

John Hapgood Temple

Farmboy Turned Instrument Maker

Editors note: *This is the first of a two-part series on John Hapgood Temple, a 19th century instrument maker. The second part will appear in the September/October issue.*

Among the lesser known but more significant American 19th century makers of surveying instruments was a Massachusetts farm boy named John Hapgood Temple. Born in Princeton, Massachusetts on October 4, 1812, he was a son of Joshua Temple and his second wife, Lucy Brooks. Although predestined to a future in agriculture, he escaped the family farm because he suffered severely from asthma throughout his boyhood. It was later said he was of "a delicate and sensitive nature," and that "his whole life was a struggle with a nervous and frail constitution." Therefore at the age of 18, and being forced to seek work elsewhere, he journeyed to nearby Sterling, where he found employment in the Hitchcock chair factory.

Soon thereafter he became acquainted with Nathan B. Chamberlain (1810-1878), a maker of philosophical instruments. Two years later, under Chamberlain's tutelage, young Temple was at work constructing philosophical apparatus used for teaching science in the schools. When Chamberlain later moved his business to Boston, Temple accompanied him (in 1850 Chamberlain was to form a partnership in Boston with Edward Samuel Ritchie [1814-1895], a former New Bedford ship chandler and inventor of the liquid compass).

Around 1835, Temple left Chamberlain's employ to join Daniel Davis in a partnership under the name of Davis & Temple, with a shop at No. 11 Cornhill in Boston.

Daniel Davis, brother of the inventor Ari Davis, was also born in Princeton and worked on his father's farm until he reached the age of 21. He moved to Boston in 1833 and worked in the Darling soda factory. Greatly interested in electrical experimentation, he became acquainted with Dr.



Courtesy of the Gurley Museum.

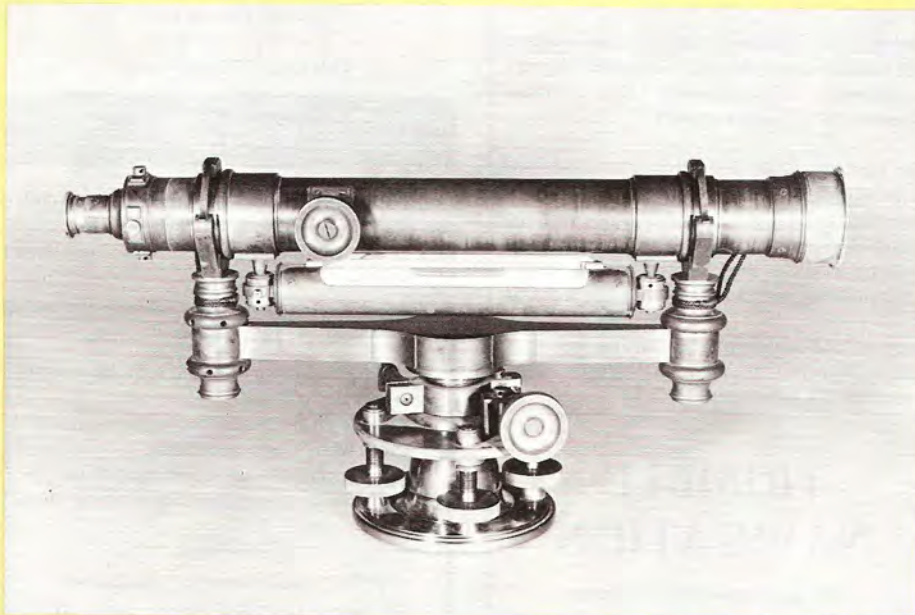
Surveyor's transit made by John Temple. Arc 5", limb 6", telescope 10-3/4", needle 4-7/16".

William King, who manufactured static electricity machines at his shop on Cornhill and also installed lightning rods. Davis soon found employment with him until 1835, when he formed a partnership with Temple. In 1837 Davis purchased Temple's interest in the shop and thereafter the two worked independently of each other, Davis later achieving recognition for his work in electricity and magnetism.

Temple's name first appeared in the Boston city directory for the year 1839 with the address at 11 Cornhill. He later moved his shop to Court Street, where he remained for 14 years, then moved to Franklin Street. He married Mary S. Magown; they had no children. In about 1865 he moved permanently to West Roxbury.

Working now as an independent maker of mathematical instruments, Temple specialized at first in the production of "apparatus for illustration" for schools and colleges. Among his early clients was

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Courtesy of Dr. David Wheatland.

Y-level made by John Temple for Harvard University c. 1870. Telescope 15-1/4" long, bubble level with metal scale. With original tripod and field case. From the Historic Instruments Collection, Harvard University.

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the newly established Lowell Institute, for the instruction of engineers. In time, as his circumstances permitted, Temple turned more and more to the production of a range of precision engineering and surveying instruments. This was the type of work which he preferred and in which he excelled, and eventually he was able to devote his entire time and effort to it. His working standards were so high, however, that he was rarely satisfied with his own production, and furthermore experienced considerable difficulty in hiring capable assistants who met his requirements. As a consequence, although his work was greatly admired, it was not as remunerative as it merited.

Nonetheless, the high quality of his instruments attracted so much attention in the profession that in 1845 he was elected

a Fellow of the American Academy of Arts and Sciences, the first mechanic to be so recognized. This unsought honor was particularly meaningful to Temple and he cherished it all his life. He retained his membership for the next 32 years, although at times he was able to do so only with some sacrifice due to lack of funds. Because of his excessive modesty and reticence, however, it is doubtful that he ever attended more than one or two meetings of the Academy.

Between 1844 and 1850, Temple produced surveying and engineering instruments for Harvard College. These instruments have not survived in the University's collections, although three surveying instruments that Temple produced for Harvard between 1860 and 1870 survive in its Collection of Historic Scientific Instruments. These instruments were purchased for instruction of students of engineering of the Lawrence Scientific School

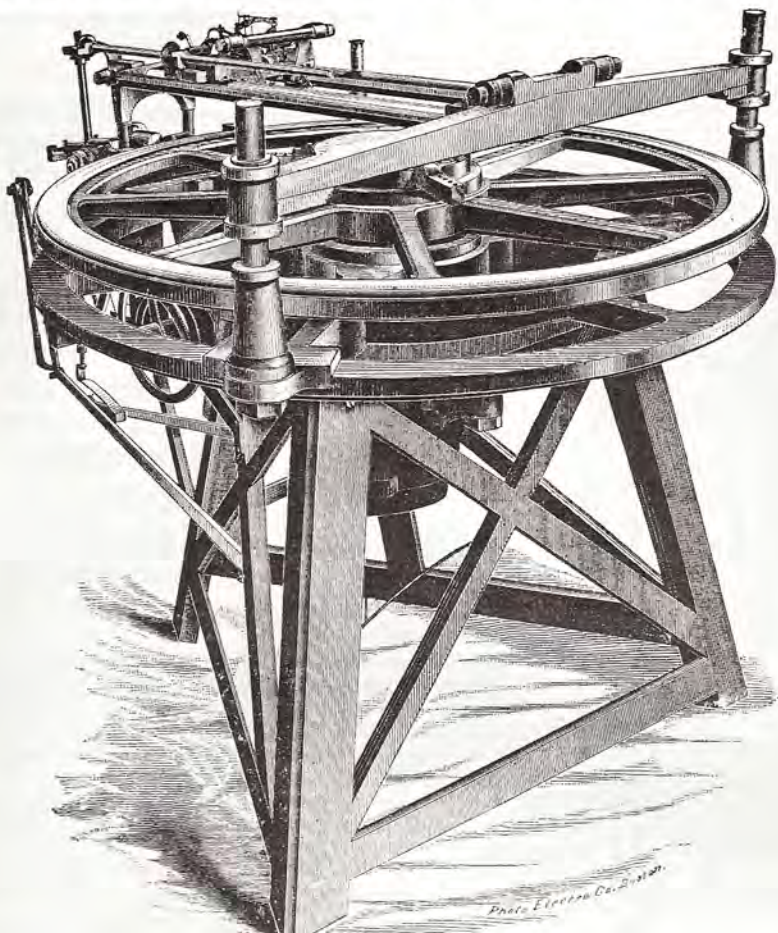


Courtesy of Dr. David Wheatland.

Surveyor's transit, made by Temple circa 1870. Telescope 10" in length, level above horizontal circle 6-1/4" diameter; with field case and tripod. From the Harvard Historic Instruments Collection.

at the Harvard Engineering Camp at Ashland, New Hampshire, and continued in use until the courses in civil engineering were discontinued in the 1960s. They consist of an alidade with a 10-inch telescope and a rule 18 1/4 inches long and three inches wide, made circa 1860; a transit with a 10-inch telescope and a horizontal circle of 6 1/4 inches, made circa 1870; and a Y-level with a 15 1/4-inch telescope also made circa 1870.

Temple had great difficulty in graduating the scales for his instruments; other makers sent the scales to England to be divided, which resulted in a considerable loss of time. For a long time he contemplated the possibility of making a dividing engine of his own, with which he could graduate scales having adequate precision. In 1852, Temple finally undertook what was to be his crowning achievement: the design and construction of a successful 36-inch dividing engine. When he began its construction, he had not seen another dividing engine and he developed his own design. He devoted all his free hours to the project, in which he invested all the money that he could spare from his frugal income. Temple continued to improve the dividing engine over the next 20 years. It was among the first dividing engines made in the United States capable of graduating scales for precision instruments. Temple was able to use it for a few years before his death. PS



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Part II

Part I of this article covered the early life of John Hapgood Temple, one of the most skilled makers of mathematical instruments in the United States.

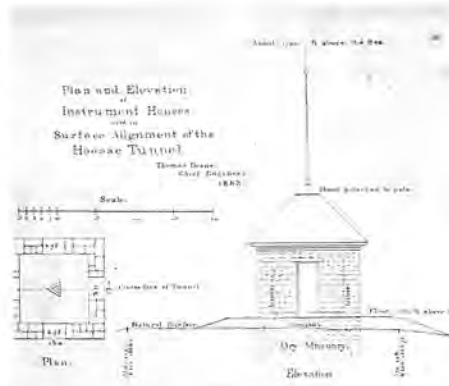
Because he suffered from asthma as a boy, Temple was spared a lifetime in farming and was directed instead to a career as a maker of precision mathematical instruments. Born on a farm in Princeton, Massachusetts in 1812, he worked first as a chairmaker, then in the production of apparatus for teaching science in schools. As a young man he moved to Boston and, after being associated with other makers, established his own shop by 1839. He soon became known for the high quality and precision of his instruments, some of which he produced for the engineering school of Harvard College. In 1852 he undertook the design and construction of a dividing engine for graduating scales of his instruments.

Temple produced precision instruments for a number of state and Federal government agencies. Among his major clients was the U.S. Coast and Geodetic Survey. For the secondary triangulation survey of Cape Ann by C.O. Boutelle, Temple made some of the instruments used and modified others for the U.S. Coast Survey. The survey base was aligned by means of an eight-inch repeating theodolite made by Gambey and sectors made by Temple. He also replaced the original telescope of the Gambey theodolite with a more powerful one.

In 1863, Temple produced a pair of twin transit instruments for Thomas Doane, chief engineer of the Hoosac Tunnel in North Adams, Massachusetts, which were required by Doane and other engineers for the surface and underground alignment of the Tunnel.

The Hoosac Tunnel, often described as "The Blasted Bore," was under construction for two and a half decades, from 1851 to 1876. The tunnel was part of an engi-

with Greenfield, Massachusetts. The success of the railroad depended on driving a tunnel through the talcose slate rock of Hoosac Mountain in the extreme north-westerly corner of Massachusetts. The



Detail of plan and elevation of the instrument houses used in surface alignment of the Hoosac Tunnel, drawn by Thomas Doane, 1863.

tunnel was to be nearly five miles long (actually 25,081 feet) which would make it the longest tunnel of its time.

The concept of driving a tunnel through Hoosac Mountain was not new. In 1825, Loammi Baldwin had proposed to extend New England's canal system through the Mountain as the most likely link from east to west. It was never built, however, and a quarter of a century later the same line was selected for the railroad. The tunnel proved to be a hazardous undertaking, with the loss of one life for every 125-to-250 feet of tunnel. It was completed at a cost of 14 million dollars after 25 years of excavation.

Concrete piers were built at each end of the tunnel, upon which the Temple transits were placed and used to establish the grade. There were numerous springs in the tunnel, so the high point was in the center. The greatest error in alignment at

The Temple instruments were used from 1863 to 1874. In 1893, one of the transit instruments was donated by Doane to Boswell Observatory. Its twin was preserved at Doane College, an institution in Crete, Nebraska, named for Thomas Doane. Subsequently, the transit instrument at Boswell Observatory, identified as Transit Instrument No. 1, was transferred to Blue Hill Observatory, maintained by the Massachusetts Institute of Technology. The instrument remained there for a number of years until 1961, when the Institute presented it to the Gurley Museum in Troy, New York. It has a 28-inch telescope with filar micrometer, two vernier vertical circles, 5 1/2 inches in diameter, and standards 16-inches high.

A similar transit instrument made by Temple—lacking the cast iron base—was acquired by the writer in Yarmouth, Massachusetts.

Transit Instrument No. 2 is at Doane College, as well as a heliotrope patented

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Courtesy of Doane College



Transit instrument used in both

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by E. Varnish Cox of London and used by Doane in the Hoosac Tunnel project.

In 1873, Temple produced an instrument used in that year for the survey of the southern boundary of Wyoming along the 41st parallel, north latitude from the 27th to the 34th degree west longitude, undertaken by government surveyor, A. V. Richards. The instrument used was described in the abstract of returns of the survey as an "Astronomical transit, 30 inches focal distance made by Temple of Boston. This instrument was purchased of the State of California through Prof. Whitney of Boston, who used it in the Geological survey of that State. It was

used in the determination of the latitude Stations, and at the Evanston Longitude Station." Josiah D. Whitney, a Yale engineering school graduate, was employed on several geological surveys in the Eastern United States before being appointed California State Geologist by legislation enacted in 1860. Although he proved to be an excellent organizer and administrator, Whitney's survey had to be terminated by 1874 (through no fault of his own) because of a periodic lack of state funding.

In his lifetime Temple produced approximately 100 instruments, chiefly for surveying. In addition to the instruments already noted, the Gurley Museum owns a Temple surveying transit with a five-inch arc, six-inch limb, and 10 3/4-inch telescope.

Temple died in West Roxbury on July 25, 1877, and was buried in the family graveyard in Princeton. Following his death, his widow sold his dividing engine to the firm of Buff & Berger. After the partnership of Buff & Berger was dissolved in 1898, the Temple dividing engine was acquired by C. L. Berger & Sons.

In his later years, Temple had employed an instrument maker named James E. Moody. After Temple's death, Moody assembled a number of instruments left incomplete by Temple in his shop and sold them locally. **PS**

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