surface of each compass well shows the same patination. The green, wavy, bubbly thin glass in the present instrument is very early and may be original.

The present example retains its original sight vanes which are 5 1/8" x 7/8". They are of cast brass with rather heavy reinforcing beads of brass on the inside of their joints. The vanes mount to the alidade with wing nuts (one is probably original) from below.

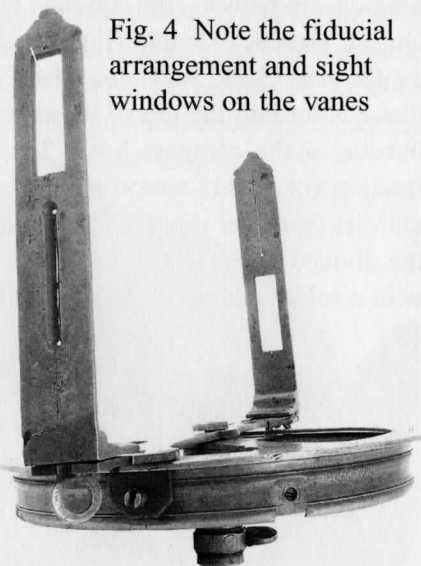


Fig. 4 Note the fiducial arrangement and sight windows on the vanes



Fig. 5 Fixing screws for the sight vanes.

The alidade on the NMAH example is 11 1/2" long, while that on the present instrument is 8 7/8" long. Both have a maximum width of 1 1/4". The shorter alidade length appears to be an alteration (only half of a previous fixing screw hole remains on one end), possibly to reduce the lever stress on the narrow pieces of brass forming the sides of the windows. Indeed, the larger window has repairs at just these points.

The staff mount (Fig. 6) on the present example, as is usual on early American instruments, is of small diameter, o.d.  $\approx$  3/4". i.d.  $\approx$  9/32", and is 1" long. It has a solder repair at its base. There are three holes in its side for fixing to a staff head, one is filled, and two are tapped, though only one accommodates the old wing nut that is present.

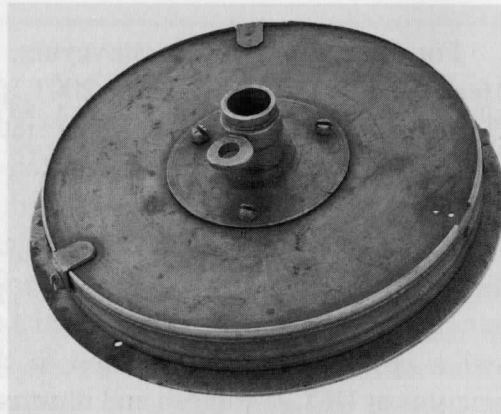


Fig. 6 The staff mount.

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#### Notes

1. Silvio A. Bedini, 'Rowland Houghton's "New Theodolite"', *Rittenhouse*, 1 (1987) pp. 30-39. Reprinted in: Silvio A. Bedini, *With Compass and Chain - Early American Surveyors and Their Instruments*, (Frederick, Maryland: Professional Surveyors Publishing Company, Inc., 2001), pp. 244-252.
2. *Boston Gazette*, January 17/24, 1737.
3. Massachusetts Bay Colony, *Province Laws (Resolves, etc.)* (1735-36), Chap. 22, passed January 16, published January 21, 1735-36.